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THE FOREST FLORA OF NEW SOUTH WALES.

BY

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VOL. VII.

PARTS 61 — 70

228019
19. 12. 28

Sydney :

JOHN SPENCE, ACTING GOVERNMENT PRINTER.

1922.

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XVIII

Eucalyptus propinqua Deane and Maiden.

Small-Fruited Grey Gum.

(Family MYRTACEÆ.)

Botanical description.—Genus *Eucalyptus*. (See Part II, p. 33).

Botanical description.—Species *E. propinqua* Deane and Maiden in *Proc. Linn. Soc. N.S.W.*, xx, 541 (1895), with Plate xliii.

A large, straight growing, cylindrical-stemmed tree, found up to 4 or 5 feet in diameter, and 120 feet and more in height.

Bark.—It has a grey, dusty-looking, slightly raspy appearance as regards its bark. Next to the Blue or Flooded Gum (*saligna*) it is one of the straightest stemmed trees in the forest. The bark darkens, peels off in large longitudinal irregular patches, leaving a smooth white surface, which in course of time darkens, peels off, and the process is indefinitely repeated. The bark closely resembles, and is perhaps not to be distinguished from, that of *E. punctata*.

Timber.—Dark coloured, and so closely resembling Red Ironbark (*E. siderophloia*) that care is required to distinguish the two timbers. Inclined to have rings or “scabs” of kino, which diminishes the demand for it for sawn stuff. Very durable in or out of the ground, but its tensile strength inferior to that of the Ironbark already referred to.

Juvenile leaves.—More broadly lanceolate, and with the marginal vein more distant from the edge, than in the case of mature leaves. At first opposite.

Mature leaves.—Narrow lanceolate and very uniform. Average length 4–5 inches, breadth $\frac{3}{4}$ inch. Veins not prominent, lateral veins nearly parallel; marginal vein on or very close to the edge of the leaf as a very general rule. Edge usually slightly recurved.

Peduncles flattened.

Calyx-tube hemispherical, and longer than the operculum. Sometimes with the angles of the flattened pedicel decurrent.

Flowers in a marked manner pedicellate; usually in tens, but the umbels containing as few as five flowers.

Operculum hemispherical in general outline, but with a low pointed apex.

Stamens inflexed before expansion, the anthers opening by parallel slits, and all fertile.

Fruit.—Very uniform in size, about $2\frac{1}{2}$ lines broad by $1\frac{1}{2}$ lines deep. Usually 4-celled; occasionally 3-celled; 5-celled not seen at present. The rim usually shows two sharp edges, with the intervening space concave. The valves are well exerted.

Botanical Name.—*Eucalyptus*, already explained (see Part II, p. 34); *propinqua*, Latin, near of kin, or allied, a name given because of its close affinity to *E. punctata* DC.

Vernacular Name.—"Grey Gum," because of the dull grey appearance of the bark. This species is fortunate in having but one general name. To distinguish it from *Eucalyptus punctata*, a Grey Gum to which it is most closely related, the name "Small-fruited Grey Gum" is suggested.

Aboriginal Name.—"Warrimbarng" of those of the Hastings River (Forest Ranger George R. Brown).

Timber.—*Characteristics.*—It is so much like ironbark in appearance that it is difficult to discriminate between the two timbers. That will be the best guide to its appearance. An expert would usually detect the substitution for ironbark (if he suspected any substitution), by noting that a chip of grey gum is more brittle than that of ironbark. It also cuts less horny. Nevertheless, the two timbers are wonderfully alike, and for many purposes grey gum is an efficient substitute for ironbark, for it is remarkably durable. Its inferior strength, as compared with ironbark, precludes its use as girders of any length, and when substituted for ironbark in sleepers, the bolts and spikes work loose in them. I would encourage its use in every possible way for wood-blocks. The chief objectors to its use at the present time are the saw-millers themselves, as the logs often contain gum-scabs or gum-veins. At present, where unblemished timber is insisted upon for wood-blocks, a saw-miller cannot afford to cut up grey gum (although it frequently turns out unblemished), because of the risk of having it condemned. I have often spoken on this subject in connection with bloodwood, and would emphasise the opinion that wood blocks should not be condemned because they contain a few gum-scabs or veins. Such excess of care practically leads to great waste of really valuable timber.

Principal uses—Recommended for paving-blocks, as already stated. It is in high repute for posts, having excellent records when employed in this very trying situation. I have seen it used for felloes and for shingles. It is very largely used as an ironbark substitute for railway sleepers, &c., which fact is in itself testimony to its excellence.

The late Mr. J. V. de Coque wrote of it :—

"This timber must not be confounded with the 'Blue Gum' (*E. saligna*). It is a remarkably close grained, durable timber, and except as regards strength (to which it is inferior to ironbark), it makes an admirable substitute, particularly in the erection of large beam bridges. It is very like red ironbark in general appearance, and is often substituted for it. An experienced man can however detect the difference owing to the shortness of grain. A chip of grey gum bent between the fingers will snap instantly. The quality of this timber varies considerably like most hardwoods in different districts. I found that the best variety is found in the Hawkesbury district, particularly around Wyong and Cooranbong. Grey gum from these places have a record of thirty years in bridge members. For general building work it is hardly so suitable as some of the pale hardwoods; it is hard to plane, and in scantling sizes subject to crack and open. As piles or girders I consider it next to ironbark, and one of the best of our timbers."

Ironbark and Grey Gum.—With the view of economising Ironbark, various suggestions were made, including the calling for tenders of sleepers of various sizes. Under date 3rd July, 1889, the Secretary for Railways wrote that the Engineer for

Existing Lines declined to recommend the acceptance of sawn instead of split sleepers, but with a view to economy in respect of timber, the Commissioners had decided that in future as far as possible, tenders should be invited for sleepers and fence posts at the same time.

One cannot blame railway engineers for preferring Ironbark to Grey Gum if they can get the former, but for a long time certain North Coast foresters, in view of the shortage of Ironbark which was everywhere proclaimed, and of the fact that Grey Gum is a really valuable timber, brought the merits of Grey Gum under notice, but the time was not opportune.

Here are two letters from Foresters who impressed its excellence on me and with whom I maintained a correspondence on the subject for years.

(a) From the late Forest Ranger Augustus Rudder, of Booral, dated 15th July, 1890.

"Fortunately we have here an excellent substitute for Ironbark in a tree locally known as Grey Gum.

"This timber is in quantity, and up to 4 and 5 feet in diameter, but it is said the railway authorities will not accept of it for railway purposes, for what reason I am at a loss to determine, unless it is their want of knowledge of its true character; probably because they have been misled by some other timber of the same local name. As to the lasting qualities of this Grey Gum in the ground, and generally, I have known and used it for over forty years, and will stake my reputation as a Forest Ranger on this my testimony to its excellence, nor is it more liable, if so much so, as Ironbark to the ravages of the white ant, and is far superior to the Broad-leaved Red Ironbark (*E. siderophloia*), which is so readily accepted for railway purposes. In what I have said of this Grey Gum I will, I am sure, be sustained by nine-tenths of the old experienced bushmen, who invariably speak well of it."

(b) From the late Forest Ranger G. R. Brown, of Port Macquarie, dated 7th July, 1890.

"In view of Ironbark timber being so much used for girders and railway sleepers, I have the honour to ask that the following suggestion might be tested:—'To use Grey Gum, and Spotted Gum, more particularly the former, for railway sleepers, and other purposes where practicable.' My reasons are: In my district Grey Gum is almost as plentiful as the Blackbutt, but only an odd log is used by the sawmills. It is more easily obtained than the Ironbark, on account of being so plentiful nearer to water carriage, distributed all over the district, and being so should tend to lower the contract price, being easily obtainable.

"It is said to be equal to Ironbark generally, except for girders, although it is often cut for girders, &c., and passed for Ironbark.

"Also a Mr. Anderson, a practical man who was under Mr. Moriarty some years ago, was willing to accept Grey Gum, for all purposes where the Ironbark was being used, at the time when the Kiama and Wollongong Harbour Works were in progress.

"It seems a pity to see such splendid timber trees eaten by white ants and decaying for want of using; and if cut where practicable it would give the Ironbark an opportunity of again reforesting, where scarce, in all districts.

"To also assist in preserving Ironbark fit for girders, now cut for sleepers, it might be ruled that Ironbark, for sleepers of not less than 8 or 9 feet girth, should be used, which would help to save the sizes squared for girders, as no other timber is as suitable for that purpose."

A very few years later I was botanising very much off beaten tracks south of Taree. In the course of my wanderings I came across a sleeper-getters' camp and some stacks of very fine sleepers were about. At that time the Railway Department

would take none but Ironbark sleepers (so it thought), but I knew there was no Ironbark in the district, but plenty of Grey Gum. As I thirsted for knowledge, the sleeper-getters told me, in response to enquiry, that these were "fine Ironbark sleepers" and said other things. I obtained proof that the sleepers were Grey Gum.

In about a fortnight I returned to Sydney and gave a railway engineer an account of what I had seen, and the precise locality. Shortly afterwards he told me that he had made inquiries, and that sleepers from the locality I had mentioned were purchased by the Department as Red Ironbark. He added that officially they only bought Ironbark, but that the Department should in future get the extra profit through the lower price of Grey Gum, and that the incident would help him in a course of action with which he had long been sympathetic, and that is to use sleepers on the railways on their merits. Not long afterwards tenders were called for sleepers of various valuable timbers other than Ironbark, and the recognition of Grey Gum as a useful substitute for Ironbark contributed to this end.

Now the attitude of various Government Departments for the utilization of our timbers on their merits is a sympathetic one, which was by no means the case, as a very general rule, a quarter of a century ago.

Size.—Trees 4 or 5 feet in diameter and with a height of 120 feet are not uncommon, and may be exceeded, but the average height is rather less.

Habitat.—This species is confined to eastern New South Wales and Queensland, usually at no great elevation above the sea. In the former State it is not known further south than the Hawkesbury River. It occurs in both States not far from the coast in New South Wales, ascending the slopes of the escarpment of the tableland. In Queensland its range has been less carefully worked out; we do not know how far it extends along the North Coast Railway.

It is frequently found on poor sandy or sandstone country, but sometimes on better soil. Its relations to soils and soil-moisture have only been imperfectly worked out.

Following are some New South Wales localities :—

Wyong District (J. L. Boorman, and J.H.M.); Yarramalong (W. A. W. de Beuzeville); Sandgate, Newcastle (A. Murphy); Sandgate to Waratah (R. H. Cambage, No. 730); Paterson River (J. L. Boorman); Dungog-Stroud road (A. Rudder); "Red Gum," Dungog (W. F. Blakely); Taree (E. H. F. Swain); Port Macquarie (G. R. Brown); Beechwood, Rolland's Plains, Hastings River (J. L. Boorman); Bellinger River (F. R. Meeham); Woolgoolga (E. H. F. Swain); Woodburn, Richmond River (W. Baeuerlen); Murwillumbah, Tweed River (E. H. F. Swain); Acacia Creek, Macpherson Range, New South Wales-Queensland border (W. Dunn).

The following notes on Grey Gum were made during a North Coast trip by road in 1895, and are arranged geographically. They are copied from my note book without alteration, and some of the remarks will supplement those already made in regard to the properties of the timber.

A. Murphy, junr., photo.

TWO GREY GUMS (*Eucalyptus propinqua*), BULLADELAH
DISTRICT, N.S.W.

R. H. Cambage, photo.

GREY GUM (*Eucalyptus propinqua*), TOOLOOM, UPPER CLARENCE RIVER.

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M. Flockton del. et lith.

SMALL-FRUITED GREY GUM.
(*Eucalyptus propinqua* DEANE AND MAIDEN.)

Grey Gum was first noticed on the Raymond Terrace side of Seven-mile Creek,—about the 6th milestone. Thenceforward it never left us. As durable as Ironbark. Occasionally shelly. The best ordinary timber for bush work. Cracks radially. Ironbark cracks concentrically.

The difficulty in regard to the use of Grey Gum lies largely with the saw-millers themselves, who do not care about cutting the timber, as it frequently shows small gum-scabs and other blemishes.

Mr. Breckenridge, of Failford, Forster, a most experienced saw-miller, cannot tell the difference between Grey Gum and Ironbark in sleepers. Is faulty, with large blisters and gum scabs.

Is accounted the most durable timber in the district. Blue Gum (*saligna*) comes next, then Red Mahogany (*resinifera*).

Should be recommended for wood-blocks; is straight in grain. Saw it cut for felloes at Tuncurry.

Plenty of Grey Gum south of Taree, valuable for sleepers, and would give the Ironbark forests a rest. Durability good, but strength of course not equal to Ironbark.

Abundant at least as far as Woolgoolga, and as far west as the eastern slopes of the Dividing Range. Grey Gum sleepers cut in Kempsey district. Use it for decking.

A little seen about a third of the way up the Dorrigo Mountain.

EXPLANATION OF PLATE 228.

- A. Twig bearing mature leaves and flower-buds.
- B. Juvenile leaves.
- C. Fruits.

Specimens from near Dungog, N.S.W.

PHOTOGRAPHIC ILLUSTRATIONS.

Two Grey Gums near Bulladelah, N.S.W. (A. Murphy, Jr., photo., October, 1913).

Grey Gum, Tooleom, Upper Clarence River, N.S.W. (R. H. Cambage, photo., September, 1911).

No. 224.

Geissois lachnocarpa n.sp.

Red Carabeen.

(Family CUNONIACEÆ.)

From what has been said in Part 58 (under *Geissois Benthami*, F.v.M.) and in Part 59 (under *Weinmannia rubifolia*, Benth.) we shall be better able to understand the position of the tree now being dealt with.

Botanical description.--Genus, *Geissois*, already dealt with in Part 58, p. 205.

Botanical description.--Species, *G. lachnocarpa* (as *Weinmannia lachnocarpa*, F.v.M., in *Fragm.*, viii, 7).

The original description may be translated as follows:—

Tall tree with trifoliate glabrous leaves, with ovate-lanceolate leaflets nearly all sessile, crenate or repando-serrulate, small flowered racemes simple or compound, pedicels longer than the calyx, which has usually 6 segments, valvate in bud, with about 12 stamens hardly exceeding the calyx, 2- or rarely 3-celled ovary, with few ovules in pairs, 4- rarely 6-septate, a small capsule densely woolly with long hairs, valves long coherent with the septum, not spreading, deeply intruding into the cells, with glabrous winged seeds, solitary in the cells when ripe, and orbicular cotyledons.

In forests on the Tweed River and on the slopes of Mount Warning; C. Moore, W. Guilfoyle.

An evergreen tree up to 100 feet high, called Marara by the aborigines. Stem erect. Foliage loose. Wood hard and tough. Branchlets and petioles glabrous. Petioles $\frac{2}{3}$ to 1 inch long. Stipules dropped in specimens seen. ("Stipules dimidiate-lanceolate, $1\frac{1}{2}$ line long," according to F. M. Bailey in "Queensland Flora": I could find none. J.H.M.) Leaflets varying from 2 to 6 inches in length, and 1 to 2 inches in breadth, thinly coriaceous, flat, often acuminate at the apex, shining and deep green on both sides, veins much spreading, slightly prominent underneath, the smaller ones copiously reticulate, base of the leaflet narrowed into a short petiole. Racemes 1 to 2 inches long, solitary, few or more on an elongated peduncle, thus often forming an ample panicle. Pedicels mostly scattered, even the fruit-bearing ones very slender, 2-3 lines long, articulate above the base, silky hoary as well as the peduncles. Calyces deeply, 6- rarely 5 or 7-parted, persistent, the lobes lanceolate or ovate-lanceolate, $1\frac{1}{2}$ lines long, outside imperfectly silky hairy, inside minutely tomentose, unchanged when old. Petals I have not seen in the already withered flowers at my disposal perhaps fugacious (Bailey writes "Petals none or very fugacious"; there are no petals, J.H.M.). Stamens long, persistent. Filaments glabrous, linear, setaceous $1\frac{1}{2}$ to 2 lines long. Anthers minute, roundish cordate, longitudinally dehiscent on both sides, obtuse, dorsifixed. Styles 2, rarely 3, subulate setaceous, about $1\frac{1}{2}$ lines long, glabrous, free. Stigma minute. Capsules ovate, about 2 lines long, nearly always with two short straight beaks at the top, and inclined to split into two, densely covered with a soft fulvous wool, so that they form globular masses (fluffy balls, J.H.M.) nearly $\frac{1}{2}$ an inch in diameter, furrowed on the commissural side. Endocarp thinly cartilaginous, divisible, glabrous, livid, shining. Ripe seeds obliquely orbicular-ovate, nearly a line long, slightly compressed. Testa membranous, light brown. Embryo straight, little shorter than the albumen which is rich in amygdalin. Cotyledons flat, radicle cylindrical, three times broader and slightly longer.

Mr. F. M. Bailey has described and figured a variety *parvifolia* (of *Weinmannia*) in *Queensland Agricultural Journal*, xxviii, 196, from the Macpherson Range, the leaflets seldom exceeding $1\frac{1}{4}$ inches long and 5 lines broad.

The critical points of the species may be enumerated as:—*Leaves* in 3's or 5's (digitate); *Stamens*—about 20; *Petals*, none; *Calyx lobes* 4–6; *Stipules*, none; *Floral bracts*, none.

As regards *Weinmannia* and *Geissois* it comes nearer to the latter, and I constitute it a species of that genus. The alternative, it seems to me, is to constitute a new genus to receive it. Comparison with the characters of *Weinmannia*, see p. 207, Part lviii, shows that it is sufficiently distinct from that genus.

Botanical Name.—*Geissois*, see Part 58, p. 207; *lachnocarpa*, from two Greek words, *lachnos*, woolly, *carpa*, fruit, for obvious reasons.

Vernacular Name.—It is known sometimes as “Red Carabeen,” a name which it shares with *Geissois Benthami* (See Part lviii).

Sometimes called “Brush” or “Scrub-Redwood” because of its colour, and in reference to the fact that it is a brush timber. (Brush is the New South Wales equivalent for the Indian word Jungle.) The word Brush is chiefly used in New South Wales; Scrub is its equivalent in Queensland. Mr. F. M. Bailey says it is also known as “Scrub Rosewood” in Queensland.

Aboriginal Name.—“Marara” is the aboriginal name, but it seems to have got a sufficient hold upon bushmen to be often adopted by them. It must not be confused with “Mararie” the equivalent of *Arytera distylis* Radlk., (*Nephelium distyle* F.v.M.) a Sapindaceous tree. Mr. Bailey says that the name “Merrany” is also in use in South Queensland.

Synonym.—*Weinmannia lachnocarpa* (F.v.M.)

Timber.—Timber red, drying to a dirty pink, of the usual character of Cunoniaceous and Saxifrageous timbers, that is to say, with little figure, moderately hard, easy to work, and a generally useful timber, but probably without very conspicuous characteristics.

“Wood light pink, close in the grain; might be used for making planes, mallets, and chisel handles.” (F. M. Bailey in *Cat. Queensland Woods, Col. and Ind. Exh.*, 1886.)

A large tree, with scaly bark; the wood of light-brown (*sic*) colour, close-grained, and rather hard, excellent for mallets and chisel handles, and is often used for resoling English planes when worn down, and sometimes for staves of casks. (*Cat. Queensland Forestry Museum*, 1904).

Mr. C. W. Chapman of Melbourne, some years ago informed me that wherever there is a shake in Marara timber there is always a little “Yellow Gum” (? calcareous deposit, see p. 146, Part lvii). It is being experimented upon for golf-sticks.

Size.—A tree up to 100 feet high, as originally described, but I think the average would be something less, say 80 feet, with a stem-diameter of about 3 feet.

Habitat.—The type comes from the Tweed and Mount Warning, New South Wales (near the Queensland border). It occurs on the Macpherson Range, and Mr. Bailey has recorded it from South Queensland.

I have not seen it further south than Coff's Harbour, but should not be surprised to hear of its occurrence as far south as the Hastings River.

We have specimens from Burringbar, Tweed River district (W. P. Pope); Murwillumbah (R. A. Campbell); "Marara," Casino, Richmond River (W. P. Pope); Grafton to Coff's Harbour (J.H.M. and J. L. Boorman).

EXPLANATION OF PLATE 229.

- A. Flowers.
- B. Flowering twig.
- C. Bud.
- D. Flower showing perianth, stamens and pistil (no petals).
- E. } Pistil surrounded by crenate disc.
- F. }
- G. Vertical section through pistil and disc.
- H. Fruit with persistent perianth, seen through a mat of fine woolly hairs.

All the details are magnified.

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M. Flockton del. et lith.

RED CARABEEN.

(*Geissois lachnocarpa* n.sp.)

No. 225.

Acacia brachystachya Benth.

(also *A. ramulosa* W. V. Fitzgerald, a Western Australian species.)

Two Narrow-leaved Mulgas.

(Family LEGUMINOSÆ : MIMOSÆÆ.)

So much confusion has arisen concerning *A. brachystachya* Benth., an imperfectly known New South Wales species, that it has been found necessary to undertake an enquiry in regard to it. It has been found requisite to disentangle it from the equally imperfectly known Western Australian *A. ramulosa* W. V. Fitzgerald, and, since the bearings of the one cannot be understood without reference to the other, a detailed study of both has been given. I return thanks to Miss Flockton and to Mr. W. F. Blakely for their valuable assistance.

Botanical description.—Genus, *Acacia*. (See Part XV, p. 103.)

Botanical description.—Species, *A. brachystachya* Benth. in B. Fl. ii, 403 (1864).

Very near *A. aneura* and perhaps a short-spiked variety, slightly glaucous or hoary, but without visible pubescence. *Phyllodia* linear-subulate, slightly compressed, rigid but not pungent, very finely striate, with numerous nerves scarcely visible without a lens. *Spikes* sessile or very shortly pedunculate, ovoid or oblong, 2 to 3 lines long. *Flowers* mostly 5-merous. *Sepals* very narrow, linear-spathulate. *Petals* smooth, often minutely pubescent. *Pod* unknown.

Benth. recognises variation in this species, for in placing it under the *Stenophyllæ* Section of the *Julifloræ*, he puts it in both "Spikes sessile" and "Spikes pedunculate," adding that the spikes may be "ovoid or oblong." (B. Fl. ii, 316.) The pod was unknown to him.

Synonyms—

1. *A. aneura* F.v.M. (?) *stenocarpa* Benth.

This is defined with a narrow-turgid pod, seeds longitudinal, with the funicle much more dilated and folded. (B. Fl. ii, 413.)

The type came from Barrier Range, Victorian Expedition (*i.e.*, in search of Burke and Wills), *i.e.*, somewhere in the vicinity of Broken Hill, N.S.W.

I have received specimens of phyllodes and pods from Prof. Ewart labelled "Yunyunga Mts. Vict. Exped." evidently a co-type. While somewhat turgid the pods are slightly twisted and two of them are flattish.

2. *A. cibaria* F.v.M.

Mueller and Forrest ("Plants indigenous around Shark's Bay, W.A." 1883), speaking of the then recently described *A. cibaria* F.v.M., say that the native name is "Wonuy" and that the aborigines use the seeds for food. Some Shark's Bay seeds that I received from Mueller at the time, I described as "two or three times as large as most *Acacia* seeds (resembling small castor oil seeds somewhat) and with excessively hard and very thick coats." I am satisfied that they do not answer to the main description of *A. cibaria* seed, although they gave the name to the species.

Tate in *Proc. Roy. Soc. S.A.*, v. 85 (1882), says that "this species includes *A. aneura* var. *stenocarpa*. He adds that it may be identical with *A. brachystachya* Benth., inasmuch as flowering specimens of *A. aneura* and *A. brachystachya* cannot readily be distinguished, and both species occur in the same region; the length of the spike is variable. Under these circumstances it seems advisable to abolish the latter specific name."

Ewart and White (*Proc. Roy. Soc. Vict.*, xxii, 92) state that ". . . *A. cibaria* F.v.M. appears close to *A. brachystachya*, and was in fact, marked by Mueller, 'Forsan *A. brachystachya*.'"

I find that the original description of *A. cibaria* is so little known, and it is so important, that I quote it here, with comments of my own in brackets.

"Branchlets not angular, slightly silky; phyllodes rather long, thick, rigid, broadly linear, very finely many-nerved, of greyish hue, curved apiculated; stipules and gland obliterated." (Applies to both *A. ramulosa* and *A. brachystachya*.)

"Spikes axillary, solitary, short-stalked, not elongated; flowers slightly short-hairy, bracts rhomboid towards the summit, very thin towards the base, surpassed in length by the flowers; sepals narrow, free, hardly half as long as the unstreaked corolla" (*A. brachystachya*); "pods straight, cylindrical, longitudinally streaked; seeds placed likewise, oblong, their two areoles minute; strophiole very short, cupular, occupying only the basal portion of the seed; funicle closely twisted beneath the strophiole." (*A. ramulosa*.)

"Between the Darling River and Barcoo, Dr. Beckler." (*A. brachystachya*).

"Near the Murchison River, Ch. Gray, near the Gascoyne River, Oliver Jones." (*A. ramulosa*.)

"A tall shrub or small tree allied to *A. aneura* in foliage, but very different as regards fruit." (*A. ramulosa* and *A. brachystachya*.)

"The aborigines use the seeds very largely for food, wherever this species occurs." (*A. sp.*)

"The fruits near Shark Bay are much larger and the seeds brownish, not black. It is the 'Wonuy' of the natives." (*A. sp.*, whose identity can only be guessed at.)

So that the description of *A. cibaria* is a mixture of *A. ramulosa*, *A. brachystachya* and *A. sp.* It had better be dropped.

Botanical Name.—*Acacia*, already explained (see Part XV, p. 104); *brachystachya*, from the Greek *brachus* short; *stachus*, an ear of corn, equivalent to the Latin *spica*. In the present case it refers to the flower-spike, and it was suggested by Bentham that it might be a short spiked variety of *A. aneura*.

Vernacular Name.—"Umbrella Mulga" is the name most usually applied to this species, so far as I know. With others it shares the name "Narrow-leaved Mulga."

Aboriginal Name.—I know of none which has been applied with certainty to this species.

Leaves.—The narrow phyllodes, sometimes nearly terete, are an important character in this species. This is an incredible species, in contradistinction to the common Mulga (*A. aneura*), which is a valuable fodder plant.

Fruit.—The pod was unknown to Bentham; it is figured on Plate 230, and more than one specimen of it is incidentally described under "Habitat."

Size.—Usually a medium sized or tall bushy shrub, it may attain the size of a tree 20 or 30 feet high.

Habitat.—It is a species of arid areas, the type coming from the Mutanie Range, I believe not far from Broken Hill, N.S.W.; Barrier Range is practically the same locality (type of *A. aneura* var. *stenocarpa*). Then we have Darling River and Barcoo (*A. cibaria*), the first locality practically the same class of country as that quoted for *A. brachystachya* and *A. aneura* var. *stenocarpa*, the Barcoo* extending from northern South Australia to Western Queensland. Some specific localities follow.

New South Wales.—1. Tree 20-30 feet. The particular specimen seen by me is without flowers or fruits, though doubtless Mueller, who named the specimen *A. cibaria*, had one or the other. Grey Range, north-west angle of New South Wales (W. Baeuerlen, who was collecting for the Technological Museum under my direction in 1885).

2. "Pointed out to me by Mr. A. W. Mullen, L.S., as differing from the common Mulga, *A. aneura*. It grows in especially dry stony places, is more branching from the base, never reaching to the tree-like dimensions that Mulga does (he is speaking of the Bourke district, J.H.M.). It has narrower leaves and is invariably untouched by stock. *A. aneura* grows in its company normal in appearance and edible." Thirty-seven miles from Wanaaring, going north (J. L. Boorman).

3. Type of *A. aneura* var. (?) *stenocarpa* Benth. Pods with valves of fawn-grey woolly texture, with brown stripes. 4-6 cm. long, about 5 mm. broad. They are flattish and somewhat twisted, evidently affected by some insect, but a portion of some pods is terete. Yunyunga (? Yayinga) Mountains, Victorian Relief Expedition.

4. Long, narrow pods, inclined to be flat, but becoming more terete as ripening proceeds. "Umbrella Mulga," North Bourke (A. Murphy).

5. A tall, upright Mulga. Fort Bourke, near Bourke (A. W. Mullen, L.S.)

A photo of this, as *Acacia aneura* "with narrow and unusually long leaves," by Mr. C. J. McMaster, will be found in Vol. iii of this work, under that species.

*Mueller does not state what part of the Barcoo, which is perhaps 500 miles long, but in view of Dr. Beckler being the collector, I assume it was collected on the Victorian Relief Expedition like the Yunyunga (Yungayunga) specimen.

6. "This *Acacia* differs from all others encountered in the west being of upright habit with almost terete leaves." (By this Mr. Abrahams indicates that it is rare in the district.) Amphitheatre, Cobar (L. Abrahams).

7. Flowers glabrous or minutely pubescent, petals not recurved, calyx very short, irregularly divided to the base and delicately fringed. Pistil with a very fine, close tomentum. Pods flattish, but one or two long and terete. Arillus with a little ridge, funicle not curved. Pod as otherwise described as Victorian Expedition specimens. (No. 1.) Cobar (Archdeacon Haviland, October, 1911). Petals united more than half way, glabrous and inclined to be recurved, of coarse texture, 5-merous. Sepals narrow, wider at the tip, a few hairs extending right up. Pistil hairy.

See Archdeacon Haviland's paper in *Proc. Linn. Soc. N.S.W.*, xxxvi, 520 (1911), where this plant is referred to as *A. cibaria*, and the pods are described as "cylindrical" and "an inch and a quarter long" (shorter than the West Australian specimens). It is called "Umbrella Mulga."

8. "Umbrella Mulga," Pods mostly short and flattish, but not ripe. Tindayrey, Cobar (L. V. d'Apice, L.S.).

9. "Narrow-leaved Mulga." Coolabah. (J.H.M. and J. L. Boorman.)

10. "Narrow-leaved Mulga." Ivanhoe, via Hay. (K. H. Bennett, No. 2.)

South Australia.—Not quite typical. Mirra Mitta Creek, Cooper's Creek district. (Captain S. A. White, through J. M. Black); Peake River (E. C. Kempe).

Pods mostly flat, but not ripe. One or two unripe seeds show the shape and position of the seed both like the type. Mount Lyndhurst (Max Koch, by whom it was labelled *A. cibaria*).

11. Phyllodes nearly terete and minutely hoary. Pod nearly cylindrical, and hence showing considerable approach to Fitzgerald's *A. ramulosa* and my Laverton, W.A., specimens of that species. Mount Gunson Mine, 90 miles north-west of Port Augusta (Mrs. Beckwith, comm. J. M. Black, No. 7).

***A. ramulosa* W. V. Fitzgerald.**

Journ. W. A. Nat. Hist. Soc. No. 1, p. 15, May, 1904).

Following is the original:—

An erect much-branched shrub of 6-10 feet in height, more or less minutely hoary, branchlets angular. Phyllodia long-linear, with straight or slightly curved callous points, rigid, thick but flat, 4-6 inches long, the numerous fine parallel nerves hardly conspicuous. Peduncles solitary or in pairs, 6-9 lines long. Flowers not seen, but from the scars remaining were in spikes of $\frac{1}{2}$ inch in length. Pod linear-cylindrical mostly 4-6 inches long, hardly or not at all contracted between the seeds, the valves striate, finely tomentose. Seeds longitudinal, oblong, shining dark-brown; funicle short, expanding into a small, somewhat cupular, pale-coloured basilar arillus.

Mr. Fitzgerald described *A. ramulosa* from Lennonville (6 miles north of Mount Magnet), W.A. He did not collect flowers, but described the pod as "linear-cylindrical, mostly 4-6 inches long, hardly or not contracted between the seeds, the valves striate, finely tomentose." It is one of the local Mulgas. I collected pods and flower-spikes from near Cue, in the Murchison district.

The description may be completed as follows:—

Flower 5-merous; calyx very irregular, but sepals bluntly lobed and almost spatulate with the tips ciliate, a third as long as the corolla; petals glabrous and recurved, united two-thirds up; pistil with a close tomentum.

The synonymy of this species appears to be as follows:—

1. *A. cibaria* F.v.M. in *Melb. Chem. and Drugg.*, July, 1882 (in part). See above, p. 10.

2. *A. stereophylla* Diels and Pritzel (non Meissn.) in Engler's *Bot. Jahrb.*, xxxv, 307 (1905).

See also Ewart and White, *Proc. Roy. Soc. Vict.*, xxii, 92 (1909).

Diels and Pritzel quote what they call *A. stereophylla* Meissn. and add *A. cibaria* as a synonym. Following is a translation of their remarks, and although I have not seen the specimen described in the first paragraph, it is evident to me that it is *A. ramulosa* W.V.F.

"To the description is added:—Up to 3 m. high, phyllodes glaucous-cinereous, legumes afterwards pendulous, thick, more or less smooth, coriaceous but scarcely woody, distinctly longitudinally striate (the younger ones sometimes shortly cinereous-pubescent), narrowed slightly between the seeds, seeds longitudinal, thick but hardly twice as long as broad, concave in the middle of both sides.

"In the Austin district, near Menzies, in open shrubby places in sandy-muddy soil, in fruit (m. Oct. D. 5,123) near Carnarvon, at the mouth of the Gascoyne River, in sandy soil, in fruit (m. Aug. D. 3,724). Also in the Berlin Herbarium there is an undetermined specimen collected at Shark's Bay in 1830 by Gaudichaud, which agrees entirely in fruit and flowers with preceding specimens.

"With these specimens collected by us and with the originals of *A. cibaria* F.v.M., in the Melbourne Herbarium, agreeing entirely with every description of *A. stereophylla* Meissn., we think *A. cibaria* ought to be suppressed.

"This species (*A. stereophylla*), with the fruit up till now unknown, was placed by Bentham with doubt close to *A. acuminatum* Benth. Now by the structure of the pod, our specimen appears to belong close to *A. xylocarpum* A. Cunn." (It is evident that the authors have got a wrong impression as to what *A. stereophylla* Meissn. is. J.H.M.)

Habitat.—This species occurs in a number of places in the Eastern and Murchison Gold-fields of Western Australia, and it has recently been found at Tanami in the Northern Territory. It will probably prove to have a very wide range in arid country. Following are some specific localities:—

Western Australia.—(a) "An erect, much branched shrub of 6-10 feet." Lennonville (Murchison River district). Type. (W. V. Fitzgerald.)

(b) A spreading shrub of 8-10 feet. Laverton, 211 miles north of Kalgoorlie. (J.H.M.)

(c) Tampa, 122 miles north of Kalgoorlie (J. F. Jutson, No. 11). Pods flat in the unripe state, and doubtful because so unripe.

(d) Coolgardie (L. C. Webster).

(e) A shrub of 2-3 m. ($6\frac{1}{2}$ -10 feet) high. Watheroo Rabbit Fence (Max Koch, No. 1,662). This was named *A. ramulosa* by Fitzgerald, with *A. cibaria* F.v.M. and *A. stereophylla* Meissn. as synonyms. See also note by Ewart and White already quoted. These authors attribute this labelling as "probably Diels and Pritzel." This may be, but the National Herbarium, Sydney, has received from Mr. W. V. Fitzgerald portion of his herbarium as a gift, and the above specimen is labelled (not recently) in his handwriting,—"*A. stereophylla* Meissn. = *A. cibaria* F.v.M. = *A. ramulosa* W.V.F."

Northern Territory.—Tree 25 feet high. Tanami, collected by Dr. H. I. Jensen, without flowers and fruits, appears to be *A. ramulosa* (C. E. F. Allen's No. 213).

EXPLANATION OF PLATE 230.

(*Acacia brachystachya* Benth., A—M.)

A. Flowering twig from Cobar, N.S.W.

B. Flower.

C. Pistil.

D. Floral bract.

E.

F. } Another flower showing slight variation from B.

G.

H. Fruiting twig from Yunyunga Mountains, Victorian Exploring Expedition. (See p. 9.)

I. Immature pod, thin and flat, but of full length, from North Bourke, N.S.W.

K.

L. } Drawings of three seeds showing variation in the length and twisting of the funicle, and

M. } in the shape of the arillus.

(*Acacia ramulosa* W.V.F., N—S.)

N. Flowering twig from Watheroo Rabbit Fence, W.A.

O. Flower.

P. Pistil.

Q. Immature fruits, terete, and of full length, from Laverton, W.A.

R. Mature fruit from Laverton, W.A.

S. Drawings of two seeds showing variation in the funicle.

M. Flockton del. et lith.

TWO NARROW-LEAVED MULGAS.

(*Acacia brachystachya* BENTH.) (A-M) (*A. ramulosa* W. V. FITZGERALD.) (N-S)

No. 226.

Callistemon viminalis (Solander) Cheel.

Large or Drooping Bottle-brush.

(Family MYRTACEÆ.)

The credit of working out this species belongs to Mr. Cheel. I have arranged the matter so as to bring it into the general scheme of this work, and that, together with a few minor additions, has received the concurrence of Mr. Cheel.

Botanical description.—Genus, *Callistemon*, R. Brown, in *Botanical Register* t. 393 (1819).

Calyx-tube ovoid, campanulate or urceolate, adnate to the ovary at the base, the free part erect or contracted; lobes 5, imbricate, more or less scarious, deciduous. *Petals* 5, orbicular, spreading, longer than the calyx-lobes. *Stamens* much longer than the petals, indefinite, usually in several series, free or very rarely collected in clusters or very shortly united opposite the petals, or all very shortly united in a continuous ring; *anthers* versatile, the cells parallel, opening longitudinally. *Ovary* villous on the top, usually convex, with a slight depression round the style, 3 or 4-celled, with very numerous ovules in each cell, horizontal or ascending and covering a peltate placenta; *style* filiform with a small terminal often scarcely conspicuous stigma. *Fruiting-calyx* more or less hardened and enlarged, with a truncate orifice; capsule enclosed in and more or less adnate to the calyx, opening loculicidally. *Seeds* linear or linear-cuneate, testa thin; cotyledons plano-convex, longer than the radicle. Tall shrubs or small trees. *Leaves* scattered, terete, linear or lanceolate, entire, coriaceous, nerveless or with a prominent midrib and nerve-like margins and pinnate veins. *Flowers* showy, pale yellow or crimson, in dense oblong or cylindrical spikes, at first terminal, but the axis very soon growing out into a leafy shoot, the lower leaves of the new shoot usually reduced to dry very deciduous scales, each flower closely sessile or slightly immersed in the woody rhachis. *Bracts* none or dry and deciduous, rarely here and there more persistent and leaf-like. *Stamens* in most species $\frac{1}{2}$ to 1 inch long or even more.

The genus is confined to Australia. As originally observed by R. Brown, it passes gradually into *Melaleuca*, with which F. Mueller proposes to reunite it, the *C. speciosum* being, as it were, intermediate between the two. On the other hand, it is as closely connected with *Kunzea* through *K. Baxteri*, and that genus again passes into *Leptospermum*. Yet the great majority of species of each of the four groups are separated by characters so marked and prominent that it appears more convenient to retain the four genera as generally admitted.

The species of *Callistemon*, as thus limited, have a remarkable similarity in their floral characters, scarcely differing but in the breadth and consistence of their leaves and in the length and colour of the stamens. They might, indeed, almost be considered as varieties of one species. (Bentham in B. Fl. iii, 118.)

Botanical description.—Species, *C. viminalis* Cheel, in *Australian Naturalist*, Sydney, ii, 185 (1913).

The first publication of this name, as *Callistemon*, however, is in the Preface to Maiden's "Illustrations of New South Wales Plants," Part iii (1911), in the key to the species of *Callistemon*, when the sub-section *Tubuloso-Callistemon* is proposed, to receive *C. viminalis* and *C. speciosus*, which are contrasted thus:—

I. *Tubuloso-Callistemon*.

Filaments shortly but distinctly united at the base and cohering into a ring or tube.

A. Leaves comparatively thin and thickly studded with poroso-punctulate or resinoid oil-glands, easily seen if held up to a clear light or if examined by a pocket-lens on both sides of the leaves.—*C. viminalis*.

B. Leaves thick, the oil-glands very obscure.—*C. speciosus*.

Then we have:—

"Mr. E. Cheel exhibited herbarium specimens, together with a number of fallen flowers of *Callistemon viminalis* Cheel, showing the filaments united at the base into a distinct ring or tube. A piece of timber measuring 10 inches diameter, was also exhibited, taken from a tree removed in May last from the border in Garden Palace Grounds, along Macquarie-street, which has now been done away with, for the purpose of widening the street.

"Specimens of this species were originally collected by Banks and Solander, when accompanying Captain Cook to these shores in 1770, and it was named by Solander in his MS. as *Metrosideros viminalis*. Solander's name was published by Gaertner in his *De Fructibus et Seminibus Plantarum*, Vol. i., p. 171, and a figure of the fruits is given in the same work on table xxxiv, fig. 4. It is also mentioned by Sir James E. Smith in *Transactions of the Linnean Society*, Vol. iii, p. 272 (1797), who says:—'At first I had a suspicion that the *Metrosideros viminalis* of Gaertner was the same as his *M. salignus*, but having examined the original specimens in Sir Joseph Banks' collection, was convinced that they were very different, having linear-lanceolate leaves, not tapering at the ends, and with downy flowers.'

"The name *Metrosideros viminalis* seems to have been overlooked by both Bentham and Mueller, as it is not mentioned in the *Flora Australiensis*, nor in any of Mueller's works.

"The habit of this species is so distinct in the field, that there should be no difficulty in distinguishing it from other crimson flowering species, as it grows into a fine tree, from 20 to 60 feet, or more, in height, and the trunk is usually fairly large, and produces some very useful timber, even larger than that of *C. salignus*.

"The leaves somewhat resemble those of *C. lanceolatus*, but are thinner in texture, and the oil-glands are different, when closely examined.

"It is interesting to note that the peculiar way in which the filaments cohere at the base into a distinct tube, was also noticed by Bentham, who included specimens collected on the Pine River, Queensland, by Fitzalan, 'with the filaments united at the base,' under *C. lanceolatus*.

"These specimens are in the collection at the National Herbarium, Melbourne, and should be now named *C. viminalis*.

"A key to the species of the genus *Callistemon* is published in Part 3 of Mr. Maiden's 'Illustrations of the New South Wales Plants.' " (*The Australian Naturalist*, Sydney, ii, 185 (1913).)

This, however, is not in itself a full description (although it quotes the old descriptions of Solander and Gaertner). Following is a full description:—

A tall shrub or more often a small tree from 15 to 40 feet high, usually with pendulous branches, and the trunk covered with a coarse persistent bark which with age becomes somewhat flaky. The trunks of some trees measure from 8 inches to 1 foot in diameter.

Leaves linear-lanceolate, very variable in size, but usually from 2 to 5 lines broad in the widest part of the leaf, and from $1\frac{1}{2}$ to $3\frac{1}{2}$ inches long.

Venation rather prominent, the lateral veins running obliquely to the intramarginal nerves.

Oil-glands very numerous, easily seen if held up to the light as transparent dots, and in dried specimens appearing on both sides of the leaves as resinoid poroso-punctulate minute tubercles.

Flower-spikes rather shorter than those of *C. lanceolatus* and brighter in colour, the rhachis is also more woolly-tomentose which with age falls off. Frequently the flowers are axillary.*

Bracts ovate-lanceolate, 5–8 mm. long, very deciduous.

Calyx-tube nearly cylindrical, covered with silky-hairs, lobes very deciduous.

Petals usually greenish-coloured, but in some North Queensland specimens of a deep red colour.

Stamens about $\frac{3}{4}$ inch long, usually bright crimson colour, but in some Queensland specimens of an intense blood-red colour, connate and cohering at the base into a distinct ring or tube.

Anthers reddish-brown or occasionally tinged with a yellowish-brown colour.

Fruits somewhat cyathiform or ovate-cylindrical in general outline when mature, quite truncate at the orifice, the valves or cells being quite exposed, the seeds maturing and fruits rarely remaining on the plant more than a year, and in this latter respect differs considerably from any other species of *Callistemon* which usually have the fruits remaining on the plants from two to four years.

Affinities.—In general habit this is very distinct from any of the other crimson or scarlet flowering species, and in the forest, or under cultivation, can readily be distinguished by its tree-like and drooping appearance. In the herbarium the specimens have hitherto mainly been confused with *C. lanceolatus*.

The Endeavour River specimens, originally collected by Banks and Solander in 1770, are recorded and figured by Britten, as already noted, as *C. rigidus*, and he expresses a doubt as to whether they can be separated from *C. lanceolatus* DC.

C. rigidus R.Br., figured in *Bot. Reg.* v., t. 393 (1819), is the type of the genus, and is recorded by Bentham as having been collected by Brown on the Lane Cove River (Port Jackson).

It seems incredible that such an eminent botanist as Brown would apply the specific name “*rigidum*” to such an unrigid branched tree as this is, or that he would have overlooked the filaments which are distinctly united at the base into a distinct ring, and which may be picked up by the handful under the trees when in bloom, still cohering.

Besides the general habit of the species, it must not be overlooked that the basis of the genus *Callistemon* was founded by Brown on the distinctly free filaments.

Botanical Name.—*Callistemon*, from the Greek *Kallistos*, beautiful, and *stemon* or *stamen*, in allusion to the beautiful stamens of some of the species. *Viminalis*, Latin adjective, derived from the noun *viminalia*, signifying “all trees and shrubs that bring forth twigs fit to bind or wind.” The idea is, having slender, tough branches, like those of Osiers. Perhaps the suitability of the name was more descriptive than Solander knew.

* See *Proc. Linn. Soc. N.S.W.*, xli, 219 (1916) for a similar occurrence.

Vernacular Names.—The only names I have actually heard applied to this tree are “Red Bottle-brush” and “Water Gum.” But most of the *Callistemons* have red filaments, so that confusion will arise through use of the name. “Large or Drooping Bottle-brush” is suggested, but these names are not free from ambiguity. “Water Gum” is in common use for *Tristania laurina*, and it is a pity to disturb it. The name “River Myrtle” has been used in Queensland, but “Myrtle” had better be restricted to *Myrtus* or allied genera.

Aboriginal Name.—“Marum,” in use by the aborigines of the Pioneer River, near Mackay, Queensland, according to Dr. Griffith, quoted by Bailey.

Synonyms and Bibliography.

(a) *Metrosideros viminalis* (Soland. MSS.) Gaertner, *De Fructibus et Seminibus Plantarum*, Vol. i, p. 171, t. 34, fig. 4, (1788) as follows:—“Calyx subhemisphaericus, crassus, edentulus. Capsula trilocularis. Semina immatura minuta, angulata.”

(b) Botany of Cook's Voyage (Banks and Solander) edited by Britten. In Vol. ii, p. 37, we have Solander's MSS. quoting this species, and at fig. 109 it is named *C. rigidus* R.Br., in error. We have Banks and Solander's specimen, kindly given to the National Herbarium, Sydney, by Mr. Britten, and it is *C. viminalis* (Solander) Cheel.

(c) J. E. Smith, *Trans. Linn. Soc.* iii, 273 (1797).

(d) In Persoon's *Synopsis Plantarum*, Vol. 2, p. 26 (1807), it is also described as follows:—“Fol. alternis lineari-lanceolatis, flor. confertis lateralibus pubescentibus.”

(e) Willdenow, *Enum.* 514 (1809).

(f) Link *Enum.* ii, 26 (1822).

(g) Spreng. *Syst. Veg.* ii, 490 (1825).

(h) Mueller *Fragm.* iv, 53 (1863) as *C. lanceolatus* (in part), and this applies to the following also.

(i) *C. lanceolatus* Benth., not of DC. in B. Fl. iii, 120 (1866).

(j) Bailey, *Queensland Flora* 168 (1883).

(k) Maiden, *Useful Native Plants of Australia* 389 (1889).

(l) Bailey, *Cat. Indig. Plants Queensl.* 17 (1890).

(m) J. W. Fawcett, *Queensl. Agric. Journ.* Feb. 1900, p. 126.

(n) Bailey, *Queensl. Flora* 2004 (1902).

Timber.—In the Catalogue of Northern New South Wales timbers, London Exhibition, 1862, two specimens of timber were supplied by our old friend, Mr. W. A. B. Greaves (then Commissioner of Crown Lands on the Clarence, and now President of the Australian Historical Society) which is probably this species. The

entry is "CX (CXI was similar). *Callistemon* (Water Gum); banks of freshwater creeks, Clarence District. A small sized tree, timber very strong and tough, used for boats' knees and braces, axe and chisel handles. Shavings of this wood will bind like a ribbon."

"Wood of a red colour, close in grain, hard and tough; used for ship building and wheelwrights' work." (*Bailey's Cat. Ql. Woods*, No. 167, as *C. lanceolatus*).

Range.—It is a denizen of the banks or beds of rivers and creeks.

If Mueller's specimen is not a cultivated one it occurs in north-eastern Victoria, but it seems very doubtful. Going north, our nearest record is from the Hunter River (and our most certain southerly record), and then we trace it, coastally, to the Gulf of Carpentaria.

It is, however, not confined to the coastal districts, as in Queensland we have it westerly as far as the Upper Burdekin River, and in New South Wales we find it on a high table-land (New England), and on the western slopes of the table-land at Bingara and Howell.

I have often seen the species when I have not had opportunities of collecting it, and I do not doubt that it will prove to be far the most widely distributed of the arboreal *Callistemons*.

VICTORIA.

German Creek, East Gippsland (Mueller). Locality to be proved. Perhaps or probably a cultivated plant.

NEW SOUTH WALES.

Hunter River (R. Brown, No. 4,661, 1802-5); Williams' River (J. L. Boorman); Copeland to Gloucester (E. Betcher); Gloucester to Taree (W. Heron); Taree (E. H. F. Swain); Dalmorton, near Grafton (J. L. Boorman and J.H.M.); Tooloom, on banks and bed of the river (J.H.M.); Tabulam (J. L. Boorman and J.H.M.); Upper Clarence River (E. Cheel); Lismore, on banks of Richmond River (W. Baeuerlen); Richmond River (Rev. W. Woolls); Sandiland Range (J. L. Boorman); Boonoo Boonoo (J. L. Boorman); Acacia Creek, Macpherson Range (W. Dunn); Mount Warning (W. Forsyth); New England (C. Stuart, Nos. 7-8); Bingara (J. L. Boorman); Howell, near Inverell (J. L. Boorman and J.H.M.).

QUEENSLAND.

Ipswich (Nernst).

"A good specimen of Bottle Brush, height about 75 feet, girth at the ground 6 ft. 10 in., and girth up 7 feet is 5 ft. 10 in.

"I thought that perhaps it would be a revelation to some to find this tree grows to such dimensions here.

"The South Barhamba or Barker's Creek bounds my land for about 2 miles on one side, is good and permanent water at all times. This is nearly due north-west from Brisbane 100 miles, and the elevation is about 1,200 feet. The climate is excellent, and very much good land. This creek is lined with this tree, and when in flower is particularly handsome." (C. H. Grove, "Kelvin Grove," Nanango, Qld.) (See the photographic illustrations.)

Brisbane (J. L. Boorman); Moreton Bay [Ugly Creek] (A. Cunningham, 1824); Pine River (Fitzalan. Already noted by Benthams, under *C. lanceolatus*, "with stamens united at the base); Pine River (W. Hill); Eales' Station on Wide Bay River (Leichhardt, 5th August, 1843); Rockhampton (P. O'Shanesy, No. 168; A. Thozet; R. Simmons); Pioneer River (Dr. Griffiths); Bowen (W. Marlborough); Shoalwater Bay (R. Brown, 1802-5); Upper Burdekin River (Mueller); Burdekin River, near Charters Towers (H. B. Walker); Antigua Estate, Ingham (R. G. Johnson); Rockingham's and Edgecombe Bays (J. Dallachy); Endeavour River (Banks and Solander, 1770); sources of the Coen River, near Gulf of Carpentaria (Stephen Johnson).

It has been cultivated in the Botanic Gardens, Sydney, for over 60 years at least; it is not rare in Sydney gardens; it has been received from Santa Barbara California, U.S.A.

Two very fine specimens in the Botanic Gardens, Sydney, are:—

One near the Herbarium in the border behind the bed of *Euphorbias* (see photograph), and another in the triangular bed opposite to the statue of "Flora" in the Lower Garden.

Size.—Attains the dignity of a moderately large tree. Mr. W. H. Grove of Nanango, South Queensland, in sending me the photographs reproduced, gives the dimensions of the large one as "height about 75 feet, girth at the ground 6 feet 10 inches, and girth 7 feet up 5 feet 10 inches."

EXPLANATION OF PLATE 231.

- A. Flowering twig.
- B. Buds.
- C. Tip showing bracts.
- D. Bract enlarged.
- E. Stamens united in a ring at the base.
- F. Fruits.
- G. Fruits enlarged.
- H. Broad leaf from Ingham, North Queensland.

[A-G, type, Taree, N.S.W., E. H. F. Swain, November, 1904.]

PHOTOGRAPHIC ILLUSTRATIONS.

1. Tree in Botanic Gardens, Sydney, back of *Euphorbia* bed, below Director's house. Height 40 feet, dividing into four trunks each about 10 inches in diameter, at 2 feet from the ground.
- 2 and 3. Tree 75 feet high, girth at ground 6 ft. 10 in., on the bank of Nanango Creek, together with a portion of Nanango Creek, South Queensland, lined with the same.

20'

DROOPING BOTTLE-BRUSH.

(Callistemon viminalis CHEEL.)

M. F. G. K. 1890. del. et lith.

LARGE BOTTLE BRUSH (*Callistemon viminalis*) IN BOTANIC GARDENS, SYDNEY.

LARGE BOTTLE BRUSH (*Callistemon lanceolatus*). NANANGO CREEK, SOUTH QUEENSLAND.

APPENDIX.

SOME NOTES ON SEEDS AND FRUITS, OF MORE OR LESS INTEREST
TO THE FORESTER.

1. These terms are very commonly in use, and the vernacular uses are not always the same as the botanical uses. It will be time well spent to endeavour to see what the words mean.

2. The seed is a fertilised and ripened ovule. (The contained embryo, the future plant, is usually well developed when the seed ripens).

3. In commerce "Grass seed" is composed of a piece of rachilla, with flowering glume and pale attached.

In the Umbelliferae (Carrot, &c., Family), the fruit is a Cremocarp, but it usually goes under the name of seed, *e.g.*, Caraway seed. In ordinary language, a seed is that which is sown, whether it be botanically a fruit, or botanically more than the seed.

In the Compositae we sow the fruit of such plants as Asters, Marigolds, Zinnias.

4. The fruit is the ripened ovary of the seed-plant and its contents. (Incidentally it is made to include such adjacent tissues as may be inseparably connected with it.)

5. A *pistil* is (usually, not always) differentiated into three different parts. :—

(a) A lower swollen portion called the *ovary*.

(b) A neck-like portion termed the *style*.

(c) The top of the style, which is called the *stigma*.

6. A single pistil is termed a *carpel*.

In a particular flower there may be one or more carpels, and the aggregate in a flower is termed the *gynæcium*.

There are names for such flowers according as the gynæcium consists of one, two, three, or many carpels. These names are monocarpellary, dicarpellary, tricarpellary, or polycarpellary.

7. Each carpel may contain one or more small bodies called *ovules*.

8. *Syncarpous gynæcium and fruit*. When a gynæcium contains more than one carpel, and its carpels cohere to form a single body, it is said to be *syncarpous*. This cohesion consists of the fusion of the walls of the carpels, and often extends to the remainder (including styles and stigmas).

When the carpels remain distinct, the term *apocarpous* is employed.

These terms are also applied to the fruits, so that we may have a *syncarpous* fruit (ex. Orange, Passion-fruit), or an *apocarpous* fruit (ex. Garden-pea, Dog-rose).

9. The covering of a fruit is termed the *pericarp*. It may be dry or fleshy. It may consist of three layers, as in the peach or plum, where the *epicarp* is the external layer or skin, the *mesocarp* is the intermediate layer or pulp of the fruit, and the *endocarp* or *putamen* is the internal layer,—the hard shell which encloses the kernel,—the seed.

10. The peculiar fruits of some of the large families of plants have received special names;

<i>Cruciferae</i>	...	...	...	...	...	Silqua.
<i>Umbelliferae</i>	...	...	...	...	...	Cremocarp.
<i>Leguminosae</i>	...	...	...	...	...	Legume.
<i>Pyrus</i>	...	...	...	...	...	Pome.
<i>Cucurbitaceae</i>	...	...	...	...	...	Pepo.
<i>Coniferae</i>	...	...	...	...	...	Cone.
<i>Gramineae</i>	...	...	...	...	...	Grain or Caryopsis.

11. The popular idea of a fruit is something to eat. In fact there is a sub-classification of edible fruits, into fruits and vegetables—cucumbers, marrows, &c., being not looked upon as fruits, which they really are. The botanical meaning of the word has been already given, and speaking from a very wide experience, I find that my correspondents have difficulty in realising this botanical meaning. As a matter of fact, a very small proportion of fruits are edible, and many of the edible ones have been brought to their present state by the efforts of man.

The flesh of the apple, pear, &c., consists of the swollen peduncle; the strawberry consists of a fleshy receptacle covered with ripe carpels (the “strawberry seeds” or achenes); the pineapple consists of the mature gynæcia of a number of flowers in a state of cohesion; in the grape we have the placentæ undergoing a pulpy development, and so on.

12. Kerner and Oliver put the question of fruit definition in this way:—

Intimately connected with the developing seeds is the structure in which they are contained, and in which they were originally fertilised. This is known at the time of fertilisation as the *pistil* or *ovary*, and later, when the seeds are ripe, as the *pericarp*, *seed-capsule* or *case*. As a rule this structure is known to botanists as the *fruit*, though this designation is open to criticism. In a broad sense the fruit in Phanerogams should include everything which undergoes alteration after fertilisation either in the flower or flowering axis. All these changes take place in the parts in question for the purpose of promoting the interests of the embryo, and properly equipping it when the time comes for its severance from the parent plant, consequently the whole of the structures which participate in this object should be regarded as the fruit. From this point of view the seed-case or pericarp (derived from the pistil) constitutes only a portion of the fruit. Since, however, the seed-case in a very large number of cases approximates to, and essentially constitutes the whole fruit, we will not press our quarrel with the descriptive botanists to the point of pedantry, but, having made our protest, fall into line with the usual terminology. (Kerner and Oliver, ii, 427.)

13. I have had more correspondence with my friends concerning Eucalyptus fruits than in regard to those of any other kind of tree, country people not finding it easy to call them fruits, but not objecting to call them “seeds” or “berries,” indeed anything but fruits. I have some notes on the subject under Capsule (see p. 27).

Classification of Fruits.

The author of almost every botanical book has his own ideas as to the classification of fruits. There are very great difficulties in the way, arising from different points of view, and what I submit is not so much a scheme of classification as a convenient arrangement for most of the fruits which have more or less interest for Australians.

We can divide fruits into dry and succulent, and into dehiscent and indehiscent.

A fruit is *dehiscent* if it bursts when ripe and lets out the seed. Ex. Wattle pod.

A fruit is *indehiscent* when it does not open when ripe, but falls off with the seeds. Ex. Peach.

The following tabular classification of fruits I have copied from Henry Kraemer's "Textbook of Botany and Pharmacognosy" (Lippincott).

The classification according to pistil will be understood from what has been just stated. My classification, though not intended to be so strictly scientific as that of Mr. Kraemer's, may have some utility from a popular point of view, while points of departure of the two groupings can be seen in a moment.

[*Etaerio* is that class of fruit of which the strawberry is an excellent representative.

A *Utricle* is an achene with a loose pericarp as in *Chenopodium* (a genus of Saltbushes).]

Here follows the classification offered in Webster's "New International Dictionary" :—

[*Cypselæ* is the special name sometimes given to the fruit of the *Compositæ* (Daisy Family). It is a form of achene.

It will be observed that *Loment* is separated from *Legume*, which seems unnecessary.

The position of *Strobile* is suggestive, and also the relegation of the *Etaerio* and *Pome* to the category of "Spurious fruits."]

1. INDEHISCENT DRY FRUITS—

Nut.

Achene.

Caryopsis.

Samara.

The *Nut* is dry and one-seeded and the pericarp is hard and thick.

In the Hazel-nut or Barcelona-nut the nut is surrounded by a green leathery partial casing or involucre.

The Acorn (Oak, *Quercus*, not the Australian Oak, which is *Casuarina*) is a nut in a cup-shaped involucre called a cupule. The calyx-tube in *Eucalyptus* used to be called a cupule by the old writers.

The Spanish or Sweet Chestnut. Fruit a one-seeded nut, the cupule prickly and bursting into valves.

An *achene* is a one-seeded fruit where the pericarp is leathery and non-adherent to the testa. Such fruits are frequently mistaken for seeds, but may commonly be distinguished by the remains of the style upon their surface.

Examples are :—

Buttercup; Clematis (with long plumose tails); the fruits of Compositæ (Daisy Family) generally. The achenes of Compositæ may be surmounted by a large feathery pappus (Black Thistle); or consist of small scales (Sunflower). In *Bidens*, "Pitchforks," we have a pappus of rigid, retorsely hispid bristles. The pappus is somewhat similar in *Calotis* (Bindi-eye).

The Strawberry consists of a fleshy receptacle, and dotted over the surface are small so-called "seeds"; these are examples of achenes, but the strawberry itself belongs of course to the category of fleshy fruits.

The mature fruit of a Rose resembles a tiny apple, but a vertical cut through it shows that it consists of a hollow receptacle with a number of achenes on it.

Where the pericarp is adherent to the testa we have a *Caryopsis*. This is characteristic of the grains of grasses (Gramineæ) *e.g.*, of Wheat. (Some authors combine achene and caryopsis).

The *Winged Nut* (or *Winged achene*, often called a *Key*) is one-seeded, and has the pericarp enlarged into a more or less membranous rim. Some writers include the "Key" in the Samara. Examples are—*Ventilago viminalis* ("Supple Jack"), see Plate 34, Part IX; Elm (*Ulmus*); Ash (*Fraxinus*).

The *Samara* is that form of winged fruit which when ripe splits into two halves, each with a single fruit and each winged half is held together by a thin divided stalk. They fall away singly. [It is a form of bipartite schizocarp. See below.] Examples are :—The Western Whitewood (*Atalaya hemiglauca*), see Plate 60 Part XV of this work; "Boyong" or "Ironwood," a tree of our northern brush forests (*Tarrietia*); Maple (*Acer*).

ii. SCHIZOCARPS OF "SEPARATING FRUITS."—

The *Schizocarp* may be regarded as consisting of a number of achenes united together. Each of its components (a closed carpel) known as *mericarps*, remains indehiscent, like an achene, and is distributed with its contained seed.

Schizocarps are mostly aggregate.

Examples :—Bipartite Schizocarp = diachenium = Cremocarp (Umbelliferae); Tripartite Schizocarp (*Tropæolum*); Quadripartite Schizocarp (*Ajuga*); Quinquelpartite Schizocarp (*Geranium*).

In such fruits as that of the Mallow (*Malva*) known to children as "cheeses" the schizocarps are many (multipartite).

Cremocarp;—In the Umbelliferae, the two mericarps into which the Schizocarp splits remain for a long time suspended from the tips of a forked prolongation of the axis. For a description of Umbelliferous fruits, see B. Fl. iii, 335.

The cremocarp may be looked upon as a wingless Samara.

iii. DEHISCENT DRY FRUITS.—

Follicle (with one carpel).

Legume (with one carpel).

Silique.—Silicula (with more than one carpel. Dehiscence longitudinal).

Pyxis (with more than one carpel. Dehiscence transverse).

Follicle.—Where the fruit opens by one suture (usually the ventral) only, to which the seeds are attached.

Kurrajong and Sycamore and Flame Tree (*Brachychiton*).

Honeysuckle (*Banksia*), Native Pear (*Xylomelum*), Waratah (*Telopea*), and some other Proteaceous plants.

Asclepiadaceæ, *e.g.*, *Gomphocarpus fruticosus*, the "Silk-cotton weed," a membranous inflated follicle, covered with long, soft prickles; Oleander (*Nerium*); Larkspur (*Delphinium*).

Legume.—In this kind of fruit the opening is by two sutures, the dorsal (back), and ventral. It is commonest called a Pod.

Examples are the Pea, Bean, and Wattle (*Acacia*). This form of fruit is characteristic of the Leguminosæ. Legumes take on an infinity of shapes, *e.g.*—

Triangular (*Daviesia*).

Turgid or inflated (*Crotalaria*, *Swainsona*, the Darling Pea or Indigo).

Winged along the upper suture (*Platylobium*).

Sometimes the portions containing individual seeds break off transversely. This form of Legume is called a Loment or Lomentum, *e.g.*, *Desmodium*, and also *Entada*, the huge pod of a scrambling tropical plant called the Queensland Bean.

Sometimes the Legume is divided into chambers or cells by transverse septa, as in the case of the Purging Cassia (*Cathartocarpus Fistula*).

The Wattle is the Leguminous plant best known to Australians, and the differences in the shapes and sizes of the Legumes have been already shown in successive plates of the present work.

An important character is the funicle, sometimes thread-like, sometimes broader, sometimes encircling the seed once and even more, usually white, but occasionally coloured. It terminates more or less gradually and imperceptibly, in a fleshy cap fitting on the top of the seed, and known as an Aril.

Siliqua.—The two carpels have a common partition or placenta which is membranous in texture, and which is termed the *Replum*. The external valves of the carpels open upwards and expose the seeds, which are attached to the replum.

This form of fruit, which is usually more or less linear in shape, is termed the *Siliqua*, and is characteristic of the *Cruciferae*, e.g., Wallflower, Radish.

The term of *Silicula* (diminutive of *Siliqua*) is applied when the fruit is as broad as long, e.g., Shepherd's Purse (*Capsella Bursa-pastoris*).

Capsule.—This is a dry syncarpous fruit, not previously enumerated, and usually opening *longitudinally*.

The slits may proceed from the apex to the base of the fruit, or may be confined to the upper part, in which case the separate valves are tooth-like.

Capsules may be winged, as in Hop-bush (*Dodonaea*). Sometimes they are covered with setae as in certain *Sterculiaceae*, e.g., *Commersonia*.

In *Syncarpia laurifolia* (Turpentine), see Plate 3, Part I., we have a capsule opening in valves, the capsules connate by their calyces.

In the Grass Trees (*Xanthorrhoea*) the fruit forms a brown, shining, dry, membranous capsule, with a few black flat seeds.

In the capsule we can have three kinds of splitting or dehiscence :—

- (a) *Septicidal*, when it takes place along the ventral sutures. Example, *Flindersia*, where there are five boat-shaped valves, bearing blunt prickles.
- (b) *Loculicidal*, when it takes place along the dorsal sutures. Examples, *Pittosporum*; *Synoum glandulosum* (False Rosewood); *Cupania*; *Doryanthes* (Gynez or Giant Lily); *Iris*.
- (c) *Septifragal*, when the valves separate from the partitions (dissepiments) of the ovary, e.g., Thorn Apple (*Datura Stramonium*).

The Capsule may open by pores or small apertures in the pericarp, when the dehiscence is said to be *porous*, e.g., Poppy (*Papaver*); Snapdragon (*Antirrhinum*).

Cases of partial dehiscence, when it only takes place at the top of the capsule, the valves being indicated by teeth, e.g., certain Chick weeds (*Stellaria*); *Primula*; but especially in *Eucalyptus*.

The fruit of *Eucalyptus* is very important to us in Australia. It consists of a more or less enlarged, tough leathery or woody calyx-tube, adnate* to and enclosing the horny capsule. The valves or capsular teeth (i.e., the tops of the capsule) sometimes protrude beyond the calyx-tube; in other cases they are flush with the top or sunk beneath the level of the calyx-tube. The calyx-tube has usually a circular sculpture or marking termed the "rim." This shows the original position of the operculum.

The rim may, in certain species, e.g., *E. tereticornis*, *E. exserta*, form a band which is really a portion of the capsule which has protruded from the calyx-tube. The capsule in *Eucalyptus* is so variable that a special chapter would be required to do it justice.

* Adnation or union of dissimilar parts, e.g., stamens with petals; calyx with ovary (as in the present case).

The capsule has a persistent axis which varies in length and shape. It is sometimes quite a column, at other times quite small. It is called a *Columella*.* Mueller calls it "placental column" and in his *Eucalyptographia*, under *E. Preissiana*, figures a good many of them, showing how variable the columella is.

Sometimes the calyx-tube has blunt teeth, but that is quite rare.

In *Pyxis* or *Pyxidium* we have a capsule in which the dehiscence is *transverse* or *circumscissile* (in contradistinction to longitudinal). The upper part of the carpels falls off in the form of a cap or lid. *e.g.*, Pimpernel (*Anagallis*); *Plantago*; *Red Clover*.

iv.—SUCCULENT OR FLESHY FRUITS.—

Drupe.

Berry.

Pome.

Etærio (see Aggregate Fruits).

Drupe.—The *pericarp* is divisible into the outer layer, which forms a thin skin (*epicarp*); the middle layer is succulent or fleshy (*mesocarp*); the inner layer (*endocarp*) forms a stone or "pyrene," *e.g.*, Cherry, Plum, Peach.

In the Almond the fleshy layer is reduced to a minimum.

In Blue-berry Ash (*Elæocarpus*) the pericarp is of a Prussian blue colour.

In the Coco-nut the drupe is large, ovoid, or oblong, with a thick, fleshy and fibrous exocarp; endocarp bony, marked at the base with three pits.

In *Fusanus acuminatus*, the Quandong, see Plate 16, Part IV, the bony endocarp is wrinkled and grooved, and is hence sought after for making beads. The same remarks apply to *Elæocarpus*.

A *Berry* has the pericarp fleshy, with the exception of the outer skin (*epicarp*); it usually has seeds embedded in the pulp.

Examples.—Grape, Gooseberry, Currant, and Prickly Pear (*Opuntia*.)

A "Date" is a berry, the stone of which is a true seed, and it must not be confused with the stone of a drupe.

As regards the Orange (and Citrus fruits generally), and Cucumber, (and Melon, &c., fruits generally), the seeds are attached to the placenta, and the fruits are sometimes given special names. The Orange is a *Hesperidium*, and Cucumber a *Pepo*.

In *Eugenia Smithii* ("Lilly Pilly") the fruit is a one-seeded, globular, drupe-like berry.

The *Pome* consists of a "core" which is five-celled, each cell having a horny coat enclosing a seed. The whole is enveloped by the swollen top of the peduncle, *e.g.*, Apple, Pear, and allied fruits.

* The *Columella* is also seen in *Callitris* (Cypress Pine). In *C. columellaris* it is particularly well developed.

AGGREGATE AND MULTIPLE FRUITS.

In a number of cases we have a congeries of fruits massed together, forming what is looked upon by a non-botanist as a single fruit.

Now these congeries may arise in two ways:—

1. From the carpels of a single flower.
2. From a number of flowers crowded together.

1. Is termed an *Aggregate* fruit.

Examples are Buttercup (*Ranunculus*); Rose; Strawberry (the individual fruits seated on a fleshy receptacle); Raspberry; Blackberry; Custard Apple.

2. Is called a *Multiple* or *Collective* fruit.—Sometimes called an Infructescence and less frequently a Sorosis (Greek for cluster), *e.g.*, Pineapple and Mulberry (consisting of a head of fruits, each consisting of a one-seeded, indehiscent nut, enclosed in four juicy perianth-pieces).

Pine-cone or Strobilus.—A spike covered with woody scales or bracts, each with two seeds at its base.

Fig (Ficus); sometimes called a *Receptacle* or *Synconus*. See Plate 2, Part 1. (Here we have a pulpy, hollowed axis, enclosing a number of achenes.)

In the She Oaks (*Casuarina*) we have the fruit a cylindrical cone, formed of the enlarged, woody bracts, which open as valves when ripe. The “seeds” are nuts, laterally compressed, smooth and shining, produced at the apex into a membranous wing. See Plates in Vols. 2 and 3 of the present work.

The Seed.

All plants to attain their fullest development should produce seed, which to be fertile must have been fertilised either naturally or by artificial means.

When the thought that all plants exist for this purpose is fully grasped by the seed-collector (I hope to live to see him paid by results, proved in the Seed Testing Laboratory), he will be the better enabled to understand the reason of the following:—

- (1) Not to collect seeds from stunted trees nor trees not characteristic.
- (2) To gather seeds from those trees facing the prevailing winds, which aid fertilisation, and thus secure a greater percentage of fertile seeds.
- (3) Not to gather seed from an isolated specimen of a species growing among other species of the same genus, as it has been proved so often that cross fertilisation may take place, resulting in the alteration of the progeny; and this may only be found out after many years by a disappointed cultivator.

Collection of Seed.—Most seeds have to be gathered before they are fully ripe (this applies chiefly to dehiscent fruits) or else they cannot readily be saved. For example, the capsules of the Red Cedar (*Cedrela australis*) and the follicles of the Silky Oak (*Grevillea robusta*), also the Jacaranda, suddenly open, and their winged seeds fly

away. This is partly the reason why these seeds are always expensive. They should, therefore, be gathered before the opening of the fruits. They can be caught on a sheet and dried out of draughts or wind or of bright sunshine.

Red Cedar seed is also very liable to attack by insect pests before it is ripe. I have known a number of fairly large trees produce not a single sound seed. The scarcity of good seed stands very much in the way of the propagation of this especially valuable tree.

A paper entitled "Seed Collection on a large Scale" (Pine Seeds), in the *Year Book of Agriculture, U.S.A.*, for 1912, p. 433, is useful for reference. It is illustrated.

Industry of seed-collecting.—Most of the forest seeds collected in this State are those of Eucalypts—trees difficult to discriminate. But that does not in any way justify collectors in supplying mixed seed or seed with misleading names. I feel indignant as evidence is furnished to me of the carelessness of the suppliers of indigenous seeds. If a man desires to learn the names of his seeds botanists will help him without fee or reward, so that ignorance can be no man's excuse in this matter, and a man who supplies named seed of whose origin he is ignorant or careless is a delinquent of a peculiarly despicable kind; one whose wickedness can only be found out after the lapse of years, when perhaps reasonable hopes have been blasted. I would like to see the purveyors of false seed subjected to the penalties of a Draconian law. Human nature is much the same everywhere, and our people are no greater delinquents in this respect than those of other lands, but I have personal experience in these matters when I say that the disastrous effects of the distribution of ill-named or bad seed are comparable—as regards agriculture, forestry, and horticulture—to droughts and pests. Planters of all kinds have quite enough discouragements of an unavoidable character without being saddled with others absolutely within human control.

Danger of planting inferior species.—Whether plantations are made by the Government or by private persons, the importance of planting only useful species cannot be overestimated. I have seen plantations in Australia which should now be revenue-producing, but the timber has no known use, and forms inferior fuel. It is, in fact, unsaleable. In re-afforestation operations by means of our indigenous trees it is necessary to emphasise this point very distinctly. This brings me to one phase of the seed question. The selection of suitable seed is not by any means a matter resting solely with the seedsmen. Customers (official bodies and individuals) ask distinctly for seed of species which we know to be inferior. The reason of this is, in some cases, owing to the fact that, through the confusion of botanical writers in regard to the merits of trees of the especially difficult genus *Eucalyptus*, species have received praise which is not really due to them, and planters, observing these favourable remarks, have placed their orders accordingly. The lesson to be learnt is that grave responsibility attaches to the man who, through imperfect information, praises a tree. The tendency to speak in superlatives as to the excellency of our native vegetation is growing, and should be restrained, and a man who is deceived by glowing accounts of our trees is apt to underrate them when the reaction takes place.

I think I am right in asserting that very few of our landowners have cultivated any considerable number of trees for timber. In the northern hemisphere this practice is well established, and it is a matter well worthy of consideration, by many of our country people, to what extent the planting of trees will afford profitable employment for capital and land. At the same time, as a very general rule, I adhere to my often-expressed view that we require conservation, much more than fresh planting, in New South Wales.

Testing of seeds.—This is a subject which is worthy of special emphasis in connection with forestry. (We have now a small seed-control station in the Botanic Gardens, in connection with our Department of Agriculture, where agricultural seeds may be tested as to name, germinating power, and purity.) The germinating power of seeds is, of course, of paramount importance to the farmer and forester. Not only do seeds vary considerably in the length of time they may be safely kept before sowing, but there is often much variability in seeds in the same parcel through admixture and other causes. I cannot do justice to this subject on the present occasion, but I venture to refer to two excellent papers, which will well pay perusal.* Hardly less valuable is a paper by another author† belonging to the same Department, where homely appliances for the testing of seeds are described. It has long been a matter of surprise to me that seed-testing is so little practised by farmers. Of course, as regards the more difficult points that present themselves in these investigations, the farmer would do well to appeal to the Department of Agriculture for help, but, as a rule, with very little practice, and with appliances to be found in every household, he can test the germinating power of most seeds as well as anybody. And if the citizen, whose purchases of seeds are limited to those required for the horticulture of a suburban garden, were to adopt a similar plan, much heartburning would be saved, and the precautions of seedsmen for the supply and distribution of good seed would be promptly increased.

The larger seeds are often tested by the senses,—the sight, smell, and even taste. The weight of them is noted, and whether they are plump or shrivelled. Many seeds can be conveniently tested in flower-pots, or saucers or pans, nearly full of silver sand and kept moist. These vessels can be kept in a frame or in a green-house.

“Farmers’ Bulletin No. 73,” of the New South Wales Department of Agriculture, by C. T. Musson, of the Hawkesbury Agricultural College, is entitled “Seed and Seed Testing for Farmers.” It contains valuable hints in regard to seeds suitable to all kinds of people who harvest and use them, and the man engaged in the collection and sowing of forest seeds would find much in it of value to him.

Nature’s Method of Protecting the Seed.—In Australia one must often have been struck with the wonderful arrangements in some fruits for the protection of the more

* (a) “Seed Control: its aims, methods, and benefits,” by Gilbert H. Hicks (*U.S. Dept. of Agriculture*). Read before Massachusetts Hort. Soc., Feb. 8, 1896. Boston, Rockwell, and Churchill; pp. 28. (b) “Pure Seed Investigation,” by the same author, reprinted from the *Year Book of the U.S. Dept. of Agriculture* for 1894. The same botanist is author of Circular No. 6, Division of Botany of the same Department, entitled “Standards of the purity and vitality of Agricultural Seeds.”

† A. J. Pieters: “Testing Seeds at Home,” reprinted from *Year Book, U.S. Department of Agriculture*, 1895.

vulnerable seeds therein contained. Take, for example, the case of the Honeysuckle (*Banksia*), *Hakea*, Native Pear (*Xylomelum*), and note the enormously thick and strong casing which protects the seed—and, hence the young plant, for the seed contains the embryo. The dehiscence of the fruit is aided by drying winds, by the heat of the sun, and (though there is vast waste in the operation) by bush fires.

Then the seeds themselves have often a tough, leathery casing, as in Wattles. The embryo can be released in two ways—by a sufficiency of moisture, and by heat—a bush fire; but although a fire may burn through the seed-coat and release the embryo, the result is usually attended with an enormous waste of plant life.

When viewing the growth of large numbers of young seedlings not long after a bush fire, we contemplate the bare, blackened areas, and the beauty of beautiful tiny plants. There are to some extent fortuitous circumstances—tall, dominant, perhaps useless plants are burnt away, and a new growth “starts from scratch” as the phrase goes—but we sometimes forget the enormous destruction of plant life, including seeds, which has caused the present conditions, and the new competition which is now under weigh.

Sowing the Seed.—Seed can be broad-casted, or it can be planted in prepared ground in the forest. But it is usually most economical to propagate forest trees in nurseries, and thence to plant out the seedlings at the proper time. In some moist localities, where it is desired to establish a tree growth on grass land, it has been recommended to sow on the *thick inverted sod*. The top of the sod is usually free from seeds of any kind which would compete with the tree seedling.

To obtain maximum results, it is a safe guide to sow to the depth of the seed's own diameter.

Sound seeds, given the necessary heat and moisture, are easy to germinate; the critical time is just after germination has taken place. When the radicles have only the seed leaves or cotyledons to support, they have already developed fine root hairs, which are easily destroyed by any sudden change of either heat or moisture. There should be just sufficient shade protection to ensure evenness of moisture. The seed beds, boxes, pans, or whatever apparatus is used for raising seedlings, should be thoroughly soaked before sowing, and after sowing at that time of the day when the sun is on the wane, with just sufficient heat to warm the surface of the ground without causing too much radiation.

A fatal mistake is often made by sowing too thickly; the seedlings come up like mustard and cress—to use a gardener's phrase—debilitating themselves for want of room.

The treatment of some tree-seeds can only be learnt by experience. Palm seeds may be six months germinating, and other seeds are so dilatory that they are often thrown out as worthless when such is not the case. The following method of treating Indian Teak seed applies also to those of our White Beech (*Gmelina Leichhardtii*) and of some other difficultly germinable seeds:—“Teak seed, if collected and sown

immediately, will generally take a year or two to germinate; but if a pit be dug, and the bottom filled to a foot deep with sand, the seed spread thickly on this (2 in. to 6 in.) and covered with another foot of sand, and the whole mass well watered; it will be found, on opening it at the expiration of three or four weeks, that germination has already commenced. If it now be taken out and sown, it will spring up almost immediately, provided it be kept well watered.”*

There is a very beautiful western tree called the “Gruie” or “Colane” and whose botanical name is *Owenia acidula*. Its fruit is a drupe, and its seed is enclosed in a “stone” (putamen), so excessively hard and thick that most people who try, fail to germinate it. Such a fruit as this (and there are others) can be best treated by such a method as that described in regard to Indian Teak.

The experience of a friend with “Gruie” seeds or fruits was as follows. He brought a sugar bag of them home and planted some of them in the ordinary way, but failed to germinate them. In disgust, he threw the whole lot away alongside a log in a paddock near the house. He forgot all about them, but eighteen months or two years afterwards he accidentally observed that quite a number of them had germinated. He potted them up, with excellent results. This character of delayed germination is of course very useful to a tree which, like the Gruie, lives in very dry country.

The throwing away of the seeds as rubbish near a log is another method of treating them as Teak seed is treated. Many others of our native trees have seeds which require treatment that is not definitely ascertained, as in the case of seeds which have long been in cultivation in European gardens. There is still much room for experiment in this direction.

Seeds which, when ripe, have tough or hard coverings, can often be germinated with facility if they be collected just before the casing has begun to be tough. Wattle seed, for example, has often been germinated before its outer casing has had time to toughen, but it is obvious that seed in that stage is very liable to injury, and the method cannot be recommended for experiment except to those who are skilled in such work, and who will handle the seeds with especial care, especially if they have to be transmitted to a distance. Such seeds have to be planted as soon as collected, as they are especially liable to shrivel, and, when they lose their moisture, they become worthless. Indeed they cannot be stored unless quite ripe, and the covering of the seed quite tough and hard.

Fully ripened Wattle or other hard seeds require special treatment. The following has been proved to be a good method.

Make a box with sides 9 inches deep, that an ordinary sheet of corrugated iron will cover, fill the box with sandy soil to the depth of 6 inches, soak well before sowing, and place in the hottest part of the propagating ground, the heat and humid atmosphere confined in the remaining 3 inches of air space rarely fails to bring about the germination of the hardest seeds.

* Amery, “Notes on Forestry,” p. 20.

As soon as germination has taken place, the iron should be removed and the box covered with 4 inch-battens, removing first one and then another until the seedlings are hardy enough to stand the full light, when the box should be removed to a cooler, but not too shady a part of the propagating ground.

Keeping of seeds.—Of course seeds vary in their keeping power; some may be stored without detriment for a number of years (*e.g.*, Wattles), others, *e.g.*, imported oaks (*Quercus*) and Black Apple (*Sideroxylon australe*), perish very quickly, and should be packed in charcoal or soil for transport immediately they are taken from the tree. Sometimes stocks of Wattle and similar seeds are shaken up with a little red lead, which helps to destroy insects and to preserve them from others.

Method of sending seeds long distances through the post, &c.—The following are useful wrinkles in regard to Palm seeds.

Palm seeds should be forwarded in little tins, packed with powdered charcoal slightly damped—a good proportion is three (3) tablespoons full of water to every pint of the finely powdered charcoal, and if seed be fresh a good percentage may be expected to come through safely,—good for forty to fifty days transit. Press down the lid of the tin with heaped up charcoal so they do not move about in transit.

Most palm seeds from any humid zone that have to bear a transit of as much as a month or two rarely survive unless packed in damp charcoal and placed in a hermetically sealed tin, as in paper or cardboard the charcoal soon dries out.

Method of storing seeds.—Seeds should never be put away unless quite dry, and care should be taken to see that no insects of any kind have taken them for a host. They should be kept air-tight if possible, or at least away from the influence of changing atmospheric conditions.

When seeds have to be kept in large quantities where bins, drawers or tins are not available or practicable, then the store should be so ventilated that neither undue drying nor sweating shall take place. Wood is preferable to metal for seed-storage, as the latter is more liable to changes of temperature, and condensation of moisture. On the other hand wood is more likely to harbour pests.

A seed store should be kept scrupulously clean and in order; no litter of any kind should be allowed that will encourage mice or other seed-eating pest to come there. Not merely ordinary cleanliness, but scrupulous and finicking cleanliness should be the ideal.

The Bamboo Method of Tree-raising.

The history of the bamboo Method of tree-raising, largely used in India, and successful in every State of the Australian Commonwealth, has been told by the late J. Ednie Brown in his "Tree Culture," and is interesting, and not generally known. "In the Forest Department of India, a system of rearing young plants in short pieces of bamboo cane was introduced a good many years ago by a Captain Beddome, one of the Conservators of Forests there. This was found to be admirably suited for the

purpose, and is thus briefly described in the *Journal of Forestry* for July, 1880 :—
 “Cut the bamboo of which estate baskets are made, and which is not more than an inch or two in circumference, into bits about 3 inches long. Place these pieces endways close together, in thousands, cover with forest mould or fine soil and sow your seed. In this way there will be from one to three or four seedlings in each piece of bamboo. When carried out in the bamboo the best plant can be left, the others being removed and utilised immediately or at a subsequent period.”

“When the subject of forest conservancy was first mooted in this Colony, His Excellency Sir Anthony Musgrave, the then Governor of South Australia, in a lecture on the subject, incidentally referred to Captain Beddome’s system, which he had heard of or seen carried into effect in India. The idea of trying to adopt the method of tree planting here was not, as far as I am aware, suggested at the meeting in question, simply, I would suppose, from the want of bamboos wherewith to carry it into effect. The idea, however, occurred to Mr. Murray, who was subsequently appointed as Conservator to the Forest Board of South Australia, that the same results might be obtained by the use of small pieces of the well-known reed, *Arundo donax*. Acting upon this notion, he had several pieces prepared, filled with fine soil, gum seeds sown in them; and the result was such that, on his appointment to the Forest Board, he suggested that he might be allowed to apply the system to the planting of the Bundaleer reserve, where the Board had just commenced operations. This the Board allowed, and, under the immediate supervision of Mr. John Curnow, nurseryman, the system has been carried out at Bundaleer with a certain degree of success in the raising and planting of *Eucalyptus* plants. *With pines it has proved a failure.*”

The “bamboo” chosen is the common Danubian reed (*Arundo donax*), which flourishes in many parts of the State in muddy situations or by the sides of lagoons. The stems are cut by means of a treadle-saw and a gauge to a uniform length of *about 5 inches* (not 3 inches, as is or was the Indian practice). It is a matter of considerable practical importance to secure uniformity of length and to see that they are cut absolutely at right angles to the axis. The properly prepared fine soil is put into a stack of tubes standing on end and placed close to each other. It is necessary that the soil should completely fill each tube, and this is secured by tapping the tubes from time to time by means of a wooden beater. A little seed is placed in each tube, and the tubes are watered. The tubes are stacked in boxes, moderately tightly, so that they will remain vertical, but not too tightly, because expansion takes place, seeing that the tubes are kept wet. And here it may be mentioned that it is of practical importance to see that the bamboos are not too thick or tough. The bamboo tube is really a flower-pot, but with this difference: that tube and all are planted, so that if the tube will not readily decay in the ground the tender plant becomes pot-bound, or rather tube-bound, and will die or be retarded in growth. It requires judgment to select the tubes, and some growers half rot their tubes before putting seed in them, and sometimes they slit the bamboo or cut away the septum (partition of bamboo). Suppose the little trees to have been successfully grown, they are taken to the place of planting in boxes of a convenient shape.

The method of planting will depend upon circumstances. In operations on the forestry scale, two or more men are employed, a slit is made in the ground by means of a spade, another man comes along and drops in a bamboo-tube with its plant and fixes the earth with his feet, or this is done by a third workman. It is very important to plant the tubes vertically, and to let the top of each be just below the surface. A farmer or other planter who wishes to put in only a few trees, may insert them with the trowel if the soil is sufficiently open. It is obvious that any man of common-sense will, according to his local circumstances, devise labour-saving methods for planting the trees thoroughly and cheaply, for forestry operations, to be successful, must have the cost of tree-planting cut down to the absolute minimum. I am not in favour of tree-planting by contract, except with a well-tried gang of men.

Mr. Walter Gill, the Conservator of Forests of South Australia, has an excellent illustrated article on the subject in the *Gazette* for December, 1900, p. 1130.

Tins in lieu of pots.—In country districts, and particularly in the far west, neither flower-pots nor bamboo-tubes may be available, and yet it may be desired to raise a small stock of trees. In every place tins, *e.g.*, jam tins, accumulate, often so much as to be a nuisance. These tins may be thrown aside till they are thoroughly rusted, and then used as pots for the reception of seeds. Their ragged edges and vertical sides prevent their contents being removed with facility as is the case with a flower-pot, but they can be buried with the plant, just as is the case with the bamboo-tube. If the tins be judiciously rusted, it will be found that when submerged in moist soil they do not long hang together, and the young tree pushes forth its roots through the holes which have rusted in various parts of the tin.

In a paper "Pour remplacer les pots. Tubes de Roseau de Provence (*Arundo donax*)," in the "Journal de la Société nationale d'Horticulture de France" (Nov. 1912), Dr. George V. Perez proposes to extend the Bamboo-method to cuttings. The bamboo-tubes will have to be of a large diameter and the circumstances special, for this method of dealing with cuttings to be useful to us in Australia.

Diagnostic value of seedlings.—In Europe the characters of the seedlings of forest trees that are commonly planted are well known, but in Australia we have much to learn in this direction, particularly in regard to the seedlings of native trees. The seedling has its own diagnostic value, and it is for us to interpret it. Pictorial illustration is necessary to bring out the points, and I only wish I could reproduce the dried specimens of seedlings, and particularly the coloured drawings in my keeping, of the seedlings of native trees.

Other literature.—The following papers more or less deal with treatment of seeds, seedlings, &c., and will be found suggestive to Australians, although they are of course written for American conditions.

1. "Tree-planting in waste-places on the farm," by C. A. Keffer ("Year-book of Agriculture," U.S.A., 1896, p. 323).

2. "How to grow young trees for forest planting," by E. A. Sterling. "Year Book, 1905, p. 183."

3. "Forest planting and Farm management," by George L. Clothier. "Farmers' Bulletin," No. 228, (1905).

Propagation of Trees other than by Seeds.—Some plants, such as planes, willows, poplars, elms, tamarisks, may be propagated by cuttings or divisions.

Layering is a comparatively costly operation, and is only practised with valuable horticultural stuff such as Camellias, Viburnums, &c.

Eucalyptus trees as a very general rule cannot be propagated by cuttings. Exceptions are the Swamp Mahogany (*Eucalyptus robusta*) of Eastern Australia, and the Flooded Gum (*Eucalyptus rudis*) of Western Australia, and in the case of these two species the property is too uncertain to have economic bearings.

Desirability of raising Plants in the District in which they are to grow.

There is great advantage in raising plants in the district in which they are afterwards to be planted out, as all sorts of risks are incurred when plants are moved from a distant locality. Plants stand a better chance if raised from seed or cuttings from plants growing in soil and climatic conditions approximating to those of their new home. Of course, a good deal of experimental work requires to be done in New South Wales, and it is not possible to predict, in many cases, whether a certain plant will succeed or not. If we do not make departures, we shall not progress in human knowledge, and I do not wish to discourage experimental work, but many residents in country districts only wish to plant to a limited extent and desire to be as safe as possible.

Having obtained the seed, the next step is, at the proper season, to sow it. As in this, so in all other important gardening* operations, I recommend professional assistance to be secured wherever possible, for it is the best and most economical course. A professional gardener should always be employed for pruning and spraying, and to supervise the planting.

Public bodies which have not the funds to employ a gardener the whole year round, will find it in the highest degree desirable to employ one for one or two of the winter months, and to pay one a retaining fee to report and advise on the plantations at stated periods during the year.

* Most of the ordinary operations of forestry are familiar to the skilled gardener, for he is the man who, by reason of his training, is best able to supplement his own knowledge with special forestry practice.

The first thing I noticed when I stepped out of the car was the smell of the sea. It was a salty, bracing scent that seemed to fill the air. I took a deep breath, feeling the cool breeze on my face. The sun was shining brightly, and the water was a deep, shimmering blue. I could see the whitecaps in the distance, and the sound of the waves crashing against the shore was a constant, soothing rhythm. I felt a sense of peace and freedom that I had never experienced before. It was as if the world had stopped for a moment, and I was the only one here. I walked along the beach, feeling the sand between my toes. The water was just a few steps away, and I could feel its pull. I wanted to jump in, to feel the coolness of the sea on my skin. But I hesitated, looking back at the car. I didn't want to leave it behind, not yet. I needed it to get home. I took a few more steps, then turned back. The car was still there, parked on the edge of the beach. I walked back to it, unlocked the door, and got in. I sat there for a moment, looking out at the sea. The sun was still shining, and the waves were still crashing. But I felt different now. I felt like I had been to a secret place, a place where time stood still. I smiled to myself, feeling a sense of accomplishment. I had done it. I had stepped out of my comfort zone. I had taken a risk. And I had survived. I looked at my watch. It was 10:30. I had been out there for an hour. I had to go home. I unlocked the car, got out, and walked back to the beach. I took one last look at the sea, then turned and walked away. The sun was setting, and the sky was a mix of orange and pink. The waves were still crashing, but the sound was softer now. I felt a sense of peace and contentment that I had never felt before. I had found a new part of myself. I had discovered a new world. And I was going to keep exploring.

Desirability of raising plants in the desert in which they are to grow.

There is a great deal of interest in the possibility of raising plants in the desert. The question is, is it possible? The answer is, yes, it is possible. But it is not easy. The desert is a harsh environment. It is hot, dry, and has very little soil. Plants that grow in the desert must be able to survive in these conditions. They must be able to store water, and they must be able to tolerate high temperatures. There are many plants that can grow in the desert. Some are native to the desert, and some are introduced. The native plants are usually small, hardy shrubs or trees. They have deep roots that go down into the ground to find water. They also have small, waxy leaves that help them to conserve water. The introduced plants are usually larger, and they are often used for landscaping. They are usually more expensive than the native plants, but they can be more attractive. The question is, which is better? The answer is, it depends. If you want a low-maintenance plant that can survive in the desert, the native plants are the best choice. If you want a more attractive plant, the introduced plants are the better choice. But no matter what you choose, you must be prepared to take care of the plant. The desert is a harsh environment, and plants that grow there must be able to survive in these conditions. If you want to raise plants in the desert, you must be prepared to take care of them. You must be prepared to water them, to fertilize them, and to protect them from the elements. If you are willing to do this, then you can raise plants in the desert. It is possible. It is just a matter of knowing what you are doing.

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Brachychiton acerifolius F.v.M.

The Flame-Tree.

(Family STERCULIACEÆ)

Botanical description.—Genus, *Brachychiton* Schott and Endlicher *Melet. bot.* 34 (1832). See also R. Brown by J. J. Bennett in Horsefield's *Plantæ Javanicæ Rariores*, p. 234.

Following is a translation of the original :—

Calyx 5-fid. Anthers congested. Styles cohering. Stigmas distinct or joined together as a peltate one. Follicles coriaceous, woody, polyspermous. Seeds albuminous, covered with stellate hairs, cohering to one another and to the bottom of the follicle. The radicle of the embryo next to the hilum. Trees (of New Holland) with lobed or undivided leaves.

Botanical description.—Species, *B. acerifolius* F.v.M. *Fragmenta* i, 1 (1858).

A large timber tree, quite glabrous.

Leaves on long petioles, deeply 5- or 7-lobed; lobes oblong-lanceolate or almost rhomboid, occasionally deeply sinuate, the whole leaf often 8 or 10 inches diameter, thin but shining, and glabrous on both sides.

Flowers of a rich red (scarlet), in loose axillary racemes or small panicles of 2 to 3 inches.

Calyx broadly campanulate, $\frac{3}{4}$ inch long, quite glabrous, with short broad lobes, valvate in the bud.

Ovary raised on a short column, quite glabrous, the *carpels* quite distinct, and the *styles* scarcely cohering at the broad radiating *stigmas*.

Follicles large, on long stalks, quite glabrous. (*B. Fl.* i, 229, as *Sterculia*.)

Botanical Name.—*Brachychiton*, from the Greek, *Brachus* short, *chiton* of mail, in allusion to the short bristles, and was given to denote the genus, chiefly distinguished by the seeds having a loose outer coating covered with hairs, which, in some species, are so adhesive that the seeds fall out in their inner coat only, leaving the outer coat adhering to the equally hairy endocarp, with the appearance of the cells of a bee-hive. The appearance of "mail" is more far-fetched. *Acerifolia*, from the Latin *Acer*, a Maple-tree, refers to the shape of the leaves, and in some old books, in which an attempt is made to invent vernaculars, we find the Flame-tree referred to as "The Maple-leaved Sterculia."

Vernacular Name.—The term "Flame-tree" refers to the abundance of the fiery red blossoms which give the tree, when in full flower, the appearance of being on fire. The precise colour of the flower is brilliant scarlet.

A large Flame-tree in full bloom is a noble and gorgeous sight, and is calculated to impress the most phlegmatic person with the beauty of our flora. In its native habitats it is best looked upon from an eminence, and the contrast between the flame-looking mass of a comparatively large tree and the more or less sombre foliage of all other trees never fails to arrest attention. It is a brush tree, and in the bush it always has fairly good conditions, including plenty of shelter. Under cultivation it is very often the case that it lacks one of the essentials of good soil, moisture or shelter, and hence instead of being in flower in one mass, before a single leaf unfolds, it may flower in patches, with more or less foliage, giving the tree a bizarre, and not so fully ornamental an appearance as when the whole shapely tree is ablaze, to be succeeded by the pale-green, also beautiful foliage.

Aboriginal Name.—The late Sir William Macarthur quoted the name "Couramyn" (*N.S.W. Cat. Paris Exhib.*, 1855), as in use in the Illawarra. It is to be noted that the same name was applied to the Kurrajong, so it probably refers to the fibrous bark. In the *N.S.W. Cat. Paris Exhib.* 1862, "Weery Wegne" is quoted by him as in use by the aborigines, presumably also at the Illawarra.

Synonym.—*Sterculia acerifolia* A. Cunn. in Loudon's *Hort. Brit.* 392 (partly) (1830).

Fruit.—A dye is obtained from the seed-vessels, according to the late Mr. W. Guilfoyle. It can only be of academic interest.

Bark.—The bark is fully 2 inches thick when the tree is full grown, and furnishes bast of a most beautiful lace-like texture. The fibre is very simply prepared by steeping, and is suitable for cordage and nets, ropes, mats, baskets, &c., and is useful as a paper material. The tow is of a very elastic nature, and is suitable for upholstering purposes, such as stuffing mattresses or pillows. (Guilfoyle.) The fibre used to be employed by the blacks for making nets and fishing-lines.

Exudation.—It exudes a gum which swells up in water. The mucilage of *Sterculia platanifolia* (young shoots) consists of araban with some galactan, according to K. Yoshimura, *Bull. Coll. Agric. Imp. Univ. Tokyo*, 1895, 2, 207; *Journ. Chem. Soc.* lxx (ii), 60, and doubtless the composition of Australian *Sterculia* gums will be found to be similar.

Timber.—Wood soft, light, and of a light colour. Like other woods of this genus, it can be torn away by the finger-nail, so it can have but a very limited use. A slab in the Technological Museum, which had been seasoned over twenty-five years (having been exhibited at the London International Exhibition of 1862), had a weight which corresponds to 27 lb. 4 oz. per cubic foot.

It and allied timbers might be experimented with by our entomologists to see if they could to any extent be substituted for cork, although I am aware they lack some of the properties of that substance.

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THE FLAME TREE.

(*Brachychiton acerifolius* F.v.M.)

Size.—It is a medium-sized and even large tree. When drawn up to the light in the struggle for existence which goes on in the brushes it may attain the height of 100 feet, with a stem diameter of 2 or 3 feet.

Habitat.—It is confined to New South Wales and Queensland, and to the brushes of the eastern portion, in many places at no great distance from the sea. The range extends from the Illawarra to Southern Queensland. It would be desirable to ascertain the most southern and most northern localities. Illustrative localities in the National Herbarium are as follows, and the reason why it is so seldom seen in herbaria is because flowering specimens, often near the top of the tree, are hard to get at, while they press very badly.

Jamberoo (O. F. D. Cooper); Weston, Maitland District (V. C. Davis); Bonnington Park, Allynbrook (E. J. Laurie).

The Cedar Brush, 10 miles from Silverwood, and 23 miles west of Scone (E. G. Eagar).

I noticed it rarely from Bellingen to the foot of Dorrigo Mountain; then, ascending the mountain, here and there it could be observed in the abyss of vegetation below. It is moderately plentiful on the Dorrigo. A very fine specimen was seen in the Glenfernie Forest Reserve, near the pine-mill. It was not again seen going west. (J.H.M.)

Acacia Creek, Macpherson Range (W. Dunn).

Eumundi (South Queensland).

EXPLANATION OF PLATE 232.

- A. Leaf.
- B. Part of flowering spray.
- C. Flower opened out.
- D. Stamens, monadelphous.
- E. Anthers magnified.
- F. Pistil.
- G. Fruits.
- H. Seed.
- I. Seed-coat broken open, showing embryo.
- K. Embryo.

No. 228.

Eucalyptus rostrata Schlecht.

Murray Red Gum.

(Family MYRTACEÆ.)

Botanical description.—Genus, *Eucalyptus*. (See Part II, p. 33.)

Botanical description.—Species, *rostrata* Schlechtendal in *Linnaea* xx, 655 (1847).

A tall tree with a greyish-white bark, smooth and separating in thin layers (*F. Mueller*, and others), rarely persistent and rough? (*F. Mueller*.)

Leaves lanceolate, mostly falcate and acuminate, 3 to 6 inches long or even more, the lower ones sometimes ovate or ovate-lanceolate and straight, not thick, the veins rather regular, numerous and oblique, the intramarginal one not close to the edge, or in some desert specimens thick with the veins much less conspicuous.

Penduncles rather short, terete or scarcely compressed, bearing each about four to eight flowers on rather long pedicels.

Calyx-tube hemispherical, 2 to 2½ lines diameter.

Operculum more hemispherical than in *E. viminalis* and about as long as or shorter than the calyx without the point or beak, which is almost always prominent and sometimes rather long, or very rarely the whole operculum is elongated and obtuse without any beak, but much shorter than in *E. tereticornis*.

Stamens about 2 lines long, inflected in the bud; anthers small, ovate, with parallel distinct cells.

Ovary short, convex or conical in the centre.

Fruit nearly globular, rarely above 3 lines diameter, the rim broad and very prominent, almost conical, the capsule not sunk and the valves entirely protruding even before they open. (*B.Fl.* iii, 240.)

Botanical Name.—*Eucalyptus*, already explained (see Part II, p. 34); *rostrata*, Latin, beaked, in allusion to the beak-like operculum or cap of the flower-bud.

Vernacular Names.—This is the Red Gum *par excellence* of New South Wales, Victoria, and South Australia. The term “Gum” is applied in Australia to those species of *Eucalyptus* which have smooth barks. This is called “Red Gum,” because it has a red timber. I proposed the name “Murray Red Gum” for it, as it is abundant on the river of that name, and to avoid confusion with the closely-related “Forest Red Gum,” but in any convention for the better use of vernacular names I feel sure that the name “Red Gum” would, by common consent, be reserved to the present tree and timber.

For obvious reasons it is also called “Flooded Gum,” “River Gum,” and “Creek Gum.” It used to be called “White Gum” more frequently than it is at the present time. I think that use is confined to South Australia.

Aboriginal Names.—By the aborigines of the Lower Murrumbidgee (New South Wales) it used to go by the name of “Biall,” while to those of the western interior it was known as “Yarrah.” “Yarrah,” however, according to the late Dr. Woolls, was applied by the aborigines to almost any tree. The late Mr. Forester Kidston stated that it was formerly known as “Gunwung” by the aborigines of the Lachlan.

It was an important tree to the aborigines of Victoria, and the following aboriginal names are quoted:—By Mr. J. G. Saxton, “Moolerr,” and “Bealiba,” Beal—Red or Flooded Gum, Ba—Creek. By Dr. C. S. Sutton, “Yarrah,” “Bwal” (Loddon), “Moolerr,” “Yooro” (Lake Tyers).

Mueller quotes the name “Polak” for the aborigines of the Gascoyne River, Western Australia.

Edible and Non-edible Leaves.—Mr. T. Grieve sent me from Moulamein edible and non-edible Red Gum leaves, on which I reported in the *Agric. Gazette* of June, 1899, p. 496, and at greater length, with the leaves of other trees, in this work, vol. v, p. 74.

I have drawn attention to this preference and repugnance of sheep and cattle for apparently the same leaves on various occasions, and believe it is worthy of the most careful investigation, but I have never been able to induce those who made reports to follow up the matter by careful collection of botanical material. Messrs. Baker and Smith, in their “Research on the Eucalypts,” p. 75, in proposing a variety *borealis*, suggest that this may be one of the forms of the Red Gum whose leaves cattle eat, but as they say that this form does not present any morphological differences to the ordinary form, we are pretty much as we were so far as solution of this particular problem is concerned.

Opercula.—Mr. Walter R. Harper exhibited before the Linnean Society of New South Wales, August, 1901, a necklet made by the aborigines of the Diamantina River, Queensland, of the opercula of this species. The necklet would not last very long, but the use of it was new to me.

Seeds.—The seeds are eaten by the Mount Lyndhurst (South Australia) blacks. (Koch.)

Kino.—This is a useful astringent, and this species could readily produce all the kino (astringent gum) required medicinally in Australia, and there would be a good balance for export; but hitherto there has not been a great demand for it. I gave some notes in a paper entitled “The Murray Red Gum (*Eucalyptus rostrata* Schlecht) and its kino,” *American Journ. Pharm.* lxi, p. 1 (Jan., 1897). Later on we have a paper from a pharmaceutical chemist, W. J. Brownscombe, “Gummi Eucalypti rostratæ,” *Pharm. Journ.* (3) 25th March, 1899, p. 276.

Timber.—It is, however, to the timber that this species owes its high reputation.

In regions of low rainfall, and in the tropics generally, it is considered to be of very little value. For example, in the far west of New South Wales, it is considered to be useless for structural purposes. Its average height is 30 to 40 feet, and diameter 1 to 2 feet. Locally it is not considered of much use, except for firewood. But the limbs and branches make excellent charcoal. A charcoal-burner "prefers it to any other wood for the purpose," while a local blacksmith pronounces the product "excellent." Some specimens of this charcoal were sent to the Technological Museum, and it is well-burnt, clean, and in every respect a good article. Mr. Robert Lucas, in giving evidence before the Victorian Royal Commission on Vegetable Products, states that, in his estimation, this species yields the best charcoal in Victoria for blacksmiths' purposes.

Speaking of Western Australia, the late Dr. A. Morrison wrote to me: "It is singular that in the Murchison district and the North-west (within the tropics) *E. rostrata* is considered the poorest timber of those that grow there."

This simply bears out a point to which I have often drawn attention—that so much depends on the district from which you obtain a timber. Just as a certain species of tree may produce a valuable timber in one locality, and an inferior one in another, so conversely we must not be surprised if a timber that we think poorly of may be very highly esteemed somewhere else. A tree may have an *optimum* as regards its timber in one district and not in another. Consideration of this point may prevent hasty judgments.

In my "Useful Native Plants of Australia" (1889) I wrote as follows:—

This timber is highly valued for strength and durability, especially for piles and posts in damp ground; it is used also for ship-building, railway sleepers, bridges, wharves, and numerous other purposes. This timber is exceedingly hard when dry, and therefore most difficult to work; this limits its use for furniture.

A drawback to this valuable timber is its liability to shell off, which limits its use for flooring, but it is an excellent girder wood.

In the durability of its timber, perhaps, it has only a rival in *E. marginata* (Jarrah), of Western Australia, resisting *Teredo*, *Chehura*, and *Termites*. When properly seasoned it is well adapted for heavy deck-framing, the beams and knees of vessels, and for planking above high-water mark. In Victoria it has been much used for railway sleepers, and various articles of furniture (Woolfs), wheelwrights' work (especially felloes), engine buffers, &c. It should be steamed before it is worked for curving. The specific gravity ranges from .858 to 1.005, or from 53½ to 62½ lb. per cubic foot. A ton of the dry wood has yielded as much as 4 lb. of pearlash, or 2½ lb. of pure potash. (Mueller.) The air-dried wood of this species contained, according to one experiment, 4.38 per cent. of kino-tannin, and 16.62 per cent. of kino-red; the latter (allied to *Phlobaphene*) is soluble in alcohol, but not in water; the large percentage of these two substances in *E. rostrata* is only rivalled, as far as known, by that of the hardest kind of Jarrah (*E. marginata*) (Mueller). In Southern New South Wales it is invariably chosen for house blocks, and preferred for posts, &c., on account of its durability in damp ground. It is also used for slabs, rails, and wheelwrights' work.

A sample of this timber, sent from Victoria to the Colonial and Indian Exhibition, was tested by Mr. Allen Ransome, who reported: "The sample sleeper sent for trial, though a hard specimen, was readily adzed and bored, and a plank passed through the planing machine gave fair results."

Some Victorian specimens were examined for tensile strength by Mr. F. A. Campbell (*Proc. R. S. Victoria*, 1879). His results are 14,000 to 21,500, 16,200, and 15,700 lb. per square inch. "The last specimen was at a disadvantage, not being hung perfectly straight. They all broke with a long fracture."

Later on I wrote :—"The characteristics of Red Gum are its red colour, its strength and durability, resistance to fungus diseases, white ants, *teredo*, &c. In common with many of its congeners, it is very hard to work up when dry. A drawback to this admittedly valuable timber is some tendency to shell off, which limits its use for such purposes as flooring and decking.

Its durability causes it to be largely used for posts and piles in damp ground. It is largely employed in Victoria for railway sleepers, for which purpose it is undoubtedly valuable, though inferior to ironbark. It is an excellent girder-wood. It is a good timber for wood-paving, though inferior to some others by reason of its tendency to warp and shrink during the process of seasoning."

It is an excellent wood for lasting in water.

Mr. J. Stead Parry says :—

Red gum is recognised as one of the best Australian hardwoods, being heavy, hard, and extremely durable, either above or under ground, or under water. The Government of Victoria use it very extensively in the construction of bridges, piers, jetties, and weirs; and for railway sleepers and other purposes. It is also used in the deep quartz mines of Victoria, and in building steamers and barges.

Much of it has a handsome grain and takes a good polish; it has about the same specific gravity as English oak. Red gum is one of the best white-ant resistant woods in this district, where these insects are very destructive; and it is largely used for studs and joists and house blocks. Some millions of feet are now being used in Melbourne and suburbs for street paving blocks.

Aboriginal Implements.—A correspondent, "Bushman," writes as follows to the *Traralgon* (Victoria) *Record* of 5th June, 1917. I am obliged to my friend, Mr. W. G. Piper, for the reference.

The evidence that connects our time with that of the aboriginal is rapidly vanishing, and in another generation or two will have entirely disappeared, at least as far as our forest relics are concerned.

The relics in stone will probably endure for all time, and are still fairly plentiful, even in this district, where the native population was never very large. Occasionally a "Mogo" or native axe is found, and spear flakes, scrapers, and skinning knives in red or grey quartzite can easily be found by the "seeing eye" for such things. The absence of "Kitchen middens" may be taken as good evidence that this part of Victoria was never largely used by the aborigines as a dwelling place, but we have ample evidence in the traces remaining that wandering parties used it from time to time in their hunting expeditions, or when the resistless call to the "walk about" came upon these restless people.

The statement that the aboriginal did not use the bark of the Red Gum tree for canoe making is an error. There were probably more canoes made from this particular specimen of the *Eucalyptus* family than any other, for the simple reason that *Eucalyptus rostrata* was generally to be found when it was most required for such purposes—near to water—and the aborigines made the best use of the material at hand, thus unwittingly carrying out the first principles of engineering. Down the whole length of the Murray River, from Tintaldra to the Goolwa, canoe trees, *i.e.*, Red Gum tree, from which bark has been removed to make canoes, are very numerous, also along the lower Goulburn, particularly from Shepparton to Echuca, they are very plentiful.

Even to-day, three or four can often be seen from one position—sometimes two or more have been removed from the same tree, one above the other. After the Red Gum, the Stringybark (*E. macrorrhyncha*.—J.H.M.) was the most used, particularly about the Tambo, Nicholson, and Upper Mitchell Rivers, and in fact, wherever that particular tree was found near to the larger waterways.

About Old South Gippsland, comprising Tarraville, Port Albert, Welshpool, and Corner Inlet, I believe the Stringybark was exclusively used for the same reason.

So, taken broadly, throughout Victoria, southern New South Wales, and lower South Australia Red Gum or Stringybark canoes were used, the former predominating. These two classes of canoes differed very much in construction, a difference necessitated by the adaptability of the material used.

The process of making a Stringybark canoe was as follows :—Usually a small-sized tree was selected, when a choice was available, generally something under 2 feet in diameter. The bark, for a length of 10 or 12 feet was entirely removed. The ends were then steamed over a fire, rendering it tough and pliant. Each end was then gathered together and securely tied with rope made from the inner skin of the same tree. All remaining chinks or openings were carefully closed up with clay. One or more spreader sticks were fixed across the middle to keep the sides out, and the canoe was complete. The process with the Red Gum bark was entirely different, as the material was not amenable to the same treatment. The bark could not be steamed, gathered, and tied, as it is without grain, and very brittle. To make a canoe, a tree was always selected having a bend or bulge, and a piece of bark, including this bend or bulge, was carefully removed, and the canoe was complete in one operation, as when the bark was laid on its back, so to speak, the ends projected out of the water. Of course this was a very primitive kind of craft, but all the canoes used along the Murray and other streams as above mentioned, were of this type. On every Red Gum canoe tree, wherever found, the bark was stripped from the “knuckle” or back of the tree, and never from a flat or concave side. This may be taken as a safe guide and the genuine canoe tree distinguished from one that may have had bark removed for some other purpose, or one on which the bark had died through the ravages of some insect, or through being struck by lightning. Many authentic canoe trees are preserved here and there, all presenting the above characteristics, about which there can be no doubt.

There is one standing in the reserve between the Melbourne Cricket Ground and Punt-road, Richmond, bearing an inscription stating that a canoe was made from the tree about the time the first white settler arrived in Port Phillip.

A few years ago, the marks of the “Mogo” or stone axe, could be plainly seen, but time and the elements have done their work, and I don't think the marks are now discernible.

Some genuine canoe trees, all Red Gum, at least half-a-dozen I should say, are to be seen to-day along the Latrobe River, between Sale and the entrance to Lake Wellington. These can be seen from the steamer passing down the river, on the northerly bank—anyone interested in the subject can see for themselves what a genuine canoe tree looks like.

According to Brough Smyth (*Aboriginals of Victoria*, i, 299), this is one of the woods used by the aboriginals for making their clubs or waddies (kud-jer-oongs or Gudgerons).

Historic Red Gums.—See the photographic view showing the spot where Hume's party sighted the Murray River, and the gum tree that Captain Hovell cut his name on, 17th November, 1824. Also the monument erected to the memory of the party.

A second historic tree is in the Melbourne Botanic Gardens, and is known as “Separation Tree” because under its shade and near about, some of the people gathered to celebrate “Separation Day,” or the legal separation of Victoria from New South Wales, on 15th November, 1850. There is an article on this tree by Mr. A. C. Neate in the “Home and Garden Beautiful,” (Melbourne), for 1st May, 1915, p. 1043.

Habitat.—It is found in all the mainland States. As regards New South Wales it occurs on the river banks of the interior, but is particularly abundant and readily available in the valleys of the rivers Murray (which forms the greater part of the boundary between New South Wales and Victoria) and Edwards, one of its tributaries. As regards the Murray, nearly the whole of the Red Gum is on the New South Wales side.

In the dry areas it is found in depressions or on creek-banks, in any place where water lodges or sometimes flows. In the interior of the various States the occasions on which the Red Gum is in the vicinity of water may be few and far between.

The Murray River Flats are subject to floods, rendering the Red Gum forests unsuitable for agricultural purposes.

Murray Forests.—Mr. J. Stead Parry, Inspector and District Forester, Deniliquin, at my instigation kindly furnished the following particulars about these Red Gum Forests :—

The most important Red Gum forests on the Murray and Edwards Rivers, both in regard to quality and quantity of timber, and in area are the following :—

Millewa State Forest	...	...	...	...	...	51,350 acres.
Moir State Forest	...	...	...	...	...	30,463 "
Gulpa Island State Forest	...	...	...	...	...	13,376 "
Bama State Forest	...	...	...	...	...	5,530 "
Perricoota State Forest	...	...	...	...	...	39,000 "
Koondrook State Forest	...	...	...	...	...	39,700 "
Campbell's Island State Forest	...	...	...	...	...	10,800 "
Werai and Colimo State Forest	...	...	...	...	...	23,750 "
Total Forest Area	...	...	...	...	...	213,969 acres.

The above forests are in all stages of growth from seedlings and saplings to matured trees.

In addition to these we have a number of small reserves, some of which are carrying very useful timber; others again, are important, not so much for their timber stand and value as for their situation.

The predominating timber on the Murray and Edwards' Reserves is the Murray Red Gum (*Eucalyptus rostrata*), which grows on the low-lying country that is subject to inundation from the overflow of the rivers. The best, most vigorous in growth and the cleanest timber is usually found on land that is annually flooded for a period of from four to six months; providing the subsoil and drainage is good. The soil is chiefly a grey loam over a good stiff clay subsoil.

Situation in relation to transport and market.

The river is navigable for from six to seven months in normal years; and log timber is mostly cut in the months from December to May inclusive; and hauled to landings or depôts on the river bank; when the river is navigable it is removed by steamers and barges to the sawmills; the principal mills being on the banks of the Murray. Piles, girders and railway sleepers are also removed in this way to the nearest wharf for loading on to railway trucks. When logs are being brought down stream they are loaded on what are termed "outrigger barges," the logs being secured at both ends to transverse outriggers. When the barges are loaded they are allowed to drift down stream; and are later picked up by the steamers and towed to the mills. Logs that are brought up stream are loaded into inside barges and towed up by paddle steamer. Loading stations for transit by rail are at Echuca and Koondrook, Victoria, and Moama and Mathoura, New South Wales.

Timber Stand.

The present average timber stand per acre is :—

- (a) Timber suitable for sawmilling purposes—2,285 superficial feet per acre.
- (b) Suitable for sleeper hewing and fencing material—2,454 superficial feet per acre.
- (c) Maturing in ten years—3,386 superficial feet per acre.
- (d) Piles—The number of piles cannot be definitely stated, except by plot or strip survey by a competent man experienced in this class of timber; but it is estimated that on Perricoota and Koondrook Reserve alone, there are now 18,000 piles of 40 to 80 feet in length.

Reafforestation.

Regeneration has taken place over practically all the flooded country; seedlings appear quickly after the débris on the forest floor has been burnt off; wherever much cutting of mature timber has taken place, and where the forests have been swept by fire.

Rate of Growth.

The rate of growth varies considerably and is dependent on character of soil, situation as regards drainage and frequency of flooding. In some instances, trees attain milling size under thirty years, but it is only under exceptional circumstances. Trees have recently been felled near Mathoura from land which I am creditably informed was cleared twenty-four years ago. Some of the trees had a centre girth circumference of 7 feet, and over 30 feet length of bole. On Millewa State Forest, on land near the bank of the river rarely flooded, which was cleared and cropped after 1870 for some years, there is now a forest of young trees 2 feet to 5 feet in girth at 5 feet from the ground. I am of opinion that these trees get good root water. Under other circumstances not so favourable to a rapid growth, I am of opinion that it takes from sixty to eighty years for trees to reach the felling girth—namely 8 feet 6 inches measured at 5 feet above the ground.

[Acquires a girth of 3 feet 6 inches to 4 feet in thirty years—Evidence of Mr. James Shackell, M.L.A., before Victorian Commission on Vegetable Products].

Rainfall and Climate.

Annual rainfall, sixteen inches. Mild winter climate, with occasional heavy frosts. High temperature in summer; a dry heat ranging from 90 to 110 degrees.

Damage caused by Fire.

Extensive damage has been caused to these forests in previous years by severe forest fires, and it is only by taking effective measures to prevent the spread of fire and to minimise fire risks that we can avoid similar losses in future.

Protective measures against Forest Fires.

Measures have been taken to establish effective firebreaks on these State Forests during the past two years; and four small gangs of men are now engaged in the preparation of breaks in different parts of the reserves where the greatest danger is believed to exist; and while they are carrying out the work of clearing breaks, their services are always available at short notice for any outbreak of fire; they are provided with fire-fighting tools for the purpose; they have also got their horses and vehicles or bicycle so that little time is lost in reaching a fire a few miles distant.

Permanent Residential Overseers are to be stationed on each of our main reserves; these men will keep firebreaks in order, and be constantly on the watch for fires during the summer months.

The breaks now being made are 4 chains in width. In their preparation, advantage is taken of existing roads and creeks, and where possible the latter are cleared of all débris. As far as can reasonably be done traffic is being diverted to the firebreaks that are being cleared through the forest. A width of from 12 to 15 feet is being cleared on either side of the 4 chains, in order to enable us to use a road-scraper for the purpose of scraping off the grass, and it is proposed to burn off the grass and débris within the 4 chains early in the summer of each year. When these main firebreaks are completed, it will be necessary to make intersecting breaks; the first, to protect the best areas of young timber; and others to be made after these until we have a complete scheme of fire protection. Once the breaks are made the cost of maintaining them will be light, but the whole scheme, in my opinion, hinges on the appointment of active and intelligent Overseers.

Silvicultural Improvements.

Forest improvement work has been carried out on these reserves during the past two and a half years, at a cost of 11s. 1½d. per acre; the total area improved during that period being 5,987 acres.

It is very desirable, in order to promote a more even and more vigorous growth of seedlings and spar timber, that judicious thinning should be carried out on the more densely timbered areas, and that inflammable debris should be burnt off, in order to protect these valuable areas from total destruction in the event of forest fires. We propose to enter upon this work as soon as our firebreak scheme is completed.

Specifications for this work are as follows :—Ringbarking useless and over-matured trees that cannot be disposed of in any other way; thinning out useless and crooked saplings and seedlings to such distances, as in the opinion of the District Forester, is considered advisable; and burning off of thinnings and inflammable débris.

Management.

The object of management is to provide for a continuous supply of matured red gum timber for all time.

The demand for this timber must increase; while existing sources of supply in Victoria are becoming exhausted.

In addition to the requirements of Public Works in the State of Victoria, this district will be drawn upon to supply a vast area of timberless country in the South-west of this State for building, fencing, railways, and probably timber for culverts, weirs and water channels. There is also likely to be an increased demand for piles and beams. This is the most profitable timber to produce, but the demand so far is limited. Under a proper system of management we can always supply the demand; chiefly by removing the piles from the thickest growth, and still have a good stand of milling timber. The removal of a few piles is often of considerable benefit to the remaining timber where the object is to provide matured timber of first-class quality.

In the past, sawmillers have left many trees because of some defect or fault which reduced their percentage of first-class timber, and under the existing circumstances they could not be profitably handled. A large percentage of these trees are now over-matured, and in order to make room for a new crop they should now be removed. The Department proposes to encourage sawmillers to remove them, either by a special royalty or by making a liberal allowance for faults. When this is done remaining over-matured trees containing timber of any commercial value will be worked up by direct conversion; useless trees ringbarked; and the areas closed for a definite period, except for specially marked pile and pole timber and for dead wood.

Hereunder is appended particulars of the revenue collected from the Murray Forests for the past seven years .—

								£	s.	d.
1910	...	...	...	...	...	...	...	13,425	8	6
1911	...	...	...	...	...	...	...	15,916	13	11
1912	...	...	...	...	...	...	...	10,400	19	2
1913	...	...	...	...	...	...	...	14,478	15	5
1914	...	...	...	...	...	...	...	14,031	2	7
1915	...	...	...	...	...	...	...	9,369	17	3
1916	...	...	...	...	...	...	...	7,007	2	1
Total Revenue								£84,629	18	11

Red Gum Forests of Victoria.—The late Mr. (Dr.) A. W. Howitt, who was deputed to inspect these forests in 1895, favoured me with a copy of the following hitherto unprinted valuable report :—

Ringbarking has also been generally done on purchased and selected land. Much timber has been cut for various purposes so that at the present time the available Red Gum timber is restricted in area and in amount. The only State Forest Timber Reserve with Red Gum is, so far as I know, a small area near Bairnsdale.

To the north of the Dividing Range the principal Red Gum areas are in the River Murray at Barmah and Yieliana, above and at Gunbower below Echuca.

In the former there are 61,500 acres and in the latter 70,000 acres.

Smaller areas exist higher up and lower down the Murray, and also on the Goulburn River. These in my opinion ought without delay to be permanently reserved as State Forests. When the Forest Branch was attached to the Mining Department I endeavoured, but ineffectually, to get this done.

Below Swan Hill there were at one time extensive forests of Red Gum along the river, and especially in the large bends liable to floods. These forests were, however, ringbarked and killed by pastoral occupants, contrary to the strenuous protests of the Conservator of Forests.

When I descended the Murray nearly three years ago from Swan Hill to Mildura I observed, with great regret, not only this destruction of most valuable timber along the Victorian banks of the river, but also the occupants in places were then engaged in destroying the young trees which would in time replace the former forest.

It will be seen from my correspondence with the Department of Lands that I endeavoured not only to have the Red Gum areas converted into State Forests, in order that the timber might be protected, but also that the destruction of young trees by grazing occupiers should be put a stop to. My efforts in this direction were also unavailing.

In contrast to the lamentable destruction of valuable forests on the Victorian bank, I observed that on the New South Wales bank of the Murray the forests from above Echuca at least, all the way down had been carefully preserved.

The results of our wasteful system, and of the wise system of the New South Wales Government, as regards the Red Gum forests, will be shown by the following facts. At the time, 1892-93, under the regulations under the Land Act, 1890, the Murray River Saw Mill Company at Echuca had obtained 1,600 logs of Red Gum from a special area of 1,000 acres in the Yieliana Forest for the sum of £31, while the same number of logs on the New South Wales side of the river would have brought in a royalty of £700. The Company had, during the year, paid to the New South Wales Government, the sum of £1,565 8s. for royalty, and £47 for license fees, in respect of Red Gum timber.

These facts go to show the manner in which our Red Gum forests have been cut out at a nominal charge, and also the large revenue which ought to have been obtained from them if managed in an intelligent manner in the interests of the whole community.

At the present time the Red Gum forests are barely, if at all, able to supply our own wants, much less to yield any surplus for export.

The only other Red Gum area in the control of the Government is in the Victoria Valley. It is not of any great area, nor are the trees numerous, compared with acreage, but what there were were of excellent quality. The Tucker Village Settlement at Vonwondah was permitted to operate on this forest on a royalty charge. I understand now that the best of the timber has been cut out and sold, but that no royalty has been paid for it.

In the remainder of the Western District the best Red Gum which I have seen is on private lands in the Upper Glenelg and Wandoo Rivers.

It will be seen from the preceding statements that for the present the Red Gum forests, at any rate under State control, are practically cut out, and that any other source of supply must be looked for on private lands, and scattered timber on Crown lands. Most of the former has, however, been ringbarked, and is therefore to some extent deteriorated, as well as hard to work.

In my opinion the proper course to take in regard to Red Gum areas will be (1) To make State Forests of all remaining patches of Red Gum forests, which are still Crown lands, especially in the Murray and Goulburn Rivers, and in Gippsland. (2) To complete the trimming out of the young forests in the 30,000 acres of young forest in the Barmah, Yieliana and Gunbower Forests, which were not thinned in 1892. (3) To carefully protect all Red Gum areas. (4) To make the royalty system of payment apply to all Red Gum, and also at the same time, if possible, to all timber in State Forests of whatever kind. The scale of royalty should be adjusted to the value of the timber for commercial purposes, and to the locality whence obtained, and the difficulties of transport.

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M. Flockton del. et lith.

MURRAY RED GUM.
(*Eucalyptus rostrata* SCHLECHT.)

RIVER GUMS. A SWAMP NEAR FORBES, LACHLAN RIVER. N.S.W.

W. A. Nicholas, photo.

HISTORIC RED GUM, SHOWING THE SPOT WHERE HUME'S PARTY SIGHTED THE MURRAY RIVER, (1824), AND THE GUM TREE THAT CAPTAIN HOVELL CUT HIS NAME ON: ALSO THE MONUMENT ERECTED TO THE MEMORY OF THE PARTY, ALBURY, N.S.W.

W. Gill, photo.

KING TREE. "RED GUM" (*E. rostrata*), WIRRABARA FOREST,
SOUTH AUSTRALIA.

S. W. Jackson, photo.

RIVER GUM (*E. rostrata*), ON MOONIE RIVER, COLLARENEBRI DISTRICT, NORTH-WEST N.S.W.,
SHOWING EXCRESCENCES.

S. W. Jackson, photo.

RIVER GUMS (*E. rostrata*), MOONIE RIVER, COLLARENEBRI DISTRICT, NORTH-WEST N.S.W.

LOG OF RED GUM MOIRA LAKE, MURRAY RIVER, N.S.W.

MULWALA RED GUM FOREST, MURRAY RIVER, N.S.W.

FELLING RED GUM TIMBER. MULWALA FOREST N.S.W., 1888.

EXPLANATION OF PLATE 233.

- A. Juvenile leaf, from Bowning, N.S.W.
- B. Buds.
- C. Fruiting twig from Bongbilla, Moulamein, N.S.W.

PHOTOGRAPHIC ILLUSTRATIONS.

River Gums. A swamp near Forbes, Lachlan River, N.S.W.

Historic Red Gum, showing the spot where Hume's party sighted the Murray River, and the Gum Tree that Captain Hovell cut his name on, 17th November, 1824. Also the monument erected to the memory of the party. (W. A. Nicholas, photo., presented by Mr. Fellowes).

King Tree. "Red Gum" (*E. rostrata*.) Wirrabara Forest, South Australia. 120 feet high; 35 ft. round at base; 25 ft. round at breast high. (W. Gill, photo.)

River Gums (*E. rostrata*). Moonie River, Collarenebri District, North-west N.S.W. (S. W. Jackson, photo).

River Gum on Moonie River, Collarenebri District, N.S.W., "showing carbuncles." (S. W. Jackson, photo).

Log of *E. rostrata*. Moira Lake, Murray River, N.S.W.

Mulwala Red Gum Forest, Murray River, N.S.W.

Felling Red Gum Timber. Mulwala Forest, N.S.W., 1888.

No. 229.

Acacia Mabellæ Maiden.

Mabel's Wattle.

(Family LEGUMINOSÆ : MIMOSÆÆ.)

Botanical description.—Genus, *Acacia*. (See Part XV, p. 103).

Botanical description.—Species, *Mabellæ* Maiden, in *Proc. Roy. Soc. N.S.W.* xlix, 475 (1915).

Arbor umbrosa mediocriter alta, trunco usque ad 1' diametro, surculis junioribus et rhachibus inflorescentiæ brevibus pilis aureis tectis. Phyllodiis longis angusto-lanceolatis apice obtuso, ad 30 cm. longis et longioribus, circa 1 cm. latis. Nervis mediis marginalibusque prominentibus, lateralibus obscurissimis. Glandula non conspicua basi 1 cm. remota. Inflorescentia racemosa, capitulis circa 9–13 floris. Calyce corollae aequilonga, calyce truncata vel fere truncata. Sepalorum apicibus pubescentibus, petalis glabris, pistillo laeve. Legumine longiusculo latiusculo (circa 13 x 1 cm.) subfalcato, seminibus longitudinaliter dispositis; seminis filiforme funiculo semen bis circumcingente, in clavatum arillum apice seminis terminante. Species *A. retinodes* Schlecht, proxima videtur.

An umbrageous tree of moderate height (up to 30 feet), with a trunk diameter up to a foot. Branchlets angular. The young shoots and the rhachises of the inflorescence densely covered with short, golden-yellow hairs. The bark of young growing trees is usually glaucous.

Seedling.—The seedling will be described by Mr. R. H. Cambage in his papers on *Acacia* seedlings, but its differences from that of *A. penninervis* and *A. rubida* may be briefly stated in the following words: the young phyllodes of *A. Mabellæ* are longer and much narrower than those of the other two species, and the venation is quite distinct from either.

Phyllodes.—Long narrow-lanceolate and slightly falcate. Up to 20 cm. and even longer. Width for the greater portion of the length about 1 cm. Rather thin in texture, blunt-pointed. Mid- and marginal-veins prominent, the lateral veins very faint, though visible under a lens, spreading. A not very conspicuous gland about 1 cm. from the base, the margin of which is slightly kinked at the place of the gland, and from which a rudimentary oblique vein sometimes proceeds. No stipules observed.

Inflorescence racemose, the flowers borne in profusion, of a pale yellow colour, and sweet-scented.

Flowers about nine to thirteen in the head, pentamerous, calyx and corolla of about equal length, calyx truncate or nearly so, glabrous except for the tips of the sepals, which are tufted with hairs. Petals glabrous, slightly keeled, the tips a little thickened. Pistil smooth.

Pod moderately long, and broad, (say 13 x 1 cm.), slightly curved. Margins of the valves thickened and somewhat grooved, the valves more or less wrinkled, the seeds arranged longitudinally, distending the valves without making the pods moniliform.

Seed with filiform funicle twice encircling it, and terminating in a clavate arillus at the top of the seed. The length and contour (whether kinked or not) of the funicle is subject to variation, as in *A. rubida*.

Affinities.—This wattle belongs to the series Uninerves and the long sub-series Racemosæ. Because of the general similarity of the structure of the flowers, *Acacia Mabellæ* has hitherto been assumed to be a form of *A. penninervis*; the seed and seedling show that it is not closely related to that species. From the point of view of the seed, with its encircling funicle, its affinity must be sought for near *A. retinodes* Schlecht., and *A. rubida* A. Cunn.

1. With *A. retinodes* Schlecht.

The phyllodes of the new species are longer, the marginal veins more marked, and the lateral veins different. The lateral veins in *A. retinodes* (a Victorian and South Australian species) are more or less parallel to the mid-rib; in *A. Mabellæ* they are attached to the mid-rib at an acute angle.

The flowers of the new species are fewer in the head and are more squat than those of *A. retinodes*, which also have the tips of the petals recurved and the pedicels glabrous. The rhachises of the inflorescence are without the golden yellow pubescence to be seen in *A. Mabellæ*.

The pods of *A. retinodes* are narrower, but the funicles are not dissimilar.

The two species bear, however, such general and detailed resemblance to each other that it is obvious that they are closely related. At the same time I am satisfied that the species are sufficiently distinct from each other.

2. With *A. rubida* A. Cunn.

A. Mabellæ resembles it in seedlings and encircling funicle to the seed only. The phyllodes of *A. rubida* are much coarser, of a different colour, and they generally have a fine more or less hooked tip. They have not the pendulous appearance of *A. Mabellæ*, neither is the persistent bipinnate foliage of *A. rubida* so obvious. The stems and rhachis of *A. rubida* are waxy smooth except at the extreme tips, which have a yellow pubescence.

The flowers also of *A. rubida* are of a rich golden yellow, while in the new species they are of a pale whitish cream colour, and the rhachis matted with hair.

3. With *A. penninervis* Sieb.

The rhachis of the new species is densely clothed with a golden pubescence; it is smooth in *A. penninervis*, though there is a tomentum of a similar character (though less copious), in the variety *falciformis* of *A. penninervis*.

The venation of the phyllodes is indistinct, but similar to that of *A. penninervis*; there is no intramarginal vein, but the edges of the phyllodes are nerve-like and the mid-rib prominent on both sides. There is a gland as in *A. penninervis*. The phyllodes are much longer than those of *A. penninervis*.

As regards the new species, the flowers are cream-coloured and sweet scented; those of *A. penninervis* have less odour. The petals are five or six in number, glabrous, broader than those of *A. penninervis*, and much more frail in texture.

The seeds of the new species have a double funicle completely surrounding them; those of *A. penninervis* have a shorter funicle. Bentham (B. Fl. ii, 362) says, "funicle long, dilated and coloured nearly from the base, extending round the seed and bent back on the same side, so as to encircle it in a double fold."

I have not been able to confirm Bentham's observations in this respect. In the specimens belonging to the typical form that I have been able to examine, the funicle has hardly extended half round the seed. In var. *falciformis* I have observed funicles that I cannot distinguish from those of the normal form and in addition, doubly folded funicles extending more than half way round the seed, but never doubly encircling funicles as in *A. Mabellæ*.

The seedlings of the two species may be briefly contrasted as follows :—the phyllodes of the former are shorter and very much broader and have a distinct venation.

Synonym.—*A. penninervis* Sieb., var. *angustifolia* Maiden in "Wattles and Wattle-barks," 3rd Edition, p. 49 (1906). It was described in the following words:—

A long narrow-phyllode form, found only on the South Coast, so far as I know. Phyllodes commonly six inches long, and under half an inch wide, straight or slightly falcate. The pods are narrower than in the normal form. The young shoots and the rachises of the inflorescence are sometimes densely covered with golden yellow hairs.

Botanical Name.—*Acacia*, already explained (see Part XV, p. 104); *Mabella*, "I constitute the Milton specimens type of the new species, which is named in honour of my young friend, Miss Mabel Fanny Cambage. The naming of a wattle after her is appropriate, because she is Honorary Treasurer of the New South Wales Branch of the Wattle Day League, in connection with which she has done admirable service, and this particular wattle has associations for her in that many specimens occur on the South Coast property of her grandparents."

Vernacular Name.—To a limited extent it shares the name "Black Wattle" with other species on the South Coast, and in New South Wales generally "Mabel's Wattle" is a distinctive and appropriate name.

Bark.—Bark from Nelligen, stripped in December, gave 32.25 per cent. of tannic acid, and 52.8 per cent. of extract; while a specimen from the Dromedary, much further south, gave an almost identical result, viz., 32 per cent. of tannic acid and 52.7 per cent. of extract.

Timber.—So far as I am aware, this timber is not used for any constructive purposes (other than rough uses), but in common with some other wattles it is a good baker's fuel.

Habitat.—Twelve to 20 feet high, Mogo about eight miles from Bateman's Bay township (W. Baeuerlen, September, 1890). Bateman's Bay (J.H.M., November, 1892). Conjola (W. Heron, September, 1898, and February, 1899).

"Black Wattle." Tree good for tan bark. Up to about 30 feet high. Milton (R. H. Cambage, No. 784, December, 1902; No. 4,113; November, 1914; No. 4,151, August, 1915). Nelligen road, 7½ miles from Braidwood (R. H. Cambage, No. 2,065).

Mr. Cambage informs me that in going south from Nowra, the Black Wattle is first met with by the roadside at about 17 miles north of Milton. Around Milton this species avoids the most basic soils, and grows on a sandy soil which is mixed with a better soil, but does not occur on the poor, highly siliceous Permo-Carboniferous formation.

Mr. W. Dunn records it from Bermagui as a tree of 50 feet. It is confined to New South Wales, and mainly a South Coast species. Its range requires to be more fully ascertained.

EXPLANATION OF PLATE 234.

- A. Flowering twig from Milton, N.S.W.
- B. Flower-head.
- C. Flower, stamens not shown.
- D. Pistil.
- E. Floral bract.
- F. Pod.
- G. Seed.

PHOTOGRAPHIC ILLUSTRATION.

For a photograph of the tree, see Part 50 of this work.

M. Flockton del. & lith.

MABEL'S WATTLE.
(*Acacia Mabellæ* MAIDEN.)

No. 230.

Callistemon salignus DC.

A White Bottle Brush.

(Family MYRTACEÆ.)

Botanical description.—Genus, *Callistemon*. (See Part LXI, p. 15).**Botanical description.**—Species, *salignus* DC. *Prodr.* iii, 223 (1828).

The history of the species is as follows :—

Smith in *Trans. Linn. Soc.* iii, 272 (1797) first described this species under the name of *Metrosideros saligna*, as “foliis alternis lanceolatis utrinque attenuatis mucronatis, floribus lateralibus confertis sessilibus glabris,” and compares it with *M. lanceolata* (*Callistemon lanceolatus*). He remarked “that he had a suspicion that this might be the *Metrosideros viminalis* of Gaertner, but the original specimens of that species are very different, having linear-lanceolate leaves, not tapering at the ends, and downy flowers.” The *M. viminalis* mentioned above has been mixed up in herbaria with *C. lanceolatus*, and Mr. Cheel has described it as a new species; see Part lxi, p. 15.

It is figured as *Metrosideros saligna*, “Willow-leaved *Metrosideros*,” in *Bot. Mag.* t. 1821 (1816), and the additional references, Willd. *Sp. Pl.* ii, p. 956, and *Hort. Kew* ed. alt. iii, p. 185, and Persoon, *Syn.* ii, p. 26, are given. The statement is made that it was introduced into England by Sir Joseph Banks about the year 1788.

Then we have—

C. salignum. Foliis lanceolatis utrinque acuminatis mucronatis adultis glabris, nervo medio pennivenoso, nervalis lateralibus margini approximatis, calycibus glabris.” *Metrosideros saligna* Smith (as quoted); Sims’ *Bot. Mag.* t. 1821; Vent. *Hort. Cels.* t. 70; Bonpl. *Nav.* t. 4. Also “Flores pallide flavescentes. Stamina petalis sub-rotundis vix triplo longiora. (DC. *Prod.* iii, 223 [1828], which is the date of the inscription of the species as *Callistemon*. Sieber’s specimen No. 320, *Pls. Exs.* is the type. This description is translated into English in *Gen. Hist. Dichlamydeous Plants* (Don) ii, 822 (1832) in the following words :—

Leaves lanceolate, acuminate at both ends, mucronate, glabrous in the adult state, with the middle nerve feather-veined, and the lateral nervules approximating the margins; calyces glabrous. Native of New Holland. *Metrosideros saligna* Smith, in *Lin. trans.* 3, p. 272; Vent. *Hort. Cels.* t. 70; Bonpl. *Nav.*, t. 4; Sieb. *Pl. Exsic.* No. 320. Flowers pale yellow. Stamens hardly 3-times the length of the petals which are roundish.

Willowly Callistemon. Fl., May, July. Ct. 1788. Shrub 4 to 6 feet.

Mueller, in *Fragm.* iv, 54 (1864), described it in Latin and gives a copious synonymy, enumerating as forms, *typica*, *C. paludosus*, *C. viridiflorus*, *C. Sieberi*.

Bentham then described it in 1866 :—

A tall shrub or small tree attaining sometimes 30 to 40 feet, and often undistinguishable in foliage and inflorescence from *C. lanceolatus*; the leaves are, however, usually more acute, more distinctly pinnately veined, and the nerve-like margins often more prominent; in some forms, however, the venation is, on the contrary, more obscure.

Spikes in the common form glabrous, more rarely the rachis and calyces pubescent or villous.

Flowers generally rather smaller than in *C. lanceolatus*, the calyx-lobes more ovate.

Stamens pale yellow or rarely light pink, usually rather under $\frac{1}{2}$ in. long.

Fruiting-calyx and *capsule* as in *C. lanceolatus*. (*B. Fl.* iii, 120).

Mr. E. Cheel has re-described it from Port Jackson specimens as follows :—

A small tree with papery bark and flexile branches, with a more or less drooping habit.

Leaves lanceolate, much narrowed towards the base, two to three inches long, and a quarter or rarely exceeding half an inch broad, pubescent when young, which is of a rufous colour, but quite glabrous when mature. Venation rather prominent at all stages, but more so in dried specimens, the lateral veins running somewhat obliquely to the marginal nerves.

Oil glands somewhat obscure on the upper and lower surface of the leaves, but if held up to the light are seen to be very numerous.

Flower-spike usually about one to two inches long, mostly glabrous.

Bracts ovate-lanceolate, glabrous, from $2\frac{1}{2}$ – $5\frac{1}{2}$ lines long and $\frac{1}{2}$ – $1\frac{1}{2}$ lines broad, pale-green at first but with age becoming brownish in colour, especially at the tips, faintly striated, deciduous.

Calyx-tube semi-ovate to sub-cylindrical, glabrous, or nearly so, lobes very deciduous.

Petals semi-ovate, rarely exceeding $\frac{3}{4}$ –1 line in length, and of a pale-greenish or pallid colour.

Stamens pale or creamy-yellow colour, slightly over half an inch long. Anthers slightly darker in colour than the filaments.

Fruits nearly globular in general outline with a slightly contracted orifice, about 2 – $2\frac{1}{2}$ lines in diameter.

Botanical Name.—*Callistemon*, already explained (see Part LXI, p. 17); *salignus*, Latin, of or belonging to the Willow, hence Willow-like, which refers to the shape and droop of the leaves.

Vernacular Name.—It is one of the “Paper-barks” or “Paper-bark Tea-trees,” because of the papery or lamellar bark. Woolls (*Flora of Australia*, p. 91) calls it “Broad-leaved Tea-tree,” but there are *Melaleucas* to whom this name is more fitly applied.

Aboriginal Name.—“Bood-joong” of the aborigines of the counties of Cumberland and Camden, New South Wales (Macarthur), “Unoyie” of those of the Clarence and Richmond (C. Moore).

Synonyms.—*Metrosideros saligna*, Sm. in *Trans. Linn. Soc.* iii, 272; *Vent. Jard. Cels.* t. 70; *Bonpl. Pl. Malm.* t. 4; *Bot. Mag.* t. 1821; *Metrosideros pallida*, Bonpl. *Pl. Malm.* 101, t. 41; *Callistemon pallidus* DC. *Prod.* iii, 223; *C. lophanthus*, Lodd. *Bot. Cab.* t. 1302 (*B. Fl.* iii, 121).

Timber.—Wood very hard and close-grained; it has the reputation of being very durable underground like that of most Tea-trees. Thus it is used for posts, for corduroy-roads, and for standing in water and in damp places generally. It has been used for engraving, but with no marked success. An engraving in which this wood is used will be found at page 50, vol. v, of the *Proc. Philosoph. Inst. of Victoria* for 1859. It is a “wood-cut designed by Dr. Ludwig Becker, and engraved by Mr. Grosse, which proves to be fully equal to European boxwood for the purpose of wood engraving.”

The wood varies in colour from a uniform drab to dark red, and some specimens have a very pretty grain, which looks well under polish. It is fairly easy to work, and dresses admirably. It resembles that of the better-known Turpentine (*Syncarpia*) somewhat. Two slabs of this wood in the Technological Museum, which had been seasoned over twenty-five years (having been exhibited at the London International Exhibition of 1862), had weights which correspond to 56 lb., 13 oz. and 60 lb. 12 oz. per cubic foot respectively. Specific gravity .983 ($61\frac{1}{3}$ lb. per cubic foot). (*Report Victorian Exhibition*, 1861.)

Size.—While often seen as a large shrub, it may attain the dignity of a medium-sized tree, especially as one goes north.

Habitat.—The normal form, as figured, appears to be confined to New South Wales and Queensland. In New South Wales it is found in the greater part of the eastern portion, where, with most Tea-trees, it frequents moist places. We require more information as to southern localities, and we do not know how far north it occurs in Queensland. The Victorian, Tasmanian and South Australian localities given in the *Flora Australiensis* are not those of the normal form.

NEW SOUTH WALES.—The following are specimens represented in the National Herbarium, Sydney.

Southern Localities.—Box Point, Wingello to Kangaroo River (banks) (J.H.M.); Badgery's Crossing, Shoalhaven River (W. Forsyth and A. A. Hamilton); Nowra (A. A. Hamilton); Mt. Kembla (A. G. Hamilton); Menangle (E. Harper); Cobbitty Bridge, near Camden, of fair size (J.H.M.). Both these localities are Nepean River.

Western Localities.—“Tall plants of 10–12 feet, much branched, with several stems, pendulous and willow-like in habit. Growing near the running water in which the lower branches dip.” Bent's Basin, Nepean River (E. Cheel and J. L. Boorman); Nepean, near Penrith (A. A. Hamilton).

Grose River and banks of Nepean River near confluence with the Grose. Robert Brown collected here about May, 1803, and January, 1805. (R. H. Cambage and J.H.M.).

Bull Ridge, near Windsor (H. J. Leroy). “An interesting form, with more prominent oil glands and woolly fruits.” (E. Cheel.)

Sydney District.—Port Jackson (Robert Brown, 1802-5); Peakhurst (E. Cheel); near Penshurst Railway Station (E. Cheel); Belmore (R. T. Baker).

Northern Districts.—A large tree, 2 feet in diameter, near Gosford (A. Murphy). 10-12 feet. The only specimen on a dry hillside. Gosford (A. A. Hamilton).

Wyong (A. A. Hamilton); Yarramalong, Wyong (W. A. W. de Beuzeville); entrance to Tuggerah Lakes (A. A. Hamilton); Awaba (J. L. Boorman); Cooranbong (Forest Ranger John Martin); Lake Macquarie (D. W. Shiress).

Flowers with white filaments. West Maitland (Miss A. Brewster). Cessnock (E. Southwell).

Dungog (W. F. Blakely); 10 inches in diameter and 30 feet high. Booral (Augustus Rudder); Crawford River, Bulladelah (E. Cheel); Bulladelah (J. L. Boorman).

Murrumbo, 50 miles north of Rylstone, near the Goulburn River (R. T. Baker). Near Warrah (Jesse Gregson).

The usual paper bark. Gloucester (W. Heron); Mograni Mt., near Gloucester (J.H.M.); "Occasional slender shrubs or small trees." Taree (E. H. F. Swain).

Mt. Seaview. See "Notes of a Trip to Mount Seaview, Upper Hastings River," *Proc. Linn. Soc. N.S.W.* xxiii, 20 (1898), and "Mount Seaview and the Way Thither," *Agric. Gaz. N.S.W.*, June, 1898.

Common all over the brackish soil of the district. Flowering from 2 feet up to 20 feet. Coff's Harbour (J. L. Boorman).

Woodford Island, Clarence River (E. J. Hadley).

"Grows on high ground. Height about 25 feet. Diameter 8 inches. Evenly distributed throughout this district. Fairly plentiful." Casino (W. F. Pope).

Flowers remarkably distant in the spike. Tree attaining a height of 20 feet. This tree grows about the edge of the scrub. Acacia Creek, Macpherson Range (Forest Guard W. Dunn, No. 126).

QUEENSLAND.—Gympie (L. Hirst).

VARIETIES.

Bentham (*B. Fl.* iii, 121) recognises four varieties of *C. salignus*, as follows:—

1. var. *australis*.
2. var. *hebestachyus*.
3. var. *angustifolia*.
4. var. *viridiflora*.

1. var. *australis*. Leaves usually smaller (1 to 2 inch), calyx and rachis glabrous. *Melaleuca paludosa* Schlecht., *Linnaea* xx, 653, not of R. Br.; *C. paludosus*, F. Muell. *Fragm.* i, 14. To this belong the majority of the Victorian, Tasmanian, and South Australian specimens. (*B. Fl.* iii, 121).

Mueller (*Fragm.* iv, 55) says this form extends to New England.

This is figured as *C. paludosus* F.v.M., and a full account given in my "Illustrations of New South Wales Plants," Part iii, Plate 24. It extends from South Australia and Victoria, over the greater part of New South Wales, at least as far north as the Clarence.

2. var. *hebestachyus*. Leaves rather small. Calyx and rhachis pubescent or villous. *C. lophanthus* Sweet *Fl. Austral.* t. 29, but not the syn. of Ventenat quoted. Victoria and Tasmania.

C. leptostachyus Sweet *Fl. Austral.*, under n. 29, is probably a weak form of the same variety. (*B. Fl.* iii, 121).

Then we have—

Melaleuca pityoides F. Muell. Herb., from Buffalo Range, enumerated doubtfully under *Callistemon* by Miq. in *Ned. Kruidk. Arch.* iv, 142, must remain uncertain until the flowers are known. F. Mueller, *Fragm.* iv, 54, refers it to *C. saligna*, but the leaves are semi-terete and pungent as in *Melaleuca nodosa* and *M. pungens*; the fruits, which may be those of *Melaleuca* or of a *Callistemon*, form a dense cylindrical spike of about 1 inch. (*loc. cit.*)

This is at least in part identical with *C. Sieberi* DC. (*C. salignus* DC.) var. *Sieberi* F.v.M. in *Fragm.* iv, 54), which is figured in my *Ill. N.S.W. Plants*, iii, Plate 25.

Mr. E. Cheel constitutes it a variety of *C. Sieberi* DC., thus *C. Sieberi* DC., var. *pityoides* Cheel (= *C. pityoides* F.v.M. in *Melbourne Chem. & Drugg.* 1883, p. 3), which description is here reproduced.

Leaves short, thinly cylindrical, somewhat awl-shaped, slightly compressed or sometimes semi-cylindrical, soon glabrous; bracts lanceolate-linear or narrow, or somewhat ovate-lanceolar; rhachis and often also the calyces short downy; lobes of the calyx semi-ovate-roundish or some almost semi-orbicular, membranaceous, about half as long as the tube, considerably shorter than the petals, finally deciduous; stamens comparatively short; filaments pale yellowish, glabrous, about twice as long as the petals, or some three times as long; anthers yellow; style glabrous; fruits truncate-ovate, rarely depressed-globular, more or less contracted at the summit; valves silky at the surface.

Mueller goes on to say that "In its external aspect this plant resembles more the larger forms of *Melaleuca ericifolia* than even the smaller of *Callistemon salignus*, to which he was at first inclined to refer it as a form."

Bentham (*B. Fl.* iii, 121, 123) somewhat demurred at its being classed as a form of *C. salignus*, pointing to *Melaleuca nodosa* and *M. pungens* as very similar in foliage, and places it as a variety of *C. brachyandrus*.

I have examined Mueller's type specimens, and can scarcely separate it from some of the forms of *C. Sieberi* DC.

At first sight it appears to be a yellow-flowering form of *C. brachyandrus*, to which, as stated above, Bentham referred it, but although the leaves very closely resemble that species, it will be easily recognised through the absence of the narrow channel, characteristic of *C. brachyandrus*. The only character which induces me to keep this as a separate variety of *C. Sieberi* is the cylindrical or semi-cylindrical leaves. All the other characters are similar to those of *C. Sieberi*. (Cheel).

Other references are Scortechini, *Proc. Linn. Soc. N.S.W.*, viii, 170 (1883); Cambage, *op. cit.*, xxix, 692 (1904).

DISTRIBUTION—*Victoria*.—Buffalo Range (F. v. Mueller); Ovens River (C. Falck); Bright District (J. H. Maiden).

New South Wales.—Cathcart, near Bombala (J. H. Maiden); Wallangarra Swamps (E. Bêche).

Queensland.—Dumaresq River (Rev. B. Scortechini); Stanthorpe, F. M. Bailey, who also suggests that it might be placed as a variety of *C. brachyandrus*.

It will thus be seen that all our recorded localities are from high elevations near the Victoria-New South Wales border, and in similar situations near the New South Wales-Queensland border.

3. var. *angustifolia*. Leaves linear-lanceolate, very rigid, almost pungent, 1 to 2 in. long. Flowers glabrous. N.W. interior of N.S.W. (*A. Cunningham*); New England (*C. Stuart*) (*B. Fl.* iii, 121).

Prof. Ewart informs me that there is no form under that name in the Melbourne Herbarium. I have a note that it forms much of the bank-side vegetation near the Bridge over the creek at Wollomombi (Wollomombi Creek). Straggling high shrubs 10 to 15 feet high.

Mr. Cheel thinks that "it is probably a form, if not identical with *C. paludosus*."

4. var. *viridiflora*. This is a synonym of *C. viridiflorus* DC., and seems a good species. It appears to be confined to Tasmania, in spite of the Gippsland reference in *B. Fl.* iii, 121.

No. 231.

Callistemon brachyandrus Lindley.

(Family MYRTACEÆ.)

Botanical Description.—Genus *Callistemon*. (See Part LXI. p. 15).

Botanical Description.—Species, *brachyandrus* Lindley in *Journ. Hort. Soc. Lond.*, iv, p. 112 (1849) [fig. p. 113].

Following is the original description :—

Rami teretibus pubescentibus, foliis linearibus pungentibus canaliculatis enerviis, calyce tomentoso, petalis inaequalibus pubescentibus staminibus sanguineis duplo brevioribus.

This is preceded by a statement in English :—

A stiff bush, with the habit of other species of the genus, but with deep-green, narrow, pungent, channelled leaves having conspicuous dots on the underside, and no veins.

The spikes of flowers are loose, and not more than 2 inches long, with very downy calyces, the number of whose divisions varies from 5 to 6. The petals are dirty white, short, downy, concave, and inconspicuous.

The stamens are deep rich crimson, not more than twice as long as the petals, and quite straight, the anthers are of a bright golden yellow, and form a beautiful contrast. The shortness of the stamens is a striking feature of the species.

In 1864 Mueller, *Fragm.* iv, 52, redescribed it in Latin, giving the range as dry country near the Murray and Darling, and towards the Barrier Range. He quotes *Flore des Serres* v, 4507 (which I have not seen). Walpers' *Ann. Bot.*, iii, 891 (1853), simply copies the original description.

It was subsequently described in *B. Fl.*, iii, 122, as follows :—

A tall stiff bushy shrub or small tree, the young shoots softly hairy, and sometimes soft loose spreading hairs persistent on the older branches and foliage.

Leaves linear-subulate, terete and channelled above, rigid and pungent-pointed, mostly $\frac{3}{4}$ to $1\frac{1}{2}$ inch long.

Spikes loose and interrupted or sometimes dense, rarely 2 inches long, the rachis and calyces loosely hairy.

Calyx-tube broadly campanulate, 1 to $1\frac{1}{2}$ lines long; lobes broad, ciliate, more or less scarious.

Petals about $1\frac{1}{2}$ lines diameter, glabrous or pubescent.

Stamens quite free and scarcely above 4 lines long; filaments deep red; anthers yellow or pale.

Botanical Name.—*Callistemon*, already explained. (See Part LXI, p. 17); *brachyandrus*, from two Greek words, signifying short stamens.

Vernacular Name.—I know of none except "Red Bottle Brush" in reference to the colour of the filaments.

Synonyms.—*C. arborescens* F.v.M. in *Linnaea* xxv, 388 (1852), quoted in *Fragm.* iv, 52; *C. acerosus* Miq. in *Ned. Kruid. Arch.* iv, 141 (1856) (but not of Tausch). Bentham adds that *C. pithyoides* Miq. (*op. cit.* p. 142) "mentioned as only known in fruit, if a *Callistemon* at all, appears to be nearer this species than to *C. salignus*."

Attention may be invited to Mr. Cheel's remarks under *Habitat*, in regard to certain pine-needle leaved specimens which would certainly be appropriately termed *acerosus*.

Habitat.—In the original description we have:

The seeds received from His Excellency Captain Grey, said to have been collected on the North Coast of Australia in 1843. Captain Grey was Governor of South Australia at the time, and it does not seem clear what is meant by the "North Coast of Australia."

Bentham (*B. Fl.* iii, 122) quotes it from—

New South Wales.—Darling River and towards the Barrier Range, *Victorian Expedition*.

Victoria.—Murray Desert, *F. Mueller*.

South Australia.—On the Murray, *F. Mueller*.

These localities are not far apart, and are interior or sub-arid.

Following are the localities of specimens represented in the National Herbaria of Sydney and Melbourne. It will be observed that they are from the same three States.

South Australia.—New Holland (Mueller, February, 1847), Mount Dispersion; Eastern South Australia (*ex* Botanical Museum of Adelaide).

Victoria.—Australia Felix (Mueller). You Yangs (J. Staer, April, 1911).

New South Wales.—Nandering Camp (Victorian Expedition, June, 1861); Murray and Darling Rivers (Mueller, Dallachy and Goodman). Between Lachlan and Darling Rivers (G. Day); Nyngan (E. F. Rogers, August, 1913); Newcastle (R. H. Cambage). The last specimen is from a coastal locality; the others are from interior ones.

We have also specimens from cultivated plants in the Botanic Gardens, Sydney, and from Christchurch, New Zealand, collected by E. Cheel in March, 1909, which have terete leaves with a distinct narrow channel on the upper side, and are identical with those found in a wild state in all three States. In addition, there are specimens from plants also cultivated in the Botanic Gardens, Sydney, October, 1914, with broader and more open channelled leaves, which more closely resemble the figure of Lindley.

It is possible that these specimens with the more terete leaves are sufficiently distinct to be regarded as a variety, but the question cannot be satisfactorily settled until we have been able to trace the locality from which the seed which produced Lindley's type specimen, and also those with broader and more flat leaves, referred to as cultivated in the Botanic Gardens, Sydney, were obtained.

62

A WHITE BOTTLE-BRUSH.
(*Callistemon salignus* DC.) (A-H)

CALLISTEMON BRACHYANDRUS LINDL. (I-K.)
var: ACEROSUS MIQ. (CHEEL.) (L-Q)

62²

PAINTING BY JAMES H. HARRIS, 1880. THE UNIVERSITY OF CHICAGO LIBRARY

Callistemon brachyandrus, LINDL. (REPRODUCTION OF THE ORIGINAL
DRAWING OF THE TYPE).

It may be that the *Callistemon acerosus* Tausch in *Flor. ad. bot. Zeitung*, Tome xx, p. 411 (1836), united with *C. pinifolius* DC. by Benthams, belongs to this rather than to *C. pinifolius*, as the latter is a low spreading shrub with distinctly greenish coloured filaments, whereas the description of Tausch states that his species is a shrub or tree 25 feet high (frutex vel arbor 25 pedalis), and that the filaments are reddish tinged with yellow (filamenta phoenicea).

When additional material becomes available to prove that the material from which Tausch's description was drawn up is distinct from that of Lindley's plants, it may be advisable to take up the name *acerosus* as a variety. (E. Cheel).

Propagation.—It is a decorative plant, which has been under cultivation in the Botanic Gardens, Sydney, for many years. It is found in other Australasian Botanic Gardens.

EXPLANATION OF PLATE 235.

Callistemon salignus DC.

- A. Flowering twig from Penshurst, N.S.W. Natural size.
- B. Bracts enclosing buds.
- C. Rhachis with buds and deciduous bracts.
- D. Bud, showing (a) Calyx-lobes and (b) petals.
- E. Flower.
- F. Flower opened out, showing—
 - (a) Sepals.
 - (b) Petals.
 - (c) Stamens.
 - (d) Rim of calyx-tube.
 - (e) Pistil.
- G. Transverse section through ovary.
- H. Fruits.

Callistemon brachyandrus Lindl.

- I. Flowering twig. Natural size.
- K. Rhachis with young buds and deciduous bracts.

Callistemon brachyandrus var. *acerosus*.

- L. Buds of var. *acerosus* from Darling River, N.S.W. Natural size.
- M. Bud magnified.
- N. Flowering twig, with terete leaves.
- O. Fruits.
- P. Larger fruit.
- Q. Tip of terete leaf showing groove.

ILLUSTRATION.

Reproduction of figure, p. 113 of the original drawing of *Callistemon brachyandrus* Lindley, in *Journ. Hort. Soc., Lond.*, iv, 112 (1849).

ADVENTITIOUS ROOTS

(INCLUDING NOTES ON STILT-ROOTS, LENTICELS, PNEUMATOPHORES;
SWAMP PLANTS.)

Adventitious roots are roots arising from stems or leaves. The rarer phenomenon of developing adventitious roots on leaves is taken advantage of to a small extent in horticulture, and need not be further referred to here. In practice all dicotyledons, and most monocotyledons, given favourable conditions, which can always be forced by the various horticultural methods of cuttage, can be made to produce this phenomena of root action.

It does not matter whether the material for the purpose is selected from the stem, root, or leaf—from growing wood, as in *Euphorbia*, or ripened wood, as in *Salix*; from short pieces of root, as in *Bouvardia*, or long pieces, as in *Rubus* (Blackberry), or from the leaf, entire as in *Echeveria*, divided as in *Begonia*, or from bulb scales, as in *Lilium*. In all these cases roots can be produced without the aid of the radicle from the seed.

Stilt-roots.—Some adventitious roots are, for obvious reasons, called “Stilt-roots,” “brace-roots,” “prop-roots.”

Stilt-roots are attached to the main trunk, being developed from the lower part of the stem, to which they are attached obliquely and stilt-like. These are well-known in the case of the Screw Pine (*Pandanus*) and certain Mangroves of our coasts, which are useful in fixing mud-banks. They are common in Maize (Indian Corn).

We have also spinous and non-spinous adventitious roots on *Palms*. *Versaffeltia splendida* H. Wendl. is a good example. The root-system often consists of a succession of roots produced farther and farther from the original base of the stem after the disappearance of the ordinary or tap-root. Some Palms and Screw Pines are ultimately borne several feet clear of the ground, in consequence of the lower ones dying away, by the stout adventitious roots which succeed each other higher and higher up the trunk. We notice this form of Stilt-root in certain Orchids in our glass-houses. For example, *Aerides odoratum* Lour., *Angraecum eburneum* Bory, *Vanda teres* Lindl.

Common Aroids illustrating this phenomenon are *Alocasia macrorrhiza* Schott., *Philodendron Andreanum* Devans, *Anthurium ornatum* Schott.

In quite a number of well-known economic plants we have adventitious roots. For example, in the Onion, the single primary root lasts but a short time, and is succeeded by others, which do not arise as branches from the primary one, but spring from the very short stem of the plant. In the case of wheat and barley, when the plants have begun to unfold a few leaves above the ground, the primary roots are succeeded by

adventitious roots, which grow from the lower nodes or joints near the surface of the soil. Such roots are common in the potato, runners of the strawberry, couch-grass, buffalo-grass, &c.

There is a remarkable development of adventitious roots on the trunks of some tree-ferns (e.g., *Dicksonia*), where they may appear in such abundance as to enclose the trunk in a spongy mass. Other ferns showing this well are *Alsophila Cooperi* Hook., *Cyathea dealbata* Swartz (both tree ferns), *Nephrolepis cordifolia* Pr., and also *Todea barbara* L. (Squatty Fern).

The tendency to form adventitious roots may be taken advantage of to raise plants from cuttings, by placing them directly in the ground (Roses, Willows), in water, or by packing with a cushion of damp moss (Figs). This is aided sometimes by incisions in the stem. Adventitious roots may be seen in the Dragon Tree (*Dracæna Draco*) and Mr. E. N. Ward, Superintendent of the Botanic Gardens, Sydney, has suggested that they may be taken advantage of to save several years in the propagation of this ornamental tree.

Coulter, Barnes and Cowles ("Text-book of Botany," ii, 503) emphasise the value to a tree of a tendency to produce adventitious roots when coming into contact with wet soil, thus Willows and Poplars possess this character in a pre-eminent degree, and this is economically useful in reclamation work, for when they are partly buried by sand or soil, as fast as the stems are buried, new adventitious roots appear at higher levels. In this connection note the lists of plants recommended for reclamation of river banks in Vol. vi, pp. 141-143 of the present work. Almost invariably they were selected because of their tendency to produce adventitious roots, a few exceptions being plants selected to clothe the normal banks. Indeed, the study of plants which produce adventitious roots is indispensable to workers in problems of river erosion, and, to a less extent, sand drift (see Part LVII of the present work).

Now Pines (*Pinus*), Cypress Pines (*Callitris*), Oaks (*Quercus*), &c., are unable to develop adventitious roots in this manner, and hence they are readily killed when partly buried. From this cause we lost our finest Cork Oak (*Quercus Suber*), and other valuable trees in the filling-up operations in the Botanic Gardens, Sydney, in the year 1903. The subject has a very practical aspect to the landscape gardener and tree-planter generally in his operations of filling in soil around the stems of trees, and one realises that very little attention has been given to it.

Adventitious Roots in Native Trees.

The photo of *Eucalyptus rostrata* Schlecht., by His Honor Judge Docker, is, so far as I am aware, the first published of this particular Eucalypt with adventitious roots.

Eucalyptus resinifera Sm.—In the Botanic Gardens, Sydney, there is a tree of this species ("Forest Mahogany") not planted by the hand of man, which has sent forth, at a distance of $4\frac{1}{2}$ feet from the ground, an adventitious root, which is now $2\frac{1}{4}$ inches in diameter, and which has now entered the ground, thus forming a small auxiliary stem.

For the following three photographs of a Flooded Gum (*Eucalyptus rudis*), Western Australia, I am indebted to Mr. W. C. Grasby, of the *Western Mail*. It inhabits the low-lying flats and banks of the rivers between the Swan and Blackwood, and is sometimes to be met with east of the Great Southern Railway. This tree is of great interest to settlers, first, because the timber is of no commercial value, and is poor firewood; second, because it is exceedingly difficult to kill; and third, because it is equally difficult to burn. Of all trees which have to be destroyed by the settler in clearing his land, the Flooded Gum is the hardest to destroy. After ringbarking it takes longer than any other to die, and is the most persistent in throwing up base shoots or suckers. Even when the suckers are kept regularly knocked off, the stump will remain green for years; but the photographs reproduced serve to illustrate the reason why this tree is so hard to destroy.

Photograph No. 1 represents an ancient Flooded Gum, about 4 feet or more in diameter, which has been thoroughly ringbarked about eight years, standing on the swampy edge of the brook at Ferndale, Balingup. It will be noticed that while the larger portion of the tree is dead, there is still a fair amount of green top, although the tree has been ringbarked about seven years. At the foot of the tree in the foreground will be seen a big limb, and just above the thick end of the limb a large scar showing the place from which the limb has fallen. The falling of this limb exposed the reason for the tree remaining partly alive.

No. 2 is a photograph of the lower portion of the trunk of the same tree. In the foreground is the thick end of the big limb, and on the front of the tree is a large scar made by the breaking away of the dead limb. The mark of the ringbarking can be seen about a foot above the fallen limb. When this limb fell the cause of the tree remaining alive was explained. It will be noticed that from the green sapwood under the upper portion of the scar left by the fallen limb, a number of roots have grown, and one, fully 3 inches in diameter, has found its way down the crack between the old limb and the main portion of the trunk, and lower down has entered through the rotten interior of the tree into the ground. There must have been a crack between this limb and the main tree at the time when the ringbarking was done, and in this crack, of course, the water would run, and there was a certain amount of rotted wood. During the wet season in that part of the State a mass of roots grew from the upper portion of the wound, and although only two, the big one and one other, are now alive, the remains of the smaller ones are to be seen in considerable number. As long as the big limb remained on the tree none of these roots could be seen.

On the bank of the same brook, a few hundred yards from the big tree, is a smaller Flooded Gum, about 9 inches in diameter, and perhaps 18 or 20 feet high. Some years ago this tree was well ringed about 6 inches from the ground, which remains wet through the whole of the summer, and in the winter time is covered with water for months. Indeed, the water probably covers the ringbarked area for several months in the winter. It will be noticed (Photograph No. 3) that this tree, instead of dying as the result of ringbarking, has put out a number of aerial roots above the ringing, and is now in a

fairly vigorous condition of health. The largest root, which is facing the camera, is quite 3 inches in diameter. It starts from just above the ringbarking, and has completely grown over it so as to hide it altogether. In addition to this big root are a number of smaller ones from as thick as a pencil to three-quarters of an inch. All these roots are on the west, south, and east sides of the tree.

Mr. Grasby's photos, published in 1914, are the first published, so far as I am aware, of adventitious roots in a *Eucalypt*.

E. robusta Sm.—Mr. T. Ormond O'Brien informed me that thirty-five to forty years ago he drove a stake of Swamp Mahogany (*Eucalyptus robusta*) 3 inches in diameter, and 9 feet from the ground. The stake took root, and was (1905) a spreading tree of 25 feet, and diameter of 14 inches below the fork. It forked at 7 feet from the ground. Water has encroached on this tree, and its present roots are at a higher level than the original roots. I saw the tree at Mr. O'Brien's house, at Bondi, a suburb of Sydney, and published an account of it in the *Sydney Morning Herald*, of 15th March, 1905, this being the first published account of adventitious roots in *Eucalyptus*, so far as I am aware.

A few days afterwards a gentleman from Kincumber stated that stakes of *Eucalyptus robusta* "sprout readily if stuck in the ground." In the *Herald* of the 17th March, 1905, a correspondent, "Farmer," wrote :—

I can state that some years ago I erected a barn on the Richmond River. The upright posts were some form of the *Eucalyptus* (Mahogany) I believe. I squared them on two sides with the adze, and finished the buildings. For some considerable time afterwards young sprouts used to push through and grow about 6 inches long. These posts would be about 12 inches through at the butt end, and about 11 feet out of the ground. The subsoil was sandy and moist.

I believe these posts to have been *Eucalyptus robusta* also.

Dr. G. V. Perez, of Teneriffe, Canary Islands, wrote to me in 1915 :—

E. tereticornis Sm.—"Stout stakes of *E. tereticornis* grown here hammered into the ground have produced shoots, but they have died after a few months." This is, of course, an Australian tree—our Forest Red Gum.

E. paniculata Sm.—Mr. F. Cridland gives me the following information concerning an Ironbark, the first Ironbark to be thus recorded :—

In June or July, 1916 (eighteen months ago), I had some Ironbark trees cut down on my property near Cronulla. I had them carted to my house about a mile away, where they lay for a week or two, then I put them in the ground as upright posts to build a rose bower. Some time after one of the posts, about 9 inches in diameter, threw out a few shoots. These died off later, but others have since taken their places, and at the present time the post has several green shoots up to 6 inches in length.

Macadamia ternifolia F.v.M.—The "Queensland Nut." Mr. W. F. Blakely has drawn my attention to a stubby mass of roots in a tree of this species in the Botanic Gardens, Sydney, a little east of the Refreshment Room. They are at the forking of some branches, and about 7 feet from the ground. During a wet season these roots are obviously alive. This is the first instance of the kind in the *Proteaceæ* known to me.

Melaleuca.—Now we come to the Tea-trees, which are closely allied to *Eucalyptus*. Mr. T. Ormond O'Brien, the well-known landowner, of Bondi Beach, wrote the following letter, which appeared in the *Sydney Morning Herald* of 9th February, 1905 :—

I would like to draw the attention of those who understand such matters to what appears to be a novelty in regard to this tree. When I speak of the tea-tree I refer to that tree which, so far as I have seen it, grows actually in or near the margins of the fresh water lagoons on the coast. It grows to a good size, say thirty feet in height, with a bole two feet in diameter, having a bark very suitable for use where shingles are not available. I have seen it used by 'Old Wingle' for making his gunyah. It bears a white cockade flower, which appears to be greatly relished by the bees, flying foxes, and paroquets. And now to the feature about the tree to which I wish to draw attention. At a lagoon on the coast where a number of these trees grew, the depth was greatly increased by reason of partial filling up, and this increased depth remained for some years. The result was that the tea-trees threw out a new set of roots—say from 3 to 6 feet from the ground. For some reason—probably a tunnel having been driven by the Sewerage Department in the vicinity—the waters of the lagoon went down below the new set of roots thrown out by the tea-trees, with the result that most of them have died. As it appears to me, the trees had ceased to live on their original roots, and the moisture being taken from their new sets of roots, death was the result. And there the trees may be seen standing, some in the water, some in the marsh, with the stems clear for a few feet above the ground, and then with a large bunch of tangled and matted roots, full of soil, which has been gathered out of the water. Two of these dead trees must be of great age, as I have known them above 50 years, and, so far as I can judge, they have not increased in size since my recollection of them.

I visited the trees, and they are the reputed *Melaleuca Leucadendron* (*M. Smithii*, R. T. Baker), and the formation of new sets of roots emanating from the trunk, was as Mr. O'Brien stated.

A few years later (1910) Messrs. C. T. Musson and W. M. Carne published a full paper, "The adventitious roots of *Melaleuca linariifolia* Sm." in *Proc. Linn. Soc. N.S.W.* xxxv, 662, with two excellent plates. The trees figured and described are on the Hawkesbury Agricultural College Farm, and also at Rickaby's Creek, near Richmond, N.S.W.

It is probable that adventitious roots will be found in all the *Melaleucas* (which are swamp-loving plants). I have found them in *M. styphelioides* Sm.

Owing to the facility with which they form adventitious roots, cuttings and stakes of this species, when forced into moist ground while in the resting season, readily form independent plants. The Chief Justice (Sir William Cullen) has propagated *Melaleuca ericifolia* on his property at Mosman, near Sydney, somewhat extensively in this way, for about twenty years to my knowledge.

Ficus.—To the category of plants with adventitious roots belong the Figs (*Ficus*), and these roots are sometimes so well-developed that they become devastating, and are hence called "Strangling Figs." I have dealt with the subject at Part LVIII, p. 225, of the present work at some length, and have given figures showing their development. In that paper I chiefly refer to *F. rubiginosa*, the Port Jackson or Illawarra Fig, but the Moreton Bay Fig (*Ficus macrophylla*) more frequently produces roots and an illustration is given of the adventitious roots of *F. Henneana*, a New South Wales Fig, already dealt with in Part XIV of the present work.

In their highest development we have the tropical Banyans, with their columnar stems covering large areas by the same tree. In Lord Howe Island a single tree of *F. columnaris* covers over three acres in this way.

Lenticels.

An excellent popular article on lenticels entitled, "How the bark breathes" will be found in the *Journal of Heredity* (Washington, U.S.A.), 15th November, 1915, p. 490. It points out that in connection with the elaborate respiratory system of plants connected with the taking in of air and giving out of carbon dioxide we have three general types of external openings, viz. :—

1. Stomata or valves on the surfaces of leaves and young shoots.
2. Ventilating pores, which occur in certain aerial roots.
3. Lenticels, pores in the older wood, whose presence can be noted by the unaided eye in almost any plant.

The earlier naturalists were quite in the dark as to the functions of these pores. Guettard, who described them in 1745, designated them merely as glands; De Candolle (1826) thought they were a kind of bud, from which roots later put forth; Unger (1838) believed they had something to do with reproduction; but as early as 1809, Dupetit-Thouars declared their purpose was ventilation, and the work of several students during the next half century demonstrated that this opinion was well founded.

It has been found that lenticels are in some plants functionless, some for a season of the year; others are permanently closed, and of no value to the plant for breathing.

Following are the legends to two admirable photographic illustrations to the above quoted paper :—

The ventilators of a rose twig.—The irregular openings or 'eruptive craters' in the bark, photographed under high magnification, are known as lenticels, and serve as pores through which air is admitted to the inside of the plant. By channels and passages of various kinds between the interior cells of the plant, the air passes to even the most distant parts. The plant is thus enabled to renew its supply of oxygen, and at the same time it discharges carbon dioxide through the lenticels.

Twig of a Chinese Magnolia, highly magnified.—The dry, powdery cells which fill the breathing pores of the bark have absorbed moisture from the air until they have swelled out and protrude like warts. One of the functions of the lenticels is to regulate the transpiration of moisture between the interior of the tree and the outside air.

The author (unnamed) of the paper includes the following comment :—

These facts have led many plant physiologists to think that, although the lenticels undoubtedly do fulfil in many cases the function of breathing pores for the bark, that is not really their *purpose*. Such a solution of the problem accords well with the interpretation of nature of certain scientists, who hold on philosophical grounds that nothing should be said really to have a purpose. (*l.c.* p. 492).

Those who desire to pursue the subject further are invited to peruse "A Text-book of Botany" by Coulter, Barnes and Cowles, Vol. II, Ecology, p. 660, under the main heading, "Carbohydrate synthesis and aeration in stems," and the sub-headings, "The structural features of lenticels," "The causes of lenticel development," "The role of lenticels." In regard to the last, they say (p. 663) :—

Lenticels are regions of gas exchange, taking the place of stomata in stems after the inception of secondary growth, and making possible the continued activity of the chlorophyll after cork formation has begun. Only a somewhat structureless organ such as a lenticel, consisting of an indefinite patch of loose cells, is fitted for gas exchange in bark, where growth and rupture occur continually.

At figure 974 is a clear photograph showing the markings with which we are familiar in Birch (*Betula*) bark, which consist of numerous transversely elongated permanent lenticels.

Swamp Plants and Respiration.

In *Proc. Australian Assoc. Adv. Science*, i, 327 (1888) the late Dr. Joseph Bancroft read a paper, "Respiration in the roots of Shore-plants," which, like a good deal of his work, was in advance of his time, and it remained, at least in Australia, little added to for a number of years. He took cognizance of the aerating roots, or breathing-roots, or pneumatophores of certain Mangroves, and "knees" in certain Conifers. Their function is to supply oxygen to the trees anchored in mud.

He also took cognizance of certain adventitious, or aerial, or stilt-roots in Mangroves. It is not always convenient to strictly separate the two classes of roots. For example, at p. 328, Dr. Bancroft refers to *Rhizophora mucronata*, the Red Mangrove, and says, "it throws up no aerial (breathing) roots, but those sent downward, tripod-like (stilt-roots), apertures are seen with elevated edges, circular, one-twentieth of an inch in diameter, and filled with reddish-brown powder." At Plate xxiii he figures these stilt-roots in this species.

Schimper, p. 401, says, "The species of *Rhizophora* do not possess special pneumatophores, yet the upper part of their stilt-roots that are above the mud perform the same function."

The stilt-roots have even an economic value. The aerial roots, being very elastic, afford good material for bows, of which the Fijians avail themselves. (Seemann.) Arched roots are similarly used by Solomon Islanders in Port Curtis, district, Queensland. C. Hedley (*Proc. Roy. Soc. Qld.* v, 11).

Dr. Bancroft, at p. 327, began his observations on *Avicennia officinalis*, the common Grey Mangrove (found pretty well round the Australian coast), near Brisbane, and Plates xxv and xxvii represent Mangroves from Moreton Bay. He refers to an earlier paper submitted to the Royal Society of Edinburgh, which was not published, and following is an abstract of the same.

Prof. Dickson read a paper by Dr. Joseph Bancroft on respiration in the roots of certain shore plants. His observations referred chiefly to the remarkable rootlets of *Avicennia*. These rootlets grow vertically upwards from the larger roots which extend themselves horizontally in the mud of salt-water creeks. The mud bank around the stem is covered by a brush of such rootlets to a distance of from 4 to 6 yards from the bole of the tree. This brush, by entangling débris, protects the bank from destruction by stream or tide. The rootlets are studded with pits or pores emitting powdery matter which consists of cells, and which may be observed floating on the surface of the brackish water of the creek. These pores he regards as corresponding to lenticels, and he finds that when air is forced into the cut end of a rootlet it issues by the pores. Hence he conjectures that the function of the pores is to contribute to the aeration of the plant, a view coinciding with that held by several botanists as to the lenticels, which they regard as structures affording, like stomata, a communication between the atmosphere and the interior of the plant. (*Nature*, Vol. xxv, 403 [1882]).

In his 1888 paper Dr. Bancroft goes on to say :—

Amongst various things that interested me, a white powder floating on the brackish water presented itself as an object of inquiry. This powder looked at a distance like the male *Vallisneria* flower, but on closer inspection it was observed to issue from openings in the aerial roots of neighbouring *Avicennia* trees, the habitat of which is restricted to the muddy banks of salt waters. Some of these upright roots in rapid growth, found casting off the white powder, I drew up, together with the horizontal white pithy parts that were in process of extension to an unoccupied mudbank. Having secured a number of specimens,

I carried them home for further examination. This powder, by the aid of a microscope, was found to consist of cells, iodine tinting them brown. This substance could have no relation to the reproductive system of the *Avicennia* tree as the flowers are high up on the branches, followed by fruits like garden beans.

The aerial roots of *Avicennia* are from a foot to 18 inches long, covered with green epidermis, on which the tides deposit mud and confervas. They never throw out leaves, but occasionally become forked. The muddy bank around the *Avicennia* stem is covered by a brush of these roots to a distance of from 4 to 6 yards from the bole of the tree.

This brush, by entangling *débris*, protects the bank from destruction by stream or tide. The roots are as thick as a pen-holder, and are covered with pores, 500 or more to be counted on a single specimen. The pores just opened are surrounded by broken epiderm, looking like the sepals of a flower, but having no regularity. The horizontal portions of the root system to which the aerial upright parts just described are attached are white, pithy, and full of air, and though living in undrained mud are quite free from any waterlogged condition. As the upright roots appear to rise out of the mud to obtain air, could the powder-discharging pores contribute anything towards aeration? Might they be mouths to admit air? After considering how this could be determined, I attached the indiarubber head of a pipette used for eye-drops to the cut part of a root, tied it, and immersed the aerial portion in water. On compressing the rubber cap, air was found to issue freely from the pores, and at no other parts.

This, then, seems to me to be the function of the pores, to supply air to the root system of the mud-inhabiting *Avicennia* tree; the office of the discharged powder being to establish a communication between the air vessels of the plant and the outer atmosphere, by bursting open the cuticle of the root.

The lenticels of the generality of trees differ somewhat from the root-pore in having no cup-like margins, and the corky mass does not fall freely in the form of powder, as is found in the root of *Avicennia*. Yet air can be blown through these organs among the foliage of *Aegiceras*, less freely in *Excaecaria*. With Paquelin's bellows and patience, it may be seen to issue from the lenticels on the young shoots of the peach, and by the same apparatus can be made to pass through the stomata near the midrib of the common *Oleander*. So far, I have seen air issue through the stomata of no other leaf, though experimenting with many.

Excaecaria agallocha has a large well-formed aperture, in which a brown powder is to be seen. I can blow air by the mouth applied to the cut stem, through all these apertures, but find the bellows of Paquelin's thermo-cautery a very convenient instrument for such experiments. (Bancroft, p. 328).

The roots that show the greatest resistance to the passage of air, are those of the *Excaecaria*. The habitat of this tree is not in such close proximity to the shore as that of *Avicennia*, *Rhizophora*, or *Aegiceras*.

The same organ I saw on dried stems of *Acanthus ilicifolia*, another shore plant.

Guided by the appearances on the roots of *Aegiceras* and *Excaecaria*, the pores of which are found to extend also higher up among the foliage, the conclusion is forced on me that these root-pores are only modifications of the organs called lenticels (p. 329).

The last is the "Blind-your-Eyes" of Australia because of its acrid juice. Blatter, at p. 653 of a paper to be presently cited, refers to some of its morphological characters, but does not refer to its pneumatophores.

At p. 330, with Plates xx, xxii and xxvi, Bancroft refers to the "breathers" (pneumatophores) of *Sonneratia acida* Willd. (Lythariaceæ). They are up to 6 feet high.

Similar remarks as to breathing roots and stilt-roots may be made in regard to another Mangrove (*Bruguiera Rheedii*), from Queensland, in Dr. Bancroft's paper, p. 331, with good illustrations at Plates xix and xxi. The whole of Dr. Bancroft's paper will well repay perusal.

We now turn to Schimper's "Plant Geography on a physiological basis," Fisher's English translation (Groom and Balfour), 1903. At p. 73 we have—

In many cases certain *lateral roots* are differentiated as *oxygen-pumps*, and in accordance with this function differ structurally from other roots. Such respiratory roots or *pneumatophores* (Jost) have been studied by Schenck in species of *Jussieua* inhabiting in numbers, as shrubs or undershrubs, the shallow waters of warmer districts.

At fig. 47 are shown the pneumatophores of *J. peruviana* L. Inconspicuous pneumatophores (spongy bodies) may be seen in the common *J. repens* L. about Sydney.

Then we may turn to the section "The Eastern Mangrove" at p. 395, the term Mangrove having more than a generic significance, including species of various families, but having a common habitat.

On the other hand, the roots of most Mangrove-trees are characterised by the possession of highly peculiar pneumatophores (figs. 223, 224, 225). These are displayed in their simplest form by *Carapa obovata* (fig. 223, 3), where the serpentine creeping roots project above the mud with their upper edge, like the blade of a thick knife, but studded with lenticels. In *Carapa moluccensis* the secondary growth in thickness in the upper part is irregular, so that the root terminates in finger-like outgrowths. (Schimper, p. 401).

The young branch of the root of *Carapa obovata* seen at fig. 223 (3) shows admirably that the lenticels in a pneumatophore apparatus may be abundantly present for breathing purposes without either the normally-shaped pneumatophore such as we see in *Avicennia* or the stilt-root, such as we have in *Bruguiera*. These have been differentiated by an author in the "Journal of Heredity," quoted at p.69, as "Ventilating Pores."

Concerning pneumatophores, Schimper goes on to say (p. 403).

That pneumatophores supply subterranean parts of the trees upon which they occur with oxygen was proved by G. Karsten and Greshoff, as has been already explained. All these structures are accordingly provided with devices for absorbing oxygen (lenticels, stomata, thin cork), and for transporting it (intercellular passages in the primary cortex or bast). . . .

Avicennia officinalis (figs. 223, 4; 224) together with two American species, *Sonneratia acida* and *S. alba*, *Ceriops Candolleana*, and the American Combretaceous *Laguncularia racemosa*, all have negatively geotropic lateral roots protruding from the ground like asparagus; these are as long as one's finger, or, in *Sonneratia*, one's arm.

See also "The Mangrove of the Bombay Presidency and its Biology," by E. Blatter, S.J. (*Journ. Bomb. Nat. Hist. Soc.* xvi, 644 (1905)) for Pneumatophores.

This is an especially valuable paper. He follows Schimper in distinguishing a Western and an Eastern Mangrove (or, more fully, a Mangrove formation), the western one covering the coasts of Western Africa and America, and the eastern one those of East Africa, Asia, Australia and Micronesia. He adds *Excavaria agallocha* L. to Schimper's list.

He gives an account of *Rhizophora mucronata* (which he styles "The True Mangrove") in some detail, and describes the long aerial roots.

Rhizophora mucronata forms sometimes tangled thickets by the interlacing of its roots, sometimes it is more isolated; but in any case it always occurs on the outer border of the mangrove formation towards the open sea, thus serving as a protective outpost of the less favoured representatives of the same formation. When the tide is out, the ground occupied by the mangrove shows a bluish-black mud, from which

innumerable short stems and longer roots arise. The "true Mangrove" may easily be distinguished from its neighbours by the long aerial roots which raise the main trunk above the level of its origin and give the tree the appearance of being supported on stilts. These arise from the usually short stem on all sides, growing first for a short distance in a horizontal direction and arching down afterwards into the water. Soon the base of the stem, with its original roots, dies and now the only support to the upper stem and its branches are those stilt-roots which reach to a height of 2 or 3 yards, and which, on account of their great elasticity, are the best possible protective system against the continuous dashing of the waves. The tree may be moved forwards and backwards by the force of wind and water, but, ultimately, it will always assume its former position. In this way the aerial roots are like as many strong anchors which would not allow the tree to be carried away even by the wildest play of the waters. We may very often observe that the growing point of such a root loses its vitality, whereas behind the apex a forked root makes its appearance. It is evident that such a change of growth can have a beneficent influence only under the conditions of existence in a soft and muddy substratum. Another means of furnishing the tree with considerable resisting power is the circumstance that not seldom a row of secondary roots breaks through the under surface of the primary aerial root, descends immediately in a vertical direction into the mud, and, by a luxurious branching into roots and rootlets, helps to strengthen the primary root. (pp. 645-6).

Father Blatter (p. 651) goes on to say that—

An interesting feature of *Avicennia officinalis*, *Sonneratia acida* and *Ceriops Candolleana* are the pneumatophores, which exhibit an aspect widely different from those of the *Bruguieras*. As soon as the shrub reaches a certain height, in *Avicennia officinalis*, e.g., 1 foot or 1½ feet, there appear in great number around the stem within a large circle, erect shoots with a soft, elastic texture like cork. They resemble very much the young shoots of *Asparagus*, except in colour, which, in our case, is a brownish black. They are very seldom observed developing leaves and growing up into bushes. If we follow them downwards we find the point of origin to be the subterranean roots of *Avicennia officinalis*, of which they are the negative-geotropic branches. In this plant they reach 1 to 1½ feet above the mud or the shallow water and do not exceed in thickness ½ or ¾ of an inch, whereas in *Sonneratia acida* they reach 18 to 24 inches in length, by 3 inches in diameter. As they do not develop into a shrub, it is evident that they serve some other purpose. A transverse section of such a root-branch gives us the looked-for explanation. In *Avicennia officinalis* our attention is drawn to a large, white ring which occupies nearly the whole plane of the section, leaving room only for a small, darker ring in the centre and a comparatively disappearing, protective skin. The white, loose portion is easily recognised as the parenchymatous tissue of the primary cortex and in it the naked eye is able to distinguish little holes which, by microscopic examination, prove to be lenticels. Those roots, therefore, represent respiratory organs like the over-ground roots of *Bruguiera*. But why do the pneumatophores reach beyond the water-level, as there is oxygen in the water? We must admit that the air dissolved in water shows, on the one hand, a higher percentage of oxygen than the atmosphere, but, on the other also a higher percentage of carbonic acid. In consequence of it the quality of oxygen available to the plant is much smaller in the water than in the air. Besides, the air diffuses very slowly in water, and thus it may easily happen that the slow movement of the water causes a want of oxygen. It is for this reason that woody plants, the stem-bases and roots of which are submerged in mud and stagnant water, are furnished with special adaptations for the absorption of oxygen from the atmosphere. That there are really graduations as to the percentage of oxygen available to the plant in different media, may be shown to evidence by the examination of a pneumatophore of *Avicennia officinalis*. The respiratory root is very thin at the base, where it is covered by mud; it grows thicker, where it is submerged in water, and it reaches its maximum, where it is surrounded by the atmosphere. And if we examine the anatomical structure, we find that the various degrees of thickness are due to the respective development of the parenchymatous tissue, which contains the lenticels, i.e., the respiratory organs. The same may be observed in the species of *Rhizophora*. They are not possessed of special pneumatophores, but the modified tissue of their "stilt-roots" takes upon itself the function of respiration and here again it is not the portion buried in the mud, but the one emerging from the mud and still more the upper part which is accessible to the atmosphere.

Then follow biological notes (p. 652) on *Carapa obovata* Bl. (Meliaceæ), *Lumnitzera racemosa* Willd. (Combretaceæ) and *Ægiceras majus* Gaertn. (Myrsinaceæ), a well-known Mangrove shrub of the Sydney district and New South Wales.

Then a paper, "Some Queensland Mangrove Barks and Other Tanning Materials," by J. C. Brünnich and F. Smith (*Queensland Agricultural Journal* xxvii, 86, 1911) may be referred to. It contains useful information in regard to the Mangroves of Northern Queensland, and incidentally to the bark-collecting. There are notes as to the area covered, and to the relative abundance of the stilt-roots.

Mr. Charles Hedley refers to *Avicennia officinalis* in his most interesting Presidential address before the Royal Society of New South Wales, *Journal*, Vol. xlix, 45, 46 (1915), and published two plates, 1 and 2, the latter, and Mr. Baker's xlviii, showing the breathing-roots, or Cobbler's Pegs, excellently.

A few months later, *op. cit.*, p. 257, Mr. R. T. Baker published an exhaustive and copiously illustrated monograph on *Avicennia officinalis*. I am only incidentally referring to this species at this moment, and content myself with drawing attention to those portions of the paper referring to breathing-roots (pneumatophores). At p. 263 Mr. Baker makes the interesting observation that the shade of the tree is necessary for the welfare of the breathing-roots underneath. At p. 264, &c., he deals with the anatomy of these roots.

Knees in Cypress trees. Aerating roots. Origin and meaning of "knees" in Conifers (Cypresses, &c.).

The effect of the quantity of water in the soil or of growing in a water medium is very marked on most plants, but has not been of great importance in inducing variations in cultivated plants. Serious lack of water (a condition which is found in deserts and sandy regions) has given rise to various devices by plants to prevent loss of water by evaporation from the leaves, water storage reservoirs in the tissue, specialised glands to absorb dew, &c. Desert trees and shrubs are commonly stunted, gnarly-stemmed plants, with large root systems. The fact that these characters almost invariably disappear (frequently in the first generation) when the plants are grown where there is an abundance of water and food, shows that they were assumed because of a lack of these materials.

The bald cypress (*Taxodium distichum*) furnishes an interesting illustration of the effect of excess of water. The cypress, as is well known, grows usually at the present time in swamps and very wet places. Geological records, however, show that centuries ago, previous to the Glacial epoch, the cypress tree grew in the present Arctic region, associated with oaks, maples, &c. As it was forced southward by the gradual change in climate, competition with other trees evidently resulted in its present habit of growing only in swamps. Plants growing on dry land secure the necessary oxygen needed in root growth from the air, which is always present in the soil. Plants growing in the water or on very wet soil, however, frequently find it difficult to secure sufficient oxygen, and this has led to the development of devices to facilitate the aeration of the tissue. Cypress trees growing in water form numerous protuberances on the roots known as "cypress knees," which extend above the water into the air. By growing numerous seedlings of the cypress under varying conditions, Dr. Wilson has shown that these roots are invariably formed by plants growing in water, and are never formed when the plants are grown on fairly dry soil which contains sufficient air. He concludes, therefore, that these peculiar organs enable the roots of the tree to secure the necessary oxygen, and are developed as a direct result of the habit assumed by the cypress of growing in swamps. It is an interesting fact that this habit of forming knees, which was acquired centuries ago, has not become hereditary, being totally lost the first generation if the tree is grown on dry soil. In swamps and on lake margins, which places are now its natural home, the bald cypress forms a ragged, spreading growth, with large limbs and sparse foliage, and is very different from the common type of closely related pine trees. This also is the result of a lack of oxygen and food, as before stated. When the tree is grown on dry soil, as it frequently is in parks, where it secures abundant air and nutrition, it

W. C. Grady, photo.

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ADVENTITIOUS ROOTS OF *Eucalyptus rudis*, WESTERN AUSTRALIA. (Nos. 1 AND 2. SEE P. 66).

W. C. Grubb, photo.

No. 3 OF THE PRECEDING. (SEE P. 66).

W. F. McLean, photo.

FIG ON BRUNSWICK RIVER, N.S.W., SHOWING ADVENTITIOUS ROOTS.

Judge Docker, photo.

ADVENTITIOUS ROOTS (*Eucalyptus rostrata*), MENINDIE,
DARLING RIVER, N.S.W.

A. R. McCulloch, photo.

ADVENTITIOUS (STILT) ROOTS OF *Pandanus*. (LORD HOWE ISLAND)

FIG TREE, ILLAWARRA RANGES, SHOWING ADVENTITIOUS ROOTS. DRAWN BY J. F. MANN, 1853.

FIG TREE, ILLAWARRA RANGES, SHOWING ADVENTITIOUS ROOTS.
DRAWN BY J. F. MANN 1853.

reverts to the normal type, forming a tall, symmetrical, columnar top. In this case no knees are developed. The difference in the form of the top developed in the swamp and that developed on uplands or in parks is evidently due to the difference in food supply, as in the case of the Juniper. (*Year book, Dept. of Agric., U.S.A.*, 1896, pp. 94 and 95.)

Speaking of "knees" in Cypress-trees, Coulter, Barnes, and Cowles, ii, 508, say :—
 "Oddly enough, knees do not develop in deep water, but only in shallow water or in swamps. If these peculiar structures are regarded as reactions to a slight oxygen content, it is difficult to account for their absence in deep water, unless it is supposed that the life-conditions there are too poor to permit of growth."

Knees are not formed on *Taxodium* in the Botanic Gardens, Sydney, under any of the conditions under which we grow them.

PHOTOGRAPHIC ILLUSTRATIONS.

Three photos by W. C. Grasby, Western Australia, of *Eucalyptus rudis*, viz. :—

No. 1. Flooded or Blue Gum. Ferndale, Balingup, W.A. Has been ringbarked seven or eight years, and kept alive by developing an aerial root 7 feet from ground, and sending it down through decayed interior. See No. 2 of base of the tree showing the root.

No. 2. Base of Blue or Flooded Gum, showing aerial root developed 7 feet from ground, and sent down through decayed centre of tree. See No. 1.

No. 3. Base of small Blue or Flooded Gum at Ferndale, Balingup. Ringbarked a number of years and has developed roots from above the ringing. (See fuller references at p.).

A giant Fig on the Brunswick River showing adventitious roots. (W. F. McLean, photo).

Roots from River Gum Stumps (*Eucalyptus rostrata*). Menindie, Darling River, N.S.W. (Judge Docker, photo).

Edge of clearing. Native forest removed for pasture. Lord Howe Island. Shows adventitious roots of Screw Pines (*Pandanus*). (A. R. McCulloch, photo).

Two sketches showing adventitious roots of Fig Trees. Illawarra Ranges, 1853. (From original pencil drawings by the late J. F. Mann).

...the normal type ... the ...

...the ... the ...

...the ... the ...

PROPOSED REVISIONS

...the ... the ...

Brachychiton populneum R.Br.

The Kurrajong.

(Family STERCULIACEÆ.)

Botanical description.—Genus, *Brachychiton*. See Part LXII, p. 39.

Botanical description.—Species, *populneum* R. Brown (*loc. cit.*).

Following is a translation of the original:—

Leaves ovate, acuminate, undivided, trilobed or with an acute or obtuse base, very glabrous, racemes axillary or almost simple. Calyx campanulate, follicles elongate-stipitate. Eastern extra-tropical Australia, 1803-4.

Bentham later on described the species (as a *Sterculia*) in the following words:—

A tree of from 20 to 60 feet, quite glabrous except the flowers.

Leaves on long petioles, glabrous and shining, either entire and from ovate to ovate-lanceolate, or more or less deeply 3 or rarely 5 lobed, the two lateral lobes sometimes very short, sometimes all lanceolate, 2 or 3 inches long, the simple leaves or their lobes always ending in long points.

Flowers in axillary panicles, rarely exceeding the leaves.

Calyx very broadly campanulate, slightly tomentose when young, attaining when fully out 7 to 9 lines diameter, acutely lobed in the middle, of a yellowish white and glabrous except the ciliate margins outside, reddish and glabrous within.

Staminal column also glabrous.

Ovary slightly tomentose.

Follicles very ovoid, $1\frac{1}{2}$ to 2 or even 3 inches long, thick and glabrous, on stalks of 1 to 2 inches, the endocarp and outer coating of the seeds very shortly hirsute and cohering. (B.Fl. i, 229, as *Sterculia diversifolia* G. Don.)

Botanical Name.—*Brachychiton*, already explained, Part LXII, p. 39; *populneum*, Latin, pertaining to a poplar tree, as the tree reminded the describer of a poplar.

Vernacular Names.—The “Kurrajong” (variously spelt in old works, Corryjong, Curryjung, and there are other variants). It is of aboriginal origin, and signifies bark-fibre. It has long been part of the English language, and the other names employed in Australia for this tree are, by comparison, insignificant.

Mr. W. Baeuerlen stated that it was known as "Yam-tree" about Colombo, Candelero, N.S.W., for reasons which will be evident presently.

The aborigines of the Milton district (South Coast, N.S.W.) had a curious belief that to cut one of these trees would produce rain, consequently they were often spoken of as Rain trees. But they must not be confused with two trees of *Eucalyptus maculata* (Spotted Gum) which grow on the roadside a few miles to the southward, and are known to residents and regular travellers as the "Water Trees," owing to the fact that they have small hollows in the base of the trunks which hold water nearly all the year round. One in particular has been the means of quenching many a thirst on this particularly dry piece of road. (R. H. Cambage, *Proc. Linn. Soc. N.S.W.*, xxvii, 577, 1902.)

Aboriginal Names.—"Bundine" of the Tumut blacks (Dr. George Bennett, "Wanderings in New South Wales," i, 264 (1834)).

It is the "Courymyn" (1855 spelling), "Couramyn" (1862 spelling) of the aborigines of the Illawarra, as quoted by the late Sir William Macarthur in the catalogues of International Exhibitions.

"Yammur" of those of the Hay district, according to the late K. H. Bennett (a well-known observer of the aborigines; no relation to Dr. George Bennett).

Known as "Currammai" by the aborigines of the South Coast (R. H. Cambage). The first two syllables of this name seem to be identical with that quoted by Sir William Macarthur.

Synonym.—*Sterculia diversifolia* G. Don ("General History of the Dichlamydeous Plants," i, 516 (1831)). The name *diversifolia* (various leaved) is well chosen, for the variation in the leaves in this species is well-nigh infinite.

An Interesting Hybrid.—There is an unstable cross between the Kurrajong and the Flame-tree (*B. acerifolium*) which has formed the so-called Crimson flowering Kurrajong (*Brachychiton populneo-acerifolium* F.v.M.), a note concerning which will be found in the "Proceedings of the Linnean Society of New South Wales," vol. xli, p. 180 (1916). I say unstable because "seed that has been taken from it has always produced the white-flowered variety (the Common Kurrajong)—it stands close to Kurrajong trees of the white-flowered variety." In other words, the Kurrajong and the Flame-tree cells have not thoroughly merged in the third or new crimson form.

Leaves.—Cattle and sheep are fond of the leaves and branches, and in some dry seasons have existed for long periods on scarcely anything else. I suppose the Kurrajong is our best native fodder-tree. Kurrajong and Quandong trees are exempted from the operations of all timber licenses and permits in New South Wales, and cutting them down is prohibited; but, in time of drought, if the leaves of the Kurrajong tree are required for feed for stock, the lighter branches may be lopped. The word "lighter" is important, because heavier branches carry bark, which is injurious.

Mr. F. B. Guthrie, in *Agricultural Gazette*, October, 1899, gives the following analysis of the leaves:—

Water, 35.61; ash, 4.99; fibre, 14.54; ether extract (oil, &c.), 1.70; albuminoids, 10.35; carbohydrates, 32.81; nutrient value, 46; albuminoid ratio, 1:3½; tannin (oak-bark), 2.4.

The following brief article, which appeared in the *Sydney Morning Herald* for 15th June, 1908, entitled "The Value of the Kurrajong," emphasises its fodder-value :—

Despite recent rains, winter prospects throughout Riverina cannot be too bright. The cold season set in far earlier than usual; there have been sharp frosts, and further heavy losses of stock seem inevitable. One lesson of the severe dry spell was that people who went in systematically for ensilage right through the abundant years, in the recent time of leanness reaped the advantage of their foresight. Not a few of the large farmers and the pastoralists were in a position to tide over the winter without any loss of stock, though the cost of keeping them alive may be very heavy. As a general thing, unfortunately, the people on the land are apt to be careless. After a good season or two they forget the bad years and trust to luck; and when the trial comes they are found overstocked, and in other ways unprepared to meet it.

In different parts of the country the kurrajong has once more demonstrated its great economic value during periods of drought. One farmer who has but a small clump of the trees on his holding, has kept his sheep in fair condition for the past three months on kurrajong foliage. As soon as this is exhausted he may be under the necessity of paying from £7 to £8 per ton—perhaps more—for fodder for his stock. So far it has cost him nothing to keep them alive and in reasonably good condition. Scores of others right along the Murrumbidgee have done the same. It is amazing—in view of the fact that this tree is a good fodder plant, that stock eat it with avidity, even to the pulpy branches, and that it flourishes in its lush greenness year in and year out, independent of droughts, and is a prolific agent in the generation of moisture—that more attention is not given to the care and the culture of this natural resister of aridity. Countless thousands of beautiful trees have been destroyed because people could not see far enough ahead to realise what they were doing, or were indifferent as to the future. In this way the kurrajong has been cut down wholesale in the past, as in times of drought stockowners found this easier than lopping the limbs off. The advantages of the latter process are that the immediate supply of fodder is as abundant as if the trees were felled; a denser growth of foliage is promoted, and the future is provided for in so far as it is within the scope of the kurrajong to provide for it. If people would only learn from experience—bitter and ruinous in many cases—and take a common-sense view of the matter, we should have extensive cultivation of the kurrajong instead of neglect and, often, positive, wanton destruction.

There is an article entitled "Scrub-cutting for Sheep-feed," by C. J. Woollett, in the *Agricultural Gazette, N.S.W.*, for June, 1915, p. 466, which is very useful. Although he refers to other plants, he mainly deals with the Kurrajong, and illustrations of the method of lopping the branches are shown from photographs. The lopping is rough pruning, and I only wish that pastoralists would lop as neatly as Mr. Woollett's men did, for a good deal of this work that I saw, especially during the 1902 drought, was simply hacking of the trees, without regard to their welfare or symmetry in the future.

Bark.—A strong fibre is obtained from the bark. It is used by the aborigines for making fishing-nets, both in east and west Australia. Fibre of this kind may be obtained by soaking the bark in water for a week or more, and then beating with a mallet, when the various layers separate out. Almost, if not all, the species of *Brachychiton* are used by the aborigines for a similar purpose.

"Fibre-twine made from the inner bark, dried in the sun, and drawn into shreds, for dilly-bags. (Middle) Palmer River, Gulf of Carpentaria, known as "Kalan." (Roth, Bulletin No. 1, N.Q. Ethnography.)

Roots.—An early record by Dr. George Bennett ("Wanderings in N.S.W." &c., i, 264, 1834) says that the aborigines in the Tumut district eat both the young roots and shoots of the tree. "Some of the roots are described to be a foot in circumference, like the stalk of a cabbage, consisting of medullary and fibrous substance, having a sweetish and agreeable taste."

The tap-roots of young trees, and the young roots of old trees, are used as food by the aborigines. (Macarthur.) When boiled they have a flavour similar to that of turnips, but sweeter.

A correspondent from the Bega district informed me, many years ago, that this tree seems hardly, if at all, known in the South Coast district as "Kurrajong," but it is well known as "Yam-tree," on account of the large yam-like root the tree possesses, at all events in the young state, which root is locally called a yam, and it is stated that these were formerly much sought after by the aborigines for food. In the case of some small trees, less than 1 inch in diameter, which were dug up for planting, they had yams from 8 to 12 inches long, and 2 or 3 in. diameter, weighing several pounds. He tells me they have been got 8 to 10 lb. in weight, and are not despised by Europeans. The outside skin or bark of these yams can be easily removed, and looks like the skin of a radish. The inside is beautifully white, a little sweetish in taste, but otherwise rather insipid. He states: "I think them on the whole rather palatable, but cannot learn whether the aborigines used to eat them raw or subject them to some process of cooking."

The following notes refer to a closely allied species, *B. Delabechii* F.v.M., of Queensland:—

"It is said that the soft juicy tissue of the stem can be eaten, and that many a wanderer in the bush has staved off hunger by its means. The young shoots and roots of young trees are agreeable and refreshing. The nuts also are eaten." (Thozet, Palmer, also Tenison-Woods, *Proc. Linn. Soc. N.S.W.*, vol. vii, p. 573.)

Thozet speaks of the natives cutting holes in the soft trunk where the water lodges and rots the trunk to its centre. These trunks are so many artificial reservoirs of water. When a tree has been cut its resources are not exhausted. The tired hunter, when he sees a tree that has been tapped, cuts a hole somewhat lower than the old cuts, and obtains an abundant supply of the sweet mucilaginous juice afforded by the tree. This is the tree from which the notorious M. Rougemont speaks of having obtained water for a considerable period.

Seeds.—"I succeeded here (near the south coast of the Gulf of Carpentaria, opposite Sir Edward Pellew Group) in cooking the seeds of *Sterculia* which had recently been gathered; first by separating them from their prickly husks, and then roasting them slightly, and pounding and boiling them for a short time. They produced not only a good beverage with an agreeable flavour, but ate well, and appeared to be very nourishing. They contained a great quantity of oil." (Leichhardt's "Overland Expedition, Moreton Bay to Port Essington," p. 411.)

"We refreshed ourselves with a pot of *Sterculia* coffee" (*op. cit.*, p. 422).

I have another reference from the same work, but I have lost the page, ". . . made, when slightly roasted, a fine coffee, and the remaining grounds were good to eat."

I do not know what *Sterculia* or *Brachychiton* was used; it may have been *B. populneum*.

The seeds of some species, and especially that of the African Cola-nut (*Cola* or *Sterculia acuminata*) contain thein or caffeine (the active principle of tea and coffee—practically the same) in large quantity, as has been known for a very long period. "In

some parts of the North-west Provinces the seeds of *Sterculia urens* Roxb. are roasted, ground, and made into a sort of coffee" (Watts' *Dict. Econ. Prod. India*, vi, 365).

The seeds of the Australian species of *Brachychiton* or *Sterculia* have been but little examined. Mr. W. M. Hamlet, at the instigation of Mr. F. Turner, found a small percentage of Caffein in those of the Kurrajong, and the late Dr. J. Lauterer, of Brisbane, did not find any in *B. trichosiphon* and *quadrifida*. But, without raising great expectations in the matter, the seeds of the Australian species should be all carefully analysed.

Timber.—Timber soft, spongy, and nearly useless. There is a family likeness amongst all *Brachychiton* timbers, and this is one of the coarsest and most open-grained of the genus. Like other timbers belonging to this genus, it is fairly homogeneous. A slab in the Technological Museum, which had been seasoned over twenty-five years, had a weight which corresponded to 29 lb. 4 oz. per cubic foot. It is lighter and more porous even than fig-timber. It is of little economic use.

The wood is very porous and tough and resembles cane; and from it the natives obtain fire, but by a different process to that with Quandong wood. They procure a piece about 1 inch thick, some 3 inches wide, and about a foot long; in this they make a hole about $\frac{1}{2}$ an inch deep, and the same in diameter; into this hole they put some finely rubbed dry grass, and then with a round piece of the same wood, which fits easily into the hole, rub briskly backwards and forwards between the palms of the hands. The principle is the same, although the method is different—as with the Quandong wood—the hot dust produced by the friction causes the dry grass to ignite. I have never seen this method practised by the natives here, but they have described it to me. (K. H. Bennett, *Ivanhoe*, via Hay.)

Exudation.—The Kurrajong, like its allies, exudes a whitish gum which distantly reminds one of tragacanth, and which swells in water. I am not aware that any use has been found for it.

Insects.—"The insects of the Kurrajong," by W. W. Froggatt, *Agricultural Gazette*, N.S.W., for March, 1905, p. 226, with two plates, is a most interesting paper.

Size.—It is an umbrageous, medium-sized tree, only occasionally becoming a large tree. A Kurrajong on Weddin Mountain measured by the late Mr. Forester Postlethwaite was 16 feet in circumference at 5 feet from the ground.

Habitat.—It is confined to the eastern half of the continent, extending from Gippsland to the Gulf of Carpentaria and Northern Territory. It seems to have a partiality for a limestone formation.

Following are the localities quoted in the "Flora Australiensis"; the Western Australia locality quoted therein is that of *B. Gregorii* F.v.M.

Queensland.—Dawson River (F. Mueller); Rockhampton (Thozet); in the interior (Mitchell), according to the natives who eat the pods.

New South Wales.—From New England (C. Stuart) and Macleay River (Beckler) to Twofold Bay (F. Mueller); in the interior (Fraser); Lachlan River (A. Cunningham).

Victoria.—Granite ranges on Snowy River and its tributaries, and Hume River (F. Mueller).

Following are some representative localities of specimens taken from the National Herbarium, Sydney.

Victoria.—Gippsland.

New South Wales.—Wentworth, Hay, Tumut to Yarrangobilly Caves, Burren-juck, Braidwood, Yass, Barber's Creek (Tallong).

It is sparingly distributed in the Sydney district (I have no specimens), and Mr. E. Cheel records a specimen between Peakhurst and Bankstown, a little south of Sydney, 11 feet in circumference at 4 ft. 6 in. from the ground (see photo).

Jenolan Caves, Bathurst, Wellington, Nyngan, Cobar, Coonabarabran, Wee Waa, Goulburn River, Scone, Walcha, Urunga, Gunnedah, Mungindi.

There are few plants having a wider range over this State (New South Wales), although it rarely grows in clusters but as isolated trees. It is found over the whole of the area described in these papers, and is dotted nearly all along the coastal districts. It grows on various geological formations, but if it shows any partiality it is first for limestone and then igneous over slate and sandstone. Near Parramatta, at the Pennant Hills quarry, it is found on basalt, while at Newcastle and West Dapto it grows on Permo-Carboniferous formation. At Tillowrie, near Milton, it may be found in limited quantities on an igneous rock extending only a short distance among the sandstone. . . . (R. H. Cambage, *loc. cit.*)

Queensland.—Springsure, Stewart River (runs into Princess Charlotte Bay), Cape York.

Northern Territory.—A few localities are cited in "Flora of the Northern Territory" (Ewart and Davies).

Propagation.—The following earnest plea for the propagation of the Kurrajong I take from the *Sydney Morning Herald* of 10th February, 1908.

In this country in time of drought, or even in the ordinary summer season, there is no more uninviting or desolate spectacle than a township set in the great open spaces where the sun has full play, and unprotected by trees of any kind. To properly understand the difference trees may make to the comfort of life in an inland community, one has to live for a time in a town where the natural timber has been destroyed and no attempt made to replace it by culture. It is common enough to hear certain towns spoken of as "very pretty," and "nice places to live in." If the matter is inquired into it will be found that the only thing which differentiates these particular towns from hundreds of others having no such celebrity, is the systematic culture of street trees. Without its street trees Wagga, for instance, would be nothing but a garish, heat-generating, and unlovely pile of desolation in the grip of a severe summer, and a place of depression for the lover of beauty and brightness at any other period of the year. But the foresight of the men who have guided the destinies of the community civically has served to overcome Nature, and even the lack of anything in the way of an ideal or a purpose in the building of the town. To a man who loves his country, and has a genuine regard for the preservation of "local colour" and the things which are truly and typically Australian, there is one characteristic feature of the tree-planting of Wagga which which pleasantly differentiates it from the great majority of the inland communities in any part of the Commonwealth. In Italy, South Africa, and other countries, the cultivation of the Australian eucalyptus has become one of the new notes of the landscape. Here the gum—which is always beautiful in its normal condition, and when not unduly wrinkled and gnarled by the ravages of age—is scorned, the lovely kurrajong treated with indifference, and the fashion is to cultivate imported trees. For obvious reasons the gum is not suitable for street purposes, but this cannot be said of the kurrajong, which is absolutely the best and most beautiful, as it is the most valuable, of the vegetation that is peculiar to the country which suffers from periodical droughts. Just as beneficent Nature seems to have provided the camel and the date palm for the desert, so the kurrajong appears to have been specially designed for the uses and needs of animal life in the great arid stretches of country which occupy such a large portion of the map of the Commonwealth. The kurrajong will grow and thrive anywhere. No soil can be too impoverished; no region too dry and inhospitable for it. When the whole of the surrounding country has wilted and withered, when the last vestige of herbage has passed into the impalpable elements of the atmosphere, and the earth is rent and blistered by the pressure of a prolonged drought, the kurrajong may be seen flourishing. In form and colour, the qualities which constitute beauty, the kurrajong is not surpassed, if equalled, by any of the trees to be met with in this country; and, what is in the practical sense of vastly more importance, it possesses fine fodder properties. In some of the great droughts of the past, herds of cattle would have been decimated but for the bounteous supply of kurrajong trees in some parts of the country. And

the pity of it is that those who should have known the value of the tree used it in such wanton fashion that in a great measure it has been wiped out. The kurrajong is a vigorous grower in its native element, and will produce a good crop of fodder every year if the limbs and the foliage are only lopped off. But people were not content with that; nothing would do but they must cut down the trees. The consequence is that hundreds of miles of country once covered in the hilly parts with the kurrajong is now almost entirely denuded. The kurrajong is seen at its best in the granitic hills of the dry interior; but it grows well all over Riverina, and even where there is no rocky substance at all. If we were as wise as the experience of the seasons of the country should make us, the whole of our country parks would be planted with this valuable tree, serving as a seed reserve.

The following hints for the propagation of the Kurrajong may be acceptable.

First, fresh, ripe seeds, usually available about May or June, should be selected and removed from the pods by hand, to prevent bruising. The soil should be some good alluvial deposit, having a good mixture of coarse sand in it, to which some fairly well-decomposed leaves should be incorporated in the proportion of one-third of the alluvial soil. As to the sowing, if done in boxes, place some loose rubble in the bottom, then scatter a few leaves over them to keep the soil from percolating through the drainage, then fill up the boxes to within 3 inches from the top, pressing down fairly solid. It would be better to sink the boxes into the ground level to the surface, to prevent too quickly drying. Sow the seed fairly thickly, almost touching each other, then cover them with some soil to a depth of a quarter of an inch, or the thickness of the seed (which is an almost infallible guide in sowing seed), then water very heavily, and mulch with leaves to an inch or so to preserve the moist condition until germination takes place. In the following autumn or winter they should be fit for transplanting to their permanent positions.

EXPLANATION OF PLATE No. 236.

- A. and B. Leaves showing variation in shape.
- C. Flowering twig. Flowers yellowish-white.
- D. Bud.
- E. Flower showing stellate hairs.
- F. Flower opened out.
- G. Monadelphous stamens.
- H. Pistils surrounded by stamens (from Mueller's Key to the System of Victorian Plants, fig. 21).
- I. Fruits.
- K. Seed coat broken open.
- L. Embryo.

PHOTOGRAPHIC ILLUSTRATIONS.

1. Kurrajong at Balagula Station, Land District of Coonamble, County of Leichhardt, N.S.W. (C. J. McMaster, photo.)
2. Koorunga Station, near Young, N.S.W. (Photo by Cecil Lewis.)
3. Near Vernon's Pic, Warrumbungle Mountains, N.S.W. (Photo by His Honour Judge Docker.)
4. Near Peakhurst, a little south of Sydney. (Photo by W. Forsyth.)
5. Remains of a Kurrajong tree eaten by rabbits in the Coolabah District, N.S.W. (Photo by R. W. Peacock.)
6. Drawing of a kurrajong on a limestone hill. It is about a century old, and is supposed to be in the Yass District, N.S.W. (Artist unknown.)

No. 233.

Eucalyptus rubida Deane and Maiden.

Candle-bark.

(Family MYRTACEÆ.)

Botanical description.—Genus, *Eucalyptus*. See Part II, p. 23.

Botanical description.—Species, *E. rubida* Deane and Maiden in *Proc. Linn. Soc. N.S.W.*, xxiv, 456 (1899), with a Plate.

Following is a description:—

Bark.—Perfectly smooth for the most part, the outer layer of bark falling off in ribbons. The “bole and limbs very white, as if whitewashed.” (A. W. Howitt, referring to Gippsland trees.) The name “Candle Bark” is also excellently descriptive of the appearance of the bark in the most southern parts of this colony and in north-eastern Victoria.

It frequently exhibits reddish or plum-coloured patches (hence the specific name); this is a colour rarely, if ever, seen in *E. viminalis*. Sometimes (e.g., Adaminaby to Cooma) the colour of the bark, especially of the branches, may be described as pale pink.

In the case of a species having such an extended range, it is not surprising that the bark shows some variation. For example, the trees about Sunny Corner show perhaps a rougher (more flaky) bark at the butt than is usual in many other localities, but neither here nor anywhere else is such rough bark ever of a fibrous character.

Timber.—Reddish, worthless timber; dries paler.

Juvenile leaves.—From nearly orbicular to nearly oblong, often emarginate or retuse, eventually taking on a lanceolate shape. The midrib usually terminating in a short and fine point. Strictly opposite; sometimes stem-clasping and even more or less connate. Very glaucous as a general rule.

Mature leaves.—Dull green; of similar tint on both sides; narrow lanceolate, of thickish texture, and hence largely concealing the oil-dots, the intramarginal vein scarcely removed from the edge, the primary veins roughly transverse. Often glaucous, sometimes very much so. Spherical brachyscelid galls are sometimes found on the leaves.

Buds.—Ovoid, axillary; in threes and cruciform; sessile or with very short stalklets; the stalks commonly under $\frac{1}{4}$ inch long, round, rarely flattened, and then only towards the insertion of the buds.

Operculum.—Nearly hemispherical when ripe, hardly pointed; rather shorter than the calyx; conoid when less ripe.

Stamens.—All fertile and inflected in the bud, anthers ovate-oblong, with parallel distinct cells.

Fruit.—Top-shaped; spreading at the orifice. Usually about 3 lines in diameter. Sometimes nearly hemispherical. Shiny or glaucous. The rim broadish and convex. Valves three or four and exert d.

Botanical Name.—*Eucalyptus*, already explained (see Part II, p. 34); *rubida*, Latin, reddish. It frequently exhibits reddish or plum-coloured patches on the bark, hence the specific name.

Vernacular Names.—Known as “Flooded Gum” at Queanbeyan, Michelago, Cooma; sometimes known as “Bastard White Gum,” “Ribbony Gum,” and “Drooping Gum.” The name “Candle-bark” in use in the Queanbeyan district is in reference to its smooth and glaucous trunk; it is very descriptive of the tree as seen in much of its range, and might be adopted for the vernacular, as the others are already appropriated. It has usually reddish or plum-coloured patches on the bark, hence the occasional name of “Spotted Gum.” Sometimes the bark is, however, of a yellowish cast (the tips of the twigs being also yellowish), and hence between Goulburn and Moss Vale it is one of the trees known in the district as “Yellow Gum.” We have also noticed the species to have a yellowish bark between Delegate and Bombala; while a label in the National Herbarium, Melbourne, shows that the species at St. Vincent’s Gulf, S.A., is also known as “Yellow Gum.”

It is also known as “Manna Gum,” and is perhaps the principal species of *Eucalyptus* yielding that substance. Although the name “Manna Gum” is so largely applied to *E. rubida*, it would appear not desirable to encourage the use of it as a definite name, since *E. viminalis* is so well known by that name. Incidentally, it may be stated that *E. rubida* is one of a number of species which masqueraded under the name of *E. viminalis*.

Aboriginal Name.—It is the “Bak-bak” of the aborigines of the Upper Murray, according to the late Lady Hay. See p. 106. Such a precious tree to the blacks has doubtless other names in various districts, but I do not know of them.

Synonyms.—This was long looked upon as a form of *E. viminalis*, and its smooth bark, and its yield of Manna, lent colour to that view. The name *E. mannifera* Mudie and A. Cunn., which is very freely quoted in old books, is of course in reference to this manna-producing quality. For other synonyms, see my “Critical Revision of the Genus *Eucalyptus*,” Part XXVI, p. 111.

Leaves.—The point I desire to invite the attention of my readers to in regard to this species, is that the sucker-leaves are nearly as round as half-a-crown, and they are white as if dusted over with flour. The sucker-leaves of *Eucalyptus viminalis* are sharply different in this respect. The exudation of manna from the mature leaves of this species is referred to at length at page 107.

Flowers.—Note that, in the typical form, the flowers are in threes, and arranged in the form of a cross, but this is by no means always the case, particularly in specimens from northern New South Wales.

Timber.—It is a pinkish timber, often so deep in colour when newly cut that it has been described as “red,” but the use of this adjective must not cause it to be confused with the recognised red Eucalyptus timbers. It is not of an ornamental character, and like that of most Gums, is inclined to shrink; the question of its durability is dealt with in the following paragraphs.

This species was for long enough confused with *E. viminalis*, and hence its timber was considered to be of very little value as regards durability, and the statements that came through as to its usefulness puzzled many, and were set down to special conditions of growth, and so on.

The following testimonies are from men whose opinions command respect, and the timber of *E. rubida* is undoubtedly valuable; I would call it a useful second-class timber. The lesson is obvious that where the experience of a reliable bushman, long resident in a particular locality, runs counter to one's preconceived ideas, we should carefully note his testimony, and, if we cannot understand it, strive to do so. The durability of a timber is a most important character, and in the same species it may vary, so that it is conceivable that an inferior quality of a normally durable species A, may approach the superior quality of a normally non-durable species B, but, making allowance for all this, we arrive at a point at which we refuse to believe that a certain inferior timber can belong to a species whose timber is reputed to be durable, and *vice versa*.

We have many of these unsolved problems in regard to the durability of timbers, the difficulty often arising from the circumstance that we may have not adequate botanical material matched to the timber. These records of durability, so important in a new country which uses such large quantities of timbers for such trying situations as fence-posts, house-posts, &c., often depend upon the personal recollection of a citizen, and memory may be fallible. In regard to certain other properties of a timber, such as tensile strength, a machine elicits the evidence, not dependent on an historical record, which may break down. Further, a timber subjected to a durability test may possess external characters resembling those of another species, while if the durability test be very prolonged, the origin of the timber may have long passed out of mind.

The matter of the *optimum* of a timber comes into consideration also.

Testimony 1.—“Knowing *E. rubida* to be closely allied to *E. viminalis*, and remembering the inferior character always assigned to the latter, I was surprised on Saturday to find from a splitter residing in *rubida* country for over fifty years that posts of this tree have lasted forty years in the ground. On close inquiry I found him well aware of the difference in sucker leaves of *rubida* and *viminalis* and *leucoxydon*, and I saw the posts myself. It is, however, too free splitting for sleepers, as the bolts can't put good enough hold.” (Walter Gill, Conservator of Forests of South Australia, 31st March, 1903, in a letter to me.)

Testimony 2.—“The parent tree of the twigs I sent you is a Gum growing in large quantities on the Bago Forest Reserve, Tumbarumba, and I consider it a species of the Ribbon Gum; it is known as such by some bushmen and regarded as a useless

tree by those who are not timber men. I have, however, made a practical investigation of this gum tree, and can state with confidence that it is of considerable commercial value; its timber is very durable, and fence posts made out of it have been known to last over thirty years in the ground. I have seen these posts, and they are still in a good state of preservation. I also saw, in good order, a bullock dray which was made out of it many years ago.

“The wood of this tree is close-grained, and of a white colour throughout. My object in forwarding you the twigs was with a view to having the tree named, and to see what you knew about it commercially, as I had been requested by my Department to report on the F.R. on which it grows, viz., No. 1,961 aforementioned.” (W. V. Nowland, Staff Surveyor, Tumut, 1903, in a letter to me.)

Now that bushmen and others can precisely understand what Candle-bark is, and there is no occasion for confusing it with *Eucalyptus viminalis*, the commonest of our White Gums, I trust that evidence will be forthcoming which will enable us to assess the value of Candle-bark timber. The problem is still unsolved.

Size.—It is usually a medium-sized tree, but it attains a height variously estimated at 100 to 150 feet. It may attain a diameter of several feet, and, when well grown, is a stately, handsome tree.

Habitat.—It is found in the States of South Australia, Victoria, Tasmania, New South Wales, and Queensland.

It is primarily a cold country species, occurring from end to end of the eastern portion of New South Wales, and but rarely descending below 2,000 feet. It occurs on the lower slopes of the Mount Kosciusko Range and ascends to about 5,500 feet. On other mountain ranges and spurs in the south-eastern part of the State it ascends nearly as high. In New England and the spurs and higher slopes arising from it, it is common, and extends into Queensland as far as the Stanthorpe district.

The type form came from the sides of dry hills in southern New South Wales, but it is not uncommonly found in low-lying situations and over a considerable area in that and other States. It is not surprising, therefore, that considerable variation is observable in the species, and this is particularly seen in its northern range. In northern New South Wales it becomes a larger, straighter tree, with coarser leaves, flowers, and fruits.

Its name of “Flooded Gum” indicates the low-lying localities in which it may often be found.

In Victoria it principally occurs in Gippsland, but it extends to the Melbourne district and further west and south.

In South Australia it is found in the Mount Lofty Range, and further localities other than those indicated should be sought for. It attains large dimensions in South Australia.

As regards Tasmania, Mr. L. Rodway (*Proc. Roy. Soc. Tas.*, 1917, p. 17) has the following note :—

“ On dry hills and poor alluvial flats, extending from Bridgewater to Russell, a tree with the character of White Gum, but with smaller fruits, and the juvenile, opposite foliage, glaucous, small and nearly rotund, is very common.”

Those who turn to my “ Critical Revision,” Part XXVI, p. 120, will see that it also occurs near Hobart and in the north-eastern part of Tasmania, *e.g.*, Cullenswood, and between Conara and St. Mary’s. I have recently found it plentifully between the Ouse and the Dee.

So that it will be seen that it has a rather extensive distribution. Those who may desire to see a large number of recorded localities, particularly in this State and Victoria, are invited to consult the details given at page 116 of Part XXVI of my “ Critical Revision.”

EXPLANATION OF PLATE No. 237.

- A. Twig (sucker) showing orbicular foliage.
- B. Twig with buds and flowers.
- C. Anther.
- D. Fruits in threes, showing cruciform arrangement.

PHOTOGRAPHIC ILLUSTRATIONS.

1. “ Manna Gums,” Moonbah, near Jindabyne, N.S.W. (Photo by His Honour Judge Docker.)
2. Ambleside, Mt. Lofty Ranges, S.A. (Photo by Mr. Walter Gill, Conservator of Forests, Adelaide.)

No. 234.

Acacia Oswaldi F.v.M.

"Miljee."

(Family LEGUMINOSÆ: MIMOSÆ.)

Botanical description.—Genus, *Acacia*. See Part XV, p. 103.**Botanical description.**—Species, *Oswaldi* F.v.M. in "Plants Indigenous to the Colony of Victoria," ii, 27 (1860).

The work containing the original description is so excessively rare (only a few pages of Part ii having been printed, and only a very few copies having been published) that it will be a public convenience to have it here.

No. 184. *Acacia Oswaldi* F.M. in *Linnæa* xxvi, 609.

Shrubby; branchlets hardly angular, glabrous or short-downy; stipules obliterated; *phyllodia subfalcate or linear-lanceolate, rarely linear or oblong-lanceolate, closely, finely and almost equally many-nerved, cuspidate* [italics as in original.—J.H.M.] rigidulous-coriaceous, on very short petioles gland-bearing at the base; *capitula small, 8-12 flowered, sessile*, or on exceedingly short peduncles, solitary or frequently geminate; bracteoles oblong- or ovate- or rhomboid-cuneate; sepals narrow- or cuneate-linear, free, about half as long as the disconnected petals; *Pods usually spirally twisted and elongated*, stiff-coriaceous, bivalved, inside continuous, gently or scarcely contracted between the seeds; funicle almost obliterated; seeds placed lengthwise, brown-black, shining, with large lateral areoles; *strophiole orange-coloured*, cordate- or rounded-cymbiform, nearly half as long as the seeds and clasping its lower part unilaterally.

In the desert on the Murray River; extending thence to the Murrumbidgee, the Lachlan River, the Darling River, Cooper's Creek, and St. Vincent's Gulf.

A good-sized bush. Phyllodia glabrous or almost imperceptibly downy, pale-green, 1-3 inches long, 1-4 seldom 6 lines broad, distinctly though finely streaked; the cuspid often straight than bent, variable in length; gland at the base of the phyllodium usually conspicuous, concave. Flower-heads very fragrant, only by the occasional want of phyllodia at the extremities of the branchlets short-racemose. Sepals acute, very slightly downy towards the summit. Petals about $\frac{3}{4}$ line long, glabrous or hardly perceptibly downy. Pods glabrous or very thinly velutinous, attaining a length of 8 inches, although usually more or less shorter, $\frac{1}{2}$ - $\frac{3}{4}$ inch broad, sometimes irregularly twisted or by abbreviation simply cyclic. Seeds 3-4 lines long, moderately compressed. Strophiole 2-2 $\frac{1}{2}$ lines long and broad, from a short narrow appressed funicular base suddenly dilated, not conduplicate, bleaching in age, blunt or slightly acute at the apex.

This species was referred doubtfully to *A. elongata* in the *Linnæa* xxvi, 609. It was named many years ago in acknowledgment of contributions to the author's collection made by Mr. Ferd. Oswald, then a resident of Adelaide, now of Nordhausen (Prussia). Seemingly the same species was collected in Queensland towards Broad Sound. (Mueller in "Plants Indigenous to the Colony of Victoria," Vol ii, p. 27.)

There is a note in *Fragm.* iv, 5, while Bentham described the species in B.Fl. ii, 384.

Botanical Name.—Acacia, already explained (see Part XV, p. 104); *Oswaldi*, in honour of Ferdinand Oswald, formerly of Adelaide, and at the time of description, of Nordhausen, Prussia. The name is spelt *Osswaldi* in Mueller's "Census of Australian Plants" and "Select Extra-tropical Plants."

Vernacular Names.—It is often called "Umbrella Bush," as it affords capital shade.

We have not quite settled down to agreement about vernaculars in this species. Mr. A. W. Mullen calls it "Curly Yarran" and "Nealie." What "Nealie" is, by the way, has not been settled. See Part XXX of the present work, p. 177. Mr. L. V. d'Apice calls it "Black Yarran," and I have received it also as "Black Myall." In cases where it has been sent as "Ironwood," this is owing to confusion with *A. excelsa* (see Part XXXIII of the present work) for the phyllodes (leaves) are a good deal alike.

It has been sent to me as "Bean Bush," from Moulamein, "because it is prolific in pods. It is known as "Coughing Bush" in the Cobar district (Archdeacon Haviland).

The leaves terminate in short spines, which have earned for the tree the unsuitable name of "Dead Finish," the inference being that a traveller, entering a cluster of these trees would suddenly find his journey finished owing to the resisting nature of these spikes. Even if this species formed scrubs, the leaves are harmless compared with those of many others. It is probable that the name properly belongs to some other tree, and has been applied to this one by mistake. Still I found it used over a very large area. About half-way between Condobolin and Dandaloo it is known by some as Gidgea, its value for stock-whip handles having probably caused it to be confused with the Bourke species of the same name, *A. Cambagei*, which is famous over most parts of the colony among stockmen. (R. H. Cambage in *Proc. Linn. Soc. N.S.W.*, p. 326, 1901.)

Aboriginal Names.—"Miljee" is its commonest name; I believe it originated in New South Wales, and suggest that it be adopted as a vernacular. The late Mr. K. H. Bennett gave me the name "Middert," as in use by the aborigines of the Ivanhoe, *via* Hay, district. Mr. R. H. Cambage gave the name "Currawa Widgee" as in use around Dandaloo, Bogan River, N.S.W. Mr. A. W. Mullen gave me "Middia" as in use in the Darling River (Bourke) district. It is known towards the Darling as "Goolia," according to Mr. A. C. Loder, Assistant Forester, Broken Hill, New South Wales.

I have had it under the name of "Karagata" or "Karagatta," as in use in Victoria. Mr. Max Koch told me that the blacks around Mount Lyndhurst, South Australia, called it "Whyacka."

Leaves (Phyllodes).—It has been quoted as a fodder-plant or browse, but it is certainly not of high value for that purpose, for it is dry and hard. Archdeacon Haviland, of Cobar, New South Wales, informed me that stockmen in his district call it "Coughing Bush" because the pungent points of the phyllodia often stick in their throats. Miss Jean E. McMaster, of "Babilah," Warialda, tells me that stock will not eat it.

Mr. Bennett told me that in the Hay district sheep, and not cattle, ate the leaves. Other correspondents have told me that it is not eaten at all. In a given district, it probably depends on the season whether it is eaten or not.

The phyllodes vary a good deal in width, and the flowers have a heavy perfume.

Fruits.—The pods often very abundant, and they are eagerly eaten by sheep. They also supply human food. Miss M. A. Clements, of Palesthan, Condobolin, informed me that the local blacks used to pound the seeds and eat them in the form of a sort of raw paste.

Gum.—Many years ago Mr. H. G. Smith and I reported on a sample collected at Nelyambo, Darling River, New South Wales. It had all the appearance of ordinary commercial gum arabic; some of the pieces are colourless. In appearance, taste, solubility and reactions with reagents, it differs in no respect from gum arabic. It is, however, very acid in aqueous solution, and is perhaps deficient in adhesiveness and viscosity to the best gum arabic. It is identical with the gums obtained from several other species of *Acacia* growing in the dry western portion of New South Wales, which have great commercial possibilities, providing they are obtained in sufficient quantities.

Mr. R. J. Dalton, then of Wanaaring, sent me, some years ago, specimens of *Acacia Oswaldi* twigs, with the following note:—

Nidgya, *Nelia*, or *Blacks' Medicine Tree*. This is held in great superstition by the blacks, which I think is on account of a peculiar habit it has, and which I have only observed twice in twenty-three years, which occurred in the very dry years of 1889 and 1902. A kind of sap oozes out of the bark and leaves in such quantities as to give the ground underneath an appearance of being covered with water, and the bush a shining appearance in the sun. It seems to me to be a close relation of *Gydgee*, as the leaves and bark are very similar in appearance.

The “*Gydgee*” is, of course, *A. Cambagei*, and I cannot quite understand the passage as to the exudation, but I give it as I received it.

Bark.—Over thirty years ago I examined the bark of an oldish tree from Ivanhoe, *via* Hay, N.S.W., with the following result:—Tannic acid, 9.72 per cent.; extract, 20.7 per cent. This much resembled the sample of *A. homalophylla* bark. It, of course, has no future as a tan-bark.

Timber.—This is too small to be used for other than small articles. Speaking of the Hay district, the late Mr. K. H. Bennett wrote to me on 6th September, 1886, “A small bushy tree from 6 to 8 feet high; timber exceedingly hard and tough, possessing very disagreeable smell when fresh or ‘green,’ used by natives in manufacture of short weapons such as clubs.”

It is commonly used for stock-whip handles. The heart-wood is dark, hard, heavy, close-grained, and durable; the timber is not used, but would be useful for cabinet-work, turnery, &c.

Mr. K. H. Bennett told me that the suckers are very tough, and that Ivanhoe, *via* Hay, aborigines used to use them for the handles of their stone tomahawks.

It was sent to me from the Balranald district as one of the six best fuel woods.

Size.—Usually a small umbrageous bush of 6 to 12 feet, hardly a tree. The trunk is usually only up to 6 inches in diameter. At the same time, in some districts it attains a larger size. About Thackaringa it may attain 20 feet, with a stem diameter of 9 inches. Mr. Surveyor A. W. Mullen gave me 15 feet for it in the Wanaaring district (see photo), and Mr. W. A. W. de Beuzeville quoted a similar height in the Warialda district.

Habitat.—In all the States except Tasmania; an inland, dry-country species. Usually the plants grow separately, and do not congregate, forming scrubs.

Under "Botanical description" it will be noted that Mueller followed the bad old practice of not quoting a type (numbered or otherwise) from a specific locality, but simply gave it as from a large area, in South Australia, Victoria, and New South Wales.

I give some notes in regard to individual States (as represented in the National Herbarium, Sydney), but we want it from very many more definite localities.

Queensland.—Following are some Queensland specimens, for many of which I am indebted to Mr. C. T. White, Government Botanist :—

Warrego River (R. Cameron); Bulloo River (J. F. Bailey); Morven (F. M. Bailey); Blackall (R. A. Ranking); Oakwood, near Bundaberg (F. M. Bailey); Bingera (J. F. Bailey); Roma (E. W. Bick); Wallumbilla (? Womalilla, a few miles west of Roma) (C. T. White); Longreach (E. Jarvis); near Mount Morgan (Dr. J. Shirley).

Bentham has it "towards Broad Sound" without collector's name.

Charters Towers (C. F. Plant).

New South Wales.—It has, from my point of view, been naturally more collected in this State than in any other. I roughly group the localities as regards Sydney.

Southern and Western.—"Has a stringy bark, like Nealia; grows to about 20 feet high, with a stem of about 9 inches in diameter. Gives a fair shade. Leaves not eaten by stock." Thackaringa (E. Kilner); Broken Hill (E. C. Andrews, Assistant Forester A. C. Loder); Moama (Forest Guard Watson); Balranald (Forester G. S. M. Grant); "Bean Bush," Bongbilla, Moulamein (T. Grieve); Ivanhoe, *via* Hay (K. H. Bennett); Zara, Wanganella, *via* Hay (Miss E. Officer); Barmedman to Wyalong (Rev. J. W. Dwyer); "Miljee," Wyalong (District Forester Arthur Osborne); Bland, between Morangorell and Young (Rev. J. W. Dwyer); Weddin, *via* Young (J.H.M.); Lake Cudgellico (Rev. J. W. Dwyer); Wooyeo, Condobolin (G. Stirling Home); Tomingley to Peak Hill (J.H.M.); Harvey Range, Peak Hill (J. L. Boorman); Dubbo (E. Betcher); Narromine (Forester A. R. Samuels); "not edible," Nyngan (Forester E. F. Rogers); Coolabah (J. L. Boorman); "Black Yarran" or "Miljee," Cobar (L. V. d'Apice, Archdeacon Haviland, L. Abrahams); "Coughing Bush," Meadows Station, 40 miles west of Cobar (Archdeacon Haviland); Mt. Hope (J. L. Boorman); Yarrowin Station, Barwon River (W. W. Froggatt).

"Middia," "Miljee," "Curly Yarran" or "Nealie." The wood is very hard, and is used for stock-whip handles. Always grows by itself on red soil, and up to 15 feet high. It is not useful as a fodder plant so far as I know, but has been cut for that purpose on the Wanaaring Road. See photograph (Staff Surveyor A. W. Mullen, Bourke). Gundabooka, *via* Bourke (L. Abrahams); Tinapagee, Wanaaring (R. J. Dalton, E. Betcher); Brindigabba-Arrara, Paroo River (J. L. Boorman); Poolamacca, Barrier Range (C. J. McMaster); Whittabranah, Tibbooburra (W. Baerlen).

This brings us to the extreme north-western angle of New South Wales.

Northern and Western.—"Cropped by sheep," Narrabri West (J. L. Boorman); Yarrie Lake, 19 miles from Narrabri, also Brigalow Creek, about 4 miles from Yarrie Lake (Dr. H. I. Jensen); the Pilliga Scrub generally; Wee Waa (T. W. Taylor, Forest Guard G. A. Withers); Forest Reserve 26,016, Ph. Brigalow, County Pottinger (Forest Guard M. H. Simon); Burren Junction (J. L. Boorman); north-west of Collarenebri (Sid. W. Jackson); Danumbra, *via* Collarenebri (C. J. McMaster); Currygundi district (W. M. Brennan); Warraldra (Rev. H. M. Rupp, J. L. Boorman); "Miljee," Mt. Mitchell, Warraldra district (Forester W. A. W. de Beuzeville); Inverell Road and Fraser's Creek, near Ashford (J. L. Boorman). We are again close to the Queensland border.

Victoria.—Dimboola, also Nhill and Lake Hindmarsh (St. Eloy d'Alton). These are all in the "Mallee," and I have no doubt it is fairly well diffused over that class of country.

South Australia.—Mannum, on the Murray River (Dr. J. B. Cleland); "Whyacka," "Bastard Myall." Used for fodder, and the seeds eaten by the natives. Mt. Lyndhurst (Max Koch). This carries us to the Port Augusta district.

St. Francis Island, Nuyt's Archipelago, with phyllodes as broad as I have seen them (Drs. Verco and Torr). This takes us to the Australian Bight.

Commonwealth Hill, north-east of Ooldea, East-West Railway (Dr. H. Basedow). We are now north of the Bight and on our way to Western Australia.

Western Australia.—12 miles north-east of Kanowna (W. V. Fitzgerald). This connects with the East-West Railway locality referred to under South Australia.

Eucla (J. D. Batt, per Herb. Melb.). This is on the Australian Bight, at the junction of Western and South Australia, and this locality connects easterly with the Nuyt's Archipelago on the one hand, and the East-West Railway, to the north, on the other.

EXPLANATION OF PLATE No. 238.

- A. Flowering twig.
- B. Flower-head.
- C. Individual bud.
- D. Flower.
- E. Corolla opened out.
- F. Pistil.
- G. Floral bracts.
- H. Twisted pod.
- I. Seed.
- K. A broad phyllode.

PHOTOGRAPHIC ILLUSTRATION.

"Curly Yarran," on red soil, Bourke District. (Photo by A. W. Mullen, L.S.)

No. 235.

Acacia neriifolia A. Cunn.

The Oleander-leaved Wattle.

(Family LEGUMINOSÆ: MIMOSÆ.)

Botanical description.—Genus, *Acacia*. See Part XV, p. 103.

Botanical description.—Species, *neriifolia* A. Cunn., in Benthams' "Notes on Mimosæ" in Hooker's *London Journal of Botany*, i, 357 (1842).

Following is a translation of the original description :—

A. neriifolia (Cunn. MSS). Branchlets subangular, and the young phyllodes with a mealy tomentum, whitish and finally glabrous, phyllodes elongate-lanceolate or linear, subfalcate, with a hard mucro, gradually narrowed at the base, somewhat thick, scarcely marginate, uninerved, veins indistinct, glands 1-3, indistinct, racemes tomentose, shorter than the phyllodes, heads of flowers small, densely many flowered, sepals distinct, spatulate, ovary tomentose.

Phyllodes 2-3 inches. Liverpool Plains, N.S.W. *Cunningham*, *Fraser*, also amongst Bauer's collections. Perhaps, notwithstanding the very narrow leaves, this species should be placed amongst the Falcatæ.

Then comes Benthams' ampler description in B.Fl. ii, 363, as follows :—

A tall and handsome shrub or small tree; branchlets slender, slightly angular, glaucous or mealy tomentose when young, but soon glabrous.

Phyllodia linear lanceolate, more or less falcate, with a small callous point often recurved, much narrowed towards the base, mostly 3 to 5 inches long and 2 to 4 lines broad, 1-nerved, obscurely penniveined, with one or sometimes two or three distant marginal glands rarely all wanting.

Racemes always simple, rather slender, much shorter than the phyllodia, the rhachis and peduncles usually tomentose.

Flower-heads globular, small, with 30 to 40 flowers, mostly 5-merous.

Sepals spatulate, more than half as long as the corolla, ciliate, free or slightly adnate below the middle.

Petals smooth, usually free.

Pod flat, straight or nearly so, several inches long, about 4 lines broad, often slightly contracted between the seeds.

Seeds oval-oblong, longitudinal; funicle with the last fold appressed and thickened from the middle upwards into a club-shaped aril, the lower folds short and filiform.

Botanical Name.—Acacia, already explained (see Part XV, p. 104); *neriifolia* Latin *Nerium*, an Oleander, and *folium*, a leaf—Oleander-leaved. Early in the nineteenth century it was a very common practice for botanists describing Australian plants to name them after some macroscopic character of plants, wild or cultivated, well known in Europe. Thus *ericifolia* was a very common specific name for plants whose leaves reminded them of *Erica*, a genus largely cultivated then. No one can be surprised at Cunningham's name of *neriifolia*. The leaf (phyllode) varies in width, but the general similarity of it, especially in the mass, to an Oleander leaf, has often struck me when standing before this Australian wattle. This similarity has often enabled one to recognise it when flowers and fruit are absent. As there is so much appropriateness in it, and I have not noticed any other Wattle with a similar character, I have recommended use of the name "Oleander-leaved Wattle."

Vernacular Name.—Often called "Silver Wattle," because of the silvery sheen of the foliage, but I know no name more commonly applied to Wattles than Silver Wattle. It is called "Black Wattle" in northern New England (N.S.W.) and Stanthorpe (Queensland) because of the dark cast of the trunk and branches of old specimens, but there are scores of other Black Wattles. It has also been sent in as "Bastard Yarran," which simply means that it is not Yarran, but they do not know what else to call it.

I recommend the descriptive and unappropriated name of "Oleander-leaved Wattle" for it.

Leaves (Phyllodes).—Not only have the leaves a charming silvery sheen, owing to short white, silky hairs, but the young foliage, the rhachises, and the young heads of flowers are decorative with a golden pubescence.

Bark.—The following analysis of the bark is given by the Queensland Commissioners, Colonial and Indian Exhibition, 1886:—Tannin, 13.91 per cent.; extract, 17.87 per cent. [*sic*]. Common around Stanthorpe, Q. (F. M. Bailey and J. L. Boorman), where it is known locally as "Black Wattle," and used for tanning purposes. I believe the analysis quoted was made on Stanthorpe bark, and that its economic use is strictly local.

Timber.—The duramen is of a light-yellow colour, the rest is of a darker colour. It is prettily marked, close-grained, and tough. It is of no economic importance, so far as I am aware.

Size.—Usually a graceful erect or semi-pendulous shrub. I have seen it a small tree of about 20 feet, and Mr. Cambage has seen it up to 30 feet. It is, however, not a timber producer.

Habitat.—It is confined to New South Wales and Queensland so far as we know for certain at present, but the fact that it appears to attain its greatest size as far west as the Nymagee district points to its vigour in that district, and consequently to its likely

occurrence in South Australia. Bentham refers some South Australian specimens doubtfully to this species, but I have not seen satisfactory specimens. I have even heard of the species extending to Western Australia (Coolgardie), but I ask for further investigation.

Bentham records it from—

Queensland.—Open forests on the Balonne River, *Mitchell*.

New South Wales.—Detached Whinstone hills, Liverpool Plains, *A. Cunningham*, *Fraser* [these would be co-types.—J.H.M.]; very common about Tenterfield, New England, *C. Stuart*; head of the Gwydir River, *Leichhardt*.

New South Wales.—Following are northern specimens in the National Herbarium, Sydney :—

Summit of Mt. Duri, 3,150 feet, near Currabubula, Andesite formation (R. H. Cambage, No. 3563); Attunga Forest Reserve, Tamworth district; Tamworth (Rev. H. M. R. Rupp); Moonbi Forest Reserve, Quirindi (Forest Ranger William MacDonald). All these Tamworth district specimens may be taken as practically from the type locality of Allan Cunningham.

“Abundant on the granite towards New England,” Barraba (Rev. H. M. R. Rupp); Emmaville (J. L. Boorman); Bolivia (J. Vernon); Jennings (J.H.M. and J. L. Boorman); Drake (J. L. Boorman). We are now near the Queensland border.

Let us come a little south-west, and we have—

Curlewis (E. Breakwell); on hills east of Boggabri (R. H. Cambage, No. 3630).

Continuing on the Inverell line we have—

“Tall shrub, almost arboreous,” Cranky Rock, near Warialda (Rev. H. M. R. Rupp); Howell (J. L. Boorman and J.H.M.). This is in the tin granite country of the Inverell district. The species seems to do well in granite country. Inverell (J.H.M., J. L. Boorman, T. McDonnough); Inverell Road and Fraser’s Creek (J. L. Boorman).

We now go south to the Mudgee district to Camboon, 7 miles north of Rylstone (R. T. Baker).

Going north again into the Pilliga Scrub we have Baradine (Forester William MacDonald), a dry locality. But it is a little surprising to find such a leap into the dry Cobar district of New South Wales. Trowel Creek Station and also Hermidale, 15 miles on the Nymagee Road, where it is known as “Bastard Yarran.” “Silver Wattle,” 25 to 30 feet high, and 4 inches in diameter, Trowel Creek, 25 miles north of Nymagee (R. H. Cambage, No. 221).

In a word, it has the surprising range of New England to the Western Plains, and it would be desirable to record very many more intermediate localities than we have at present.

Queensland.—“All over the district in rich land and sheltered situations on the sides of hills. Trees grow to 20 feet, but have exceedingly thin stems in proportion to the height. Known locally as “Black Wattle,” and used for tanning purposes. *Callitris calcarata*, *Eucalyptus macrorrhyncha*, *E. Andrewsii*, *Dodonaea triquetra* &c., grow around it.” Stanthorpe (J. L. Boorman).

Ernest Junction, near Southport and Nerang, nearly 50 miles south of Brisbane (Dr. J. Shirley).

The Stanthorpe locality is contiguous to that of those of New England (New South Wales), but the Ernest Junction locality is unexpected, and shows that the species, at all events in Queensland, extends to the coastal area. The range of this species is therefore most interesting and worthy of more complete investigation.

Propagation.—This is one of the most beautiful Wattles I have ever seen. We miss the beauty of many of our Wattles by neglecting to visit them in winter or in the earliest spring. My recollection of this species around Howell, during some bitterly cold days in August, 1905, was that of sheets or billows of bloom, set off, though not dominated, by the beautiful silvery foliage. It will stand snow and considerable frost.

EXPLANATION OF PLATE No. 238.

- A₁. Flowering twig.
- B₁. Head of flowers.
- C₁. Individual bud.
- D₁. Bract.
- E₁. Flower opened out showing—(a) calyx, (b) petals, (c) stamens, (d) pistil.
- F₁. Pods.
- G₁. Seed.
- H₁. Flower.

The flowers and twig from Attunga, N.S.W.

The pod and seed from Warialda, N.S.W.

No. 236.

Harpullia pendula Planch.

The Tulip Wood.

(Family SAPINDACEÆ.)

Botanical description.—Genus, *Harpullia* Roxburgh, in *Hortus Bengalensis*, p. 86 (1814).

Flowers regular, polygamous. *Sepals* 4 or 5. *Petals* as many, without any scale, but sometimes with inflected auricles at the base of the lamina. *Disk* inconspicuous. *Stamens* 5 to 8. *Ovary* 2-celled, with 2 ovules in each cell. *Style* short or elongated and spirally twisted. *Capsule* coriaceous, somewhat compressed, with 2 turgid lobes opening loculicidally in 2 valves. *Seeds* 1 or 2 in each cell, with or without an arillus; cotyledons thick. *Trees*. *Leaves* pinnate; leaflets usually large, the primary veins prominent underneath. *Flowers* in loose terminal little-branched panicles, sometimes reduced to simple racemes, *Capsules* usually large, red or orange coloured. (B.Fl. i, 470.)

Botanical description.—Species, *H. pendula* Planchon, in F. Mueller's paper in *Trans. Vict. Inst.*, iii, 26 (1859).

The following comprises the whole of the original description :—

Leaflets 2-6, chartaceous, glabrous, lanceolate-ovate, somewhat acuminate, entire; calyx deciduous; cells of the capsules as long as broad, inside glabrous.

In the forests near Moreton Bay.

Here follows Bentham's amplified description :—

A tall tree, glabrous or the young shoots and panicles minutely hoary-tomentose.

Leaflets 3 to 6, or rarely more, from ovate to elliptical-oblong, obtusely acuminate, 3 to 5 inches long, membranous.

Panicles loose and slender.

Pedicels in flower 3 to 4 lines, in fruit $\frac{1}{2}$ to 1 inch long, slender.

Sepals deciduous, about 2 lines long.

Petals ovate, nearly 3 lines long, with inflected ciliate auricles at the base, representing the inner scales of many other *Sapindaceæ*.

Stamens 5 to 7, much longer than the calyx, with slender filaments in the males, small and short in the females.

Ovary tomentose, with a long style twisted at the top.

Capsule glabrous or slightly pubescent, 1 to $1\frac{1}{2}$ inches broad, the lobes inflated.

Seeds apparently without any arillus. (B.Fl. i, 471.)

There is an Indian species, and one from Madagascar, but nothing seems recorded of its economic value. The Australian *Harpullias* are five in number, viz., *pendula*, *Hillii* and *alata*, natives of New South Wales and Queensland; *frutescens* and *Leichhardtii*, natives of Northern Queensland.

Botanical Name.—*Harpullia*, from Harpulli, the vernacular name at Chittagong, India, of *H. cupanioides*, the species on which the genus was founded; *pendula*, Latin, drooping, which refers to the fruit bunches (panicles).

Vernacular Name.—"Tulip Wood." The tulip of Europe is a flower which is large and showy in colour; indeed, people sometimes say, "As showy as a tulip." I believe this to be the origin of the name, as applied to the *timber*, of our Tulip Wood—showy, and perhaps a little loud. I was told many years ago that this was the origin of the name; at the same time I do not know the circumstances under which it was first applied, and by whom.

Aboriginal Names.—"Moulubie" of the Clarence River aborigines, according to the late Mr. Charles Moore. "Mogum Mogum" is another aboriginal name.

Timber.—This is one of the handsomest of Australian woods. It is tough, close-grained, and beautifully marked with different shades from black to yellow, and therefore much esteemed for cabinet work. It is sought after for all kinds of turnery and fancy-work, *e.g.*, table and chair legs, auctioneers' mallets. Billiard tables have been made of it (*e.g.*, a very handsome one at the Centennial International Exhibition, Melbourne, 1888), while it has been used as panels in doors and dadoes, and with selected pieces the effect may be described as gorgeous. It resembles olive wood somewhat in general appearance. It is very durable. The outer, or lighter coloured wood, is very tough and easily worked. It is said to be the best in Australia for lithographers' scrapers. There is a coloured plate of the wood in Baker's "Hardwoods of Australia."

Size.—It is a medium-sized tree, usually attaining a height of 50 to 60 feet, with a stem diameter of 1 to 2 feet, but exceptionally very much larger.

Habitat.—It is a native of the coastal brushes and those penetrating the coastal escarpment, in northern New South Wales and Queensland.

Bentham quotes the following localities:—

Queensland.—Moreton Bay, known as "Tulipwood" (*Fraser, Cunningham*); Wide Bay (*C. Moore*); Port Denison (*Fitzalan*); Broad Sound (*Thozet*).

New South Wales.—Clarence River (*Eckler*); Richmond River (*C. Moore*).

I collected it on the Bellinger River and in the Dorrigo in 1893, which brings the range a little further to the south, and I should not be surprised to find it as far south as the Hastings.

Following are some New South Wales specimens represented in the National Herbarium at Sydney :—

Grafton. Fairly common about Grafton and the islands of the Clarence River. Casino (District Forester); Kyogle (E. G. McLean); Lismore (Miss Rothwell, W. Baeuerlen, E. Bêche); Acacia Creek, Macpherson Range (W. Dunn); Murwillumbah (R. A. Campbell); Tweed Heads (J. L. Boorman). I have also received it from Toowoomba, Queensland (H. A. Longman).

Propagation.—From the photograph of the tree taken in a Grafton street, it will be seen that the Tulip Tree is most handsome, and well worthy of cultivation. But it must be borne in mind that it is a native of the brush and therefore accustomed to deep, rich soil, with a sufficiency of shelter.

EXPLANATION OF PLATE No. 239.

- A. Flowering twig.
- B. Flower with imbricate calyx and 5 petals. 8 stamens, no staminodes.
- C. Petal with auricles, pubescent on the inner side.
- D. Flower, petals removed.
- E. Flower, petals and stamens (8) removed.
- F. Stamen.
- G. Twisted stigma, pubescent at the base.
- H. Transverse section of ovary showing ovules.
- I, K. Fruits.

PHOTOGRAPHIC ILLUSTRATIONS.

1. Tulip Tree in Grafton, N.S.W. (Photo by Mr. Alfred Thompson, Bank of N.S.W., Grafton.)
2. Tulip Tree in Botanic Gardens, Sydney. (Photo by Government Printer.)

APPENDIX.

AUSTRALIAN MANNA.

Since *Eucalyptus rubida*, the principal producer of Australian manna, is dealt with in this Part, it seems appropriate to refer to the whole subject, in order that we may see how imperfect our knowledge is in regard to it. It will be seen what a puzzle it yet presents to entomologists, while botanists desire to record further Eucalypts on which manna and lerp are found, and chemists have not exhausted the possibilities of the substances, by any means.

I will classify the information I have got together under the following heads, and solicit the assistance of my readers in making it more complete.

1. Mannas and sugary substances on plants other than Eucalyptus.
2. Botanical notes on Eucalyptus Manna.
3. Zoological notes on Eucalyptus Manna.
4. Chemical notes on Eucalyptus Manna.

Also, but less pertinent to our present inquiry—

5. Watery liquids from Eucalyptus trees.

1.—Mannas and sugary substances on plants other than Eucalyptus.

Two mannas naturally occur to one, the manna of the Old Testament and the medicinal manna of Europe.

The manna of the Scriptures is referred to and described in Exodus xvi, 14, &c., and Numbers xi, 7, &c. “And the manna was as coriander seed, and the colour thereof as the colour of bdellium.”

I take the following from Tristram's “Natural History of the Bible.”—

Manna.—The vegetable product so named, which is collected in the deserts of Arabia Petraea, has no connection with the miraculous food of Israel in the wanderings, beyond the fancied similarity in its taste, which is extremely sweet. It has no resemblance whatever to coriander seed, being simply a sweet exudation, which is distilled in hot weather after rains from the Tamarisk trees, and carefully collected before sunrise, boiled and strained, and then used as honey. When kept for any length of time it becomes quite solid, and forms a hard cake, which, however, melts on exposure to the sun. It is only collected in very small quantities, and is considered a great delicacy by the Bedouin. Both the common species of Tamarisk yield it, and also, in smaller quantities, the Oak. We frequently observed and tasted this gummy exudation on the Tamarisks by the Jordan in the early morning, but before evening the sun's rays had melted it all away.

The manna of the Bible is, however, usually attributed to a lichen (*Lecanoria esculenta*), but this is only a guess.

The second, or Medicinal Manna, is the manna of the Manna Ash (*Fraxinus Ornus*).

There is in Bentley and Trimen's "Medicinal Plants," iii, 170 (1880), a figure of the Manna Ash, and an account of the method of extraction, by incision of the stems, with a bibliography. It is chiefly collected in Sicily. Its principal constituent is Mannite, or Manna Sugar.

In the "Correspondence of John Ray" (Ray Society) we have the following two letters:—

(1) From Dr. Robinson to Mr. Ray, 8th September, 1685—

I travelled from Capua to Naples in the company of an ingenious Neapolitan physician, who entertained me with the history of his country. He assured me that the *Fraxinus*, or *Ornus*, in many places north-west of Naples, afforded manna, of which the inhabitants made advantage, though it was not so much esteemed as that of Calabria; for gathering and evaporating in the sun this saccharine juice, they always make use of wooden instruments and vessels, for it will prey upon metalline, or bony ones, and so lose its white colour when concremented. The afore-mentioned Neapolitan informed me that the Cicada did feed much upon the *Ornus*; which makes me conjecture that this insect (which you have well distinguished from our grasshopper) does pierce the tree, and so opens the passage for the manna to sweat out. I remember, in one of the German Ephem. I lately sent you, there is an account and figure of an Indian tree, upon which some insects are said to work, and prepare a sort of manna. I am apt to believe it may be a mistake, and that the manna works itself out of the tree opened and sucked by the insects; but you are best able to judge of these matters.

(2) Mr. Ray to Dr. Robinson, 14th September, 1685—

I better approve your conjecture concerning the exudation of the manna; for I do not observe any kind of gum, or resin, or concrete juice, to issue out of any tree or herb but at some incision, or wound, or rift, or contusion, and therefore it is likely enough that the manna may issue out of the vessels containing the specific juice of the tree perforated by some insect. Your other conjecture also concerning the insect preparing a kind of manna is not improbable.

Following are a few Australian references to non-Eucalyptus mannas.

Mr. Froggatt collected (July, 1895) a small quantity of manna on a twig at Manly, Sydney, from a Tea Tree (*Leptospermum scoparium*), which is, of course, allied to *Eucalyptus*. It was not analysed.

The present writer, in a report on the Vegetable Exudations collected by the Elder Exploring Expedition (*Proc. Roy. Soc. S.A.*, vol. xvi, 1, 1892), stated that that of *Myoporum platycarpum* proved to be identical in composition with the manna of commerce yielded by the Ash.

Collected 29th September, 1891, at Camp 65. Clayey sand. Collector's note:—

This gum [*sic.*] was collected partly off a small tree 20 feet high, and 4 inches in diameter, and is the one on which I noticed gum [manna.—J.H.M.] oozing out, and partly from under it. The tree had been bleeding profusely, and for a long time, as there was a great deal of decaying gum (manna) round the trunk. I believe the cause of bleeding to be insect-bores, but had not sufficient time to examine it closely, as my camel was very restive. The taste is sweet as sugar.

In spite of its sweetness, Mr. Helms informs me that the natives were not partial to it, preferring the gum of *Acacia leiophylla*; probably because of its laxative property, and not from any objection to its sweetness, inasmuch as the blacks eat lerp and eucalyptus-mannas, honey stored by bees, and also suck the honey-laden flowers of certain plants. It will be remembered that Sir Thomas Mitchell offered sugar to an aboriginal child, who spat it out with every manifestation of disgust, but the blacks usually do so with any edible to which they are unaccustomed.

That other natives (at least those of western New South Wales) do eat of this manna is borne out by the following statement by the late K. H. Bennett, in *Proc. Linn. Soc. N.S.W.*, vii, 351. It is well known that Mr. Bennett's knowledge of such matters was both extensive and accurate.

During the hot summer months another and totally different-looking substance exudes from the trunks and branches of some of these trees in large quantities. This substance when freshly exuding from the tree resembles a thick froth, either pure white, and resembling snow, or of a pink or rose colour. These exudations assume various forms, and become solidified by exposure to a certain extent to the air. Sometimes they are in lumps as large as a man's hand, and sometimes in the form of stalactites over a foot long, as large as an ordinary candle, and gradually tapering to a point. This substance is of a highly saccharine nature, with a peculiar sickly sweetness; it melts in the mouth like ordinary sugar; the natives are very fond of it, and either eat it, or by dissolving it in water make a kind of drink.

The sample of manna collected by the Expedition at first sight resembles a brownish earthy substance, e.g., a marly soil containing much lime. On closer examination it is seen to have a pinkish tinge, while selected portions are quite white or cream-coloured. It is vesicular in structure, soft and friable, sweetish and almost gritty to the taste. Should a demand for it for medicinal purposes spring up, it could be obtained quite pale-coloured and pure, and in considerable abundance, if it were systematically collected as is the product of *Frazinus Ormus*.

I sent a specimen to Professor Flückiger, of Zurich, Switzerland, who more fully examined it, and reported on it in *Apoth. Zeitung*, 1893, s. 39, and *Archiv. der Pharmacie*, 1894, s. 311.

Then we have a paper by R. T. Baker and H. G. Smith, "On the presence of a True Manna on a Blue Grass, *Andropogon annulata* Forsk. (*Proc. Roy. Soc. N.S.W.*, xxx, 1896). The substance came from Queensland and the investigation shows the principal constituent to be Mannite. It is not a little surprising that exudations from plants so dissimilar as the Manna Ash and a Grass should be identical in chemical composition.

2.—Botanical Notes on Eucalyptus Manna.

Ordinary manna has been reported from the following species, in some cases in only very small quantities. There is no doubt that observers will greatly augment the list. The following species are arranged in alphabetical order.

a. *E. cinerea* F.v.M. Rev. Dr. Woolls exhibited "lerp or manna" on the branchlets of *E. pulverulenta* (*cinerea*) Sims, at Buckley's Crossing, Snowy River, N.S.W. (*Proc. Linn. Soc. N.S.W.*, xvi, 381, 1891.)

Ebert ("Ueber Isopulegon") states that I forwarded to him manna of this species. I find that some was sent under the name *E. pulverulenta* Sims, var. *lanceolata* Howitt. It was of identical origin to Dr. Woolls' specimen.

E. cinerea F.v.M., variety *nova-anglica* Maiden (*E. nova-anglica* Deane and Maiden).

Mr. W. W. Froggatt informed me that the above "Peppermint" produced manna very freely, "so as to make the ground quite white," at Uralla, New England, N.S.W. See p. 108. In speaking before the Field Naturalists Society of New South Wales in December, 1915, he attributed it to the operations of a coccid.

b. *E. corymbosa* Sm. See p. 115.

c. *E. eximia* Schauer. See p. 115.

e. *E. fœcunda* Schauer. "Mr. Duboulay saw manna occur on this Western Australian species." ("Eucalyptographia.")

f. *E. gomphocephala* DC. The Tuart (perhaps).

"A manna is said to drop also from a species of *Eucalyptus* occurring near Cape Leeuwin." ("Conditions of forests and timber trade of W.A.," 1883, p. 22.) This is a quotation by Mueller in "Eucalyptographia" under *E. viminalis*, but the actual reference is "Manna Gum is found on portions of the coast west of Bunbury. It is little inferior (if at all) to the manna of commerce, and is used as food and for other purposes."

I have made local inquiries in regard to this manna, but unsuccessfully so far.

g. *E. punctata* DC.

"The foliage produces occasionally melitose-manna." ("Eucalyptographia.") In the Sydney district I have seen the bitten edges of leaves of this species encrusted with manna, an observation, I believe, originally made by the Rev. Dr. Woolls. Mr. D. W. C. Shiress has found it on the fruits and flowers of var. *grandiflora* near the first section, Spit-Manly tram.

Mr. J. J. Fletcher showed a rather larger quantity of manna on *E. punctata* DC. than is usually seen on the leaves, and he observed the avidity with which honey-eaters of two genera, viz., *Acanthorrhynchus tenuirostris* and a species of *Ptilotis*, availed themselves of this addition to their ordinary food-supply (*Proc. Linn. Soc. N.S.W.*, xxviii, 686, 1903).

See also H. G. Smith "On the saccharine and astringent exudations of the Grey Gum, *Eucalyptus punctata* DC., and on a product allied to Aromadendrin" (*Proc. Roy. Soc. N.S.W.*, xxxi, 177 (1897)). An investigation of the sugary exudation, and the isolation from it of Raffinose. The manna was found on the bark at Belmore, near Sydney. Its origin does not appear to be clear. "When exuding it must have been liquid as it had run down the tree." The material obtained was more or less mixed with bark and débris, caused by boring beetles. Mr. Smith's analysis is ample, but we require further investigation in regard to the physiological aspect, i.e., the way in which sugar in such large quantities has been manufactured, and has exuded from the tissues of the plant.

Dr. Greig Smith recorded the occurrence of a race of *Bact. Eucalypti* Greig Smith in a sample of manna of *E. punctata* (*Proc. Linn. Soc. N.S.W.*, xxviii, 831, 1903).

h. *E. resinifera* Sm.

X. Landerer, "On the varieties of manna not produced by the Ash" (*Pharm. Journ.*, xiii, 411), mentions "Manna Australis produced by *Eucalyptus resinifera*."

I enumerate *E. resinifera* because this has been done by several of the early writers, *e.g.*, T. Thomson, on manna, and copied by others (*e.g.*, Ebert), but I have never seen it on that species, and it may be that attribution of manna to *E. resinifera* is only one of the many mistakes which has clustered around that species.

i. *E. rubida* Deane and Maiden.

It was until recent years believed that *E. viminalis* was the only species that produced manna in quantity, and hence it is most usually, in books, referred to as "Manna Gum." But I have no hesitation in saying that the present species yields it over a far larger area, and perhaps more abundantly. A good deal of manna referred to *E. viminalis* in the past belongs to *E. rubida*, because, until the description of the latter, it was usually looked upon as a form of *E. viminalis*. At all events, these two species are the two principal Manna Gums, so far as we know at present.

The following extracts are given, with their context, in Part XXVI of my *Crit. Rev. genus Eucalyptus*.

It will be observed that Mudie says the manna is not produced by the puncture of insects.

Following are some western New South Wales localities:—

Eucalyptus mannifera A. Cunn. This species of *Eucalyptus* is very generally dispersed through the country bordering on the downs of Bathurst, where it forms a tree of irregular growth, 30–40 feet high, flowering in the months of August and September, and in very dry warm weather giving out a sweet juice or sap, which becomes white and concrete by exposure to the atmosphere, when it drops to the ground. N.B.—Throughout the late long and painful season of drought (in New South Wales) to the agriculturist, the exudation from this tree has been very considerable, so that so long as the atmosphere continued very dry and not charged with moisture it might be gathered from the ground beneath the tree in a quantity sufficient in a few minutes to fill a pint pot. The *Manna*, as it is called by our ultramontane settlers, thus produced, is frequently collected for medicinal purposes, is of a pleasant sweet taste, and not in the least affected by the essential oil with which every part of the plant abounds. It dissolves immediately in water, so that it disappears at once from beneath the trees on the falling of the slightest shower of rain. It is frequently taken by persons at Bathurst as a pleasant purgative, so gentle in its operation that it may be administered to the tenderest infant—the dose for a healthy adult being from 2½ to 3 table-spoonfuls. The timber of the tree is considered useless for the purposes of rural economy, and is in consequence only used as fuel. A. Cunningham.

Like the manna of Europe, it is reported to contain a saccharine and a mucous ingredient, both of which are easily soluble in water, and partially so likewise in the atmosphere when moist. It obviously arises from a rupture in the cortical vessels of the tree, produced not by the puncture of insects, but by atmospheric action, as it is produced only in the dry season, and the quantity varies with the degree and duration of the drought.

Towards the close of a long dry season, it is found so abundant on the ground under the trees that several pounds may be collected by one person in a few minutes, but when rain begins to fall, it melts, and disappears almost as rapidly as snow. (Mudie, in *Trans. Medico-Botanical Soc. of London* for 1832 and 1833, p. 24.)

In the lowlands here (Brucedale, Bathurst) as at Coombing (near Carcoar), the *Eucalyptus mannifera*, or Flooded Gum, grows in great profusion and to a majestic size. It sounds strange to English ears,—a party of ladies and gentlemen strolling out in a summer's afternoon to gather manna in the wilderness; yet more than once I was so employed in Australia. This substance is found in small pieces on the ground under the trees at certain seasons, or in hardened drops on the surface of the leaves. It is snowy white when fresh, but turns brown when kept like the chemist's drug so called, sweeter than the sweetest sugar,

and softer than Gunter's [Gunter was a famous London pastrycook.—J.H.M.] softest ice-cream. The manna is seldom plentiful, for birds, beasts, and human beings devour it, and the slightest rain, or even dew, dissolves its delicate components. Theories have been hazarded and essays published as to the origin of this singular substance; but whether it be formed by the puncture and deposit of an insect, or is the natural product of the tree, no one, I believe, can venture to assert. Nor was there wanting hereabouts another special article of the heaven-sent food of the wandering tribes of Israel; for hundreds of quails were to be found within a few paces of the manna-fields. (Mundy's "Our Antipodes," vol. i, 2nd ed., pp. 351-2, or 3rd edn. p. 176.)

Following are southern localities :—

E. rubida in some years yields an enormous quantity of manna in the Monaro district. I supplied Dr. F. W. Passmore with a quantity of this manna under the name of *E. Gunnii* var., and he prepared an exhaustive paper upon it which was published in *Pharm. Journ.* (3), xxi, 717, under the title of "The carbohydrates of manna from *E. Gunnii* Hook., and of Eucalyptus Honey." It came from Wollandibby, near Jindabyne, Snowy River. It is the same as that collected by Mrs. (afterwards Lady John) Hay, at Wyllorewang (?Welaregong) on the Upper Murray, and contributed by her to the Paris Exhibition, 1855. The catalogue says: "This is a specimen of the most common kind of Australian manna. It is found in considerable quantities in many tracts, generally rather upland, scattered under the trees from which it exudes. The tree has a white bark streaked with red, which shells off annually. The manna falls in March and April. The trees are called by the blacks Bak-Bak."

Mrs. Hay's was the identical specimen of manna, I believe, examined by the celebrated M. Berthelot; see p. 117.

I received some of the same manna from Mr. A. M. N. Rose, from "The Manna Gum," of Dalgety, Snowy River, southern New South Wales. He said: "I saw manna white as snow, splashed about like molten lead; the Manna Gum produces manna annually, and not each ten years as *E. Stuartiana*."

I sent a little manna of this species to Herr Alfred Ebert, of Zurich, from the Cooma district in 1906, under the name of *E. Gunnii* var., as I had to Dr. Passmore many years previously.

The following is the var. (b) of *E. viminalis*, according to Howitt, but which in *Crit. Rev.* xxvi, p. 114, I have shown to be *E. rubida*. The localities are Gippsland, Victoria, at no great distance from the Upper Murray and Snowy Rivers.

This tree is the manna-producing Eucalypt of the mountain country. The manna is produced as plentifully, in the same manner and of the same kind, as that produced by the typical *E. viminalis*. When travelling through the Morwell district, where this tree forms part of the forest, some school children, whom I requested to point out the "manna gum," indicated this tree, saying that in December the ground under the tree was white with manna.

I must note, in this connection, however, that I have found small quantities of manna indistinguishable from that of *E. viminalis*, either by appearance or taste, attached to slight injuries of the leaves of saplings of *E. Stuartiana* at Toongabbie. (Howitt in *Trans. Roy. Soc. Vict.*, ii, 99, 1890.)

k. *E. Stuartiana* F.v.M. "I have found small quantities of manna, indistinguishable from that of *E. viminalis*, either by appearance or taste, attached to slight injuries on leaves of saplings of *E. Stuartiana* at Toongabbie, Victoria." (Howitt in *Trans. Roy. Soc. Vict.*, ii, 100 (1890).)

"Apple tree" of Dalgety, Snowy River, sent by Mr. A. M. N. Rose. He informed me that this species produced manna about every tenth year. He made this statement to me in 1901. It resembled *E. rubida* manna.

Mr. R. Greig Smith read a paper entitled "A gum (levan) Bacterium from a saccharine exudate of *Eucalyptus Stuartiana* (*Proc. Linn. Soc. N.S.W.*, xxvii, 230, 1902). It was supplied by Mr. A. M. N. Rose, of Dalgety.

The exudate was in the form of a pale straw-coloured syrup, very similar in appearance and consistency to honey or golden syrup, and had fragments of bark and *Eucalyptus* capsules scattered throughout the mass. When dissolved in water and separated from woody débris, a portion contained—

Non-reducing but hydrolysable sugar* calculated to saccharose	...	1.1	gm.
Reducing sugars		2.5	„
Crude gum		0.8	„

Three specimens of exudate (varying somewhat amongst themselves) were examined and they all contained a *Bacterium eucalypti*, n.sp. Specific characters and very full details are given of this new gum-forming Bacterium.

See also *E. punctata* DC.

l. E. terminalis F.v.M. See p. 115.

m. E. viminalis Labill.

There is no doubt that the first notice available of Australian manna refers to *E. viminalis*.

I do not presume to say that I know the first record of *Eucalyptus* manna. Historians might hunt the matter up. Here is one dated 1808; Colonel Paterson sent some to Sir Joseph Banks from Port Dalrymple (Launceston). He says:—

... also an insect which produces very fine manna, which has been given as that medicine, and proves equally good. It is only found on the narrow-leaved *Eucalyptus* [probably *E. viminalis*.—J.H.M.], where thousands of these insects resort to about the beginning of November, and continue until January in the winged state, when they deposit their eggs in the earth and die. I have them now in two stages—one without wings, and the other in maturity. I now only wait to get the larva, when I shall send you the whole tolerably complete, with specimens of the tree, &c. The saccharine substance can be gathered in large quantities; I am certain upwards of 20 lb. might be procured from one tree. By a former conveyance I sent Governor Bligh a specimen of it, which I have no doubt he will take to England. (*Historical Records of N.S.W.*, vi, 768.)

My next reference is thirty-five years later.

The White Gum (? *E. virgata*) [probably a slip for *E. viminalis*.—J.H.M.] from wounds on its shoots and the cartilaginous margins of the leaves, produces the manna of Van Diemen's Land. It is white, sweet, and well flavoured, and falls (sometimes in considerable abundance) about the trees in dry weather in small, irregular pieces. (*Bot. Mag.* t. 4, 036, 1843.)

* This is probably raffinose, the sugar of *Eucalyptus* manna. The reducing sugars probably consist of mixture of levulose and melibiose.

Mueller, in "Eucalyptographia," says: "The real and special interest of *Eucalyptus viminalis* is concentrated in the fact that it is this particular species which mainly, if not almost solely, furnishes the melitose-manna." I have already shown that this is not correct.

Other references to *E. viminalis* will be found at p. 111.

3.—Zoological Notes on Eucalyptus Manna.

It will surprise a good many people to be informed that very little is known from the entomological side as to the biology of manna.

The following extracts from letters by Mr. Froggatt to me are in point:—

My experience is that under certain conditions the injury to foliage by many insects, cockchafer beetles, and many homoptera will cause an encrustation of crisp white manna, but the Cicadas do not cause the large quantities of manna that fall from the Peppermint Gums (*E. cinerea* var. *nova-anglica*) in the New England district. The season (1915) I was at Uralla, in the early summer, the manna was thick under the clumps of trees long before the first Cicada appeared, and I could find no insects puncturing the foliage. I could have filled a half pint tin in a few minutes with the crisp, crinkly manna that you find under the trees in large quantities. The same remarks as to absence of Cicadas apply to a place below Goulburn. From here I had a large quantity of similar manna sent, that had been collected in a similar manner on the ground not in country frequented, even in summer, by many Cicadas. (? *E. rubida*.)

Our manna is not produced by Cicadas; a little is often caused by frog-hoppers of the Genus *Eurymela*, but this is only local. What is the origin of the large quantities I do not know.

At the back of Manly some years ago the Red Eye or *Black Cicada* (*C. moerens*) used to swarm over the stems of the smooth-stemmed White Gums in the gullies, and when disturbed used to discharge a regular spray of liquid; this species is much more prolific in this way than any other species, yet this liquid never formed manna on the ground under the trees, it simply remained as a honey-dew glazing the foliage. As far as my observations have gone, I have never been able to convict any Cicada of producing manna of any kind, yet at Terrigal I have counted 400 on the trunk of a large gum in the early morning.

I trust that a research will be undertaken in regard to the entomology of manna. The exudation of this substance has been attributed to the Order Hemiptera, Sub-Order Homoptera, in its Families Cicadidæ, Cercopidæ, and Psyllidæ; and also to Coleoptera. A few notes are submitted, and it will be observed that some are the work of non-entomologists, while others have been repeated by authors without separate inquiry. It is for the entomologists to separate the various kinds of manna (including the Lerp), and also to correlate the different kinds of insects to their corresponding mannas.

According to the suggestion of Darwin, in the following passage (and note the reference to the Manna Ash), the question of the flow of manna may be a physiological one, and the insects, either as leaf-cutters, or as wood or bark-borers, may be mere mechanical agents in releasing the flow of saccharine sap.

Many years ago I suggested that primarily the saccharine matter in nectar was excreted as a waste product of chemical changes in the sap; and that when the excretion happened to occur within the envelope of a flower, it was utilised for the important object of cross-fertilisation, being subsequently much increased in quantity and stored in various ways. This view is rendered probable by the leaves of some trees excreting, under certain climatic conditions, without the aid of special glands, a saccharine fluid often called honey-dew.

This is the case with the leaves of the Lime (*Tilia*), for although some authors have disputed the fact, a most capable judge, Dr. Maxwell Masters, informs me that, having heard the discussion on the subject before the Horticultural Society, he feels no doubt on this head. The leaves, as well as the cut stems, of the manna Ash (*Fraxinus Ornus*) secrete, in like manner, saccharine matter. According to Treviranus, so do the upper surfaces of the leaves of *Carduus arctioides* during hot weather. (Darwin, in "Cross and Self-fertilization of Plants," p. 402.)

HOMOPTERA.

Cicadidæ.

(Cicadas, the "Locusts" of Australian boys.)

Many of them pass parts of their life-cycles on Eucalypts; the entomologists alone can speak fully on the subject.

From the following it would appear that the connection between manna and Cicadas is at least centuries old. See p. 102.

The "Correspondence of John Ray" are letters from John Ray to Dr. Robinson, and reply *re* the formation of manna by Cicadas in Italy, September, 1685. (*Ray Society*, 1848, 176 (already quoted).)

Now we come to Australia, and I cite writers with Australian experience.

In "Discoveries in Australia" (J. Lort Stokes, i, 285-286, 1846), at Hobson's Bay, near Melbourne, the author says:—

The trees swarmed with large locusts (the Cicada), quite deafening us with their shrill buzzing noise. We found the branches of these trees and the ground underneath strewn over with a white substance resembling small flakes of snow, called by the colonists manna. I am aware that an erroneous idea exists that this matter is deposited by the locusts; but in fact it is an exudation from the Eucalyptus; and although I saw it beneath another kind of tree, it must have been carried there by the wind. A different sort, of a pale yellow colour, is found on a smaller species of Eucalyptus growing on highlands, and is much sought after for food by the natives, who sometimes scrape from the tree as much as a pound in a quarter of an hour. It has the taste of a delicious sweetmeat, with an almond flavour, and is so luscious that much cannot be eaten of it. This is well worthy of attention from our confectioners at home, and it may hereafter form an article of commerce, although from what has fallen under my own observation, and from what I have learnt from Mr. Eyre and others, I should say it is not of frequent occurrence. The first kind being found strewn underneath the tree, probably exudes from the leaf, whilst the second oozes from the stem.

At Vol. II, 482, Mr. Bynoe, Surgeon to the Expedition, relates his experiences.

Near Melbourne, I (Captain Stokes) again noticed the manna mentioned in a former page, but had no opportunity of making further observations upon it. Mr. Bynoe, however, having since visited Australia, has turned his attention to the subject, and the result of his experience, which will be found below, tends to overthrow the opinion I have previously expressed, to the effect that this substance is the exudation of a tree, not the deposit of an insect.

Mr. Bynoe states: "There is a prevailing opinion in some parts of New Holland, particularly on the east side, that the gum trees distil a peculiar form of manna, which drops at certain seasons of the year. I have heard it from many of the inhabitants, who, on a close investigation, could only say that it was to be found adhering to the old and young bark of the trees, as well as strewn on the ground beneath.

In the month of December, about the warmest period of the year, during my rambles through the forest in search of insects, I met with this manna in the above-mentioned state, but could never find in any part of the bark a fissure or break whence such a substance could flow. Wherever it appeared, moreover, the red-eyed cicadæ were in abundance. I was inclined to think that the puncture produced by these suctorial insects into the tender shoots for juice, would in all probability give an exit for such a substance; but by wounding the tender branches with a sharp-pointed knife, I could never obtain a saccharine fluid or substance. It was the season when the cicadæ were abundantly collected together for reproduction;

and on warm, clear, still days they clung to the more umbrageous parts, particularly to trees that, having been deprived of old limbs, shot forth vigorous stems, thickly clustered with leaves. To one of these, in which the male insects were making an intolerable noise, I directed my steps, and quietly sheltered myself from a hot wind that was crossing the harbour, bringing with it a dense column of smoke, which for a short time shut out the powerful rays of the sun. I found that the ground about the root of the tree was thinly covered with the sugar-like substance, and in a few minutes I felt that a fluid was dropping, which soon congealed on my clothes into a white substance. On rising cautiously to ascertain from whence it came, with a full determination not to disturb the insects but to watch their pursuits, I observed that it was passing of a syrup-like consistence per anum from the cicade. As it ran down the smooth branches of the gum-tree and over the leaves it gradually congealed, and formed a white efflorescence. Whilst ejecting this fluid, the insect raised the lower part of the abdomen and passed off three or four drops in sudden jets, which either streamed down the stem, or fell on the leaves or ground.

I watched them for nearly half an hour, and in that space of time observed between twenty and thirty distil this fluid, which gradually concreted into a white substance. I collected above three ounces, some of which I still have in my possession. The natives gather it in their rush baskets and use it as a part of their food.

Every traveller seems to observe it. G. Bennett, "Wanderings of a Naturalist in New South Wales," &c., i, 319-321 (1834), speaks of it in southern New South Wales:—

The elegant drooping manna-trees (*Eucalyptus mannifera*) were numerous, and at this season secreted the peculiar saccharine mucilaginous substance called *manna*, which, in greater or less quantities, was lying upon the ground beneath them, or upon their leaves, trunks, and branches, in small white flakes, resembling bits of starch. The taste of this secretion is sweet and mucilaginous, having a greater or less aperient effect on different individuals; it is quite a sweetmeat, and seems to consist of mucilage, sugar, and probably some magnesia; although it readily acts as an aperient on some persons, upon others it produces no effect; it does not dissolve in the sun, but, on the contrary, becomes dryer and of harder consistence, by exposure; rain dissolves it, but more secretion of it takes place after wet than during a continuance of dry weather. Many of the colonists supposed the manna was secreted from the leaves of the tree, but from the foliage having a strong camphorated taste and odour, which the manna has not in the slightest degree, it was not probable; others again supposed it to proceed from the nectaries of the flowers, which are white, growing in clusters, and give to the tree a beautiful appearance when in bloom, attracting multitudes of parroquets.

The tree is called in the aboriginal language, "Bartoman," and the manna is named "Cuningaban"; it is collected and eaten by the natives. The growth of the tree, when young, is graceful and elegant; the bark is covered with a whitish powder, which readily rubs off upon the fingers, and the bark underneath is of a greyish colour; the bark of the "white gum" (*Eucalyptus species*) resembles this tree, but may be distinguished by not having a black butt like the manna-tree. On examining the tree to ascertain positively from what part of it the manna was secreted, I found in several that the manna exuded in a liquid form in minute drops from the bark, and then concreted; on some it had oozed out and had concreted upon the trunk in large thin flakes; it exuded about the consistence of syrup, and in taste was sweet; when secreted from the branches it falls from those above, upon the leaves, &c., of others beneath, and upon the ground, where, during a plentiful season, a large quantity may be collected.

The rain that had fallen the day previous to my examination of these trees, and the heat of the sun causing a quantity of manna to exude from them, its mode of secretion could be more readily distinguished. It is usually secreted about the commencement of December; but it depends on the weather whether the secretion is in greater or less quantity; this season it was abundant.

The manna trees had commenced, during the latter part of December, to throw off their outer bark; their trunks, therefore, had a ragged appearance, and the ground underneath was strewn with dried, crisped pieces which had fallen off, leaving a smooth and handsome new bark in their place.

In the above passage, *E. rubida* is probably referred to.

In Dr. Bennett's later work, "Gatherings of a Naturalist in Australasia" (1860), pp. 270-3, there are some interesting notes which are a supplement to the former ones. A somewhat detailed account of the "Tettogoniæ or Tree-hoppers which are known in Australia as Cicadas or Locusts" is given.

Then we have F. M'Coy—*Cicada moerens*. "The great black or manna cicada." *Prodromus of the Zoology of Victoria*. Decade V, Plate 50. Gives a life history of *Cicada moerens*, and states that *Eucalyptus manna* is formed by this cicada.

This large species of *Cicada* piercing the young twigs of the Peppermint Gum tree (really the White Gum) (*Eucalyptus viminalis*) causes an abundant exudation of sap, which, drying in the hot, parched air of midsummer, leaves the sugary solid remains . . . white sweet manna in little irregular masses.

Mueller says that M'Coy wrote to him also tracing the "Melitose flow" also to the action of *Cyclocheila australiæ* (also figured in the *Prodromus*). This is *Thopha saccata* Amyot, syn. *Cyclochila australasiæ*. See below, p. 112. See also notes on its "music" in Bennett's "Gatherings of a Naturalist," p. 270, already referred to.

The great geographical explorer, Captain Sturt, also in one of his works [I do not find a statement in his "Narrative . . . Central Australia."—J.H.M.] spoke already of the occurrence of the *Eucalyptus Manna*, where the large *Cicadæ* abounded, an observation confirmed by many observers, and in Tasmania by Mr. S. H. Wintle, who remarks that these insects have been most numerous where the manna has been most abundant. ("Eucalyptographia," under *E. viminalis*.)

Mr. Augustus Simson, a Tasmanian observer, wrote to Mueller that—

He had seen near George's Bay trunks of *E. viminalis* with streams of so-called manna adhering to them even to near their base; it was exuding from perforations of the bark made by *Cicada moerens*; hundreds of these insects were on the trunk, with their boring organs buried in the bark.

Then follow other details of the life history of the insect.

Eucalyptus manna occurs, however, also in the south of Tasmania, where the large *Cicadæ*, according to Mr. Simson, are unknown, but where species of much smaller size are to be met with. ("Eucalyptographia," under *E. viminalis*.)

Mr. James Dawson, of Camperdown, Victoria—

Found a considerable quantity of manna adhering to leaves and twigs, which he had experimentally closed in a muslin bag, though the exudation seemed to emanate from insect punctures previously formed; thus it was proved that the melitose could not be secreted by the *Cicadas* themselves, as erroneously still supposed by many colonists. He, moreover, found leaves, with accidental holes, around which manna was exuded on both sides. ("Eucalyptographia," under *E. viminalis*.)

On p. 42 of his work, Ebert writes—

The flow of the manna of *Eucalypts* is caused by the sting of *Cicada moerens*, but the manna is of vegetable origin caused to flow by the insect but not secreted by the insect.

He is following M'Coy and others.

Now we come to some papers having for their object the scientific classification of these insects.

"Notes on Cicadas," by W. W. Froggatt, *Proc. Linn. Soc. N.S.W.*, x, 526 (1895). "As a general rule the *Cicadas* prefer the trunks and stout branches to the young twigs and foliage, for with their long and powerful sucking mouth they can perforate the bark and obtain a plentiful supply of nourishment where the flow of sap is most abundant."

Thopha saccata Amyot, "Double Drummer," on North Shore and Manly, Sydney, seemed to prefer clumps of stunted specimens of *Eucalyptus corymbosa*, *E. robusta*, and *E. resinifera*, clinging to the stems.

Macrouistria angularis Germ., "The Union Jack," was found commonly on smooth-stemmed gums about Sydney, viz., *E. Sieberiana* and *E. hæmastoma*.

Melanpsalta melanopygia Germ. clings to the stems of young Eucalypts.

See also "Cicadas (Locusts) and their habits" by W. W. Froggatt, *Agricultural Gazette, N.S.W.*, xiv, 334, 418 (1903), a popular account of the species in Australia and other parts of the world. Full descriptions and illustrations are given of several species. A valuable appendix to this paper is the Bibliography at p. 423, much of which is, of course, only of interest to entomologists.

An important paper is "Monograph of the Australian Cicadidæ," by F. W. Goding and W. W. Froggatt (*Proc. Linn. Soc. N.S.W.*, xxix, 561, 1904, with Plates XVIII, XIX). They are placed in 21 genera, included in 119 species. *Thopha saccata* Fabr., the "Double Drummer." "It frequents the more open forest country, clinging to the trunks of the large rough-barked Eucalypts."

Psaltoda moerens Germ., the "Black Cicada," or "Red Eye," frequents the trunks and branches of the smooth-stemmed Eucalypts. (On *Angophora lanceolata* in Froggatt's paper, *Agricultural Gazette*, xiv, 340.) See *Cicada moerens*, above.

Pauropsalta léurensis sp. nov., the "Black Squeaker" of the Blue Mountains, N.S.W. (also found in South Australia), clings to the stems of the small Eucalypts.

Then we come to Mr. Froggatt's "Australian Insects," which gives us a condensed statement of the preceding papers. A useful additional illustration is a portion of a stem of Eucalyptus showing its appearance when the Black Cicada (*Psaltoda moerens*) has laid her eggs.

Every tree (around Ega) was tenanted by Cicadas . . . One species was very handsome, having wings adorned with patches of bright green and scarlet. It was very common; sometimes three or four tenanted a single tree, clinging as usual to the branches. On approaching a tree thus peopled, a number of little jets of a clear liquid would be seen squirted from aloft. I have often received the well-directed discharge full on my face; but the liquid is harmless, having a sweetish taste, and is ejected by the insect from the anus, probably in self-defence, or from fear. (Bates' "Naturalist on the Amazons," Murray's Pop. Edn., 1910, p. 274.)

CERCOPIDÆ.

(Frog-hoppers.)

Mr. H. Marshall, writing from Angaston, S.A., to Mr. Otto Tepper, mentions large flows of manna occurring, when a black Cercopis, with white transparent spots on the wings, much covered Eucalyptus stems or branches about Bald Hill, the saccharine mass partially encrusting the bark to a thickness of half an inch like white sugar, and it fell occasionally in such quantity as to knock down in places the surrounding wheat. ("Eucalyptographia," under *E. viminalis*.)

The late Mr. T. Stephens, of Hobart, in a letter to Mueller (*loc. cit.*) said that manna is regarded as a simple exudation from the bark, brought about sometimes by the puncturing of *Eurymela spectrum*.

PSYLLIDÆ.

1. The Sugar Lerp (*Psylla Eucalypti*), whose larvæ cover the leaves of several species of *Eucalyptus* with their white woolly shells, was first described by Dobson from Tasmania in 1851. It is now placed in *Spondylaspis*. As it is the species which first brought Lerp (a term which has come to be more or less generic) into prominence in the scientific world, some notes concerning it are presented at this place.

The substance is produced by the operation of this insect on *Eucalyptus dumosa* A. Cunn., and other species. This Lerp-manna consists of threads from this insect exuded in a syrup-like state through the rings of the body and plastered together in a sort of web in which the insect passes its chrysalis state.

2. Following is an important early paper:—

Thomas Anderson, M.D.—“On a new kind of manna from New South Wales.” *Edin. New Philosoph. Journ.*, July, 1849. Reprinted in *Papers and Proc. R.S. V.D. Land*, Vol. i, 241, 1851. This gives an account of lerp received from the north-western part of Victoria which he analysed. He refers to Dr. Thomson’s work on the manna of *E. mannifera (rubida)*.

Lerp is different from manna, and possesses a regularly organised structure. It is, in the typical form, from a Mallee, *Eucalyptus dumosa*. Mr. Cay, who found the material, said “Lerp is very sweet, and is formed by an insect on the leaves of gum-trees; in size and appearance like a flake of snow, it feels like matted wool, and tastes like the ice on a wedding-cake.” He gives further interesting local notes concerning it, and quotes Westgarth’s *Australia Felix*, p. 73, and says that this is the only published notice he has seen of this substance, and points out that it is different in external appearance and composition from all previously described forms of manna.

“Ueber eine neue Mannasorte aus Neu Süd Wales,” *Journ. für prakt. Chemie*, xlvii, 449, is a translation of Dr. Anderson’s work.

3. T. Dobson.—“On Laap or Lerp, the cup-like coverings of Psyllideæ found on the leaves of certain Eucalypti.” *Proc. R.S. V.D. Land*, Vol. i, Pt. iii, 235 (1851) (with two plates). Descriptions and drawings of several species of Psyllidæ found in Tasmania. This is an entomological paper. It refers to Dr. Anderson’s paper and amends it only slightly.

The following papers may also be referred to.

4. T. West.—“A brief description of a singular insect production found in some parts of Australia.” *Sydney Magazine of Science and Art*, i, 75 (1858). An account of Lerp or Laap.

5. D. Hanbury.—“Minor notes on the *materia medica* of the International Exhibition (London, 1862).” *Pharm. Journ.* (2), iv, 107. A description of *Eucalyptus* manna, and Australian Insect manna called Lerp, is given amongst references to other substances.

6. W. H. Tietkens in *Proc. Linn. Soc. N.S.W.*, v, 280 (letter read 30th June, 1880). He was at the Bunda Plateau, north of the Australian Bight.

At this particular time of the year a white substance is found on the Mallee leaves; it is commonly called manna, and is a secretion formed by a small insect, under which its eggs are laid, upon the leaf. This is collected in enormous quantities, and any savage you meet will offer you his wommai or bale of this substance. Seen in a lump as they carry it, it has a dazzlingly white appearance, and is very sweet and agreeable.

7. W. H. Wooster.—“How the Lerp Crystal Palace is Built.” *Journ. Micros. Soc. Vict.*, Vol. i, No. 4, p. 91 (1882) (1 plate).

Observations on a Victorian species of *Psylla* which he watched building its covering under the microscope.

8. P. Beveridge.—“On the aborigines inhabiting the great Lacustrine and Riverine depression of the Lower Murray, Lower Murrumbidgee, Lower Lachlan, and Lower Darling.” *Proc. R.S. N.S.W.* xvii, 63 (1883). Contains notes on the “Laarp” harvest.

9. This is criticised by Froggatt (*Proc. Linn. Soc. N.S.W.*, xxv, 251) in the following words:—

Mr. Beveridge “referred to it under the heading of ‘Laarp,’ which, he says, ‘is the excrement of a small green beetle wherein the larva thereof is deposited.’ He gives a very remarkable account of how the natives collected and fed upon the lerp-scales during the summer months; and he adds that it is so plentiful ‘that a native can easily gather from 40 to 60 pounds weight of it in a day.’ But this must be a slip, for old residents of the Wimmera, where it was very plentiful before the Mallee scrub was cleared off, have informed me that 2-3 lb. was quite as much as anyone could obtain in a day; and that the blacks used to gather it for food in winter, rolling it up in bark and hiding it in the trees; when they wanted to eat it they first moistened it with water.

“Many species form regular galls and blisters upon leaves, chiefly those of Eucalypts. These first appear as little pits, which swell into either bubble-like excrescences or thickened rounded masses enclosing the larva. This emerges from an opening either on the upper or under surface of the leaf.

“Others again hide under loose bark on the trunk or branchlets of a tree, enveloping themselves in a mass of flocculent matter, which exudes and forms white spots dotting the trunk all over. These species are so diligently looked after by several kinds of ants, which sometimes form galleries over them, that it is difficult to collect specimens.

“Most of the naked species are more common upon Acacias and other scrub trees than upon Eucalypts, and swarm in such numbers on the under surface of the leaves or over the young branchlets, as at first sight to be easily mistaken for aphides.

“Some of the true lerp-producing species present very curious examples of insect architecture. . . .

"All the lerp-scales are fabricated by the larvæ and pupæ from the excess of sap or juice sucked up through their sharp bills from the food-plant. This is ejected in small globules from the anus, but it is quite different from the excrement. It is another form of honey-dew, which when drawn out into fine threads by the feet and spun into the net-like sugar lerp, solidifies and hardens in the sun."

10. J. G. O. Tepper.—"Remarks on the Manna or Lerp insect of South Australia." *Journ. Linn. Soc. (Zoology)*, xvii, p. 109 (1883). A general account of the formation of Lerp, and its formation in South Australia.

He speaks of it on *E. leucoxydon* and *E. gracilis*. He further says *E. odorata* and *E. oleosa* yield "solid manna." Mueller ("Eucalyptographia," under *E. viminalis*) quotes him as finding lerp on *E. uncinata*.

11. J. J. Fletcher and C. T. Musson have raised the question (*Proc. Linn. Soc. N.S.W.*, xliii, 226) as to whether the abundance of Lerp Manna at certain seasons indicates the presence of some form of sugar in the sap likely to be a source of nutriment to parasitic microbes.

12. Mr. W. F. Blakely has shown me a specimen of *E. citriodora* (cultivated, of course) at Brookland Park, Hawkesbury River, with Lerp insects thereon.

COLEOPTERA.

(Beetles.)

1. *E. corymbosa* Sm. Mueller ("Eucalyptographia") quotes the Rev. Canon King (then of Sydney) as having noticed Melitose manna to a small extent on the leaves of *E. corymbosa* when pierced by a beetle (*Anoplognathus cereus*). I cannot trace the original statement; perhaps it gives additional information.

2. *E. terminalis* F.v.M. The following refers to Flinders and Mitchell Rivers, North Queensland.

Manna is procured from the leaves and small branches by being gathered and laid on pieces of bark, when the particles of sugar or gum fall off, or are scraped off with mussel-shells into a kooliman (bowl) or the leaves when covered with the white exudation are pounded together with a stone, and roasted in the ashes. Sometimes the sugary particles are gathered as they fall from the trees. After the rainy season this food is said to be abundant. (E. Palmer, in *Proc. Roy. Soc. N.S.W.*, xvii, 98 (1883).)

3. *E. eximia* Schauer. Dr. J. B. Cleland told me that he had seen a small quantity of manna on the leaves of this tree near the Hawkesbury River, N.S.W.

4. "Mr. E. P. Ramsay, late Curator of the Australian Museum, Sydney, is of opinion that boring coleopterous insects may be active in causing the extrusion of Melitose. He saw it occasionally in large stained lumps, which would remind (one) of the saccharine secretions on the stem of *Myoporum platycarpum*" (Mueller). See also notes on *E. punctata*, above.

4.—Chemical Notes on Eucalyptus Manna.

It is a crumbly white substance (which turns cream-coloured on keeping), of a very pleasant, sweet taste, and in much request by the aborigines and small boys. The latter make a toffee from it. It is in small pieces, about the size of peas, but of irregular flattened shape. In appearance it very much resembles lime which has naturally crumbled or slacked by exposure to a moist atmosphere.

So far, analyses have been made of manna authenticated as from *E. viminalis*, *E. rubida*, and *E. punctata*. Their composition appears to be identical, and to consist mainly of Raffinose (Melitose).

1. Passmore states that the first reference to Eucalyptus manna was made by Virey in 1832. This is presumably a chemical reference, and is *Journ. de Pharm.* (2), xviii, 705, which I have not seen. I do not therefore know whether it is the same as a paper with a German title by the same author (quoted by Ebert), "*Manna von Hedysarum Alhagi*" (*Buchner's N. Repert*, i, 32, s. 201).

Then we have—

2. T. Thomson, "Chemistry of Organic Bodies. Vegetables." At p. 640 is an account of Australian manna.

But there is a tree in New South Wales, the *Eucalyptus mannifera* [see *E. rubida*.—J.H.M.] which, according to Dr. Mudie, yields a manna exactly similar to that of the (*Fraxinus*) *Ornus*. It is now imported from Botany Bay for medical purposes. [I believe this to be quite incorrect, except as regards small quantities, because of the distance from Sydney and the sparseness of the population.—J.H.M.]

At p. 642 Dr. Thomson goes on to say—

About the year 1815 specimens of a sweet substance were obtained from Botany Bay. They were snow-white, in the form of tears, and had obviously dropped in a liquid state from some vegetable . . . Some bushels of it might have been collected.

This substance is probably from *E. rubida* from the Bathurst district, opened up about 1815.

Dr. Thomson obtained crystals on boiling both European manna and Australian manna in boiling alcohol and cooling. "The crystals are white and have the form of four-sided needles." Perhaps he was repeating Virey's experiments.

Then we have—

3. J. W. F. Johnston—"On the sugar of the Eucalyptus." *Mem. Chem. Soc.*, i, 159 (1843). Read before the Chemical Society, 20th December, 1842.

"On the sugar of the Eucalyptus." *Phil. Mag.* (2nd ser.), xxiii, 14 (1843). Examination of a manna from Tasmania. Same as the preceding.

"Ueber den Zucker von Eucalyptus." *Journ. für prakt. Chemie*, xxix, 485. A translation of the preceding.

This manna was from *E. viminalis*, and Johnston extracted a crystalline sugar from it.

4. M. Berthelot.—“Sur quelques matières sucrées.” *Compt. Rend.* xli, 392 (1855). Examination of an Australian manna received from the Paris Exhibition of 1855. The author examines the Melitose of Johnston (see p. 42), and from it obtains an unfermentable sugar called Eucalin (Eucalyne).

The manna examined by Berthelot was probably that exhibited by Mrs. (afterwards Lady) Jolin Hay, then of Welaregong, Upper Murray, at the Paris Exhibition of 1855, obtained from *Eucalyptus rubida*.

“Sur quelques matières sucrées.” *N. Ann. Chim. Phys.* (3), 46, 66. A copy of the preceding.

“Ueber einige zuckerartige Substanzen.” *Journ. für prakt. Chem.*, 67, 230. A translation of the preceding. See also *Chem. Centr.*, 1855, 69. *Chem. Organ.*, Paris, 1860. Deals with Melitose at ii, 260, and Eucalin at ii, 250.

Thus Berthelot found the same crystalline sugar (that Thomson and Johnston had found), and called it Melitose. Eucalyn (Eucalin) is a saccharine amorphous body obtained by fermenting Melitose with yeast. There is a brief abstract of Berthelot's work in Passmore.

5. Then we come to a paper by Rischbieth and Tollens (*Berichte d. deutsch. chem. Ges.*, xviii, 2611, 1885), who established the identity of the sugar contained in the manna from *E. viminalis* with the Raffinose or “plus sugar” of molasses, and the “Gossypose” of cotton seeds. The further history of Melitose is that of Raffinose (see Passmore).

6. Scheibler (*Berichte*, 3566) proposes to rename Melitose Melitriose to bring it into conformity with the newer nomenclature of sugars, and Passmore appears to adopt this name.

7. F. W. Passmore.—“The Carbohydrates of Manna from *Eucalyptus Gunnii* Hook. and of *Eucalyptus* honey.” *Pharm. Journ.* (3), xxi, 717 (1891).

He worked at *E. rubida*, then looked upon as a variety of *E. Gunnii*. The paper is an admirable one, and I have freely referred to it.

8. H. G. Smith.—“On the saccharine and astringent exudations of the Grey Gum (*Eucalyptus punctata* DC.)” (*Proc. Roy. Soc. N.S.W.*, xxxi, 177 (1897).)

The material came from Belmore, near Sydney. The trees had been wounded by the larvæ of an insect [? of a beetle.—J.H.M.] and a considerable amount of manna had run down the trunks. More or less impure, therefore, were the saccharine and astringent exudations since they commingled somewhat.

Mr. Smith (p. 179) makes the interesting observation that there is no record of manna being obtained from the Renantheræ, it appearing that only Eucalypts whose kinos contain eudesmin or aromadendrin can produce manna.

He finds the manna of *E. punctata* to largely consist of Raffinose (Melitose).

For reference see also :—

9. Gmelin.—“Chemistry,” xv, 296. Articles—Melitose, Eucalin.
10. A. H. Allen.—“Commercial Organic Analysis” (J. and A. Churchill), Vol. i, (1885): p. 191, Glucoses (Eucalyptose, Eucalyn); p. 192, Saccharoses (Melitose, Eucalypton; Melezitose).
11. D. Hooper.—“Chemical Notes on Mannas.” *Druggists' Circular*, 4, 1891, and brief abstract in *Bulletin of Pharmacy*, v, 117. *Eucalyptus manna* is referred to amongst others.
12. A. Ebert.—“Ueber Isopulegon,” by Alfred Ebert, Zurich, 1908, being his thesis for Ph.D.

This paper contains a useful account of the various kinds of manna from different parts of the world. It concludes with a long bibliography of the subject. It contains a contribution to the knowledge of rare kinds of manna. The first part of the work contains no reference to Australian products. The second part, “Contribution to the knowledge of rare kinds of manna and allied substances,” contains several pages on Australian products. From page 82 to 87 he describes the *Eucalyptus* mannas; the description is mainly chemical.

So far we have been dealing with the ordinary manna of Eucalypts. Now we come to Lerp or Lerp Manna, which was first chemically examined by Dr. Thomas Anderson in 1849 (see the reference at p. 113).

The following additional references will probably be sufficient from the chemical point of view :—

13. F. A. Flückiger.—*Vierteljahresschr. de Wittstein*, 1868, xvii, 161. A chemical investigation of Lerp.

This substance occurs on the leaves, and consists of white threads, clotted together by a syrup proceeding from the insect (*Psylla eucalypti*) which spins those threads. It contains, in round numbers—of water, fourteen parts; thread-like portion, thirty-three parts; sugar, fifty-three parts. The threads possess many of the characteristic properties of starch, from which, however, they are sharply distinguished by their form. When lerp is washed with water the sugar dissolves and the threads swell slightly, but dissolve to a slight extent, so that the solution is coloured blue by iodine. The threads, freed from sugar by washing, consist of a substance called *Lerp-amylum*.

Lerp-amylum is very slightly soluble in cold water, not perceptibly more so in water at 100°, but entirely soluble to a thin transparent liquid when heated to 135° in sealed tubes with thirty parts of water. This solution, on cooling, deposits the original substance in flocks, without forming a jelly at any time. The separation is almost complete.

If the material employed in this experiment were entirely free from sugar, the liquid left after the separation of the flocks will also be free from sugar. The flocks deposited from solution are insoluble in boiling water, therefore *lerp-amylum* suffers no chemical change on being heated to 150° with water. Heated in the air-bath to 190° while dry, it turns brown, and is afterwards merely reddened by solution of iodine; at the same time it becomes partly soluble in hot water, hence it appears that *lerp-amylum* undergoes a change similar to that which occurs when starch is converted into dextrin. By oxidation with nitric acid it yields oxalic acid, but no mucic acid; it is neutral to vegetable colours, and is not precipitated by lead acetate, and is, therefore, not to be confounded with the gums, &c.

It gave, by analysis, 43.7 and 43.07 carbon, 6.6 and 6.4 hydrogen, agreeing with the formula $C_6 H_{10} O_5$ (44.4 C. and 6.24 H.). Like starch, lerp-amylum rotates the plane of polarisation to the right, and on digestion with dilute sulphuric acid, &c., forms a crystallisable carbohydrate, which agrees in its properties with dextrin. It is insoluble in ammonia cuprate, and is homogeneous.

Though the behaviour of lerp-amylum to iodine and to water, and its insolubility in cupr-ammonia, distinguish it from cellulose, it is to be borne in mind that there are forms or conditions of cellulose which are blued by iodine and dissolve in water. (Flückiger in *Watts' Dict.*, vii, 2nd Suppl., 733.)

(Also "Lerp Manna von *Eucalyptus dumosa*." *Jahresb. d. Pharm.*, 1868, s. 124, and 1869, s. 114.)

14. See also F. A. Flückiger and D. Hanbury.—*Histoire des Drogues*, ii, 59. "La Manne d'Australie" and "La Manne de Lerp d'Australie."

5.—Watery Liquids from Eucalyptus Trees.

Everyone who has given attention to Eucalyptus has heard of the sweetish sap of the Cider-tree of Tasmania (*Eucalyptus Gunnii* Hook. f.) which, however, we have heard less of since the standard of living in the bush has been raised.

1. The first reference I can find is the following. Sir William Hooker (*Bot. Mag.*, t. 4,036, 1843), had been speaking of the manna of Van Diemen's Land (*E. viminalis*, by a slip referred to as *E. virgata*). He goes on to say, "Another Eucalyptus on the mountains of Van Diemen's Land is called the Cyder Tree; it yields a liquor resembling black beer, by boring into its trunk."

2. In the following year Dr. J. D. Hooker described the cider-tree under the name of *E. Gunnii*.

Following is Hooker's account of the cider (*London Journal of Botany*, iii, 499, 1844) given with his description of *E. Gunnii*. A good modern chemical analysis of this liquid in a fresh state, for it soon ferments, is a desideratum:—

At the time when I visited the habitat of the cider-trees the sap had not commenced to flow, and the wood, which is of a pale yellow colour, merely tasted, when fresh cut, rather sweet. I am indebted to Mr. Gunn for a bottle of the fluid, collected about two years ago. It has now a very acid taste. For the following interesting analysis of it I am obliged to my friend, Dr. R. D. Thomson, of Glasgow:—Specific gravity, 1,338.1; water being 1,000. The smell resembles that of foreshot spirits, that is—a faint alcoholic fluid. When distilled in the water-bath a distinctly acid fluid came over, which smelled of alcohol; the liquid in the retort remaining also acid. The acid was neutralised by saturating with carbonate of soda. On evaporating the saturated solution, fine needle-shaped crystals remained, which, when heated with sulphuric acid, emitted a strong smell of acetic acid, and proved to be acetate of soda. The liquor in the retort, when evaporated, afforded a quantity of syrup, and the fluid smelling of alcohol was proved to contain that substance. The cider, therefore, consists of —

Sugar,	Water,
Acetic acid,	Alcohol,

besides a small quantity of albuminous substance, coagulated by heat, and which probably acted as the ferment in converting the sugar first into alcohol and then into acetic acid.

It is worthy of note that country people usually term all watery liquids from trees "cider."

3. Following is an early account, by Mr. R. C. Gunn, which would be about 1842, and doubtless formed the basis of Sir W. J. Hooker's, and his son's, Dr. J. D. Hooker's, remarks.

The shepherds and stockmen cut with an axe into the tree about 5 or 6 inches, inclining the cut downwards so as to hold about a pint. The sap flows into this hole from above and below, and when first made fills at least once a day, but later in the season yields less, and ceases altogether. The sap is drunk as it comes from the tree. Some trees yield sap of a very thin consistency and slightly acid; others again yield a sweeter, and as thick as syrup.

The effect at first to many who drink it is slightly aperient, but it ceases afterwards.

4. Shortly afterwards we have the following account, for which the author appears to be indebted to Gunn, although he does not say so.

On the Western Range there is a species of the *Eucalyptus* called the Cider Tree. The shepherds and stock-keepers who tend the flocks and herds on that elevated region are in the habit of making deep incisions wherever an exudation of the sap is perceived upon the bark. The holes are made in such a manner as to retain the sap that flows into them, and large enough to hold a pint. Each tree yields from half a pint to a pint daily during December and January; but the quantity lessens in February, and soon after ceases.

The cider, or sap of the tree, has an agreeable sub-acid taste, and sometimes is of considerable consistency. It is said to have an aperient effect on those who drink much of it.

(Excursion to the Western Range, Tasmania. By W. H. Breton, Lieut. R.N., in "Tasmanian Journal of Natural Science," Vol. 2, p. 140, 1846.)

5. Speaking of Tasmanian plants, Daniel Bunce (copying Ross, "Hobart Town Almanack" for 1830, p. 119, although he does not mention it), says:—

Of the trees also belonging to this order, were many of the *Eucalyptus resinifera* [*Gunnii* is meant.—J.H.M.] or cider tree of the lakes. This tree, at certain seasons, yields a quantity of slightly saccharine liquor, resembling treacle, which the stock-keepers were in the habit of extracting, and using as a kind of drink. The natives had also a method, at the proper season, of grinding holes in the tree, from which the sweet juice flowed plentifully, and was collected in a hole at the bottom, near the root of the tree. These holes were kept covered over with a flat stone, apparently for the purpose of preventing birds and animals coming to drink it. When allowed to remain any length of time, it ferments and settles into a coarse sort of wine or cider, rather intoxicating if drunk to excess. (*Australatic Reminiscences*, p. 47, 1857.)

6. Coming to other species of *Eucalyptus* with "cider," in Part XXVII, p. 126, of my "Critical Revision of the genus *Eucalyptus*" there is a reference to *E. maculosa* R. T. Baker being affected by a yellow-coloured lerp; whether edible or not is not stated. Also the species (called by Mr. Baker *E. lactea* on that account) "exudes a whitish substance, called by the settlers 'buttermilk.'" Perhaps this is a sweetish sap, allied to the "cider" of *E. Gunnii*, but the statement is not clear. *E. maculosa* (*lactea*) is allied to *E. Gunnii*.

7. Mueller ("Eucalyptographia," under *E. viminalis*) says: "In all probability the sugary substance in the sap of *E. Gunnii*, and particularly in *E. corynocalyx* (*cladocalyx*), would prove large also, though it seems not to become at any time concreted and exsiccated into firm masses."

8. Mueller ("Eucalyptographia") says that from cuts in the stem of *Eucalyptus Raveretiana* an acidulous, almost colourless, liquid exudes in considerable quantity, in which respect the species resembles *E. Gunnii*.

9. Other Eucalypts exude a watery liquid, not always drinkable. I saw a tree of Orange Gum (*Eucalyptus Bancrofti* Maiden) felled near Port Macquarie, and a large quantity of a sour, rusty-coloured liquid squirted out with considerable force. A watery liquid exudes from the "apple-tree" (*Angophora intermedia* DC.), and doubtless my readers can quote other instances.

10. The Wandoo of Western Australia (*Eucalyptus redunca* Schauer, var. *elata*) gives out a watery liquid from the prominent tumours so common in this tree, when they are tapped by means of an axe.

11. Speaking of the Salmon Gum (*E. salmonophloia* F.v.M.) in the Goomalling (an agricultural) district, Mr. Percy Murphy informs me, "Difficult to get without gum-veins. It sometimes has hollow spaces from which you may obtain a couple of buckets of water." It is, however, sound as a rule, and Goomalling is too far west for the species to attain its best development. These hollow spaces, filled with liquid, are of pathological origin.

C. J. McMaster, photo.

KURRAJONG (*Brachychiton populneum*) AT BALAGULA STATION, COONAMBLE, N.S.W.

Cecil Lewis, photo.

KURRAJONG (*Brachychiton populneum*) AT KOORINGA STATION, NEAR YOUNG.

His Honour Judge Docker, photo.

KURRAJONG TREE (*Brachychiton populneum*) NEAR VERNON'S PIC, WARRUMBUNGLE MOUNTAINS, N.S.W.

R. W. Peacock, photo.

REMAINS OF A KURRAJONG TREE (*Brachychiton populneum*), COOLABAH DISTRICT.

W. Forsyth, photo.

KURRAJONG (*Brachychiton populneum*), NEAR PEAKHURST.

Artist unknown.

DRAWING OF A KURRAJONG (*Brachychiton populneum*) ON A LIMESTONE HILL. IT IS ABOUT A CENTURY OLD, AND IS SUPPOSED TO BE IN THE YASS DISTRICT, N.S.W.

Walter Gill, photo.

Eucalyptus rubia NEAR AMBLESIDE, MOUNT LOFTY RANGES,
SOUTH AUSTRALIA.

His Honour Judge Docker, photo.

MANNA GUMS (*Eucalyptus rubida*) AT MOONBAH, NEAR
JINDABYNE, N.S.W.

1223

A. W. Mullen, photo.

CURLY YARRAN (*Acacia Oswaldii*), BOURKE DISTRICT.

A. Thompson, photo.

TULIP TREE (*Harpullia pendula*), GRAFTON.

Government Printer, photo.

TULIP TREE (*Harpullia pendula*), BOTANIC GARDENS, SYDNEY.

THE KURRAJONG.
(*Brachychiton populneum* R.Br.)

THE CANDLE-BARK.
(*Eucalyptus rubida* DEANE AND MAIDEN.)

THE MILJEE.

(*Acacia Oswaldi* F.v.M.) (A-K)

THE OLEANDER-LEAVED WATTLE.

THE TULIP WOOD.
(*Harpullia pendula*.)

THE FOREST FLORA OF NEW SOUTH WALES.

J. H. MAIDEN, I.S.O., F.R.S., F.L.S.,
Government Botanist of New South Wales and Director of the
Botanic Gardens, Sydney.

PART LXIV.

*Published by the Forest Department of New South Wales, under authority of
The Honourable the Secretary for Agriculture.*

Published by Authority of
THE GOVERNMENT OF THE STATE OF NEW SOUTH WALES.

Sydney:
WILLIAM APPLEGATE GULLICK, GOVERNMENT PRINTER.

1920.

PRICE, 1/- per Part, or 10/- per dozen Parts, payable in advance.

Pittosporum undulatum Vent. ¹²³

The Pittosporum.

(Family PITTOSPORACEÆ.)

Botanical description.—Genus, *Pittosporum*. See Part I, p. 29 of the present work.

Botanical description.—Species, *undulatum* Ventenat, “Description des plantes nouvelles ou peu connues du jardin de J. M. Ccls.” Paris, 1800, p. 76.

A tree, attaining in favourable situations, 40 feet, or, according to Macarthur, 60 to 90 feet, although in barren exposed localities it remains a shrub, quite glabrous, except a slight appressed pubescence on the young shoots and inflorescence.

Leaves from oval-oblong to lanceolate, mostly 3 to 6 inches long and acuminate, flat or undulate on the margin, narrowed into a petiole of $\frac{1}{2}$ to $\frac{3}{4}$ inch, coriaceous and shining, with veins little conspicuous, the upper ones often almost whorled. *Peduncles* several, in terminal clusters, much shorter than the leaves, mostly bearing a simple cyme or umbel of three or four rather large white flowers, and one or two often one-flowered. *Sepals* lanceolate, acuminate, often connate at the base. *Petals* 5 to 6 lines long, spreading from the middle. *Ovary* almost sessile, hairy, the two placentas united at the base, each bearing numerous ovules. *Capsule* nearly globular, rarely attaining $\frac{1}{2}$ inch, smooth, with thick coriaceous valves and numerous seeds. (B.Fl. i, 111.)

In Edwards' *Botanical Register*, t. 16 (1815), it is figured as “Wave-leaved Pittosporum,” and the statement is made that it was introduced into England by Sir Joseph Banks as early as 1789.

Botanical Name.—*Pittosporum*, from two Greek words, signifying “pitch” and “seed,” referring to the stickiness of the seeds. Gardeners who have to handle them rub them up with sand, so adhesive are they. *Undulatum* is from the Latin, and refers to the undulate or wavy character of the leaves.

Vernacular Name.—“The Pittósporum,” par excellence, of New South Wales people, and why not encourage the use of the name, which seems far more in use than any other? I am aware that the classical pronunciation should be Pittospórum, but this seems reserved for purists.

It used to, more or less, go under the name of “Cheesewood,” because of the texture of the timber, but the name was somewhat far-fetched. In Smith's “Dictionary of Plant Names” it is called “New South Wales Box Tree,” but I never heard it called by that name in Australia. At one time substitutes for Box (*Buxus*) for engraving

and for rules, tools, &c., were very much sought after, but wood engraving will soon be a lost art, owing to photographic processes for illustration. The Boxes of Australia are mostly Eucalypts.

This species is sometimes known as "Mock Orange," because of its white, sweetly-scented flowers, which remind one of orange-blossom. It is sometimes called "Native Laurel" because of the appearance of its foliage, but the use of such names is purely imitative, and should not be encouraged.

Aboriginal Names.—"Wallundun-deyren" is quoted by Sir William Macarthur as the aboriginal name for this "common brush tree of the Illawarra." (Cat. Indig. Woods, Southern districts, N.S.W., Paris Exh., 1855.) "Bart-barb" of the Lake Tyers (Gippsland, Victoria) aborigines, according to Dr. C. S. Sutton.

Flowers.—The morphology and the physiology of the flowers, and particularly of the stamens, have formed the subjects of investigation for many years. Following are the principal papers, and they are given at some length to interest our young people (and, indeed, others) in Nature Study.

The reproductive organs in this species.

J. C. Bidwill (who was Director of the Botanic Gardens, Sydney, for a short period in 1847) seems to have been the first botanist who drew attention to the subject. Writing to Captain P. P. King, R.N., F.R.S., of Sydney, on 27th September, 1847, he says, "I am inclined to think that your *Pittosporum* is only the female plant of *P. undulatum*. They are sometimes hermaphrodite, sometimes male, and sometimes female by abortion of the stamens; if you examine further, I think you will find this to be the case." (J.H.M., in *Journ. Roy. Soc. N.S.W.*, xlii, 90, 1908.)

The subject appears then to have been lost sight of for a number of years. Following are some references.

1. A. G. Hamilton, in *Proc. Linn. Soc. N.S.W.*, xix, 583 (1894).

Recently, in examining some flowers of this plant, I found the anthers very slightly developed, and the stigma mature, suggesting that the plant was strongly proterogynous. In flowers from another tree, however, the anthers were found to be well developed, while the stigma was immature. Further examination of similar specimens has led me to the opinion that in this species a differentiation of the sexes is going on. The short stamens contain pollen in an undeveloped state; and honey is freely secreted. I have been unable to find any record of this fact, or any figure of the flowers with short stamens. Trees with flowers bearing short stamens are very plentiful here at Mt. Kembla, and Mr. E. Bêche, to whom I pointed out the facts, informs me that trees about Sydney also exhibit the same peculiarity.

2. A. G. Hamilton, "On the Fertilisation of Some Australian Plants," *Rep. Aust. Assoc. Adv. Science*, vi, 405, with Figs. 1-3 of Plate LI (1895).

Pittosporum undulatum Andr.—In the majority of trees the flowers are proterandrous, the anthers being well developed and full of good pollen. The flowers are very attractive to insects, from their powerful sweet scent and free secretion of nectar. But in a small proportion of trees the anthers are small and short, and the pollen does not appear to be functional, in addition to which the anthers do not dehisce. They are very closely appressed to the base of the ovary, and secrete nectar. The flowers of this form are also sweet-scented. These short anthers vary much in size, even in the same flower, and I think it

probable that the trees are in a state of transition towards separation of the sexes. . . . Mr. E. Betcher pointed out the following passage to me in Engler and Prantl's "Naturliche Pflanzenfamilien" (1): "The large coloured flowers (of Pittosporæ), the sweet smell, and secretion of honey in many flowers indicate fertilisation by insects; but very few actual observations have been recorded. Mr. Thomson records, in *Trans. and Proc. of the N.Z. Inst.*, 1880, that the flowers of *Pittosporum tenuifolium* are proterogynous, and that *P. eugenoides* inclines to separation of the sexes." It is very interesting to have this confirmation of the facts above stated from New Zealand.

The flowers of both forms are much frequented by bees, both native and introduced, and by butterflies, especially the Pieridæ and *Papilio Macleayanus*, and fruit very freely.

Fig. 1 shows the ordinary form of stamen and ovulary; Fig. 2, stamens and ovulary in form, having short stamens; while Fig. 3 is a semi-diagrammatic representation of a short stamen, showing the position of the pollen, which is undeveloped and abortive.

3. A. G. Hamilton, in *Proc. Linn. Soc. N.S.W.*, xxiii, 759 (1898), "Notes on the Fertilisation of Some Australian and Other Plants"—Pittosporæ.

I have given an account of the two forms of flowers noticed in this plant—1st, those with perfect stamens and pistils; 2nd, those with perfect pistils, but having stamens very short and converted into nectaries, and not functional as pollen-bearers. Since then, I have seen a tree in Dr. Lee's garden in Wollongong, which sprang up as a seedling among ferns transplanted from the bush. In this tree the stamens are perfect, but the pistil is imperfect, and never sets seed. This completes the series of forms.

T. Kirk ("Forest Flora of New Zealand," p. 81) says of *Pittosporum eugenoides* A. Cunn.: "In this species the flowers are in many specimens practically unisexual; although both stamens and pistil are invariably present, one or other is abortive. The perfect stamens have longer and more slender filaments, and produce abundance of pollen; the imperfect stamens are carried on shorter, less slender filaments, and produce but little pollen. The pistil exhibits but little variation. Flowers with perfect and imperfect stamens may be produced on different trees, or both forms may be found on the same tree associated with perfect flowers; in the former case the trees are practically dioecious. Other New Zealand species of *Pittosporum* exhibit the same phenomenon."

Pittosporum undulatum has manifestly reached a farther stage of differentiation, as the various forms are never found on one tree, so far as my experience extends; the anthers in the second form are always quite abortive, having only a couple of dozen ill-formed pollen-grains in the sacs, which never open, and the anthers are mere honey-secreters. The filaments are very short, almost suppressed.

In the other Illawarra species, *P. revolutum* Ait., I have never seen any approach to this state of affairs. All the flowers are perfect.

4. "Notes on Variable dioecism in *Pittosporum undulatum* Andr.," with a plate—Thomas Steel, *Proc. Linn. Soc. N.S.W.*, xxxvi, 329 (1911).

Mr. Steel gives a useful bibliography of the observations of previous workers, and then proceeds:—

Again, in 1902, Mr. R. H. Cambage (*Proc. Linn. Soc. N.S.W.*, 1902, p. 593) brought evidence forward confirmatory of the observations made by the previously quoted botanists. During the last few years I have had opportunities of making close observations on several trees of *P. undulatum* growing in my garden, at Petersham, near Sydney, and on numerous others in gardens in the vicinity, which have yielded further information of an interesting nature.

Usually towards the end of June, in the neighbourhood of Sydney, the flower-buds on the male or staminiferous trees are well advanced, many of them being on the point of opening, while on the female or non-staminiferous trees nothing but leaf-buds are visible. The blossoms on the latter begin to open about three weeks or a month later than the others, and are accompanied by a succession of staminiferous flowers on the adjacent male trees during the whole period of flowering. The male trees are much handsomer than the female, because of the larger size of the blossoms and the bright yellow of the anthers; while both are fragrant, secrete nectar, and are freely visited by bees.

I have repeatedly noticed a few seed-vessels occurring, either solitary or in clusters, on the male trees, and have ascertained by trial that the seed contained in these is fertile, and germinates as readily as that from the female trees. In normal blossoms, when fully open, the ovary of the stamiferous type, though of about equal length to that in the female flower, is not nearly so stout and globose; while the stamens are long, and have the anthers projecting above the top of the pistil (Pl. ix, figs. 2-3). In the female flowers, as has been very clearly described by Mr. Hamilton, the stamens are mere rudimentary scales appressed to the base of the ovary (Pl. ix, fig. 5). With the aid of my sons, I have, in several successive years, made a close examination of many hundreds of blossoms on both kinds of tree; and have found, on the male tree, blossoms having short stamens, with shrivelled abortive anthers which did not dehisce or form pollen. By marking these with little pieces of cord tied round the petioles, I was able to keep them under observation, and found that these were the blossoms which gave rise to the fruit noticed on the male trees. The abnormal blossoms, though by no means easy to find amongst the multitude of others, are readily identified when seen, because of the absence of visible anthers. The stamens in these blossoms are not like those in the female flowers, but are about one-half the normal length, reaching to about the top of the ovary, and as has been mentioned, are non-dehiscent (Pl. ix, fig. 7). The ovary in the abnormal blossoms is, in size and shape, quite different from that in the ordinary male blossoms, but precisely like that in the female. On no occasion have we found a stamiferous blossom on a female tree, although we have searched carefully.

The abnormal or fruit-setting blossoms on the male trees are erratically developed, sometimes only one in a cluster, at other times two, three, four, or even a full cluster, but they are never abundant. Intermediate blossoms are met with occasionally. One example, which I have carefully preserved, and which was on a male tree, contained two normal stamens, two abortive, and one intermediate (Pl. ix, fig. 6); while the ovary had the small, slender shape normal in male blossoms.

We thus see that, while the trees have differentiated into the dioecious state, the male trees have occasional female flowers which retain abortive stamens, and, more rarely, single blossoms which may be considered intermediate in having some normal and some abortive stamens; the female trees appear never to have any but normal female blossoms.

The normal number of petals in each blossom is five. Variations are exceedingly rare, and I have noticed only two examples, one of which chanced to be a male, and the other a female blossom. The former possessed only four petals and stamens, while the latter had six petals and a like number of the small, scale-like, undeveloped stamens.

It would be interesting to know whether the seeds derived from male trees show any predisposition to produce male or female plants, and with this object in view, in 1906, I gave Mr. Maiden a quantity of seed which I had watched ripen on the male tree. This grew freely, but unfortunately, through some mishap, all the plants but five were lost sight of. These, however, are now growing in the Palace Ground section of the Botanic Gardens, Sydney; they have not yet flowered, but will be kept under observation. I shall endeavour to give Mr. Maiden a fresh supply of similar seed, and it is proposed to continue the experiment.

Oil from Flowers.—In 1862, Mr. Bosisto, of Melbourne, distilled an oil from the flowers, obtaining 2 oz. from 100 lb. of material. It was described as—

“limpid, colourless, lighter than water, of an exceedingly agreeable, jasmine-like odour; the taste disagreeably hot and bitter, reminding one slightly of turpentine and rue.” The report he obtained from London was: “A charming fragrance, resembling a mixture of jonquil and jasmine. A few drops dissolved in silent spirit resemble many varieties of Eau de Cologne.”

Bark.—The following chemical investigation will be found interesting, and a modern one is a desideratum:—

Pittosporine—Glucoside of the bark and fruits of *Pittosporum undulatum*. The pulverised bark is extracted with hot alcohol, filtered when cold, mixed with an equal bulk of ether, filtered again, and evaporated. It is a whitish loose powder, sweetish at first, afterwards bitter and acrid; dissolves in water and alcohol, not in ether; froths with water, gives precipitates with acetate and sub-acetate of lead. Separates, by boiling with diluted acids, into sugar and a white substance, insoluble in water.

(Mueller and Rummel, in Wittstein's "Organic Constituents of Plants," p. 175, 1878.)

As it has such a bitter, acrid taste (like the fruits) I quite expected it would possess medicinal properties, but Dr. Thomas Bancroft informs me that this genus is physiologically inert, or practically so.

In an article, "The Medicinal Uses of Pittosporum Barks" (*Pharm. Journ.*, xviii, 4th ser., 30th April, 1904, p. 588), will be found a useful abstract of papers referring to the resins and bitter principles contained in barks of the genus.

Dr. M. Greshoff found a Saponin in this species (*Kew Bulletin* for 1909, p. 414). The note is valuable, and will be found at p. 57, Part LIII, of the present work.

Exudations and Oils.—These are obtained from both the bark and from the fruit, and the following papers may be referred to :—

1. "Notes on the Exudations yielded by some Australian Species of Pittosporum," by J. H. Maiden (assisted by H. G. Smith). (*Rep. Aust. Assoc. Adv. Sci.*, iv, p. 289, 1892.) This will be useful for reference.

2. The late Dr. Joseph Lauterer, of Brisbane, examined a soft resin from this tree. See his paper, "Gums and Resins exuded by Queensland Plants Chemically and Technologically Described," in Bailey's *Botany Bulletin* (Queensland), No. XIII (1896), p. 50.

It remains to be mentioned that the fruits and the wounded bark of this species exude a peculiarly aromatic gum-resin, which is very viscid, and which apparently possesses stimulating properties, and might therefore be found useful in medicine, both for external and internal application. I do know that it was applied to the wounds of a dog, and that the dog soon got well, and that the cure was attributed to the resin, but should be sorry to generalise from this one incident.

3. "Note on Some Products from the Fruit of *Pittosporum undulatum*, and from the Leaves of the Pepper Tree, *Schinus molle*," by R. H. Threlfall, *Proc. Roy. Soc. N.S.W.*, xxix, p. 456 (1895).

He obtained 70 c.c. of a thick juice from 500 gm. of fruit by means of a screw filter-press. From this an oil was obtained by distillation. The residues were also treated. The oil was subjected to fractionation, with results stated, and the refractive index was also measured.

4. "The Constituents of the Essential Oils from the Fruit of *Pittosporum undulatum*," by Frederick Belding Power and Frank Tutin. (*Journ. Chem. Soc.*, July, 1906, pp. 1083-92.)

Its fruits when bruised have an odour similar to that of the Tangerine orange, and yield on distillation 0.44 per cent. of essential oil. The oil undergoes change on keeping. A sample of freshly distilled oil gave the following constants :—

Specific gravity, 0.8165; (n_D) = + 74° 4'; a trace of free acid, a large amount of esters, no aldehydes or ketones, and a small quantity of phenols having the odour of eugenol. On distillation the following fractions were obtained :—Up to 165° C., pinene 4 per cent.; up to 173°-180° C., limonene

75 per cent.; up to 200°–225° C., probably an alcohol which on oxidation gave a ketone with a coumarin-like odour, and having the composition $C^9H^{14}O$; up to 263°–274° C., a sesquiterpene $C^{15}H^{24}$, which is optically inactive, and having a specific gravity of 0.910 and a refractive index of 1.50. It is a dicyclic sesquiterpene, gives no nitrosochloride, and does not form a stable compound with bromine or hydrochloric acid. *Pharm. Journ.* xxii (4th Ser.), p. 755 (30th June, 1906). There is also a briefer abstract in the *Yearbook of Pharmacy* for 1907, p. 129.

Timber.—An early report on this timber, referring to specimens from the Counties of Cumberland and Camden, N.S.W., sent to the Paris Exhibition of 1855, and to that of London, 1862, is from the pen of Sir William Macarthur, who wrote:—

A small tree, with very close-grained, hard, white, or whitish-brown wood, which, when seasoned carefully, is excellent for turning, and promises to be good for wood-engraving; sound transverse sections of more than 10 to 16 inches would be rare.

It furnishes a light, even-grained wood, which attracted some attention at the International Exhibition of 1862. Blocks were prepared from it and submitted to Prof. de la Motte, of King's College, who reported as follows:—

I consider this wood well adapted to certain kinds of wood engraving. It is not equal to Turkey box, but it is superior to that generally used for posters, and I have no doubt it would answer for the rollers of mangles and wringing machines.

Mr. W. G. Smith, in a report in the *Gardeners' Chronicle* for July 26th, 1873, says:—

The wood is suitable only for bold outlines; compared with box it is soft and tough, and requires more force to cut than box. The toughness of the wood causes the tools to drag back, so that great care is required in cutting to prevent the lines chipping.

The above is the gist of a report by J. R. Jackson in *Journ. Soc. Arts*, xxxiii, 567.

In December, 1889, I wrote as follows in a Sydney journal:—

Cheesewood is a moderately hard, homogeneous wood, which has been brought forward during the last few years as a substitute for boxwood in engraving. Like ivory, boxwood is getting scarcer year by year, and no efficient substitute for either the animal or the vegetable product has yet been found. The verdict in regard to cheesewood was a guarded, half-hearted sort of deliverance, and I am not aware that the wood has passed beyond the "sample" stage. A wood not entirely suitable would involve serious consequences to a skilled wood engraver, and therefore cheesewood has uphill work before it. I have seen cheesewood seasoned (or rather not seasoned) in a disgraceful manner, and before making recommendations for the special utilisation of particular timbers, it would be well to devote more attention to that most important operation connected with timber—seasoning. Until we can get timber merchants and others to patiently season timbers, and then patiently set about ascertaining their probable uses, many of our timbers will remain unappreciated. In New South Wales we have a range of timbers suited for almost all purposes of use and ornament—timbers which are not excelled by those of any single country in the world. But we have not got beyond the alphabet of our knowledge of the uses of 90 per cent. of our timber trees.

But, returning to our muttons, cheesewood is a splendid working and turning timber, and should prove useful for tool handles. If it may not yet be promoted to the dignity of a substitute for boxwood in engraving, it would form an efficient substitute for rules, miscellaneous philosophical apparatus, &c.

It will be observed that most of the uses above referred to are those for wood-engraving, now rapidly becoming an obsolete art.

A modern use is as follows :—

A pale yellow-coloured, close-grained timber, very durable and (for heads of golf-sticks) drives ball equal to Mararie. By some it is preferred to any other Australian or foreign timber. It closely resembles Yellow Tulip (*Hemicyilia australasica*). R. T. Baker, in "Golf Illustrated," 28 July, 1905.

Mr. Baker, in his "Hardwoods of Australia and Their Economics," has a coloured plate of the timber, and gives the weight at 56 lb. per cubic foot. He describes the anatomical characters of the timber at page 41, gives microphotos and recommends it for carving and for screws.

Size.—It is a medium-sized tree. Following are some specific estimates and measurements. Sir William Macarthur gave the size for Illawarra trees many years ago as 50–80 feet, with a stem diameter of 18–30 inches. Mr. W. Baeuerlen gave the height as 60–80 feet, diameter 18–22 inches, Jasper's Brush, Broughton Creek, Illawarra, N.S.W. Mr. Forest Guard W. Dunn gave the height of Macpherson Range trees as 30–40 feet.

Habitat.—It occurs native from Tasmania (on the Arthur River, one tree only found, according to Rodway, "Tasmanian Flora") to Southern Queensland. In Victoria it is found in Gippsland, while in New South Wales it is found throughout its entire length, east of the Dividing Range, luxuriating in shady gullies at no great distance from the coast. This is, in fact, its favourite situation in most of the States.

It is a native of Port Jackson, and of the Sydney district generally. It is an aboriginal inhabitant of the Botanic Gardens and Outer Domain, Sydney. At the same time, it has been so abundantly cultivated as an ornamental and sweet-scented plant in the Sydney district and in various parts of this and other States that it sometimes becomes a difficulty to say whether a certain plant is indigenous where it is collected. But in the true bush there is no difficulty.

It is represented in the National Herbarium, Sydney, from the following localities :—

VICTORIA.

Snowy River (Victoria and N.S.W.) (C. Walter).

NEW SOUTH WALES.

Southern Localities.—Eden, on the fringe of Twofold Bay, adjacent to the bush (J. L. Boorman); Conjola (W. Heron, 38); Berry Mountain (J.H.M.). These are coastal localities, and we pass on to the brushes near Sydney. Following are southern tableland localities further removed from the coast : Queanbeyan (E. Breakwell); Sugar Loaf Mountain, near Braidwood (W. Baeuerlen); Shoalhaven River, at Wingello (A. Murphy).

Northern Localities.—Gloucester Buckets (J.H.M.); Murrurundi (J.H.M. and J. L. Boorman). 30–40 feet, but attaining a height of 70 feet, Barraba (A. L. Kefford).

Tree of 18 feet, growing in the bed of Horse Arm Creek, Ph. Billyena, County Nandewar, Pilliga (E. H. F. Swain, No. 36).

Woodford Island, Clarence River (E. J. Hadley, Nos. 19 and 25).

Acacia Creek, Macpherson Range, Queensland border (Forest Guard Dunn, No. 129).

QUEENSLAND.

Tambourine Mountain (Dr. John Shirley); Bunya Mountain (F. M. Bailey); both in South Queensland.

Propagation.—It is easily multiplied by seed, which is abundantly produced. It is one of the Australian plants esteemed in other countries. Prof. C. F. Baker, now of the Philippines, then of California, distributing it in his series of "Economic Plants of the World," has the label: "It is entirely hardy in Southern California, and one of the most valuable species of the genus for garden and park plantings. It does well planted alone or in hedges."

Many years ago it was introduced into the Azores, and proved a useful tree to protect the orange orchards from the prevailing winds. Its planting should be encouraged in windy seaside localities.

The only drawback to it that I know is that it is liable to the attack of a borer, which makes an annular channel round the bark and wood, and branches, even of considerable size, fall off when thus attacked.

EXPLANATION OF PLATE No. 240.

- A. Flowering twig.
- B. Part of flower showing fully developed stamens.
- C. Vertical section of pistil.
- D. Part of flower with abortive stamens.
- E. Part of flower with rudimentary stamens.
- F. Back of flower.
- G. Fruiting twig.
- H. Fruit opened.

PHOTOGRAPHIC ILLUSTRATION.

Tree of *Pittosporum undulatum* growing out of stump of Bangalay (*Eucalyptus botryoides*), Milton, South Coast, New South Wales. (R. H. Cambage, photo.) See with *Eucalyptus viminalis* photo.

E.A. King lith.

THE PITTOSPORUM.
(*Pittosporum undulatum* VENT.)

No. 238.

Eucalyptus viminalis Labill.

A White Gum.

(Family MYRTACEÆ.)

Botanical description.—Genus, *Eucalyptus*. See Part II, p. 33.

Botanical description.—Species, *viminalis* Labill., *Nov. Holl. Pl.* ii, 12, with plate 151 (1806).

A copy of the original description will be found in my "Critical Revision of the Genus *Eucalyptus*," Part XXVIII, p. 167, and following is an unpublished translation:—

A *Eucalypt*, operculum rather hemispherical, mucronate; leaves linear-lanceolate; heads 3-flowered, lateral. A medium-sized tree, branchlets angular at the apex. Leaves linear-lanceolate, acuminate, nervelets hardly distinct, length the breadth of the palm to that of a small span; petiolate, alternate. Flowers on a common axillary peduncle, somewhat two-edged, scarcely the length of the petioles, very often 3 cruciform, the central one having a longer pedicel than the others. Calyx semi-globular, the operculum a little shorter than the calyx and coriaceous. Style rather shorter than the stamens, stigma subcapitate. Capsule globular, calyx corticate, half covered, 3-4 celled. Otherwise similar to the preceding species (*E. incrassata*). Habitat, Cape Van Dieman.

Bentham then describes it in B.Fl. iii, 239, in English.

Botanical Name.—*Eucalyptus*, already explained, Part II, p. 34; *viminalis*, Latin, twiggy, a term mostly applicable to small saplings and to the branches of small trees. Subsequently the species was found to attain large dimensions, particularly in the mainland States, when the specific name ceased to have special appropriateness.

Varieties.—The normal number of flowers is three, but the species is often multi-flowered. This is discussed in my "Critical Revision of the Genus *Eucalyptus*," Part XXVIII, p. 169.

1. Var. *rhynchocorys* F.v.M., with a pointed operculum. Type from the Snowy River (Victoria and New South Wales).

This pointed operculum is not rare; on the other hand, it is not common. We also have it from Fernshaw, Victoria (Jefferson), from Melb. Herb., and from the Swansea district, Eastern Tasmania (late Dr. Story), and a few other specimens.

2. Var. *racemosa* F.v.M. The type appears to be Port Phillip, February, 1880. (See also a note by the present writer, *Papers and Proc. Roy. Soc. Tas.*, 1918, p. 90.)

Following are *Victorian* localities :—

Moorabool River (P. R. H. St. John); Hawkesdale (H. B. Williamson); Wando Vale, 7th April, 1842, Weeping Gum, red (*sic.*) timber (J. G. Robertson, No. 242).

South Australia.—Cave Range, Forest Reserve, S.A. (Walter Gill).

Tasmania.—In front of University, Hobart (J.H.M.); Circular Head Sandhills (Gunn, No. 1090).

Vernacular Names.—Usually known as White Gum in New South Wales, and usually a prominent object, with predominantly white bark.

Although it is more frequently known as Manna Gum in Victoria (Gippsland) than in New South Wales, it sometimes goes under that name in the latter State, chiefly on the Monaro, sharing it with *E. rubida*.

Howitt says it is called "River Gum" in Gippsland, since it lines the banks of streams.

In New South Wales it is often called Ribbony Gum, because it has long, thin darker coloured deciduous strips. These ribbons are best seen on wet windy days. They then flatten out and are seen to be of great length like streamers or pennants.

A very old name in Victoria (*e.g.*, Robertson, of Wando Vale) was "Weeping Gum," as the branches are more or less pendulous.

Aboriginal Name.—In the Yarra district of Victoria it was formerly called "Binnap" by the aborigines. I have been surprised that I have not been able to find additional names for a tree which must have been well known to the natives.

Synonyms.—There is a complicated synonymy, which has been discussed at p. 171, Part XXVIII, of my "Critical Revision," and to which I refer interested readers. There seems to be sufficient evidence that *E. angustifolia* Desf., *E. saccharifera* F.v.M., *E. crucivalvis* F.v.M., and *E. elata* Dehn. (in part) are true synonyms.

Juvenile Leaves.—The typical juvenile leaves are narrow and moderately long (say about 1 cm. wide and 5 cm. long). They are very common, this being one of the species in which they are most abundant. As a rule, these juvenile leaves (similar to suckers) grow quickly, partly because the species grows under favourable conditions for plant-life, *i.e.*, moderately deep and even good soil, and plenty of water. But where the growth is impeded, owing to shallow, and even impervious soil, and during periods of drought, the juvenile leaves may be shorter and even short, broadish, and otherwise abnormal. But while such abnormalities are not rare, in a species which produces juvenile leaves so freely, and while individual specimens have caused a good deal of contemplation and discussion, it seems proper to say that the normal juvenile leaves are long and narrow, but that they may vary in dimensions and texture. This is only emphasising the point that every organ varies in Eucalyptus. The same remarks can be made conversely, though with less emphasis, as regards the chiefly Tasmanian *E. viminalis*, but in that species the juvenile leaves are broad, though with some tendency to a narrower width.

For some instances of variation in the size of the juvenile leaves of *E. viminalis*, see my "Critical Revision," Part XXVIII, Plates 118 and 119.

"The leaves of young seedlings are narrow-lanceolar, with roundish base, sessile, opposite or exceptionally ternately verticillar (an illustration of this is given at the left-hand side of the plate)." ("Eucalyptographia," *E. viminalis*.)

They are also figured at "Lamina 4" and "Lamina 5" in the pamphlet of "El Gomero de Mana o Eucalyptus viminalis," by Federico Albert, Seccion de Aguas i Bosques, Santiago de Chile (1907).

Seedlings do not change their linear, opposite character until they attain a height of several feet.

Leaves.—The mature leaves are lanceolate and inclined to be narrow. They possess a dainty odour which can always be noticed when they are confined in a limited space, say on lifting the lid of a herbarium-box of this species, even in the presence of a moderate amount of naphthalene.

The foliage has a dainty ethereal odour, not easily described. (See Crit. Rev. xxviii, 169.)

According to Mr. E. Cheel, in the district of Pakenham, Victoria, the species is known as "Sweet Willy," presumably from recognition of this pleasing odour.

Messrs. Baker and Smith ("Research on the Eucalypts," p. 92) refer to a "var. a" of this species having an "almond-like odour." This statement should be examined in connection with what has already been said.

Flowers.—Mr. E. A. Coleman, an apiarist of Mount Barker, S.A., said that "*E. rostrata* (Murray red gum) is the best, and *E. leucoxydon* (locally blue gum) a good tree, that produces the best honey, being clearer and having a rather better flavour than the other. Some eucalypts produce very strong honey. One now blossoming in the hills about Adelaide (March), *E. viminalis* I think it is, produces a strong, dark, rank honey, no good for sale. We use it to feed the bees with."

We want data in regard to the value of each of our Eucalypts to the apiarist. We know very little as to the flowering periods of most of our Gums and allied trees in different districts. Some flower annually, some biennially, others irregularly, but to what extent we do not know.

Exudation.—Besides a reddish-brown astringent kino, this tree exudes, chiefly from the leaves, a sugary substance known as Manna, which, however, has been dealt with at length at p. 107, Part LXIII, to which my readers are referred.

Bark.—It is a White Gum, often smooth and dazzlingly white, but it has at the butt a variable amount of dark, scaly or scaly-fibrous bark. Sometimes the dark-coloured portion is tough and drawn out, forming long ribbons, which extend to the branches, and which, rendered supple by rain, if blown by the wind, form pennons or streamers nearly at right angles to the trunks.

Rodway, speaking of Tasmania, where the type came from, says ("The Tasmanian Flora," p. 57): "Bark usually smooth and white from the base, but sometimes the trunk coarsely scaly or scaly fibrous, even to the upper branches."

The aboriginal (Yarra) Geeam, or spear-shield, at one time used in battle, was made of the bark of his tree. The method of making it is explained and figured in Brough Smith's "Aboriginals of Victoria," i, 332.

Timber.—The usual printed statement in regard to *E. viminalis* timber is that it is inferior. Mueller ("Eucalyptographia") speaks of it in quite a minor key.

L. Rodway, in his "Tasmanian Flora," says, "Wood yellow, brittle, worthless."

A Tasmanian official statement says "*Eucalyptus viminalis* (White or Manna Gum) is not a durable wood when exposed to the weather, but is excellent for floors, furniture, and inside work generally."

Coming to Victoria we have :—

"The timber varies from a light colour to a dull brick colour. That from straight stems is employed for shingles, rails, and also as rough building material. It is not so durable as the wood of many other species of *Eucalyptus*, but is stronger than that of *E. amygdalina* and *E. obliqua*" (Mueller). (I think that most people would not place it below *E. obliqua*.—J.H.M.)

"Fourth Class.—I have placed the River White Gum (*E. viminalis*) first in this list, simply because in regard to all the other Eucalypts, these which are herein included, there is very little choice so far as durability is concerned. Of this species there are two marked varieties, one of which is specially found in the alluvial flats and gullies of rivers, following their course up to the very sources in the mountains." This is from an official, unpublished report of A. W. Howitt, dated 1895. The second "variety" referred to is what is now known as *E. rubida* Deane and Maiden.

We now come to New South Wales :—

"White or Ribbon Gum (*E. viminalis*).—A timber condemned wherever it occurs in New South Wales. Very subject to the attacks of insects and the dry-rot." (Henry Deane, reporting on timbers used in the Glen Innes to Tenterfield Railway, 1885.)

"Ribbony Gum (*Eucalyptus viminalis* Labill.) is an inferior timber, possessing no durability, and of no interest to architects, except to be avoided. It is sometimes called Manna Gum. It is used extensively throughout the Colony where it grows for cheap rough fencing." (J. V. de Coque.)

My view is that country people would do well to reconsider their estimates of the value of the timber of this and of allied White Gums.

I could quote other opinions, some of them of a more favourable character, in regard to the timber of *E. viminalis*, but we had better wait until the qualities of the timbers of *E. viminalis*, *E. Dalrympleana*, *E. rubida*, and perhaps some others, have been more accurately ascertained.

Size.—Mueller ("Eucalyptographia") quotes a Victorian tree up to 320 feet high and with a diameter of 17 feet, and another of 20 feet, but in view of the shrinkage which has taken place in the reputed heights of *E. regnans* from the same districts, when taken in hand by a surveyor, I recommend that authoritative measurements be sought for. At the same time the species attains a very great height. I have personally seen enormous trees.

Habitat.—Mueller ("Eucalyptographia") gives the range as Spencer's Gulf (South Australia), also Kangaroo Island, to Gippsland, thence to Tasmania and New South Wales (north to New England and west to Lachlan River). I doubt if it goes as far west as the Lachlan. In Tasmania, the home of the type, it is found all over the island.

It loves the banks of streams or fresh-water lakes. It is partial to good, deep soil, when it attains a large size. It is, however, tolerant as regards soil, and is found on the side of hills, but it never attains the same development as when plenty of moisture is available.

At pp. 174–179 of my "Critical Revision," Part XXIII, will be found a large number of specific localities in the various States.

TASMANIA.

It is common in most parts of the island, and L. Rodway says it seldom or never occurs at or above 1,000 feet in Tasmania.

SOUTH AUSTRALIA.

In this State it has been chiefly recorded, so far, from the Mount Lofty Range and the Mount Gambier district.

Mr. J. M. Black, however, records it from Ferguson Gorge, near Moolooloo, which takes it much farther to the north, *i.e.*, to between Blinman and Beltana on the northern railway line, about 31 deg. S.

VICTORIA.

It is common in the moister, cooler districts of the State. See Part XXVIII of my "Critical Revision," p. 175. It is the (*a*) of p. 167, which is a fuller note.

NEW SOUTH WALES.

It is a denizen of well-watered, cold localities, ascending to over 4,000 feet. Passing through from Victoria, it will be found on the southern and northern tablelands of the State from end to end, passing into Queensland by means of New England.

In addition to the specific localities given at Part XXVIII, p. 176, of my "Critical Revision," the following are worthy of note:—

Cobargo (E. Cheel), Cobargo and Quaama (W. Dunn), Durran Durra, near Braidwood (E. Cheel). "River Gum, Swamp Gum, Ribbony Gum," Banks of Shoalhaven, Colombo, Braidwood district (F. W. Wakefield). A straggly, shrubby tree about 12 feet high.

Near top of Mount Budawang (4,000 feet), Mongarlowe, Braidwood district (F. W. Wakefield, No. 17).

A tall tree of 60 feet, trunk 2 feet or more at base. Bark white, deciduous and ribbony. *Multiflowered*. Mongarlowe, Ribbony Gum (F. W. Wakefield, No. 13).

"Ribbon Gum," Parker's Gap, between Queanbeyan and Braidwood. (W. A. W. de Beuzeville.)

Plentiful on slopes and in gullies, reaching its greatest development in the latter position. State Forest No. 577, Tallaganda, Braidwood district (C. J. Weston, No. 57).

The tallest tree in the Federal Territory, up to 130 or 140 feet high. Foot of Mount Coree, Condor Creek, Brindabella-Uriara road. (C. J. Weston.)

"Ribbon Gum," "White Gum," "Mountain Gum." Used for building purposes above ground, of poor lasting quality in the ground. Found principally in gullies and creeks in the more sheltered spots. Ph. Molonglo, Co. Murray, Queanbeyan district. (Forester G. Boyd.)

Bed of the Nattai River, *via* Hill Top; also Colo, near top of Mount Flora (E. Cheel.) Mittagong (E. Cheel). . 30-50 feet, 3 and 5 miles from Mittagong (W. Dunn).

Piri, Upper Hunter (Dr. Leichhardt). Moonbi Range, 3,500 feet (Forest Guard E. Julius).

QUEENSLAND.

It is found in the New England portion of this State, but the area in which it occurs requires to be defined.

EXPLANATION OF PLATE No. 241 (IN PART).

A Manna Gum.

(*Eucalyptus viminalis* Labill.)

- G. Flowering twig, from Wyndham, near Eden, New South Wales.
- H. Fruits, from Mittagong, New South Wales.
- I. Fruits, from Ilford to Capertee, New South Wales.
- K. Juvenile leaves from Wyndham, and characteristic of the species.
- L. Broad juvenile leaves from Cox's River, New South Wales, given to show that exceptionally we may have leaves as broad in this species. The matter is discussed at pages 132 and 140.

PHOTOGRAPHIC ILLUSTRATIONS.

- 1. Tree near Hobart, Tasmania, showing the ordinary appearance of the tree in the district. (L. Rodway, photo.)
- 2. Trees near Lake George, New South Wales (probably *E. viminalis*).
- 3. Tree in Orange district, New South Wales, showing the gnarled appearance this tree sometimes assumes. (Sketch by Mrs. Hodges, The Hermitage.)
- 4. Manna Gum, Kuitpo Forest.
- 5. Manna Gum, on road Clarendon to Meadows. (4 and 5 are from South Australia, and were photographed by Mr. Walter Gill, Conservator of Forests.)

No. 239.

Eucalyptus Dalrympleana Maiden n.sp.

A Mountain or White Gum.

(Family MYRTACEÆ.)

Botanical description.—Species, *Dalrympleana* n.sp.

White Gum grandissima, cortice saepe maculis claris et lamellis longis tenuibus secedente, ligno carneo. Foliis juvenilibus pallidis cordatis vel orbicularibus vel ovoideis, amplexicaulibus, sessilibus vel brevissime petiolatis. Venis patentibus, reticulatis. Foliis maturis petiolatis, lanceolatis, falcatis, rare minus 1 dm. longis et 2 cm. latis, venis patentibus vena peripherica a margine distincte remota. Inflorescentia axillare, 3 floribus breve pedicellatis cruciformibus. Alabastrorum calycis-tubo cylindroideo, angulare, operculo conico aequilongo margine commissurata distincte. Fructibus truncato-ovoideis, ca 8 mm. diametro, margine rotundata vel plana, non lata, valvis 3 vel 4 mediocriter exsertis.

A large tree, sometimes attaining an enormous size. "I have seen them 30 feet in girth, with a barrel of almost 100 feet. They are generally 15 or 16 feet in girth. Known locally as 'Mountain Gum' or 'White Gum.' The trees present a remarkable appearance. During early spring the bark is quite white, but later this changes to a vivid red (sometimes almost vermilion), and the trunks have the appearance of being painted in large irregular blotches. Timber pinkish in colour and dries irregularly." (W. A. W. de Beuzeville.)

Branchlets angular, juvenile leaves scabrous in the earliest stage, pale coloured, cordate to orbicular or ovoid, stem-clasping, sessile or with very short petioles, with a short innocuous point; 5 cm. long and 5 cm. broad are average dimensions. Venation spreading, reticulated, the leaf dotted with black spots, scarcely seen with the naked eye.

Mature leaves petiolate, lanceolate, usually more or less falcate, rarely under 1 dm. long and 2 cm. wide, venation spreading, intramarginal vein distinctly removed from the edge; black-dotted.

Inflorescence axillary, petioles flattened, under 1 cm. long, supporting three shortly pedicellate appressed, rarely cruciform, flowers of medium size. The buds with cylindroid calyx-tube, angled, with a conical operculum of equal length. Commisural rim marked. Anther small, opening in parallel slits. Gland at the back.

Fruits truncate-ovoid, about 8 mm. in diameter, rim rounded or flat-topped, not broad, valves 3 or 4, moderately exsert.

Affinities.—*E. Dalrympleana* has been confused, not only with *E. viminalis*, but also with *E. rubida*, and hence it is that we shall not fully understand the technology of this species until, throughout its range, we are able to discriminate it and to disentangle reports of the timber, &c., of individual trees from those with which it has been confused in the past.

1. With *E. rubida* Deane and Maiden. The two species have been often confused by reason of the fact that they are both Gums, and both have broad sucker leaves.

Following is an extract from a letter from Mr. W. A. W. de Beuzeville, Assessor, Forestry Commission, who has specially studied the two trees in the type locality of *E. Dalrympleana* :—

“ In reply to your query as to the differences between the two, I would say that there is a considerable difference.

“ (1) In the first place, *E. rubida* is a considerably smaller tree, and much more gnarled and twisty. In this locality *E. rubida* seldom attains a height of more than 50 feet, while *E. Dalrympleana*, which is the giant tree of the mountains, reaches about 150 feet or more.

“ (2) The *E. rubida* generally grows on poorer soils than the other.

“ (3) The *E. rubida* is very glaucous, while *E. Dalrympleana* is not.

“ (4) The sucker leaf of *E. rubida* seems to be much coarser and larger, while the fruit is a great deal smaller. The bark of *E. rubida* is not so thick. I have often seen the bark of this new species 2 inches thick.

“ The timber of *E. rubida* is much more brittle, and also *rubida* has a different flowering season, being in full bloom nearly a couple of months later than the other. In this locality *E. rubida* clings to western and southern slopes, while the other is found on the eastern and northerly.

“ It is rather a difficult matter to describe these differences, but they are very apparent to the eye. I would never mistake the two trees in the bush. There is a different ‘look’ about them.”

2. With *E. viminalis* Labill.

“ *E. Dalrympleana* is a good deal like *E. viminalis*, but can always be distinguished from that tree, even at a distance. Its foliage is never so green as *E. viminalis*. The latter generally keeps to the damp gullies, and can be distinguished some miles away (when looking at the side of a mountain) by its very bright green leaves. This species is much duller in appearance, though not at all blue looking.” (W. A. W. de Beuzeville.)

The writer is comparing the two trees in the typical locality of *E. Dalrympleana*, but they usually may be sharply separated by the width of the juvenile leaves.

The following table shows the principal differences between *E. Dalrympleana*, *E. rubida*, and *E. viminalis* as we know them at the present time. For differences in the oils, see p. 140.

	1 <i>Dalrympleana</i> .	2 <i>rubida</i> .	3 <i>viminalis</i> .
<i>Size and habit of tree</i>	Very large, erect, non-glaucous tree.	Not very large; smaller than <i>E. Dalrympleana</i> . Grows on poorer soils. Glaucous.	Frequents good, moist soil. Large size.
<i>Bark</i>	Smooth, spotted or patchy, very thick; sometimes 2 inches thick. More or less rough at butt.	Smooth, spotted or patchy, thickish, but not so thick as that of <i>E. Dalrympleana</i> .	Moderately thick; not very patchy; much less ribbony than the other two. See p. 141.
<i>Timber</i>	Pale-coloured, shrinks irregularly. Not much tensile strength. Valuable for building purposes when kept under cover. Valuable for paper pulp.	Much more brittle than that of <i>E. Dalrympleana</i> .	Good. Few gum veins.
<i>Seedlings and suckers</i>	Broadish; glaucous but less so than those of <i>E. rubida</i> .	Broad, glaucous	Narrow, non-glaucous.
<i>Mature leaves</i>	Non-glaucous	Dull green or glaucous ...	Non-glaucous; have sweet ethereal smell.
<i>Buds</i>	Elongated, usually in threes. Rarely cruciform. Has a flowering season in its type locality nearly a couple of months earlier than <i>E. rubida</i> .	Ovoid, often glaucous. Operculum nearly hemispherical. Usually in threes, cruciform.	Same as (1). Usually in threes.
<i>Fruits</i>	Nearly globose, with very protruding valves, usually about 6 mm. diam. Banded rim. Found on easterly and northerly slopes in its type locality (Tumberumba district).	More urceolate. Top shaped; 3 lines diam. Less banded. Smaller than those of <i>E. Dalrympleana</i> . Found on westerly and southerly slopes (Tumberumba district).	Like (1). Most usually found on river or creek banks.

Botanical Name.—Eucalyptus, already explained, Part II, p. 34; *Dalrympleana*, in honour of Richard Dalrymple Hay, Chief Commissioner of Forests of New South Wales, whose name will ever be connected with his arduous endeavours, extending over a number of years, to place the working of the forests of New South Wales on a sound basis.

Vernacular Names.—This tree does not possess an exclusive vernacular name. The name "Mountain Gum" is usually given to it in the mountain district in which it is best known—*e.g.*, Yarrangobilly, Batlow, Tumberumba, &c., but this is a name previously applied to *E. gonicalyx* in other parts of the State. Similarly, the name "White Gum" is shared with *E. viminalis* and *E. rubida*. It is also a "Manna Gum," a name it shares with *E. viminalis* and *E. rubida*.

Aboriginal Name.—I know of none.

Juvenile Leaves.—These become a matter of special importance, because they are the most obvious character to distinguish this species (and *E. rubida*) from *E. viminalis*. Juvenile leaves, whether of the seedlings or of adventitious shoots, are an important morphological character in Eucalyptus, largely employed in the differentiation of species, and very often narrow or broad. When two geminate species differ in that one has the leaves narrow and the other broad, we do not say they are conspecific. To act otherwise would be contrary to Eucalyptus classification as we know it at the present day. Just as the juvenile leaves of *E. viminalis* are typically narrow, those of *E. Dalrympleana* are typically broad. Seedlings or adventitious shoots of the two species are obviously different, and therefore they cannot be placed in the same species.

I have a few notes on broadish seedlings in *E. viminalis* at bottom of p. 168, Part xxviii, *Crit. Rev.* In Tasmania, which is the home of the type of *E. viminalis*, Mr. Rodway (*Proc. Roy. Soc. Tas.*, p. 16, 1917) says of it: "Juvenile leaves usually oblong, with a constricting base, opposite, sessile, sometimes broadly heart-shaped." In the volume for the following year (p. 88) I quoted broad juvenile leaves in supposed *E. viminalis* from near Hobart, and also from near Sheffield, also in Tasmania. I remarked: "It would be absurd to speak of such specimens (as) having narrow juvenile leaves," and therefore they do not belong to *E. viminalis*.

Until I raised the question, no one seems to have noted narrow juvenile leaves on trees attributed to *E. viminalis* in Tasmania, but some narrow juvenile leaves have since been found on the island.

In other words, we have in Tasmania the narrow juvenile-leaved form of *E. viminalis*, and also a reputed "broad juvenile-leaved *viminalis*," which appears to be referable to *E. Dalrympleana*. The type of the latter species is, of course, found on the mainland of Australia.

Leaves (Oil).—Mr. R. T. Baker has kindly furnished me with the following particulars in regard to the oil of this species, as worked out by himself and Mr. H. G. Smith at the Technological Museum.

"The amount of oil yielded by this tree is greater from the abnormal leaves than from the mature leaves, the average being about 0.5 per cent.

"Oil has been distilled from material collected at Laurel Hill, near Batlow, and also at Bungendore, both localities in New South Wales. The oil belongs to the cineol-pinene group, and when rectified would pass the standard fixed by the British Pharmacopœia. The terpene phellandrene, does not occur in the oil of this species, a character which distinguishes it from those of *E. viminalis* and *E. rubida*. It also contains considerably more cineol than does the oil of *E. rubida*.

"The cineol content in the freshly-distilled oil of *E. Dalrympleana* was 50 per cent. in both our samples."

Flowers.—Mr. de Beuzeville informs me that *E. Dalrympleana* exhibits most regular habits of flowering and fruiting. “In early December the trees are a mass of bloom, which by mid-January has become almost fully-developed fruit. Once the flowering season has passed it is almost impossible to find a solitary bud on a tree. I have searched for them repeatedly without success. The trees appear to flower almost simultaneously, and once the young fruit is showing it is a case of waiting until the following spring to obtain any buds. Such a species as *E. stellulata*, sometimes found in the same district, carries buds and fruit in all stages of maturity during the year.”

Bark.—It has already been pointed out that this species is a Ribbony Gum. “The bark of *E. Dalrympleana* sheds here (Tumberumba, &c.) about the middle of February and the whole forest appears to throw its bark at the same time. The upper bark peels in long streamers, often 50 to 60 feet in length. During this bark-shedding period the forest presents a remarkable spectacle. The ground is often knee-deep with fallen bark, while should a breeze arise the rattle of the hanging streamers is almost deafening.” (W. A. W. de Beuzeville.)

Timber.—Following are two reports from Mr. de Beuzeville:—

“This tree is known locally as ‘Mountain Gum’ or ‘White Gum.’ The trees grow to an enormous size. I have seen them 30 feet girth, with a barrel of almost 100 feet. They are generally about 15 or 16 feet girth. It is the predominating species of these mountains. The timber is used for milling and building locally, but it is not a good timber, is very subject to white ants, and is often full of their tunnels running right through. In the Bago district it is used to an appreciable extent for fruit cases. The timber is pinkish in colour.

“These trees present a very remarkable appearance. During early spring the bark is quite white, but later this changes to red, and the trunks appear to the eye as if they had been painted in large irregular blotches.”

“I will now confine myself to the timber of this tree. I note what you say *re* its uses at Kopsen’s Mill. Now I can speak with the experience of more than thirty-five years in regard to this timber, as I have been associated with it all my life. I have used it in all ways—in buildings, and for fencing, and for the hundred and one things that timber is used for in the bush.

“The timber is alright for any building work where it can be kept under cover, and for this purpose is used largely in all these mountain districts. As a local timber it ranks next to Mountain Ash. I have seen excellent rusticated weatherboards cut from this tree, and they last well when painted and kept under cover. It is likewise used largely for flooring, studding, and, in fact, for all building locally, when Mountain Ash is not obtainable. Its greatest drawbacks are excessive and uneven shrinking, also the great partiality shown towards it by white ants, but, of course, this latter fault is equally applicable to Mountain Ash. [These two faults are, however, possessed by

many timbers, and are largely remediable.—J.H.M.] In this respect I have seen the white ants go through a house built of mixed timbers and eat every board of this gum and ash, and leave stringybark and other timbers untouched. Of course, if any care were given to seasoning, it may prove to be one of our most useful mountain timbers, for in this respect it never gets a fair trial. Here a man takes an axe, walks into the forest, and cuts down a tree and draws it into the mill one day; the next day it is sawn up, and the following day he will commence to build his house, and if the timber won't last him fifty years he will say that it is no good. We do not know its possibilities, if properly treated. This is the timber which was tested for paper pulping under the name of *E. rubida*, and, I believe, gave excellent results.

“A great drawback is the faulty nature of the tree, very subject to dry rot and other faults, though I believe much of this may be ascribed to fire injury. You will see how this affects them from one of the photos I am sending. I have seen handles and oars manufactured from this timber, but they were very inferior for that particular purpose.

“If treated properly and protected from fire it should become a valuable asset, as it is not exaggerating to say that there are millions of acres of this timber.

“This timber is also used considerably now for fruit cases in the Batlow district. Most of the houses for the Soldiers' Settlement at Batlow were built from this timber.”

Following are two reports from Mr. J. A. Timms, Forester, Tumberumba:—

“This is locally known as Mountain Gum, and comprises one of the best timbers in the district. It grows to a fairly large size, height over 100 feet, with a diameter of over 5 feet, many trees containing 3,000 to 4,000 super. feet of timber fit for sawmilling. This gum is most plentiful at about the 3,000 feet altitude, and is spread all over the mountain country. It grows equally well along sides of gullies and on sides and tops of hills. It is considered a good building timber, being very free from gum spots or veins. It is extensively used at Laurel Hill factory for short boat oars and hoe, broom and pitch-fork handles. In some respects this tree is equal to Mountain Ash (*E. gigantea*), as it has a splendid grain and cuts beautiful timber, which is wonderfully free from gum veins. In appearance it somewhat resembles Ash, but is of a pink colour. This timber is far superior to the Gum with the round-shaped sucker-leaf (*E. rubida*), which grows throughout the mountains and resembles it so closely that most people look upon them as the same tree. . . . It is practically the most abundant timber to be found in the mountainous parts of the district—Tumberumba.” (J. A. Timms, No. 16, April, 1918.)

“The timber from apparently the same tree in the higher altitudes (above Tumberumba) is almost free from gum, and is extensively used at both Kopsen's and G. C. Brown's sawmills. At the former it is used for short boat-oars, &c.; at the latter it is used for flooring, lining and weatherboards, and general building material.” (Tumberumba, J. A. Timms, No. 17.)

I have had the advantage of discussing this species with Mr. R. T. Baker from many points of view. He is at work on the technology of this timber, examining its merits for the supply of paper pulp and for other uses.

Habitat.—The type comes from the Yarrangobilly, Batlow, Tumberumba districts, and it has been found in the mountainous country in the counties of Wellesley, Wallace, and Selwyn, in south-eastern New South Wales.

It has been so long confused with other White Gums that there is little doubt that its range will be very greatly extended on critical inquiry.

It undoubtedly occurs in the adjacent country in Gippsland, Victoria.

It is highly probable that the "broad suckered *viminalis*" from Tasmania (e.g., Hobart (Chimney Pot Hill, L. Rodway) and Sheffield (R. H. Cambage), and the Dee (J.H.M.), referred to in my paper in *Proc. Roy. Soc. Tas.* 1918, p. 88, belongs to this species.

Following are some representative specimens from New South Wales :—

"A Mountain Gum." Peppercorn Plain, Yarrangobilly, about 20 miles north of Kiandra, elevation about 4,700 feet. W. A. W. de Beuzeville, Nos. 1, 2, 3. A large tree as described in his letter No. 409/20 January, 1920. (The type.)

"Mountain Gum," Bago Forest Reserve, Batlow district (de Beuzeville, No. 1, January, and also March, 1917).

"A White Gum," Yellowin Creek, Bago Forest Reserve (de Beuzeville, No. 2, January, 1917).

"Large Gum-trees," Laurel Hill, Tumberumba (R. H. Cambage, No. 847). Considered at one time as coming between *E. rubida* and *E. ovata* (*acervula*).

"This is like a broad-suckered *E. viminalis*, but the timber is much inferior to the ordinary. This tree grows generally on poor soil, and is usually stunted. Occasionally a large specimen may be seen growing with the ordinary *viminalis*." Tallaganda Forest, Braidwood-Queanbeyan district (W. A. W. de Beuzeville, October, 1918, No. 14).

"An inferior White Gum," Parker's Gap, same general locality (de Beuzeville, October, 1918, No. 5).

(Mr. de Beuzeville's No. 9, same place and date, is called "Ribbon Gum," and has the conventional narrow suckers of *E. viminalis*.)

Size.—A very large shaft-like tree, whose dimensions are already referred to at p. 141 and 142.

EXPLANATION OF PLATE 241 (IN PART).

A White or Mountain Gum.

(Eucalyptus Dalrympleana Maiden, n.sp.)

- A. Flowering twig.
- B. Immature buds, showing variation.
- C. Broad, juvenile leaves.
- D. Fruits.

The type all from Tumberumba, New South Wales.

E and F. Juvenile leaves of various width, but most of the specimens available certainly broad.

From Chimney Pot Hill, Hobart, Tasmania (L. Rodway). These are probably, but not certainly, *E. Dalrympleana*.

PHOTOGRAPHIC ILLUSTRATIONS.

E. Dalrympleana.

- 1. Tree at Peppercorn Plain (5,000 feet), showing large masses of deciduous bark.
- 2. Tree at Peppercorn, showing the effects of fire.
- 3. Forest of the tree at about 5,000 feet.
- 4. Forest of the tree at Mr. de Beuzeville's Flying Camp at Big Creek, about 4,500 feet.

E. rubida.

(Photographs of this allied tree are offered from the same district. Photographs of *E. rubida* from other districts will be seen in Part 63.)

- 5. Tree at Peppercorn Plain, showing the bark.
- 6. More distant view of No. 5.

(All taken by Mr. F. A. Needs, Mr. de Beuzeville's Assistant, in the Kiandra-Yarrangobilly district New South Wales, January, 1920.)

E.A. King lith.

A WHITE OR MOUNTAIN GUM.

(*Eucalyptus Dalrympleana* MAIDEN, N.SP.) (A-F)

A MANNA GUM.

(*Eucalyptus viminalis* LABILL.) (G-L)

R. H. Cambage, photo.

TREE OF *Pittosporum undulatum* GROWING OUT OF STUMP OF BANGALAY (*Eucalyptus botryoides*),
MILTON, SOUTH COAST, N.S.W.

L. Rodway, photo.

TREE (*Eucalyptus viminalis*) NEAR
HOBART, TASMANIA.

TREES NEAR LAKE GEORGE, N.S.W. PROBABLY *Eucalyptus vitinifolia*.

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Eucalyptus viminalis
S. H. Hodges

S. H. Hodges, sketch.

TREE (*Eucalyptus viminalis*) IN ORANGE DISTRICT, N.S.W.

W. Gill, photo.

MANNA GUM (*Eucalyptus utimnalsis*), KUITPO FOREST, S.A.

W. Gill, photo.

MANNA GUM (*Eucalyptus utimnalsis*) ON ROAD, CLARENDON TO MEADOWS, S.A.

TREE (*Eucalyptus Dalrympleana*) AT PEPPERCORN
PLAIN, SHOWING LARGE MASSES OF
DECIDUOUS BARK.

TREE (*Eucalyptus Dalrympleana*) SHOWING
EFFECTS OF FIRE.

FOREST OF *Eucalyptus Dalrympleana* AT ABOUT 5,000 FEET.

FOREST OF *Eucalyptus Dalrympleana* AT BIG CREEK.

CLOSE VIEW OF *Eucalyptus rubida* AT
PEPPERCORN PLAIN, SHOWING
THE BARK.

TREE (*Eucalyptus rubida*) AT PEPPERCORN
PLAIN, 5,000 FEET.

Acacia stenophylla A. Cunn.

The Gurley.

(Family LEGUMINOSÆ : MIMOSÆ.)

Botanical description.—Genus, *Acacia*. See Part XV, p. 103.**Botanical description.**—Species *stenophylla*, Bentham in Hooker's *London Journal of Botany*, i, 366 (1842).

A translation of the original is offered herewith.

A. stenophylla (Cunn. MSS.) glabrous, branchlets angular, phyllodes very long, linear, acuminate gradually narrowed at the base, finely coriaceous, striate—many nerved, peduncles solitary or very shortly racemose, heads many flowered, puberulous. Phyllodes 8–10 inches long, or almost a foot, 2–2½ lines broad, and hardly striate to the naked eye. Peduncles half an inch long.—Lachlan River, New South Wales, Cunningham.

Following is a translation of Mueller's account of the species :—

From the Murray River, near the source of Sturt's Creek, in the north-west of Australia [*i.e.*, from the Murray River, which forms a partial boundary of New South Wales, Victoria and South Australia, to the north-west of the Northern Territory.—J.H.M.]. A rather small tree. Legumes pale, stipitate compressed, woody-coriaceous, very much contracted between the seeds, cells scarcely ½ inch broad, seeds longitudinal, rather like an olive, ovate, slightly compressed, 2½ lines long, impressed on both sides. Strophiole minute, deep yellow coloured, funicle straight. I have not seen pods of tropical specimens; they will come, however, with others collected by Sir Thomas Mitchell, in Extra-tropical Eastern Australia. (*Journ. Linn. Soc.* iii, 133, 1859.)

Then we have the same author's description in a regrettably rare work :—

Arboreous; branchlets hardly or distinctly angular, nearly or entirely glabrous; stipules obliterated; *phyllodia coriaceous, very elongated, broad or narrow linear, finely, closely and almost equally many-nerved*, falcate or nearly straight, curved-acuminate, on very short petioles; marginal gland basal or obliterated; peduncles forming a short raceme, seldom geminate or solitary, appressed, short-downy, usually longer than the many-flowered capitula; bracteoles narrow or capillary-linear, dilated at the apex; calyx short-toothed, bearded at the summit, about half as long as the silky corolla; *pod*s almost lomentaceous, lignescent-coriaceous, indehiscent (the italics are those of the author), between the seeds often very strongly contracted; funicle nearly as long as the seed, slightly dilated into a very small cymbiform livid strophiole; seeds large, roundish-ovate, squalid-brown, opaque, with conspicuous long lateral areoles.

On the banks of the Murray River; thence to the Darling River, the Murrumbidgee and the Lachlan River, and distantly and widely dispersed through the interior, having, for instance, been found on Cooper's Creek, in sub-central Australia, and on Sturt's Creek, in the interior of N.W. Australia.

A tree with exquisite dark hard wood. Leaflets of the compound leaves of the young plant oblong-lanceolate, 3–5 lines long. Phyllodia not unfrequently more than 1 foot long, seldom reduced to a few inches in length, 1–4 lines broad, pendent, sometimes pruinous, flat, occasionally, when very narrow, so

convex as to become compressed-filiform; the apex usually worn away. Peduncles 2-6 lines long, smooth in age. Calyx except the margin glabrous. Corolla about 1 line long, perfectly or imperfectly pale-silky. Pods 2-4 inches long, 6-9 lines broad, more or less curved or almost straight, sometimes long-stipate, sometimes subsessile, grey or pale brown, pruinous or shining, hard, readily breaking at the often long and narrow interstices between the seeds, occasionally not contracted into joints, more or less turgid, at the margin often rather sharply edged. Funicle with a slight plicature at the summit, or not folded, rather narrow. Seeds 3-4½ lines long, moderately compressed. ("Plants Indigenous to the Colony of Victoria," Vol. ii, p. 26.)

He also quotes "F.M. Record of Plants of F. Gregory's Expedition into N.W. Austr.," in *Edinb. New Philos. Journ.* 1863, which I have not seen.

Then we come to Bentham's description, in English, of a species he first brought under notice shortly after Allan Cunningham's death.

A very hard-wooded tree, quite glabrous, with angular branchlets. *Phyllodia* long-linear, acuminate or falcate, much narrowed at the base, 6 inches to 1 foot long, about 2 to 2½ lines broad, thinly coriaceous, not at all hoary, finely striate, with numerous prominent parallel nerves. *Peduncles* under ½ inch long, usually in short racemes of 3 to 6, but sometimes solitary, bearing each a globular head of 20 to 30 or more flowers, mostly 5-merous. *Calyx* half as long as the corolla, with short broad densely ciliate lobes. *Petals* pubescent. *Pod* long, moniliform; valves coriaceous, 4 to 5 lines broad, and convex over the seeds, but not striate, much narrowed between them. *Seeds* ovate, longitudinal; funicle in short folds, the last slightly thickened into a small aril.

Botanical Name.—*Acacia*, see Part XV, p. 104; *stenophylla*, from two Greek words meaning "narrow-leaved," and it is worthy of note that a form has been found with leaves (phyllodes) narrower than those of the normal form.

Vernacular Names.—One of the several wattles known as "Willow" or "Native Willow," because of the shape of the leaves (phyllodes) and their pendulous habit. Mitchell speaks of it as a "long-leaved, grey kind of wattle."

Said to be called "Ironwood" on account of the hard and heavy timber, and "Dalby Myall" on account of its occurrence in the vicinity of that Queensland town.

Aboriginal Names.—"Munumula" of Queensland aborigines, according to Mitchell (*Trop. Aust.* 82). Baldwin Spencer gives me the name "Balkura" as in use amongst the Lake Eyre blacks for the narrow-leaved form. Turning to New South Wales, I have heard this tree called or written variously "Eumong" or "Umong" or "Eumung." It is often called "Gurley" or "Gooralee" (apparently the same word), in the Moree district, and presumably the railway station between Narrabri and Moree is named after it. Mr. Cambage refers to it as the Eumung of western New South Wales, or River Cooba of the Lachlan, besides "Cooba" or "Cuba" or "Yuba."

If my readers will turn to pp. 149, 150 of Part XXX of this work, they will see that *A. salicina* var. *varians* shares the names of "Gurley," "Eumung" and "Cooba" with the present species. I think that a good deal of the confusion arises from the non-botanical proclivities of the white man.

Not without doubt, I propose to reserve "Cooba" and "Eumung" for *A. salicina* var. *varians*, and to reserve "Gurley" for *A. stenophylla*.

Fruit.—"On one tree large pods hung in such profusion as to bend the branches to the ground. From this abundance I supposed it was not good to be eaten; nevertheless I found in another place many of the same pods roasted at some fires of the natives, and learnt from our guides that they eat the pea." (Mitchell, *Trop. Austral.*, p. 81.)

Bark.—A sample of bark obtained from Yantara, Milparinka, N.S.W., gave the author (*Proc. Roy. Soc. N.S.W.*, 1888, p. 270) 9.49 per cent. of tannic acid and 24.46 per cent. of extract. Height of tree, 15 to 20 feet; diameter, 6 to 12 inches; collected November, 1887; analysed September, 1888. A rugged-looking, coarsely-fissured bark, possessing the characteristic appearance of those of the dry-country wattles. Average thickness, $\frac{5}{8}$ inch.

Timber.—"A tree with exquisite, hard, dark wood, which serves the purposes of Myall-wood; locally known as Ironwood." (Mueller, "Select Extra-Tropical Plants.") This timber is very hard, heavy, close-grained, dark, beautifully marked, and takes a fine polish. It planes excellently, showing a very smooth surface.

Mr. Baker ("Hardwoods of Australia") contents himself with grouping it as a hard, dark coloured timber like Myall, Yarran and Gidgee.

"Riparian Acacia of weeping habit. Capital light wood. I have seen some trees of it here about 2 feet in diameter. In the old days this timber was much sought after for swing gates, but I think it is well suited for cabinet work and carriages." (A. N. Grant, Hillston, N.S.W.)

It has already been referred to as Ironwood and Myall, and I am not altogether satisfied as to the characters of this timber. It may be that the timber becomes harder and darker as it recedes from the moister localities in which it flourishes best, or is there any confusion with *A. salicina* and *A. coriacea*? I have often got most valuable information through stating a case to my readers, and I appeal to them confidently in the present situation.

Size.—Height from 40 to 60 feet, diameter 15–24 inches.

At Hillston it attains a diameter of 2 feet.

A tree of about 30 feet at Nyngan, as seen by me, but Mr. E. F. Rogers tells me that near Nyngan he has seen it far higher, and with a girth of 7 feet.

Attains a height of 60 feet and a stem-diameter of 2 feet (Mueller).

Habitat.—It occurs in all the States except Tasmania, frequenting only regions of low rainfall, although it lines the banks of watercourses. It would appear to be especially widely distributed in New South Wales.

Bentham gives the following localities for the species:—

North Australia.—Hooker's and Sturt's Creeks, *F. Mueller*.

Queensland.—Maranoa and Narran Rivers, *Mitchell*.

New South Wales.—Lachlan River, *A. Cunningham*; thence to the Darling River, Barrier Range and Cooper's Creek, *Victorian Expedition*, &c.

Victoria.—Banks of the Murray, *F. Mueller*.

South Australia.—Murray desert, *F. Mueller*.

NEW SOUTH WALES.

It will be observed that Allan Cunningham collected the type on the Lachlan River. Nos. 1-2 may be taken as from a type locality, and 3-5 have precisely similar conditions.

1. Condobolin (J.H.M.).
2. "Cuba," Wooyeo Station, Lake Cudgellico (G. Stirling Home).
3. Drooping Acacia on the banks of the river Murrumbidgee at Hay (W. W. Froggatt).
4. Zara, Wanganella, Hay (Miss E. Officer).
5. "Cuba," edible. Bongbilla, Moulamein (Th. Grieve).

Then going northerly and westerly, we have "Native Willow, 12-20 feet. Looks like a Willow and grows in Lignum Swamps, vicinity of bore waters and streams. Mt. Harris, near Warren (J. L. Boorman).

"Eumong," on river banks, Nyngan (District Forester C. Marriott). "Umong," on watercourses. A useful timber, girth to 7 feet. Nyngan (Forest Guard E. F. Rogers). Common on the banks of the Bogan at Nyngan (J.H.M., J. L. Boorman). Coolabah (R. W. Peacock, J.H.M., J. L. Boorman).

"River Willow or Yuba." This is a durable timber found close to water on all the western rivers. It is not edible for stock as far as I know. (Secretary, Western Land Board, 1907.)

"Native Willow or Yuba tree," Murrawombie, Bogan River (A. W. Mullen L.S., No. 4).

"Willow-like Acacia," Bourke (R. W. Peacock). "Water-willow," with bark like Gidgee (*A. Cambagei*), North Bourke (A. Murphy, No. 2).

Then making a long detour south-westerly, we have Broken Hill (E. C. Andrews).

Going north, and almost approaching the Queensland border, we have "Ironwood," Yantara Lake (W. Baeuerlen), Tibbooburra (O. E. Crouch, Nos. 23 and 93); also "Willow," Tibbooburra (A. R. Bate, through R. T. Baker).

We now come considerably east, though not very far south of the Queensland border.

Brewarrina (J. L. Boorman), Yarrawin Station, Barwon River (W. W. Froggatt, No. 19), Barwon River, near Collarenebri (Forester Gordon Burrow, No. 3x).

New Angledool (A. Paddison, August, 1899, through R. T. Baker).

Wee Waa (G. A. Withers No. 1), Currygundi district (Forester W. M. Brennan, No. 9). "Trees of 12-20 feet, reputed a good fodder tree. It should be encouraged for shade purposes, even tree-planting, in some of the inland towns." Cuttabri, Pilliga Scrub (J. L. Boorman).

"Gourley or Gooralee. Found occasionally from Moree to Mungindi." (C. T. Kerry, photographer.) "Gurley. Is utilised to form 'shelter rings' for stock. A characteristic I noticed about these rings is the fact that numerous seedlings were growing round the circumference of the ring, some of which have developed into small trees. No evidence appeared that the sheep were very partial to these seedlings. As the seed appears readily capable of germination, it is very probable that this *Acacia* could be used as shelter-rings for stock." (E. Breakwell, Agrostologist.) Gurley, 14 miles from Moree.

Inverell (R. T. Baker).

Moor Creek, Tamworth (B. E. Sampson, through R. T. Baker).

QUEENSLAND.

As regards Queensland localities, Maranoa and Narran Rivers, *Mitchell*.

R. H. Cambage, in *Proc. Roy. Soc. N.S.W.*, xlix, 432 (1915), says it "occurs to within 80 miles south of Normanton, and grows along the banks of streams, the long narrow pendulous phyllodes, sometimes bluish in colour, often hanging over the watercourses. It was noticed at various points, including Richmond Downs and Winton to Longreach, where it is called Native Willow. This species prefers basic to siliceous soils and is not common along creeks in sandy areas."

See his paper, pp. 428, 432, for the record Normanton to Cloncurry; p. 436, Cloncurry to Hughenden; p. 438, Hughenden to Winton; p. 439, Winton to Longreach. Following are two of his specimens:—

Flinders River, 80 miles south of Normanton (R. H. Cambage, No. 3939).

Head waters of Diamantina River, Winton, Central Queensland (R. H. Cambage, No. 3969).

12 feet, Brighton Downs, Diamantina River, Western Queensland (S. W. Jackson, No. 8).

Georgina River (E. W. Bick).

Bulloo River (J. F. Bailey). With narrow phyllodes.

NORTHERN TERRITORY.

Lake Eyre region. See *Proc. Roy. Soc. S.A.*, xi, 93.

Hooker's and Sturt's Creeks (B.Fl. ii, 385).

Newcastle Waters, large bush, 17th July, 1911. Flowers past maturity (G. F. Hill, No. 468).

Dalhousie Springs (Thomas Gill).

Cootanoorinna and Arkaringa Creeks, S.A. (R. Helms, Elder Exploring Expedition, 10th May, 1891).

Tallacallarra Creek, 20 miles from Hergott Springs (Walter Gill).

Var. linearis Var. nov.

The typical width of the phyllodes of the normal form is $2-2\frac{1}{2}$ lines, say 5 mm. But we have a form which seems to be fairly uniform, and which can be readily picked out. The phyllodes are mostly 2 mm. wide, but they are as broad as 3 mm. The word *stenophylla* of course, means narrow leaved, and hence there is some difficulty in suggesting a descriptive name for a narrower form.

Range (of Variety).

The only two specimens so far seen by me are as far apart as western New South Wales and the Northern Territory. It is very likely that it has been passed over (particularly when not in flower or fruit) for Grevilleas, Hakeas, &c., and further search will bring to light many intermediate localities.

NEW SOUTH WALES.

"River Cooba," Euabalong, Lachlan River, with unusually narrow phyllodes (R. H. Cambage).

NORTHERN TERRITORY.

Newcastle Waters (Prof. W. Baldwin Spencer, 1902).

"Balkura" (native name; they eat the seeds). Lake Eyre. S.A. (Prof. Baldwin Spencer, September, 1903).

EXPLANATION OF PLATE No. 242 (IN PART).

- A. Flowering twig.
- B. Flower head.
- C. Flower.
- D. Corolla opened out.
- E. Calyx.
- F. Ovary.
- G. Floral bract.
- H. Pod.
- I. Seed.
- K. Narrow phyllode of var. *linearis*.

The length of the typical phyllode is 8-12 inches ("8-10 inches long or almost a foot"). The figure in Mueller's "Iconography of Acacias" shows them rather longer than that, and those of my plate are shorter, because of the exigencies of space.

PHOTOGRAPHIC ILLUSTRATIONS.

1. *A. stenophylla* in the immediate foreground, and *Eucalyptus microtheca* trees in the distance Tallacallarra Creek, 20 miles from Hergott Springs. (Walter Gill, photo.)
2. "Gurralee," Mungindi district, New South Wales. (Kerry & Co., photo.)
See under *A. coriacea*.

Acacia coriacea DC.

Wirewood.

(Family LEGUMINOSÆ: MIMOSÆ.)

Botanical description.—Genus, *Acacia*. See Part XV, p. 103.**Botanical description.**—Species, *coriacea* De Candolle (Augustin Pyramus). “Memoires sur la Famille de Legumineuses,” No. XII, p. 446, Paris (1825), and “Prodromus,” ii, 451 (1825).G. Don’s translation of DC. *Leg. Mem.* XII (which I have not seen), and of DC. *Prod.*, ii, 451, is as follows:—

Stipulas wanting; phyllodia very long and linear, quite entire, nerveless, thick and coriaceous; when young they are clothed with adpressed, velvety down, but in the adult state they are glabrous; heads of flowers solitary; branches terete. Native of New Holland, on the eastern coast. Legume linear, curved into a circle, when young clothed with cinereous down. The down on the leaves is at first yellowish, but at length becomes cinereous.

Coriaceous leaved *Acacia*. Cult. 1824. Shrub of 4-6 feet. (*Dichlamydeous Plants*, ii, 403.)

“Eastern coast” in the above is a slip of the pen for “western coast,” and has caused some confusion.

I now offer a translation of Bentham’s description of 1842:—

Ash-coloured, covered with very fine close hair, branchlets terete, phyllodes elongate-linear, somewhat arched, rather obtuse, gradually tapering towards the base, thick-coriaceous, very finely and many nerved, peduncles short, pod moniliform, striate. Phyllodes $\frac{1}{2}$ a foot long and longer, 2-2 $\frac{1}{2}$ lines broad, nerveless to the naked eye, under the lens finely and densely striate, many nerved. Pod 6-9 inches long, linear, bow-shaped or twisted, ash-coloured, the pseudo-joints an inch long, 4-5 lines broad, valves coriaceous, convex.

N.W. Coast, Bay of Rest and Dirk Hartog’s Isle, Cunningham. I have not seen the flowers. (*London Journal of Botany*, i, 366, 1842.)

Then we have Bentham’s description in English in 1866:—

Ashy-grey, with the young shoots silky-hoary or almost golden; branchlets terete. *Phyllodia* long-linear, straight or curved, obtuse, narrowed towards the base, often $\frac{1}{2}$ foot long or more, 1 to 2 $\frac{1}{2}$ lines wide, thickly coriaceous, with numerous fine and closely packed longitudinal nerves, only visible under a lens. *Peduncles* usually in pairs, $\frac{1}{4}$ to $\frac{1}{2}$ inch long, bearing each a globular head of 20 to 25 flowers, mostly 5-merous, hoary-pubescent in the bud. *Calyx* $\frac{3}{4}$ line long, tubular, with ciliate lobes. *Petals* rather longer, united above the middle. *Pod* 6 to 9 inches long, moniliform; valves coriaceous, very convex, 4 to 5 lines broad, oblong and striate over the seeds, much contracted between them. *Seeds* longitudinal, distant; funicle folded and dilated under the seed, but not seen perfect.

Northern Australia.—Bay of Rest, N.W. coast, *A. Cunningham*; Depuech Island, *Bynoe*; Nichol Bay, *F. Gregory’s Expedition*.

Western Australia.—Shark’s Bay, *Baudin’s Expedition*; Dirk Hartog’s Island and Shark’s Bay, *Milne*. (B.Fl. ii, 385.)

Differences between *A. coriacea* and *A. stenophylla*.

Mueller many years ago wrote :—

The evidence, derived from our material, is not quite conclusive for ascertaining whether *A. coriacea* should be reduced to *A. stenophylla*, as seemingly necessary; the characters which separate it consist in the golden-yellow silky indument which clothes the young branches and phyllodia, in the still closer and more subtle nervature of the latter, in all peduncles of our specimens being geminate or solitary and in longer pods, which, however, in our collection exhibit no matured seeds for comparison.

(*Plants Indigenous to the Colony of Victoria*, Vol. 2, p. 26). Mueller overlooked the fact that *A. coriacea* is very much the older name.

A. stenophylla is a more glabrous plant than is *A. coriacea*. The vestiture on the shoots, phyllodes and buds is hoary in *A. stenophylla*, not golden pubescent as in *A. coriacea*. The pods of the species are very different, as can be seen from the plate. The funicle and arillus are different. There is a good deal of similarity in the inflorescence.

It is singular that each species has a linear-leaved form.

Botanical Name.—*Acacia*, see Part XV, p. 104; *coriacea*, Latin leathery, in allusion to the tough phyllodes.

Vernacular Name.—I have not been able to trace a name applied to this Wattle except Wirewood (applied to the variety). I believe it really refers to the phyllodes, but have adopted it as not without claims to recognition.

Aboriginal Name.—I know of none.

Timber.—The only definite particulars I can find as to the wood are furnished by Mr. Cambage for the variety. "The wood, which is used for posts, is pale yellow near the outside, and dark brown towards the centre."

Size.—It varies from a diffuse shrub to a small tree. The largest size (30 feet) recorded is of trees in the north-west angle of New South Wales.

Habitat.—Some confusion has arisen through G. Don's statement, already quoted (I do not know if the mistake originated with De Candolle himself) that the type came from the *eastern* coast. As a matter of fact it came from the *western* coast. I will presently quote specimens from Shark's Bay to Cossack.

Then it extends to the Northern Territory, but it has only been recorded, so far, from inland localities, and the same remarks apply to Queensland and New South Wales. I expect it will in future be recorded in coastal localities in the Northern Territory and Queensland—say about the Gulf of Carpentaria.

WESTERN AUSTRALIA.

I place in geographical order, going north, the localities recorded for this species, or for specimens I have seen.

1. Dirk Hartog's Isle (a co-type locality), lat. 25.45 (approx.), long. 113, a long island south-west of Shark's Bay.

2. Shark's Bay, on the west coast, say about 25 deg. south lat. Bentham says Baudin's Expedition collected it here.

3. Carnarvon (W. V. Fitzgerald, No. 10); in dunes (C. H. Ostenfeld, No. 550). This township is on the Gascoyne, lat. 24.50.

4. Bay of Rest ("N.W. Coast") (a co-type locality), lat. 22.20, long. 114. This is in Exmouth Gulf.

5. Ashburton River (Dr. A. Morrison), say about Onslow, lat. 21.40.

6. "Shrubby. Height 6-10 feet, in the rocky cliffs above high-water mark." Nickol Bay (Pemberton Walcott). Pronounced *A. coriacea* by both Mueller and Bentham. Nickol Bay is a few miles west of Cossack, and the specimen was collected on F. Gregory's Expedition.

7. Depuech Island, a few miles east of Cossack, which is in lat. 20.40. This specimen was quoted by Bentham as collected by Dr. Bynoe, of Captain Lort Stokes's Expedition.

NORTHERN TERRITORY.

Between Mt. Olga and Barron Range, Macdonnell Ranges. (E. Giles, 1873-4). From Melbourne Herbarium, comm. Dr. F. Stoward. With comparatively short phyllodes.

Then we have the following three specimens collected by Mr. G. F. Hill on his overland expedition:—

"202. Near Haast's Bluff, Macdonnell Range, 22nd May, 1911. On ranges, up to 10 feet." Hardly in flower.

"221. 25 miles N.N.W. of Meyer's Hill, Macdonnell Range, 1st June, 1911, up to 25 feet 6 inches in diameter." In pod.

"236. 40 miles N.N.W. of Meyer's Hill, 2nd June, 1911." Flower and fruit.

Tanami (Dr. H. I. Jensen).

It will be observed that all these localities are inland. That of Tanami is to the north-west of the Territory.

NEW SOUTH WALES.

The only specimen of the normal form collected in our State, so far as I am aware, is one from the Grey Ranges at the extreme north-west angle of New South Wales. It was described as a tree of 15-30 feet (W. Baeuerlen). It is a plant easily passed over for other plants (e.g., *Hakea* and *Grevillea*) when not in flower or pod, and all the differences between it and *A. stenophylla* should be looked for. The specimen is in young fruit and is not perfectly satisfactory, but I am not prepared to say that Mueller was wrong in naming it *A. coriacea*.

Var. angustior Var. nov.

With wiry, fairly uniform, narrow phyllodes of 1-2 mm., and of normal length. In the normal species the width may be up to 8 mm., 5 mm. being an average width. Exceptionally a phyllode may be as narrow as 2 mm. in the normal form.

Range (of Variety).

Certain very dry localities in New South Wales and Queensland.

NEW SOUTH WALES.

New Angledool (A. Paddison, Feb., 1900, through R. T. Baker).

QUEENSLAND.

"Wirewood, 15 feet. Wood sometimes used for posts. Leaves up to 13 inches and pods up to $7\frac{1}{2}$ inches long." At 1,400 feet, in sandy tableland. Prairie, 30 miles east of Hughenden, North Queensland (R. H. Cambage, No. 3961).

Mr. Cambage gave the following fuller account of it :—

"Wirewood was also growing on the sandy tableland, some of the trees being 15 feet high, with narrow linear phyllodes from 6 to 13 inches long, and twisted pods contracted between the seeds, from 4 to $7\frac{1}{2}$ inches long. The bark is scaly and somewhat furrowed; the wood, which is used for posts, is pale yellow near the outside, and dark brown towards the centre."

I have also received it from Mr. J. R. Chisholm, of Prairie, a very old correspondent.

"A large shrub or small tree, having rough, corky bark. The appearance of this tree reminds me of *Hakea lorea* (see Part XLIX of this work). It flowers but sparingly." Beta (J. L. Boorman). Beta is a railway station about 300 miles west of Rockhampton, and so well inland.

EXPLANATION OF PLATE No. 242 (IN PART).

L. Flowering twig.

M. Flower head.

N. Flower.

O. Corolla opened out.

P. Calyx.

Q. Ovary.

R. Floral bract.

S. Pod.

T. Seed.

U. Narrow phyllode of var. *angustior*.

E.A. King lith.

THE GURLEY.

(*Acacia stenophylla* A. CUNN.) (A-K)

WIREEWOOD.

(*Acacia coriacea* DC.) (L-T)

W. Gill, photo.

VIEW OF TALLACALLARRA CREEK, SHOWING *Acacia stenophylla* IN IMMEDIATE FOREGROUND
AND *Eucalyptus microtheca* IN THE DISTANCE; WITH "OLD MAN SALTBUCH"
(*Altriplex rhagodioides*) TO THE RIGHT IN THE MIDDLE.

Kerry and Co., photo.

GURRALEE" (*Acacia stenophylla*). MUNGINDI DISTRICT, N.S.W.

No. 242.

Geijera salicifolia Schott.

An Ironwood.

(Family RUTACEÆ.)

Botanical description.—Genus, *Geijera*, in “Heinrich Schott, Rutaceæ. Fragmenta botanica. Vindeboniæ (Vienna), Wallishäuser, 1834, folio, 14 pp. 7 tab.”

Flowers hermaphrodite. Sepals 4 or 5. Petals 4 or 5, valvate or imbricate. Disk thick and fleshy. Stamens 4 or 5; filaments subulate. Ovary depressed, partly immersed in the disk, 4 or 5-lobed; styles terminal, immediately united into a single short style, with a capitate 4 or 5-lobed stigma. Fruit of 4 or 5 or sometimes fewer, distinct, 2-valved cocci, the endocarp adherent or partially separating. Seeds with a hard or crustaceous shining testa; albumen fleshy; embryo straight; cotyledons broad. Trees or shrubs. Leaves alternate, simple, not articulate on the petiole. Flowers small, in terminal panicles. Sepals small.

Botanical description.—Species, *salicifolia* Schott, *Fragm. Rut.*, t. 4.

A moderately-sized tree, glabrous, or with a minute hoary pubescence on the inflorescence, and sometimes on the under side of the leaves. Leaves from ovate to ovate-lanceolate or rarely oblong-lanceolate, obtuse or acuminate, mostly 3 or 4 inches long, entire, coriaceous, narrowed or rarely rounded at the base, with a rather long petiole. Panicles rather loose, broadly pyramidal, but much shorter than the last leaves, alternately branched, with numerous small white flowers. Petals about 1 line long, valvate. Cocci often reduced to 1 or 2, obovoid, not beaked, 2 to 3 lines long, the endocarp persistent or partially separating (B.Fl. i, 364).

Variety *angustifolia* Maiden and Bêche.

Tia Falls, New England (W. Forsyth, October, 1900). Leaves not above 7 to 8 lines broad, with a length of $2\frac{1}{2}$ to nearly 3 inches. Benthams says, in a footnote in the *Flora Australiensis*, “Schott’s figure (Schott, *Fragm. Rut.* t. 4) represents a remarkably narrow-leaved form, which I have only seen in Brown’s specimens, and in those from Warwick and from Rockhampton” (Queensland localities). Our Tia specimens agree exactly with the narrow-leaved Warwick specimens in the Melbourne Herbarium. (*Proc. Linn. Soc. N.S.W.*, xxvi, p. 80, 1901.)

I have not seen either Schott’s type nor his figure of *G. salicifolia*, and the late Mr. Bêche and I constituted a variety, *angustifolia*, assuming that Benthams had correctly described the leaves. But bearing in mind the name *salicifolia*, which implies a narrow leaf, and Benthams’s note as to Schott’s “remarkably narrow-leaved form,” it may turn out that instead of a var. *angustifolia* being desirable, the widely-diffused form described by Benthams should be more properly looked upon as a variety, and given a name to indicate the greater width of its leaves.

Botanical Name.—*Geijera*, in honour of J. D. Geijer (according to Bailey), whether a German or Austrian I cannot trace. He may not have been a botanist. *Salicifolia*, from the Latin *salix*, *salicis*, a willow, and *folium*, a leaf, with a leaf like a willow.

Vernacular Names.—"Balsam of Copaiba" tree is a name given because of the taste of the bark. The first printed use of the name is in the Catalogue of the Northern Timbers, N.S.W., London Exhib., 1862.

"Lignum Vitæ," of Rudder, "because it breaks axes." This axe-breaking capacity is referred to in the name "Ironwood," being one of several timbers which bear such a designation. The name "Black Teak" has been given to it, but I do not know to what extent that name is in use.

Aboriginal Name.—"Koko" of some Queensland aborigines.

Synonym.—*G. latifolia* Lindl. in Mitchell's *Tropical Australia*, 236 (1848). It was collected at Balmy Creek, lat. 24° 15', long. 147° 20', and is referred to as a forest tree with broad, lance-shaped leaves. "This appears to differ from *G. salicifolia* in its long-stalked leaves." It seems impossible to separate it from the usual form, which is fairly uniform.

Leaves.—For some remarks on the leaves, see under "Variety," above, p. 155.

Flowers.—Small and white, borne in great profusion.

Fruits.—Small and green, with black seeds.

Bark.—The box-like, dark bark contains a bitter principle, and has the odour reminiscent of the drug from which it obtains one of its vernacular names. Dr. Thomas Bancroft, of Brisbane, informs me that it is physiologically inert, or practically so.

Mr. Charles Moore, in the Catalogue of Northern N.S.W. Timbers, at the London Exhibition of 1862, said, "Ink of good quality has been made from the bark of this tree," by which he meant, I presume, that it is astringent.

Timber.—Wood close, tough, firm, pale yellow when fresh, light brown in colour when old, and nicely marked. (Mr. Baker has a coloured plate, No. 5, illustrating it in his "Hardwoods of Australia," and recommends it for veneers.) It has no dark heart-wood. It polishes fairly well, but is apt to split, and is somewhat difficult to dress down to an absolutely even surface. It is rather heavy. Mr. Augustus Rudder informs me that it is so hard that it breaks axes. It breaks with a long, tough fibre. A slab of this wood in the Technological Museum, which was seasoned over twenty-five years (having been exhibited at the London International Exhibition of 1862), had a weight, determined by me in 1887, which corresponds to 59 lb. 5 oz. per cubic foot.

Size.—It attains a height of 60–80 feet, with a girth of 6–8 feet, but is frequently much smaller.

Habitat.—It extends from the Illawarra, N.S.W., to Northern Queensland, and is a denizen of brushes, chiefly at no great distance from the coast. Following are the localities as given in the “Flora Australiensis.”

NEW SOUTH WALES.

Clarence River (C. Moore); near Parramatta (Woolls.)

QUEENSLAND.

Broad Sound (R. Brown); Moreton Bay and Brisbane River (A. Cunningham, F. Mueller, and others); Brigalow scrub on the Burdekin, and near Warwick (F. Mueller); Wide Bay (C. Moore); Port Denison (Fitzalan); Rockhampton (Thozet); Mantua Downs (Mitchell).

Specimens from the following localities are represented in the National Herbarium, Sydney.

NEW SOUTH WALES.

Southern Localities.—Illawarra (Dr. Leichhardt). “Beautiful shade tree, edge of brush,” West Albion Park (R. H. Cambage, No. 410).

Northern Localities.—Gosforth, near Maitland (R. H. Cambage). Ash Island, Hunter River (J.H.M.). In brush, Pokolbin (R. H. Cambage, No. 2529). From hill at corner of W. T. Parkes’s (land), Booral district. Soil broken, shale surface. Height about 75 feet, diameter 22 inches. Little Manning River (both, Forester Augustus Rudder).

Tia Falls (Walcha district), (W. Forsyth), with narrow leaves. Type of var. *angustifolia*.

Tee Dee, Macleay River (C. O. Sullivan.)

Clarence River (C. Moore, 1864). Richmond River (D. J. McAuliffe). Height 20–25 feet, diameter 3–6 inches. Lismore (W. Baeuerlen). “Black Teak,” Casino (G. E. Rumney). Murwillumbah (W. Baeuerlen). Height 60–80 feet, girth 6–8 feet. Valuable both for shade and timber. Acacia Creek, Macpherson Range (Forest Guard W. Dunn, J. L. Boorman).

QUEENSLAND.

“Leaves glossy green and rather lemon-scented, trees now loaded with their small green berries,” Townsville (F. P. Dodd, through W. W. Froggatt).

Rockhampton (A. Thozet). Balmy Creek. Type of No. 170, *G. latifolia* Lindl. (Sir Thomas Mitchell).

Height 12-20 feet, Bundaberg (J. L. Boorman). Mundubbera (E. W. Bick). Mt. Perry (J. L. Boorman).

Var. *angustifolia*, Warwick (F. M. Bailey).

Propagation.—This is a handsome, densely-foliaged tree, and it is to be recommended as an ornamental subject in sheltered localities with fair soil.

EXPLANATION OF PLATE No. 243 (IN PART).

- A. Flowering twig.
- B. Flower.
- C. Flower opened out, showing
 - (a) petals.
 - (b) stamens.
 - (c) disc.
 - (d) pistil.
- D. Part of flower, showing stamen, disc, pistil of 5 carpels.
- E. Stamens.
- F. Transverse section of pistil.
- G. Calyx.
- H. Fruit.
- I. Narrow leaf of var. *angustifolia* from Tia Falls.

No. 243.

Geijera parviflora Lindl.

The Wilga.

(Family RUTACEÆ)

Botanical description.—Genus, *Geijera*. See p. 155.**Botanical description.**—Species, *parviflora* Lindl., in Mitchell's *Tropical Australia*, p. 102.

A tall shrub or small tree, with slender, erect or pendulous branches, glabrous, or the inflorescence and young parts slightly hoary. *Leaves* linear, acute or obtuse, 3 to 6 inches long, and rarely above 3 lines broad, coriaceous, narrowed into a rather short petiole, the midrib prominent underneath.

Flowers and *fruit* of *G. salicifolia*, or the flowers sometimes, but not always, rather smaller (B.Fl. i, 364).

Supposed Variety.—Var. (?) *crassifolia*.

Leaves 1 to 2 inches long, very obtuse or retuse, thick, with the midrib scarcely conspicuous. Perhaps a distinct species.—*Eriostemon linearifolium* DC., *Prod.* i, 720; *Zanthoxylum australasicum* A. Juss. in *Mem. Mus. Par.* xii, 503.

South Australia.—Near Adelaide, *Herb. Hooker*; Spencer's Gulf, *F. Mueller*; South Coast, *R. Brown*; isles of St. Francis, *Herb. Mus. Par.*

Western Australia.—King George's Sound, *Maclean* (B.Fl. i, 365).

This is the coastal form, as referred to under "Habitat," p. 162. It does not seem to me a useful variety, although its seaside environment certainly causes it to have thicker leaves.

Botanical Name.—*Geijera*, see p. 156; *parviflora*, from two Latin words signifying "Small-flowers," because, in the words of Bentham, the flowers of this species, as compared with *G. salicifolia*, "are sometimes, but not always, rather smaller."

Vernacular Name.—Its common name is "Wilga," doubtless of aboriginal origin. It is sometimes known as "Willow" for obvious reasons. One writer says, "The leaves are long, narrow, and pendant, and it is commonly called the Australian Willow."

A Queensland correspondent sent it to me under the name "Peppermint," and this is doubtless how such a name came about. Mitchell, in *Journ. Trop. Austr.*, 102,

says, "We there met with (on the banks of the Narran River, say in lat. 29°) a new species of the rare and little-known genus *Geijera*, forming a strong-scented shrub, about 10 feet high, and having long, narrow, drooping leaves. Its fruit had a weak, peppery taste." This was the original reference to the Wilga.

Aboriginal Name.—"Gingerah" (hard G), name in the Dubbo district, N.S.W., according to District Forester Samuels.

Synonym.—*G. pendula* Lindl., in Mitchell's *Tropical Australia*, 251. Possibly a variety of *G. salicifolia* (B.Fl. i, 365). The original reference is, "Another new species of the genus *Geijera* formed a tree 20 feet high, with long, slender, weeping branches. It was otherwise much like the *G. parviflora*, except that its flowers were larger." It was collected "under the tropic line," going north (say, west of Rockhampton). I think it is only an exuberant form of the Wilga. It must be borne in mind that the species varies in length and width of leaf, and in the amount of the tendency to be drooping.

Leaves.—Mr. R. W. Peacock had a good deal of experience with this plant, particularly in the Bogan country, N.S.W., when he was in charge of the Experiment Farms at Girilambone and Nyngan. Here are two of his statements:—

1. Sheep eat the foliage of it but not freely, only when grass cannot be got.
2. This elegant shrub or tree is not relished by stock sufficiently in this district to be considered anything more than of second-rate value. It is always neatly trimmed by sheep around the bottom, and is rather ornamental, it being one of the most beautiful of our native trees. It provides an excellent shade, and is sometimes called the "Boundary Rider's Delight." Sheep will eat it better after it has been felled for some time to allow of the wilting of the leaves, but will leave it for many of the others above-mentioned. Cattle are not fond of it. I have seen young Wilgas untouched by cattle fed solely upon scrub. *It has the peculiarity of being browsed upon more during certain periods of the year.* [The italics are mine.—J.H.M.]

Then we have, "An edible tree for stock, but they are not very fond of it." (Letter of Secretary, Western Lands Board, in 1907.)

"It is not a very valuable fodder tree. In some parts of the Bourke district sheep do not appear to touch it, but it is generally kept trimmed by stock, especially sheep." (A. W. Mullen, L.S.)

Speaking of South Australia, Mr. S. Dixon states that sheep only are particularly fond of this bush, and it seems quite unaffected by droughts.

Because of its value to the pastoralist, it is one of the trees exempt from the operation of licenses or permits to fell under certain regulations affecting leases of Crown lands.

In the *Agricultural Gazette* for October, 1899, will be found two analyses of the Wilga as to its value for forage purposes. Following are the results. Two analyses were made, because of the conflicting statements that one was edible and the other not so.

	Water.	Ash.	Fibre.	Ether extract (oil, &c.).	Albumi- noids.	Carbo- hydrates.	Nutrient Value.	Albumi- noid Ratio.	Tannin (oak- bark).
Wilga 	47.73	5.21	7.61	2.18	14.25	23.02	42	1 : 2	2.4
Wilga (second sample)	50.84	5.18	8.01	2.55	12.45	20.97	39	1 : 2	2.2

Wilga Edible and not Edible.—The perplexing subject of apparently the same tree being eaten by stock or refused to be eaten by them has been touched upon already in this work. See Part LXII, p. 43, for one reference.

I have before me—

(a) Specimens of Wilga received from Mr. F. B. Guthrie, Chemist of the Department (who has made many analyses of our native fodder plants), under date 19th August, 1908. One sample is labelled “Edible” and the other “Non-edible.” They are identical, so far as I can see.

(b) And, again, No. 1, parish Coreen, near Nyngan, county Flinders (E. F. Rogers, Forest Guard). “Stock will eat.”

No. 2. “Stock will not eat.” (E. F. Rogers.) Again I cannot see any difference between the two specimens.

The matter is, of course, one for experiment by trained veterinary officers, and is one of our unsolved, but not insoluble, problems. I suggest that the truth of the matter is that sheep object to the pungent taste of Wilga at first, but when they get used to it they eat it ravenously, if grass and herbs are scarce.

Leaves (as Rustic Medicine).—“Make an infusion of leaves only. Either apply as lotion or take inwardly. Has good results in alleviating pain. A leaf chewed into a pulp and placed in hollow tooth will stop ache.” A former district forester at Dubbo made this statement to me some years ago. The plant has some local reputation similar to that stated, and has doubtless received it because of the pungent principle contained in the leaves and fruit. But better remedies are readily available in these days, although some country people cling very tenaciously (and I am sympathetic with the feeling in a general way) to the bush remedies.

Fruit.—“The bronze-winged pigeons and other game live on the seeds, and domestic poultry will readily eat them. . . . With considerable knowledge of bushcraft, I never knew domestic livestock by any mistake to touch it.” (A. N. Grant, Hillston.)

Bark.—Rough, dark-coloured bark near the butt, but smooth and of a much lighter colour on the upper part and branches.

Timber.—An old official catalogue of the Forests Branch of the Department of Mines says :—

“ Timber hard and close-grained, liable to split, and subject to gum-veins. Used for naves of wheels, blocks, &c.” But I think this report, which has been often reprinted, exaggerates its importance.

Mr. G. Stirling Home, who had experience in the Lake Cudgellico district, however, calls it a useless timber, and says the trees cannot be killed by ringing. He informed me that in the Lachlan district this timber is not considered to have any economic value. It is palish in colour, of a yellowish tint.

In a Queensland official publication it is described as red-brown, hard and close-grained, and its uses are stated for “ turnery, and perhaps for small parts of cabinet work.” Its timber does not seem to have any economic importance at the present time.

Size.—A small tree, with a height of 20-30 feet, and a stem diameter of 10-12 inches.

An Excellent Shade Tree.—The Wilga is one of our best shade trees in the Western district. It is also the one that stands extreme drought better than any other, not excepting the Kurrajong. When in blossom or seed the ants frequent it, but at other seasons they avoid it, so that one can camp under it and not be pestered with insects.

Mr. (now Rev.) G. S. Home, speaking of the Lake Cudgellico district, says it is said to be the only tree in the district that ants will not climb, consequently a workman, where possible, always leaves his swag on its branches, and it remains free from their attacks.

Another writer speaks of it as a very handsome, dense spreading, pendulous shade tree, resembling the common wild olive (*Olea europæa*) in foliage and habit of growth, and well worthy of cultivation as an ornamental tree.

Habitat.—Following are the localities quoted in the *Flora Australiensis*.

Queensland.—Broad Sound (R. Brown); Burdekin River (F. Mueller); Belyando River (Mitchell).

New South Wales.—Liverpool Plains (A. Cunningham); Narran River (Mitchell); between the Darling and Lachlan Rivers (Victorian Expedition).

Victoria.—Murray Desert (F. Mueller).

South Australia.—Near Adelaide (Herb. Hooker); Spencer's Gulf (F. Mueller); South Coast (R. Brown); Isles of St. Francis (Herb. Mus. Par.).

Western Australia.—King George's Sound (Maclean).

(The tree of South and Western Australian localities was supposed to form a variety, as already stated.)

QUEENSLAND.

Let us begin with this State, since the type came from the banks of the Narran River, say, in lat. 29°, and Sir Thomas Mitchell also found it due west of Rockhampton.

An official report says, "Plentiful in scrubs, and fairly so in thick forest country, the best trees being in open country in the Goondiwindi, St. George, Roma, and Inglewood districts."

It is represented in the National Herbarium of New South Wales from the following localities, taking the northernmost first.

Central Railway Line.—Duaringa, 65 miles west of Rockhampton (A. Beck).

Received under the name of "Peppermint," as already explained, from Sapphire or Anakie, 193 miles west of Rockhampton, just south of Clermont (A. Morrison).

Maryborough to Mundubbera Line.—Mundubbera (E. W. Bick).

Western Line.—Cunnamulla, extreme south-western end (F. H. Perkins).

Copy of a label, "Small tree and shrub, 10–15 feet high, in the scrubs west of Darling Downs, mentioned in my Expedition. Jimba." (Dr. Leichhardt.) Near the modern Jimbour, 16 miles from Dalby.

Chinchilla, 50 miles from Dalby (Dr. John Shirley).

Goondiwindi, on a branch line south of Warwick, and not far from the New South Wales border (R. B. McIntyre).

NEW SOUTH WALES.

Ticketty Well, between Wallangra and Yetman (Forest Guard A. Julius). Warialda (Rev. H. M. Rupp, J. L. Boorman). Bingara (Miss P. M. Blundell).

"Beautiful shade tree, grows up to 30 feet high and 2 feet thick, 50 miles north-west of Collarenebri" (S. W. Jackson).

We now come to the Pilliga district. Wee Waa (Forester T. W. Taylor, No. 16). Baradine Creek, Baradine (Dr. H. I. Jensen, No. 86). Yarrie Lake, Pilliga Scrub, 19 miles from Narrabri (Dr. H. I. Jensen, No. 21). Common near Narrabri (J.H.M.). Parish Dumbleda, County Pottinger, 6 miles from Boggabri, 16 feet high, 36-inch girth (Forester M. H. Simon). Gunnedah to Coonabarabran (W. Forsyth). "Bushy tree of 12 feet, with Buddha and Narrow-leaved Box, county White (E. H. F. Swain, No. 19).

We now go a little west. Coonamble (E. Breakwell).

We now go to the Northern railway line, and the following five specimens get so far east through the Cassilis Geocol. Murrurundi (Forest Guard L. A. Macqueen). Belltrees, Scone (H. L. White). Page River, Scone district; also Hunter River, 4 miles easterly (J.H.M., August, 1899). Most eastern localities recorded. Murrumbo, Goulburn River (R. T. Baker). Minembah, Whittingham, near Singleton (Denis Browne, August, 1904). A western plant hitherto only recorded in the east from the Page River.

Now we return far west and keep to the Western railway line.

Coreen, 6 miles from Nyngan (W. F. Blakely). Nyngan (E. F. Rogers, J. L. Boorman, J.H.M.). Coolabah (R. W. Peacock). Afford a grateful shade to sheep and cattle. Cropped by stock, Cobar (J. L. Boorman).

The "Wilga" tree or shrub grows as a general rule on red soil, occasionally it grows on grey soil. I have never seen it growing on grey soil that is subject to inundation. Bourke (A. W. Mullen, L.S.; J.H.M.). Brewarrina Common (C. J. McMaster). About 30 feet, near Bourke (C. J. McMaster). In sending a photo. from this locality Mr. McMaster points out how sheep have eaten the foliage as high as they could reach. "Fairly good fodder for sheep."

We are now less far west and are going south-west and south.

Condobolin to Euabalong (J.H.M.). Wooyeo, Lake Cudgellico (G. Stirling Home). Lake Cudgellico (J. L. Boorman). Lachlan district (J. Duff). Forbes (Forester H. W. Garling). Marsden to Forbes (A. Murphy). Wyalong (District Forester A. Osborne, No. 50).

"Native name, Wilgur. This is our most ornamental tree, attaining a height of 25 feet. The branches start some 3 or 4 feet from the ground and spread outwards for a long distance, drooping until the end leaves touch the ground. The foliage is dark green in colour and very dense, forming an almost impenetrable shade. Stock will not eat it." (K. H. Bennett, Ivanhoe, *via* Hay.) Mueller named this particular specimen *G. parviflora* Lindl. var. *pendula*.

Broken Hill (Forester A. C. Loder).

VICTORIA.

I only have it from the Mallee district.

SOUTH AUSTRALIA.

Murray Flats, west of Blanchetown (Dr. J. B. Cleland). "A large shrub." Port Pirie (M. Koch, No. 772). Mt. Weedina, 15 miles south of the Gawler Range (Walter Gill).

Kingscote, Kangaroo Island; Cape Donington; Streaky Bay; Murat and Denial Bays; Fowler's Bay. All these (Dr. R. S. Rogers).

WESTERN AUSTRALIA.

Eucla (Paul Le Mesurier).

Propagation.—The most successful cultivator of the Wilga in the Sydney district I ever knew was Mr. C. J. McMaster, President of the Western Land Board, who made a great success of it in his garden on the highest part of Point Piper. In the Botanic Gardens, Sydney, we have been much less successful, partly because of the moister conditions there.

1641

E.A. King lith.

AN IRONWOOD.
(*Geijera salicifolia* SCHOTT.) (A-I)

THE WILGA.
(*Geijera parviflora* LINDL.) (K-O)

Kerri, photo.

WILGA (*Gelera parviflora*), WEELAMURRA, N.S.W.

1642

Sid. W. Jackson, photo.

WILGA TREE (*Geijera parviflora*), SHOWING NEST OF SPOTTED BOWER-BIRD,
COLLARENEBRI DISTRICT, N.S.W.

His Honour Judge Decker, photo.

WILGA (*Geijera parviflora*) NEAR BUGGY; SUPPLE-JACK (*Ventilago viminalis*) NEAR MAN.
NORTH-WEST PLAINS.

C. J. McMaster, photo.

WILGA (*Geijera parviflora*) AT BREWARRINA, N.S.W.

C. J. McMaster, photo.

WILGA (*Geliera parviflora*), NEAR BOURKE, N.S.W., SHOWING HOW SHEEP EAT THE FOLIAGE AS FAR AS THEY CAN REACH. FAIRLY GOOD FODDER.

H. Ellington, photo.

WILGA (*Geliera parviflora*), MOREE, N.S.W., SHOWING NIBBLING BY SHEEP.

EXPLANATION OF PLATE No. 243 (IN PART).

k. Flowering twig.

l. Flower showing (a) petals.

(b) stamens.

(c) crenulated disc.

(d) pistil.

m. Pistil showing 5 carpels.

n. Back of flower showing calyx.

o. Fruiting twig.

PHOTOGRAPHIC ILLUSTRATIONS.

1. Weelamurra. (Kerry, photo.)
2. Small tree, with nest of Spotted Bower-bird, Collarenebri district, New South Wales. (Sid W Jackson, photo.)
3. Wilga, near buggy, Supple-jack (*Ventilago viminalis*), near man. (See Part IX.) North-west Plains. (His Honour Judge Docker, photo.) I take this opportunity of saying that I am also indebted to His Honour for the photograph, "Red Gums in Swamp near Forbes," in Part 62 of this work.
4. Moree, New South Wales, showing nibbling by sheep. (H. Billington, photo.)
5. Brewarrina, New South Wales. (C. J. McMaster, photo.)
6. Bourke, New South Wales, showing nibbling by sheep. (C. J. McMaster, photo.)

APPENDIX.

PHENOLOGY: A FORM OF NATURE STUDY WITH VERY PRACTICAL APPLICATIONS.

What is Phenology?

THE word is from the Greek, and means the science of "appearances"—first appearances. The derivation is from a Greek word meaning "to show," and few dictionaries yet contain it. Webster (Supplement) says that the word is a contraction of phenomenology, and defines it as "the science which treats of the relations between climate and the phenomena of animal and plant life, such as the migration and breeding of birds, the flowering and fruiting of plants." I will proceed to show that the subject is of considerable importance to the forester, amongst others.

Work in Canada.

I wrote a paper on the subject before our local Royal Society in the year 1909, and on reading my paper, Dr. C. B. Robinson, then a botanist attached to the Bureau of Science in the Philippines, and who afterwards lost his life in botanical exploration in Celebes, drew my attention to the phenological work conducted in schools in Canada since about 1891, and largely inspired by Dr. A. A. Mackay, the indefatigable Superintendent of Education for Nova Scotia. The following particulars are abbreviated from an official circular:—

Local "Nature" Observations.

(To be sent into the Inspector with the Returns in February and July.)

This sheet is provided for the purpose of aiding teachers to interest their pupils in observing the times of the regular procession of natural phenomena each season. First, it may help the teacher in doing some of the "Nature" lesson work of the Course of Study; secondly, it may aid in procuring valuable information for the locality and province.

What is desired is to have recorded in these forms, the dates of the *first* leafing, flowering and fruiting of plants and trees; the *first* appearance in the locality of birds migrating north in spring or south in autumn, &c. While the objects specified here are given so as to enable comparison to be made between the different sections of the Province, it is very desirable that other local phenomena of a similar kind be recorded. Every locality has a *flora, fauna, climate*, &c., more or less distinctly its own; and the more common trees, shrubs, plants, crops, &c., are those which will be most valuable from a local point of view in comparing the characteristics of a series of seasons.

Teachers will find it one of the most convenient means for the stimulation of pupils in observing all natural phenomena when going *to* and *from* the school, and some pupils radiate as far as two miles from the school room. The "nature study" under these conditions would thus be mainly undertaken at the most convenient time, without encroaching on school time; while on the other hand it will tend to break up the monotony of school travel, fill an idle and wearisome hour with interest, and be one of the most

valuable forms of educational discipline. The eyes of a whole school daily-passing over a whole school section will let very little escape notice, especially if the first observer of each annually recurring phenomenon receives credit as the first observer of it for the year. The observations will be accurate, as the facts must be demonstrated by the most undoubted evidence, such as the bringing of the specimens to the school when possible or necessary.

The estimated length and breadth of the locality within which the following observations were made miles. Estimated distance from the sea coast miles. Estimated altitude above sea level feet. Slope or general exposure of the region . General character of the soil and surface . Proportion of forest and its character . Does the region include low-lands or intervalles ? , and if so, name the main river or stream . Or is it all substantially highlands ? . Any other peculiarity tending to affect vegetation .

The most central Post Office of the locality or region .

Wild Plants, &c.—Then follow a list of 51 well-known plants. No. 52 is “Expanding leaves in spring made trees appear green—(a) first tree; (b) leafing trees generally .”

Cultivated Plants, &c.—number 53 to 65, and include such plants as Cherry, Plum, Apple, Red and White Clover, Timothy Grass and Potato.

Under *Farming Operations, &c.*, we have—(66) Plowing begun ; (67) Sowing begun ; (68) Planting of potatoes begun ; (69) Shearing of sheep ; (70) Hay cutting ; (71) Grain cutting ; (72) Potato digging .

Under *Meteorological Phenomena.*—(73) Opening of (a) Rivers, (b) Lakes without currents (these are, of course, of especial importance to Canada) ; (74) Last snow (a) to whiten ground, (b) to fly in air ; (75) Last spring frost (a) “hard” (b) “hoar” ; (76) Water in streams, rivers, &c. (a) highest, (b) lowest ; (77) First Autumn frosts (a) “hoar” (b) “hard” ; (78) First snow (a) to fly in air, (b) to whiten ground ; (79) Closing of (a) Lakes without currents, (b) Rivers ; (80) Number of thunder storms (with dates of each) .

Migration of Birds, &c.—(81) Wild duck migrating ; (82) Wild geese migrating . Then comes a list of local birds (Nos. 83-98), ending with (99) Piping of frogs ; (100) Appearance of snakes.

Other Observations or Remarks.—(101) *Senecio Jacobaea* (St. James’ Ragwort). Is it found within the school section? If so, to what extent, &c. ; (102) The brown tail moth, &c. . (N.B. These two pests are of special importance to Canada.)

Under such a heading as “First Flowering of the Apple,” it would be obviously desirable and even necessary to refer to the variety, and even the same tree, as obviously we must not refer to an early sort one year and to a later one another. But these are details.

Then we have annually, in the local “Journal of Education,” “Comments on the phenological observations conducted in the public schools of Nova Scotia, during the school year ended by the educational staff of phenologists.”

Nova Scotia is divided into Regions or Slopes, which are subdivided into Belts, and there is a Map of Regions. The teachers (I notice they are mostly ladies) have numbers or marks assigned to their efforts in regard to the annual reports. Sometimes special attention is given to a weed, as, for example, in the Journal for 1910, there is a figure of the St. James’ Ragwort (*Senecio Jacobaea*) which poisons cattle, and the yearly records did something to help the local authorities in destroying the pest. One of the agencies was to offer prizes for collecting and destroying it. If children can usefully

co-operate with the Stock Department and with stock-owners in Canada, it is only a matter of time when, in various ways, they can co-operate with our New South Wales Stock Department and Forestry Commission.

The phenological observations for the whole of Canada are tabulated and published in the annual report of the Botanical Club of Canada (included in the Transactions of the Royal Society of Canada).

Value to the Meteorologist.

It is for a meteorologist to dwell upon the importance of these observations to meteorology. They have been proved to be most useful in a country like Britain, and I believe they will be found to be much more important in Australia. An annual report of phenological observations has appeared for many years past in the Quarterly Journal of the Royal Meteorological Society of London. Instructions to the observers who supply the observational material for the report are contained in "Hints to Meteorological Observers," a book of instructions issued by the Society. The reports give for different districts in the British Isles the date of first flowering of thirteen *uncultivated* plants. The Society also records observations in regard to animal life.

The late Mr. E. Mawley, who managed this branch of the Society's work, pointed out that it is preferable to have a small number of plants for observation and a large number of observers than a large number of plants and, in consequence, a small number of observers. A most important matter is uniformity of observation. "The same individual trees and shrubs must be observed every year, and, in the case of herbaceous plants, those growing in the same spots." Comparable observations and those only are of any value.

In considering the British practice to select few plants for observation, and the Canadian one of a comparatively large number, it is probable that the Canadian example will be followed in Australia, inasmuch as by this means, in addition to obtaining meteorological data, we are widely diffusing nature study in a pleasant and practical form, and, like M. Jourdain in "Le Bourgeois Gentilhomme," our citizens, and particularly our young, impressionable ones, are imbibing scientific methods without knowing it.

The work of the first appearances of various birds, insects, &c., can well engage the attention of individual naturalists and naturalists' associations throughout Australia, but I naturally give most attention to plants.

I think the work for this continent can only be properly carried out by the Commonwealth Meteorologist, who has Australia studded with observers, and who has the machinery for systematically tabulating results. His local officers in the various States could be put in touch with the Government Botanists in order that the plants referred to may be accurately determined, without which the observations would be valueless. The Meteorologist would obtain valuable data, and the various State Botanists would obtain plants from practically all over their respective States. Thus, science would receive an impetus in two directions.

Notes and Suggestions.—(a) New South Wales (speaking of my own State only) would require to be subdivided into “regions” for the purpose of this work. The various States have already been subdivided into various divisions for various requirements, and the present work would result in climato-botanic divisions better defined than at present, and these would be of scientific value. Great Britain and Ireland are so divided, as I shall show presently. By having as observing stations those of the various meteorological workers, there will be provision for continuity of observations.

(b) I have taken the flowering (first expansion of the flower) only, but it is obvious that other observations could be taken, though not so easily perhaps, *e.g.*, unfolding (flushing) of new leaves, the ripening of the fruits.

(c) If the flowering periods of all important plants, such as timber trees, were systematically recorded by competent observers, the results would have high scientific and practical value. But, as a rule, the number of plants selected would have to be limited, as already hinted.

Practical Value.

In a country like ours, science is greatly helped if she can point out the practical value of a suggested course of action to everyday people. In the present case I will indicate some advantages arising from a study of plant phenology.

1. The Australian blacks on the coast are expert fishermen, and Mr. Edward Hill, who possesses much information on the subject, informs me that when the beautiful Waratah or Native Tulip blooms, it is a well-known sign to these children of Nature that the sole (a rare fish to be seen in the Sydney market, but of excellent flavour) is very abundant on the sandbanks about Botany Bay, and in the vicinity of Cook's River, where they may be captured at early dawn, before the ripple comes upon the water. According also to the flowering season of other trees and shrubs, the blacks know the season when the mullet, schnapper, Port Jackson shark (*Cestracion*), or other fish are plentiful in the bays or harbours of the coast.

This aspect of the subject could be followed up with fishermen and anglers, and the local evidence that they have got together as to the relations between the behaviour of plants and the migration and other habits of fish could be classified and checked.

2. A good many bee-keepers make phenological records for their own convenience. For instance, Mr. G. H. Smith, of Recherche, Tasmania, showed me his records for many years. I learnt from him that *Eucalyptus obliqua* (Stringybark) and *E. amygdalina* (Peppermint) flower two years, and then are three years off—*i.e.*, they flower two years out of every five. *E. globulus* (Blue Gum) flowers every year, and so does *Eucryphia Billardieri* (Pinkwood). Mr. Andrew Murphy, a seed collector in New South Wales, told me that *Angophora lanceolata* (Smooth-barked Apple), *Eucalyptus corymbosa* (Bloodwood), and *Eucalyptus dealbata* (a Red Gum), and *E. diversicolor* (the West Australian Karri) all flower every other year. In the Report of the Royal Commission of Inquiry in Forestry (N.S.W.), 1908, at Part ii, p. 607, Mr. William Ager, bee-farmer, of Grafton, gives useful information in regard to the flowering period of the native trees, which is the more valuable since we have so few data. Indeed, the importance of the subject to bee-keepers is so important that I have dealt with the matter as a Section at p. 177.

3. They furnish data for hybridisation observations, whether artificial, or the natural processes which go on in the bush—*e.g.*, such as have been fully proved in regard to the genus *Eucalyptus*.

4. They furnish data for ringbarkers, as flowering periods are especially suitable for ringbarking operations. The philosophy of ringbarking is dealt with elsewhere.

Look at the millions of money wasted by the timber-getter and clearer, who fell the timber at times when it is in full growth, and thus produce an inferior article, or stimulate the formation of suckers, which are the pest of both small and large land-owners.

Another advantage is that a more intelligent interest on any aspect of our trees will lead to a greater appreciation of our forest wealth, which will promote its conservation.

5. They furnish data in regard to meteorological conditions, and we want as many useful methods of tackling meteorological questions in this climatically difficult continent as it is possible to contrive. This has already been referred to, and will be touched upon again.

6. They are important in connection with the collection of native seeds—an important Australian industry, and one capable of very great development.

7. The direct educational value for schools, the importance of which it is not possible to overrate. This has already been indicated, in speaking of the work carried out in Nova Scotian schools.

8. They indicate proper times for Field Naturalists' excursions to visit specific localities.

9. In fine, the advantage of accustoming people to the systematic making of observations in Natural History cannot be fully ascertained. Under 7 and 8 I would recommend that the methods adopted in the Nova Scotian schools be followed and expanded systematically, as found necessary.

10. Sir Joseph Carruthers (*Sydney Evening News* of 24th November, 1919) touches on its agricultural importance in the following words :—

In studying my crops and the time to sow, I have made it a habit to watch the native trees and shrubs. They are real tell-tales of the secrets of Nature. If these flower early, then we shall have an early spring; if late, then so will the spring be. Acting on the guidance of these "tell-tales," I have timed the sowing of my seeds, not only in my garden, but in my fields. I have never been deceived in my conclusions. During the last ten years the message of these native trees has been that the spring would be late in coming, except in 1917, when an early blossoming foretold the bumper crops of that wet year, with its early and long-continued spring.

The fact has been apparent, that if there be good autumn rains and fair winter rains, then Nature will respond with bloom soon after the days have begun to lengthen from 21st. June. Rain in abundance keeps the cold in check, and is a preventive of frosts. Even where it does not prevent frost, it minimises damage, because a plant with full sap suffers less than one with very little of that vital fluid. This season, for instance, I observed my lucerne fields, and noticed that wherever the plants had suffered for lack of moisture they were badly frost-bitten; whereas on lower land, under irrigation, the frost had practically no effect.

In dealing with New South Wales plants, I have not referred either to weeds or to cultivated plants. A useful list could only be submitted by a conference of agriculturists, say, of inspectors of agriculture at their annual gatherings, and amended, if necessary, from year to year.

Tentative Selection of Plants for Phenological Observations.

In Britain the selection of plants for phenological observations is comparatively easy, firstly, because the vast majority of plants have vernacular names with which a large number of people are familiar (indeed, in the Reports of the Royal Meteorological Society the plants are referred to by their vernacular names only), and, secondly, because an enormous amount of information in regard to the flowering periods of plants is already a matter of common knowledge.

In our extensive State, to say nothing of other Australian States, we shall probably find it desirable to submit lists of three groups of plants, as already hinted—*e.g.*, 1, Coast; 2, Table-lands; 3, Western Plains.

Following are some of the practical difficulties in submitting lists of plants in Australia :—

1. Few of our plants have common names.

2. Many names are more or less confusing—*i.e.*, we have more than one Blackbutt, Peppermint, Stringybark, Grey Box, Red Gum, &c. Of such plants as “Tea-trees” and “Everlastings,” “Buttercups,” and “Goodenias,” we have so many as to cause difficulty.

3. Big trees are not suitable as a rule, as they are too high up, and their flowers are often inconspicuous. Trees are much higher in Australia than in Britain as a general rule.

4. There is readily room for confusion amongst Green and Black Wattles, well as most people know them in a particular district. There is even difficulty with the Christmas Bush (*Ceratopetalum gummiferum*), as many people ignore the true flowers and only take note of the coloured calyces.

New South Wales, for the purpose of these observations, may be provisionally divided into the following regions :—(1) Coast districts; (2) Table-land and Western Slopes; (3) Western Plains.

Following are some well-known plants diffidently submitted to form a preliminary list to serve as a basis for making selections :—

Coast Districts.

- Eucalyptus paniculata*, “Grey Ironbark.”
 „ *microcorys*, “Tallow Wood.”
 „ *longifolia*, “Woolly Butt.”
 „ *resinifera*, “Red Mahogany.”
 „ *corymbosa*, “Bloodwood.”
 „ *maculata*, “Spotted Gum.”
 „ *siderophloia*, “Broad-leaved Ironbark.”

Melaleuca styphelioides, "Prickly-leaved Tea-tree"
Tristania conferta, "Brush Box."
Syncarpia laurifolia, "Turpentine."
Avicennia officinalis, "White Mangrove."
Xylomelum pyriforme, "Native Pear."
Telopea speciosissima, "Waratah."
Actinotus Helianthi, "Flannel Flower."
Boronia serrulata, "Native Rose."
Acacia decurrens normalis, "Green or Black Wattle," the August flowerer.
Acacia decurrens var. *mollis*, "Black or Green Wattle," the November flowerer.
Acacia longifolia, "Sydney Golden Wattle."
Pittosporum undulatum, "Pittosporum."
Bursaria spinosa, "Black Thorn."
Linum marginale, "Native Flax."
Corea speciosa, "A Native Fuchsia."
Melia Azedarach, "White Cedar."
Jacksonia scoparia, "Dogwood."
Dendrobium speciosum, "Rock Lily."
Doryanthes excelsa, "Gymea, or Giant Lily."

Table-lands and Western Slopes.

Eucalyptus stellulata, "Black Sally."
 „ *melliodora*, "Yellow Box."
 „ *sideroxylon*, "Fat-cake Ironbark."
Angophora subvelutina, "Apple Tree."
Acacia melanoxylon, "Blackwood."
 „ *dealbata*, "Silver Wattle."
Brachychiton populneum, "Kurrajong."
Banksia marginata, "Honeysuckle."
Bursaria spinosa, "Blackthorn."
Helichrysum bracteatum, "Large Yellow Everlasting."

Western Plains.

Acacia salicina, "Coobah."
 „ *homalophylla*, "Yarran."
 „ *aneura*, "Mulga."
 „ *excelsa*, "Ironwood."
 „ *pendula*, "Myall."
Eucalyptus populifolia, "Bimbil."
 „ *melanophloia*, "Silver-leaved Ironbark."
 „ *ochrophloia*, "Yappunyah."
Ventilago viminalis, "Supple Jack."
Alstonia constricta, "Quinine."

Angophora intermedia var. *melanoxydon*, "Coolabah."

Geijera parviflora, "Wilga."

Grevillea striata, "Beefwood."

Heterodendron oleaefolium.

Canthium oleifolium, "Lemon."

Capparis Mitchelli, "Orange."

When we have made a provisional list of well-known plants, we have still to remember that they should be arranged, as far as possible, under the months of flowering, in order that—as March comes round, for example—the observer may be on the look-out for specific plants. Now this arrangement, with our irregular flowering seasons, due, in part, to our continental climate, presents real difficulties. For example, I turn to the herbarium and see *Eucalyptus paniculata*, the Grey Ironbark, collected in flower in eight months of the year, viz., November to February, and June to September. I should not be surprised if it flowers in other months as well. Of course, it does not flower in all these months every year. Again, turning to Tallow Wood, *Eucalyptus microcorys*, I see it flowers in July, and from September to December. Some plants, as the Native Rose, *Boronia serrulata*, have, however, a very limited flowering period in winter and spring, as everyone knows. It is, therefore, difficult to construct a floral calendar at this stage, but if I invite attention to the matter and secure the co-operation of a large number of observers, I am sure that in a few years many of the difficulties of making a list of plants in flower during certain months will disappear.

In going through a large herbarium it would be useful to take notes of the dates of flowering (with locality and date) of each species, particularly noting the earliest and latest days. It does not follow that the flowering dates as represented in the herbarium, being of specimens collected for a different object, will be of paramount importance for phenological observations, but they will certainly valuably supplement information collected in front of plants with a phenological end in view.

Bibliography non-Australian.

In the International Catalogue of Scientific Literature (Botany), Phenology is assigned the sequential number 3,800, under the division Physiology. In each volume, beginning with the first (1902), we have a list of papers and larger works in various languages on the subject, and it is not necessary to recapitulate them at this place. A few, mostly earlier, references will, however, be given presently.

Leaving aside the strict meaning of the term, Phenology includes such papers as, "Flowers on Christmas Day," and all kinds of observations in regard to the obvious appearance of the various organs of plants.

I have no doubt that, apart from the inherent value of the records themselves, they will lead to the provision of data for a botanical survey of individual States and

of Australia as a whole. For this desirable object, of value in so many directions, we must seize upon every opportunity of increasing our knowledge, but it is a fact that "the harvest truly is great, but the labourers are few."

(a) Some of the earliest phenological observations are probably those of Gilbert White, made at Selborne, Dorset, England, and those made by William Markwick, at Catsfield, in Sussex, from the years 1768 to 1793. They form an Appendix to most editions of White's Selborne, where they are placed in parallel columns for comparison.

(b) Inquiry of the Director of the Meteorological Office, London, led Mr. R. G. K. Lempfert, Superintendent of Statistics, to refer me to the following list of papers in Prof. R. de Courey Ward's translation (Macmillan) of Hann's "Klimatologie," Vol. 1, p. 90. As the work and the translation are so excessively scarce in Australia, I quote the bibliography here:—

1. S. Günther: *Die Phänologie*, Munster, 1895. A short, concise account of researches in this field.

2. O. Drude: *Handbuch der Pflanzengeographie*, Stuttgart, 1890, pp. 17–48; and *Deutschland's Pflanzengeographie*, Part i, Stuttgart, 1896; Section v, *Die Periodische Entwicklung des Pflanzenlebens im Anschluss an das mittel europäische Klima*.

3. A. von Oettingen: *Phänologie der Dorpater Lignosen*. Ein Beitrag zur kritik phänologischer Beobachtungs—und Berechnungsmethoden, Dorpat, 1879.

4. H. Hoffmann: *Phänologische Untersuchungen*, Giessen, 1887.

5. R. Hult: "Récherches sur les phénomènes périodiques des plantes," *Nova Acta R. Soc. Sc. Upsala*, Series iii, 1881.

6. E. Ihne: "Phänologische Jahreszeiten," *Potonié Naturw., Wochenschrift*, x, No. 4, 1895; also "Karte der Aufblühzeit von *Syringa vulgaris* in Europa," *Bot. Zentralblatt*, 1885, Vol. XXI, 3–5.

7. H. Hoffmann: "Vergleichende phänologische Karte von Mitteleuropa," *Peterm. Mitt.*, XXVII, 1881, 19–26.

8. M. Stauq: "Phänologische Karte von Ungarn," *ibid.*, XXVIII, 1882, 335–339.

9. Very instructive phenological charts were published by A. Angot in his paper entitled, "Résumé des Etudes sur la Marche des Phénomènes de Végétation et de la Migration des Oiseaux pendant les dix Années, 1881–90," in the *Ann. Bur. Centr. met. de France*, 1892, I. Mémoires, Paris, 1894, B. 159–B. 210; also Angot's great work, "Etude sur les Vendanges en France," *ibid.*, 1883, I. Mémoires, Paris 1885, B. 29–B. 120, which is important in the study of changes in climate as well. The numerous works of Fritsch, Linsser, &c., bearing earlier dates, cannot be referred to here.

10. The Annual Reports on Phenological Observations in the British Isles, by E. Mawley, are published in the Quarterly Journal of the Royal Meteorological Society for recent years.

11. See also C. Abbe, in *Maryland Weather Service*, Vol. 1, 1899, 267-278. Professor Abbe has prepared a report of great value, published in 1905 (officially known as No. 5,119, Sig. 91), on "The Relations between Climates and Crops," dealing with the physiological and experimental work which has been carried on in laboratories, and also with the results of experience in the open air under natural climatic conditions.

(c) Hoffman and Ihre, of Giessen, Germany (some of their papers are already referred to), wrote "Nature," of 30th March, 1882, giving a list of the "First buds open" and "First fruit ripe" observed at Giessen for many years.

(d) In "Nature" for 13th April, 1882, Mr. J. Edmund Clark has an interesting letter on the same subject, containing useful information.

(e) See also "Instructions for the Observation of Phenological Phenomena," published by the Council of the Meteorological Society (of London). Price, 6d. The instructions are under the heads of Plants, Insects, and Birds (also first appearance of Frog-spawn). "Annual Report on the Phenological Observations." These have been conducted for many years by Mr. Edward Mawley, and are published in the Quarterly Journal of the Society. England is divided into sections bearing the letters A, C, E, D, F, I (includes part of Scotland), Scotland H, J, K, and Ireland B, G. There were 106 observers, scattered over the three kingdoms, in 1906. Discussion of the tabulation of the result is most interesting, and an abridgment is published.

(f) "A Simple Method of Taking Phenological Observations," by Edward Mawley. *Trans. Hertfordshire Nat. Hist. Soc.* vi, 117-122 (1892) is a most valuable paper. Mr. Mawley's papers in successive volumes are most valuable.

We have seen what a hold the study has got in Nova Scotian schools, while Rugby School (one of the most celebrated of English schools) takes it up, and the records will be found in the School Natural History Journal. The Journals of various County Natural History Societies contain such records in England and Scotland, and we also find records in Journals published in Belgium, Germany, Holland, Hungary, Italy, Poland, Russia and Sweden; Canada (referred to separately), the United States, the Argentine, and doubtless other countries.

In the Missouri (U.S.A.) Botanic Garden Report for 1894 are Phenological Notes for 1892 and 1893, observations having then begun in the arboretum. This paper (by J. C. Whitten) has enhanced value, because of the preliminary American bibliography. The records of woody plants will most interest my readers.

"The Phenology of Weeds," by Charlotte M. King (Bulletin No. 4, Iowa Geological Survey, pp. 783-90, 1913), may be referred to. The records are given from May to November, but no year is mentioned, and the flowering period is alone noted. The author says, "The time of bloom is, in each species, related to its definite physiological constant of warmth, sunshine and moisture. . . . The culturist is greatly influenced by considerations of blooming time, seed time, and time of seed germination in his efforts to control and exterminate weeds."

Bibliography, Australian.

(a) In the Papers and Proceedings of the Royal Society of Tasmania there were recorded for many years phenological observations in regard to plants (chiefly cultivated exotics) in the Botanic Gardens at Hobart. I do not know of any other systematic records of the same kind in Australia.

(b) Haviland, Edwin. Beginning *Proc. Linn. Soc. N.S.W.*, xi, 1049 (1886), Mr. Edwin Haviland has a series of papers entitled "Flowering Seasons of Australian Plants," being a list of plants in the Sydney district in flower during specified months. There were eight papers in all, and the last was in 1888.

(c) Prince, J. E. "Phenology and Rural Biology." (*Vict. Nat.*, viii, 119 (1891). A useful paper of a general character, drawing attention to the desirability of encouraging such observations in Victoria.

(d) The statement is made, *Ib.*, viii, 126, "previous phenological reports have been published by the Astronomer's Department" (Mr. Ellery's). On inquiry of the Government Astronomer at Melbourne, Mr. Baracchi writes, under date 20th October, 1908: "So far as I am aware; no Phenological Reports have ever been published by this observatory."

(e) French, F., junr. "Observations on the flowering times and habitats of some Victorian Orchids" (*Vict. Nat.*, xii, 31, 1895). The list comprises 72 species out of the 90 then (1895) recorded for Victoria, chiefly in the Melbourne district. A calendar for every month of the year is given, showing the orchids observed to have flowered in that month. No years are given, so that the value of the list, for phenological purposes, is not as complete as it otherwise would have been.

(f) Maplestone, C. M. "Flowering Times of Orchids" (*Vict. Nat.*, xii, 82). Mr. Maplestone supplements Mr. French's list by records from a wider range in Victoria. He also gives the months without the years, and thus it is not a guide as to the comparative climatic conditions of any particular year.

(g) Maplestone, C. M. "Calendars and the Indexing of Natural History Observations" (*Ib.*, xii, 120). In this paper the author explains that he has kept a diary, more or less continuously, since 1861, and has many dated observations concerning Orchids (not published in the paper). The "indexing" refers to his use of Todd's "Index Rerum" a device which he used as an index to his diary.

(h) "Notes on Eucalyptus Trees from the point of view of the Bee-keeper," by J. H. Maiden. (*Agric. Gaz. N.S.W.*, January, 1902.)

This compilation is useful only to show how irregular are the flowering periods of some of our trees. Of course, "Stringybarks," "Box," &c., include more than one kind of tree, but some of the trees, such as "Yellow Box," and "Tallow Wood," certainly only include one kind.

At my instigation the Under Secretary for Lands, in 1905 and 1908, requested the foresters to make records of the dates of the trees flowering in their respective districts, and no doubt in time valuable data will be accumulated from this source (Papers 05/2,070 and 08/4,192).

Supplement.

Mr. H. A. Hunt, Commonwealth Meteorologist, Melbourne, to whom my 1909 paper (Royal Society of N.S.W.) was submitted, writes as follows concerning it. In regard to the suggestion as to communicating with entomologists and ornithologists, the present paper is entirely preliminary in character, and it is hoped that it may reach observers who deal with the subjects named :—

Department of Home Affairs,
Meteorological Bureau,
Central Office, Melbourne,

DEAR MR. MAIDEN,

23rd August, 1909.

It is very kind indeed of you to accord me the privilege of perusing your paper entitled "A Plea for the Study of Phenological Phenomena in Australia." I hail with pleasure any effort that will induce the residents of Australia to take this matter up, and record systematically the seasonal peculiarities of plant, insect, and bird life. After all, these phenomena are in some respects a truer index of the character of the season, they are the result of a complexity of elements that go to make climate, and which results cannot adequately be gauged by the mere tabulation and discussion of figures of the few elements of which we only have instrumental records.

These are often found contradictory when compared with animal and cereal statistics. The cause of these contradictions is probably due to factors that we know operate, such as insolation, ionization, &c., for which we have no satisfactory means of acquiring knowledge on an extended scale, and probably also, to a number of unknown influences, the character of which will only be brought to light by a systematic study of phenological peculiarities of seasons.

At the inception of the Commonwealth Meteorological service, I invited our esteemed observers, who now number some 5,000, to include any phenological phenomena with their ordinary weather notes. The request has not been very encouragingly replied to.

It must be remembered that in our country districts, we have no leisured class, and I fear that, from occasional remarks furnished with returns, the recording of fundamental climatological data becomes at times irksome, and a tax upon the time of many of our worthy settlers; I have, therefore, hesitated to press for phenological observations.

It may be that if a tabulation and grouping into districts of plants, insects, and birds, such as you suggest, were supplied to observers, it would stimulate an interest and facilitate a study of the subject. This Department has neither the material nor the qualification to classify and locate the plant, insect and bird life of Australia, but should the work be undertaken, I will gladly distribute such with our usual annual supplies to observers, and plead again with them for co-operation in this interesting and valuable science. To place your views effectively and completely, would it not be advisable to consult with the entomologists and ornithologists of the various States before submitting the question to observers?

Honey and Eucalyptus Flowers.

Taken as a whole, Eucalyptus trees flower freely and have a good nectar yield. Individual species are not gregarious as a rule, but *E. rostrata* of the Murray and other inland rivers, *E. crebra* of Northern New South Wales are exceptions. Turning to Western Australia, so also are *E. marginata* (Jarrah), *E. diversicolor* (Karri), and *E. calophylla* (Red Gum), also trees which are found preponderatingly in certain limited areas.

We know little of the honey-yielding potentialities of the dense scrubs of Eucalyptus—the Mallees of the Eastern States and the Marlocks of Western Australia. The notes which follow show what a wide field there is for investigation in regard to the native trees and other plants interesting to the bee-keeper in Australia.

Eucalyptus is only found under cultivation in New Zealand, and following is New Zealand experience:—

All the species of Eucalyptus secrete nectar abundantly, but in general the quality of the honey is inferior, of bad flavour, and difficult to extract. In this latter respect it resembles pure Manuka (*Leptospermum*) honey, and it is interesting to note that the manuka and the gums are botanically related. It would appear as though the gums were not suitable for honey production, but the quality produced by different species varies enormously. It is quite probable that certain species would produce good marketable honey, as is the case with *E. rostrata*. If certain species combine good timber and honey production, it would certainly be advantageous to restrict the planting to these. This matter requires careful investigation, and such an inquiry is recommended to bee-keeper's organisations. ("Present and future sources of honey in New Zealand," by A. H. Cockayne, Biologist. *Journ. of Agric. N.Z.*, Vol. xiii, 20th July, 1916.)

I take the following extract from another work emanating from a country where Eucalypts do not grow naturally:—

"Eucalypts Cultivated in the United States," by A. J. McClatchie, Bulletin No. 35, Bureau of Forestry, U.S. Department of Agriculture (pp. 41-42).

As a source of honey.—The Eucalypts generally bloom so freely and so early in their development that as a group they are an important source of nectar for bees. The fact that some species can be found in bloom any day of the year, often during droughts, when other blossoms are scarce, in many cases in great profusion, makes them especially valuable as a constant source of bee food. Mr. Kinney, who has made extended observations on the blooming of the Eucalypts, writes in his "Eucalyptus":—

Taking the sixty species and marked varieties of this genus in Southern California, I have never seen a day that flowers could not be found on some of them. . . . When we consider the free production of nectar by the Eucalyptus at seasons when there is little or no other resource for bees, and also the claimed medicinal value of honey from Eucalyptus flowers for relieving irritation from the mucous membrane, and as a nerve sedative, the presumption is strongly in its favour. Bee men will doubtless find it to their interest to study the species, and plant in waste places such sorts as will furnish the best kinds of nectar during the most difficult season for the bees. . . . I believe that by some study of this subject, species of Eucalyptus with plenty of nectar could be so selected as to give a constant crop of flowers, or flowers at such times as those are absent in other plants. . . .

Since Mr. Kinney wrote the above, bee-keepers have become more interested in the Eucalyptus as a source of nectar. William Shutt, foreman of the Santa Monica Forestry Station, informs the writer that he receives many inquiries concerning the merits of certain species for bee pasture. In a subsequent portion of this publication will be found a list of the species useful for this purpose. In planting trees for forest cover, wind-breaks, shade, timber or fuel, it would be well, wherever the bee industry is important, to select varieties recognised as flower producers. Several species valuable for the purposes mentioned above—notably the Sugar Gum (*Eucalyptus corynocalyx*), the Red Gum (*E. rostrata*), the Red Ironbark (*E. sideroxylon*), *E. hemiphloia*, and *E. polyanthema*—are profuse bloomers, and are thronged with bees during the blooming season, which with some species is quite protracted.

Attention is invited to a paper on the "Honey Wealth of Forests" in "The Australian Forestry Journal" (Sydney), for October, 1918, by A. Shallard, a well-known authority on the subject.

He states that there are nearly 5,000 people keeping bees in New South Wales alone, and possibly four times that number in Australia. "It may occasion some surprise to be told that the honey-yield last season was between 5,000 and 6,000 tons; also that practically all this honey came from Gum-trees."

The short paper is one of the best I have read, and should be referred to. The quotations I have made below concerning different species under "Shallard," are from this paper.

The matter of phenology is destined to go a long way towards stabilising the bee-keeping industry. If in a number of years we can scientifically ascertain the beginning and end of the honey-flow as regards different species of trees in different districts, we shall have done a great deal to remove it from the empiricism from which it has never arisen in any part of Australia.

I would like to see the question as to what trees and other flowering plants (especially the native ones) are important to the bee-keeping industry, both in regard to honey-flow and pollen, investigated by agricultural and forestry research students. We are lamentably ignorant on this important subject.

An Adelaide correspondent puts it this way :

What I want to see done is this. Foresters as well as officers of the Apicultural Department should be placed on the same footing in relation to inspection of honey as officers of Pure Foods Acts, or more particularly, inspectors of milk, *i.e.*, they should be authorised to call on an apiarist or bee-keeper who markets honey, and, producing 2-4 oz. bottles, take a sample, pay 2d. for it if payment be demanded, enquire how it is defined, Red Gum honey, and so on, call on bee-keepers during extracting period, forward sealed samples to the Department, with particulars as to date, &c., and then you would be able to state where "XLNT" samples come from, and to have the area properly botanised. Inspectors, *i.e.*, foresters, &c., should obtain, especially on State lands, samples of the trees or shrubs playing, or reckoned to play, the most important part in flow of honey, necessitating the extraction at the time the sample was obtained. This should not take up much of a forester's time, and by proving which trees do produce honey, we should make reafforestation more popular.

NEW SOUTH WALES.

All the following Eucalypts are figured in the present work, are abundant, more or less gregarious, and are profuse bloomers. The various Parts should be referred to, and I append a few additional notes from the bee-keepers' point of view. Our data are still very scant.

In my "Notes on Eucalyptus trees from the point of view of the Bee-keeper" (*Agric. Gaz. N.S.W.*, January, 1902, p. 4) which is compiled from foresters' reports, it will be observed that the definite information as to the periodicity of blooming is almost entirely absent. It is evident that foresters, at that date, did not note, in their pocket-books, the dates of flowering of their tree-charges, nor did they botanically check the names, *e.g.*, Stringybark could be one of half a dozen species. At the same time, my compilation has for nearly twenty years formed the principal mass of data connecting species with honey-yield and flavour.

1. *Eucalyptus acmenioides* (White Mahogany).

One of the first to bloom in the spring, and fairly regular every year, but very little good to the bees. (S. T. Main, Krambach.)

This is a profuse bloomer, and occasionally a heavy yielder of good flavoured light honey. (Shallard.)

2. *E. coriacea* (White or Cabbage Gum).

3. *E. corymbosa* (Bloodwood).

Comes second to *E. maculata* (Forester Rudder, Booral). Most foresters speak of the profusion of the honey and of its good quality.

"On another occasion I saw the Tea-tree and Bloodwood blossoms full of honey, so much that a shower of nectar could be got by shaking the blossoms, and yet an apiary right in among it was doing nothing. For some reason the bees did not like the nectar and would not gather it.

"Early in March the Bloodwood comes into bloom, and generally it is a good yielder of a dark amber honey of rather strong flavour. I would like to say here that taste in honey is, I think, governed by early impression. I find that where people have been used to a strong honey in infancy that taste endures through life, and *vice versa*." (Shallard.)

4. *E. crebra* (Narrow-leaved Red Ironbark).

5. *E. dives* (Broad-leaved Peppermint).

6. *E. eugenioides* (Stringybark), probably.

Yields fairly good honey (Forester Rotton, Picton). Valuable as a honey-plant (Forester McGee, Narrabri). Others speak less favourably, alleging that the honey is dark, and not of good colour. But Stringybarks, like the Ironbarks, may mean several different species.

"The Stringybarks will also bloom this spring. These usually bloom in March and April, but they (like some other of our timbers) sometimes bloom out of season, or, rather, change their season. They were in full bud last March on the coast, and also in the western honey district, but only about 10 per cent. bloomed, and the balance are still in bud, and promise to bloom this spring. For some years they bloomed regularly in the spring on the Blue Mountains, and then for some climatic reason they changed and came into bloom during the autumn." (Shallard.)

7. *E. grandis* (Flooded Gum).

"On the North Coast the Flooded Gum will be in bloom in September. This is usually (depends upon the season) a good yielder of beautiful light-amber honey." (Shallard.)

8. *E. hemiphloia* (Grey or White Box).

See notes in Part VI of the present work, as to yield of honey, for which it is highly prized. Most foresters speak well of it as a honey-plant, though others are not enthusiastic about it.

9. *E. maculata* (Spotted Gum).

As a honey plant I think Spotted Gum comes first (Forester Rudder, Booral). Most foresters speak very highly of it. "It blooms after Christmas, and yields a good light honey with, however, a cloudy appearance. It yields better around the Hunter River valley than it does on the North Coast. Very heavy crops are taken from it at times at the former place." (Shallard.)

10. *E. melliodora* (Yellow Box).

For notes as to honey yield, see Part IX, p. 195. This is a tree in regard to which petitions have been made to preserve it from felling or ringbarking, on the ground that it was more valuable to the country as a honey-yielder. Everybody speaks well of it.

The Scotch like heather honey, which would not sell in Sydney at all well. One thing should be remembered which will have a big influence on our export trade, viz., that the English market does not judge honey by our standard. Our darker and stronger honeys are valued more there than our best western box, while here they are classed as seconds. (Shallard.)

11. *E. microcorys* (Tallow-wood).

Yields a good honey and blooms after Christmas. It is usually a fair yielder of a good light honey—by light, I mean light amber. (Shallard.)

12. *E. microtheca* (Coolabah).

13. *E. numerosa* (River White Gum).

14. *E. obliqua* (Broad-leaved Messmate).

15. *E. paniculata* (Grey Ironbark).

"Before it became diseased with the blight (an insect belonging to the Psyllidæ) would be in bloom in December and January, but not every year." (S. T. Main, Krambach, Manning River district.)

Probably confused a good deal with *E. siderophloia*. There are several Ironbarks, and until we know which species the reporters had in their minds, we do not know how to fit in the following reports:—"Not considered a good honey plant on account of the dark colour and strong flavour of honey" (Forester Rotton, Picton). "Yields honey harsh to taste" (Forester Martin, Gosford). "Bees are very fond of this tree" (Forester Cobcroft, Singleton). "Valuable as a honey plant" (Forester McGee, Narrabri).

"This is the end of August and the Ironbarks and clover are just coming into bloom. These two produce beautiful honey, and the former are of the very greatest value to the apiarist; their blooms come in very early and help brood rearing, and the different kinds continue in bloom nearly up to Christmas. They usually yield well, although all flora are subject to climatic conditions, which help or hinder honey secretion, and which produce for the apiarist a good or bad season. I have at times seen the bush literally white with bloom, but no honey in it, and no bees flying at all." (Shallard.)

16. *E. pilularis* (Blackbutt).

Reputed a fair yielder of good honey. . . . "It blooms during March and part of April, and is usually a good yielder of good light honey." (Shallard.)

17. *E. polyanthemos* (Red Box).

18. *E. populifolia* (Bimble or Shiny-leaved Box).

A very free-flowering, dry-country species.

19. *E. propinqua* and *E. punctata* (Grey Gums).

"Grey Gum comes in about the same time (as Blackbutt) but it is not at all a certain yielder, although when it is 'on the job,' there are few that can beat it, and I have known an apiary of 250 hives to fill up every ten days from this bloom alone. As the hives would average 30 lb. an extract, and the flow lasted six weeks, the yield can easily be estimated." (Shallard.)

20. *E. radiata* (as *E. amygdalina*) (a Peppermint).

Very good, honey excellent in flavour, and of good colour (Forester Rotton, Picton).

21. *E. robusta* (Swamp Mahogany).

Comes after Spotted Gum and Bloodwood (Forester Rudder, Booral). Mr. Shallard says he never saw bees working much on it.

22. *E. rostrata* (Murray Red Gum).

Most foresters speak of the great value of this tree to bee-keepers, though one or two speak less favourably than the others.

23. *E. sideroxylon* (Mugga or Red Ironbark).

This is the next valuable to Yellow Box (*E. melliodora*) for honey (Forester Postlethwaite, Grenfell).

24. *E. Sieberiana* (a Mountain Ash).

A good honey-plant, as it flowers abundantly, and is a favourite with bees (Forester Allan, Milton). Very good honey, nice and clear, of good flavour, but rather thin (Forester Rotton, Picton).

25. *E. tereticornis* (Forest Red Gum).

A useful species, though one of those which produces a rather dark honey.

26. *E. tessellaris* (Carbeen).

Valuable as a honey plant (Forester McGee, Narrabri).

27. *E. viminalis* (Ribbony Gum).

Flowers profusely, honey excellent in flavour and of good colour. It is a great help to the bees, as the other principal honey-producing plants are then without flowers (Forester Benson, Bega).

VICTORIA.

The following notes are taken from "Bee-keeping in Victoria," by F. R. Beuhne, in the *Journal of Agriculture*, Victoria, from October, 1914, to April, 1916 :—

A good locality for bees means to have within range of the flight of the bees sufficient honey and pollen-producing plants of the right kind. It is a question of quality of flora rather than quantity.

1. *Eucalyptus botryoides* (Mahogany Gum).

Nothing definite is as yet known of its value to the bee-keeper as a nectar or pollen producer.

2. *E. corymbosa* (Bloodwood).

No Victorian data are available as to its honey-producing value, owing to it not occurring in any present bee-keeping localities.

3. *E. hemiphloia* (Grey Box).

To the bee-keeper it is one of the most important and useful Eucalypts, being very regular in its flowering habits, and producing more or less nectar and pollen every year. Although the individual trees blossom every second year there are some in flower every year, enabling the colonies of bees to breed up in autumn and lay in winter stores, even when no actual surplus honey can be obtained from hives. The honey is of excellent flavour, medium density when fully ripe, amber in colour when free from other honeys, but candies rather quickly. When heating Grey Box honey to reliquify it after it has granulated or at time of extracting, care should be taken that the temperature does not rise beyond 165° Fahr., otherwise it may darken considerably, particularly when in contact with iron.

4. *E. hemiphloia* var. *albens* (White Box).

It flowers earlier in the season, and is freely worked on by the bees for nectar and pollen.

5. *E. leucoxydon* (Yellow Gum).

This tree is a fairly regular bloomer and heavy yielder of nectar. . . . It blossoms more or less every year, but heavier every alternate season. A peculiar feature of this tree is that sometimes it secretes nectar which the bees will not collect, although honey-eating birds freely avail themselves of it. Till quite recently it was assumed that, owing to the humidity and low temperature of the atmosphere at the time of blooming, the nectar was too thin and watery to attract bees. The honey from Yellow Gum is of the finest quality, of pale-straw colour, dense when properly ripe, clearer and milder in flavour than Yellow Box honey.

6. *E. longifolia* (Woolly Butt).

Nothing is so far known as to its value to the bee-keeping industry.

7. *E. melliodora* (Yellow Box-tree).

Undoubtedly the most valuable nectar-yielding tree of Victoria. Yellow Box honey is perhaps the best liked and best known of our Victorian honeys. When quite free from other honeys (which it seldom is), it is of a pale, straw colour, very dense, aromatic, with a pronounced flavour. It keeps liquid almost indefinitely when free from Red Gum honey.

8. *E. piperita* (Peppermint Gum).

Of its value as a nectar-producing tree nothing can be said.

9. *E. polyanthemos* (Red Box).

The honey is one of the palest, but rather dull in appearance, very dense, and on this account very difficult to extract from the combs. It has generally, but not always, a somewhat oily or tallowy flavour, not noticed, however, by palates used to it. When quite free from other honey it does not candy. Blended with other honeys it gives body and reduces the colour. When kept for at least twelve months the oily taste almost disappears.

10. *E. rostrata* (River Red Gum).

The blooming period is comparatively short, but the secretion of nectar often very profuse; it is in fact one of the heaviest yielders. The honey is of a clear golden colour, not quite so dense as that from Yellow Box, less aromatic, but of a milder and very good flavour; it candies quickly and sets very hard when from trees in the Grampians country, but is less inclined to granulate when from trees on the Murray.

11. *E. rubida* (Candle Bark Gum).

It yields pollen as well as nectar, and the honey, so far as is known, is identical with that of Manna Gum.

12. *E. sideroxylon* (Red Ironbark).

The honey is of fine quality, much like that of Yellow Gum, but no great yields of it appear to be harvested, partly perhaps because it blooms in winter, and partly because it does not occur in great numbers together.

13. *E. Sieberiana* (Silver Top).

Nothing is known about it from the apiarists' point of view.

14. *E. tereticornis* (Forest Red Gum).

As to the value of this tree to the bee-keeper, the character of the honey, the time and frequency of flowering, no reliable information is at my disposal.

WESTERN AUSTRALIA.

These observations on the gum trees of Western Australia, with respect to bee-keeping, are taken from the Mutual Help column (Mr. W. C. Grasby) of the *Western Mail*. Interest having been awakened in this matter in the western State, I expect further and more definite particulars, since in some respects the trees are better defined than in the east.

1. *Eucalyptus accedens* (Powder Bark Gum).

This tree is also called "Spotted Gum" and "Bastard White Gum." The "Powder Bark" blooms very irregularly. The period of the year is usually about the same as that of the free blooming time of the Red Gum, viz., from February to April, it being in full bloom in March. The tree produces honey of very fine quality. The buds form about a year before blooming, *i.e.*, they form at the end of the summer before that in which the tree blossoms, whereas the buds of the Wandoo form two seasons ahead. The buds of Powder Bark Gum differ materially in shape from those of the Wandoo. (Mr. A. H. Smith, Baker's Hill, W.A.)

2. *E. calophylla* (Red Gum).

This species normally blooms from February to April, and is usually in full bloom in March. Every year a few trees, chiefly saplings or young trees, are found in bloom, the number varying; but as a rule the Red Gum forest is in bloom profusely every third year, *i.e.*, the trees bloom one year and miss two. Sometimes there is a profusion of blossom two years in three, *i.e.*, there is only one season missed; and sometimes there are three seasons without free blossoming, in which case there is only one profuse blossoming in four years. From a bee-keeper's point of view, a Red Gum honey harvest may be expected once in three years; but he cannot tell whether he is likely to obtain his harvest until the December or January preceding, as it is only then that the buds are formed. In a year of profuse blossoming, the majority of Red Gums from Albany to Perth will be in flower about the same time. (A. H. Smith, Baker's Hill, W.A.)

The old-time blacks used to say when Red Gums flowered heavily, that it would be a wet winter, but my father and I came to the reverse conclusion, that is, the wet winter came first; certainly the following winter might be wet too. (C. A. Fauntleroy, Uberin Hill, Dowerin, W.A.)

3. *E. diversicolor* (Karri).

Two trees bloomed last year, 1918, starting the first week in April. The same trees carried a heavy crop this year, starting the middle of March, but I am inclined to think the blooming period varies very much as my bees are still working on Karri. I was out at Nornalup in January of this year, and the Karri trees were in bloom then. ("Bee-keeper," Denmark—August, 1919.)

4. *E. jœcunda* (York Gum).

This tree produces blossom more or less every year. It carries its buds from ten to twelve months, and bloom from August to November, being usually in full bloom in September and October. The blossom is not large or a prominent feature of the tree. (A. H. Smith.)

The younger York Gums commenced to flower about the end of August, and older trees a little later, and both are still flowering on 4th December. The blossoming takes place on last year's growth, and at the same time as the flowering starts a new growth is sent out at the top, on which in some trees I found little spurlets, which I thought to be flower buds. This has proved to be the case, as now each spurlet has a well-defined bunch of buds as a crown to it for next year's flowers. I asked an old resident who has had about fifty years in the Toodyay district if he thought the York Gums were flowering early this season, and his opinion was that they are. (C. A. Fauntleroy.)

5. *E. marginata* (Jarrah).

This tree blossoms irregularly, the usual time being from September to November, with odd trees in December. It commonly blossoms at the same time as the Wandoo, and as Jarrah honey is dark in colour and strong in flavour, while that of the Wandoo is light in colour and of fine quality, the coincidence of the blossoming period often gives the bee-keeper trouble. Mr. Smith believes that the blooming season varies more or less in different districts, so that the observations of others are required. (A. H. Smith.)

The Kalamunda Jarrahs used to bud every year, but only a few trees, as a rule, would reach the blossoming stage. The buds when about half to three-quarters grown would mostly fall off. Then there would come a year when almost every tree would blossom heavily, but I cannot fix the date of bloom, as it is so many years since I was among Jarrah. (C. A. Fauntleroy.)

6. *E. redunca* (Wandoo, or White Gum).

This gum tree, which is widely distributed, blooms very irregularly. It forms its blossom buds practically two seasons ahead, and when in bloom it may have the buds for the following year well formed; or when the bloom falls it may at once form buds for the second season ahead. The tree may bloom two years in succession, but as a rule the majority of trees bloom freely on a rough average one year out of three. As before stated, irregularity of blooming appears to be a characteristic, but the blooming appears to be influenced by bush fires. The species may bloom freely in one district, but not in another. The period of the year also varies considerably. Odd trees are often in blossom in July, August and September. Usually free blooming takes place in October and November, but odd trees continue to bloom much later. On the eastern side of the Darling Range, as at Mokine and York, it may bloom in May and go on

through the winter further west in the range, as at Baker's Hill and Chidlow Well. Mr. Smith (A. H. Smith, Baker's Hill, W.A.) states that he has seen Wandoo trees in bloom in every month of the year; but not in the same district or in the same year.

7. *E. rudis* (Flooded Gum of the South-West; also called the Blue Gum).

This tree varies with regard to blossoming. As a rule, it appears to bloom every second or third year, the period being from August to September. (A. H. Smith.)

8. *E. salmonophloia* (Salmon Gum).

T. K. O'Dwyer, Yorkrakine, writes in the *Western Mail* of 19th January, 1917 :

"Some six years back I was passing under some large Salmon Gum trees that were left for shade near the house. I noticed under one tree several patches of what appeared to be something like honey. As there seemed to be a considerable quantity I started to investigate, and found that the honey-like fluid was coming from the large limbs of the Salmon Gum. I put a plate under the largest drip, and in the morning was surprised to see the plate half full of what my taste and smell could not distinguish from honey. Inspector White came along the same day, and I asked him if he could explain Salmon Gums giving honey-like substance in such large quantities. Mr. White was as much puzzled as I was, and could not give any explanation. The matter passed out of memory until last year, when several of the Salmon Gums dripped off a very large quantity of the same honey-like substance after an interval of five years. I took a dessert-spoonful, but as I did not know what medicinal or other properties it might possess I refrained from making any further experiments on my digestive organs. What I took seemed to have the same effect in cleansing the mouth and throat as any other honey. If you have no recorded instances on the subject, some of the old pioneers in the Salmon Gum districts might have similar experience, or some of your numerous readers in the country districts may throw some light on the matter of Salmon Gums giving a large quantity of honey-like substance in certain years."

The Editor of the "Mutual Help Column," who is a South Australian, comments : "In my boyhood days it was no uncommon thing to find gum tree blossoms so full of nectar that it ran out and dripped to the ground. We used to gather dry leaves sticky with this honey and lick it off them. Often we would get curved leaves with as much honey as would fill a salt-spoon. Possibly the phenomenon described is similar, but Mr. O'Dwyer does not state that the trees were in bloom. I remember also having seen the leaves of small gum trees wet with "honey dew" as the result of the excretions of numerous colonies of coccus, scale, or similar insects. Such trees were usually the happy hunting-ground of thousands of ants, but I have known the secretion to be plentiful enough to drip. Possibly this may account for the 'honey.'"

I would suggest that our friend the Locust or Cicada may have been at work. (See Part 63 of this work, p. 109.)

SOUTH AUSTRALIA.

Mr. Spafford, Superintendent of Experimental Work, Department of Agriculture, Adelaide, kindly favours me with the following remarks about his State :—

“ From what I have seen of apiaries in this State, (1) the majority are placed in the Blue Gum (*E. leucoxydon*) country, (2) some in the Sugar Gum (*E. corynocalyx*) belt on Eyre’s Peninsula, (3) some in the Adelaide Hills where the Red Gum (*E. rostrata*) and Stringybark (*E. obliqua*) predominate amongst trees, but here I think the undergrowth plays a great part in providing honey, and (4) some among the *E. fasciculosa*.

“ *Eucalyptus odorata* is considered a good honey-producer, and much of the *E. leucoxydon* country where bees are kept shades off into *E. odorata* country. Again, some of our *E. leucoxydon* country shades off into *E. viminalis* and *E. capitellata*, so possibly these two species have something to do in helping the bee-keepers.”

Pollen.

Next to honey, pollen is the principal food which animals seek for in flowers. There are some plants from which honey is entirely absent, and which offer only pollen to the food-seeking animals. Bees and humble-bees collect pollen in large quantities and carry it to their nests as food for the larvæ.

I have already referred to the fact that hitherto there has been but little research work in regard to Australian native pollen plants, particularly *Eucalyptus*.

Edgeworth’s work on “Pollen” depicts no *Eucalyptus*, nor do the beautiful figures in Kerner and Oliver, ii, 98, 99, 101. The *Gardeners’ Chronicle* of 8th December, 1900, has some excellent figures, but they are not Australian subjects.

In “*Eucalyptographia*,” under *E. pachyphylla* are two slight sketches of pollen grains x 300.

Under *E. erythrocorys* Mueller has shown that the size of pollen grains varies in different species, but we require very many more measurements than are available to be in a position to place any interpretation upon the results. This list contains forty-eight species, and the sizes given vary between .0128 mm. and .033 mm. Most of them are given as .0268 mm. (11 species), .0229 mm. (11 species), .0203 mm. (9 species), .0178 mm. (9 species). An investigation as to the shapes of the pollen grains and the relative size might be useful for a number of young microscopists to undertake.

Casuarina torulosa (Forest Oak) is the tree from which pollen is mostly obtained in this district (Forester Stopford, Penrith). Doubtless this is more or less the case in regard to all our native oaks.

Mr. R. Waters has a series of three brief papers in the *N.Z. Journal of Agriculture*, September and November, 1915, and April, 1916, entitled, “Pollen Grains as Source Indicators of Honey.” The first paper begins with an account of the technique of the

microscope work. The papers only deal with clovers, &c., and garden shrubs, *i.e.*, they do not take cognizance of trees.

Then we have a short paper on the "Pollen Grains of Families Epacridaceæ, Proteaceæ, and Myrtaceæ," by Agnes Brewster, *Aust. Nat.*, iii, 194 (July, 1917).

The pollen grains of Proteaceæ are very typical of the order. The grains have usually a distinct triangular form, more or less bulged, to look like little pincushions. At each of the three angles are distinct caps of thin-walled tissue, forming "corner caps" for the exit of the pollen-tube from one of these.

In the Myrtaceæ the grains are again triangular, but with a marked difference (in most cases) from those of the Proteaceæ. The Myrtaceous grain, when dry, has either a general smooth outline with no corner-caps showing, or else a sunken dark central triangle, which disappears slowly when the grains are placed in water, the central triangle being a fold in the wall of the grain, and it spreads out as the water is absorbed. Then can be seen three bands meeting at the centre of the pollen grain, and one running out to each angle. This is seen in *Eucalyptus*, *Melaleuca*, *Callistemon*, *Leptospermum*, and many others. The corner-cap also differs from the Proteaceous grain in having a button-like cap, and the edges of the extine (outer hard coat of the grain) curved inwards.

VICTORIA.

The following notes are taken from "Bee-keeping in Victoria," by F. R. Beuhne, in the *Journal of Agriculture*, Victoria, from October, 1914, to April, 1916 :—

1. *E. hemiphloia* (Grey Box).

Bees usually gather great quantities of pollen from Grey Box, which often is the only available source at the end of the honey season.

2. *E. hemiphloia* var. *albens* (White Box).

As it precedes the Grey Box by about a month, it is very valuable to the bee-keeper in providing a pollen supply to get the colonies into good working condition for the Grey Box bloom, as there is often a dearth of pollen just before. To the best of the writer's knowledge this tree does not occur anywhere in very large numbers, and is, therefore, valuable more as a pollen yielder than a nectar secretor.

3. *E. leucoxydon* (Yellow Gum).

No pollen is gathered from it by bees.

4. *E. melliodora* (Yellow Box).

So far as is known, bees do not collect pollen from Yellow Box blossom. Pollen which, by some apiarists, was credited to this source was by means of the microscope proved of different origin (Wattle or Grass tree). Where pollen-yielding plants are absent during the Yellow Box honey flow, the worker force of the colonies of bees generally diminishes owing to restricted reproduction, and queen bees raised during this period are of little value.

5. *E. polyanthemos* (Red Box).

The blossom does not yield pollen to bees in quantities worthy of consideration.

6. *E. rostrata* (River Red Gum).

It also produces pollen in great quantities, and is therefore exceedingly valuable in Yellow Box country, as the pollen not only keeps the bees going in brood rearing, but also enables them to lay in a good store for a time of scarcity, which not infrequently follows.

7. *E. sideroxylon* (Red Ironbark).

No pollen is gathered from the blossom.

NON-EUCALYPTS.

Following is a list of some of the profuse bloomers (non-Eucalypts), already figured in this work :—

Acacia Baileyana (Cootamundra Wattle).

Acacia decurrens (Green and Black Wattle).

Acacia pycnantha (South Australian Golden Wattle).

Angophora lanceolata (Smooth-barked Apple).

All the *Angophoras* are said to be useful bee-plants, yielding large quantities of honey of excellent flavour and colour (Foresters Rotton, Picton, and Deverell, Glen Innes). Other foresters speak highly of it.

Atalaya hemiglauca (Western Whitewood).

Mr. Froggatt tells me that this profuse flowerer will always be an important plant in the west for any bee-keeper. He informs me that it is specially attractive to the native bees; it is a perfect collecting ground for them.

Banksias (Honeysuckles).

See notes under *B. integrifolia* (White Honeysuckle).

Callicoma serratifolia (the original Black Wattle).

One of the best plants in the Gosford district for honey, both as regards quality and quantity (Mr. Gringle). Not figured in the "Forest Flora of New South Wales" but in "Illustrated Flowering Plants and Ferns" (Maiden and Campbell).

Flindersia (Teak and allies).

Grevillea robusta (Silky Oak).

Grevillea striata (Western Beefwood).

Jacksonia scoparia (Dogwood).

Yields honey bad in taste and smell (Forester Martin, Gosford). Not in "Forest Flora."

Leptospermums.

These free-flowering Tea-trees, usually shrubs and chiefly found in the coast districts, are very valuable for bees.

Melaleuca Leucadendron (the Broad-leaf or White Tea-tree).

Again let me remind my readers that "Ti-tree," which is the *Cordyline* of New Zealand and the Islands, is a totally different tree. The name "Tea-tree" was given by Captain Cook to a species allied to *Melaleuca* simply because his men made "tea" of the leaves. Polynesian islanders made "whiskey" out of the roots of the *Cordyline*, but that is another story.

This is what Mr. Shallard says of the above Tea-tree :

"The broad leaf, or white Ti-tree (Tea-tree) comes in about the end of March, and yields (usually well) a dark strong-flavoured honey. The odour from the newly-gathered honey is nauseating, and can be smelt half a mile to leeward. This, however, largely disappears after storing for a while. It is a peculiar tree, and has three distinct times of blooming, and it also yields honey while in bloom in sort of cycles. For instance, the bees will go at it with a regular roar for three or four days, and then they will steady up and do comparatively nothing for a couple of days, although the bloom is still on. The third period of bloom usually lasts well into June, and my northern apiaries have several times been extracted in June.

"There is one peculiarity about Ti-tree (Tea-tree) honey and that is the fiendish bad temper it always creates in (at other times) peaceful bees. As soon as the flow stops, every hive will mount three or four hundred guards, and they are all looking for fight. If a hive is opened they are at it to rob it out at once, and extracting at this time is a work of art, and not likely to be tackled by anyone who does not know the Alpha and Omega of robbing preventives."

Melaleuca styphelioides (Prickly-leaved Tea-tree).

Flowers regularly every November; it is the best flower for honey in this part, it being always a good bright colour (Forester Crowley, Casino).

Melia Azedarach (White Cedar).*Tristania conferta* (Brush Box).

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Archontophænix Cunninghamiana

Wendl., and Drude.

The Bangalow Palm.

(Family PALMÆ.)

Botanical description.—Genus, *Archontophænix* Wendl. and Drude, in *Linnaea* xxxix, 182 (1875).

We have only to turn to B.Fl. vii, and other works, to see how this palm has been confused with *Ptychosperma*, and it is therefore convenient to have a translation (from p. 190) of Wendl. and Drude's contrast of the two genera.

Stamens 9-24. Albumen ruminatè.—

Male flowers oblique. Stamens 9-18. Seed without furrows. Segments acuminate, marginal nerves fine ... *Archontophænix*.

Male flowers symmetrical, straight. Stamens about 24.

Seed 5-furrowed. Segments erose, marginal nerves marked ... *Ptychosperma*.

I offer a translation of the genus from p. 182 of the above work.

Archontophænix.—Spadices triplicate-branched. Spathes 2. Glomerules 3-flowered, spirally arranged towards the apex of the branches, or biflowered by abortion of the female flowers. *Male flowers* obliquely evolute. Stamens exsert, 9-18, anthers versatile, venation geniculate. The imperfectly developed ovary pyramidal styliform. *Female flowers*—Buds parietal, fruits elliptical-globose, scarlet; the terminal portion of the stigma oblique.

The fibres of the mesocarp strong, branched, forked; endocarp very fine, firmly adhering to the seed. Seed without furrows; the broad raphe emitting a few branches, more from the chalaza.

Albumen deeply ruminatè. Stems tall. Leaves equally pinnatisect, segments acuminate, the inferior nerves distant from the margin; petiole and midrib slightly scaly. On the north and east coasts of Australia.

Then again we have from p. 211 :—

8. *Archon'ophænix* H.W. et O.Dr.

Monœcious Palms. Spadices triplicate-branched, the branchlets pendent, elongate, involute before expansion, two complete caducous spathes. Flowers arranged in 3-flowered glomeruli at the base of the branches, the intermediate female flower late, the male flowers gathered together in twos in the upper part or even in the middle, or solitary at the apex, sessile in bracteolate hollows; all form a loose spiral. *Male flowers*—Calyx 3-lobed, sepals during estivation convolute-imbricate, rotundate, keel-shaped, closely

inclosing the corolla. Corolla much longer than the calyx, petals in prefloration valvate, oblique, acuminate. Stamens 9-18, free from the corolla, forming a common disc at the bottom of the flower; filaments elongated, attenuate, beaking, towards the attenuate apex, which is bent before expansion, the versatile anthers inserted arrow-shaped with a long connective and entirely bifid below. The rudiment of the pistil large, styliform, or filiform from the ovate base, immersed in the staminal disc. *Female flowers*—Calyx and corolla 3-ternate, convolute-imbricate during estivation, sepals and petals rotundate acute, coriaceous. Rudiment of the androecium minute. Gynæcium ovate-oblong, one-celled, gemmula solitary, parietal, cohering with the raphis to the germen, and firmly affixed to the enlarged chalaza; stigmas minute, 3, vertical, one larger one surrounding the fertile carpel. Fruits fleshy, baccæform, globose or ovoid; pericarp smooth or runcinate in the dry state, firmly attached to the seed, crowned at the apex with the remains of the stigma. Seed ellipsoid, the broad marked raphis enlarged to the chalaza, sending out thin branches descending horizontally and then obliquely, more from the chalaza; albumen dense and deeply ruminant. Stems tall, slender, smooth. Leaves crowded into a thick tuft, very long, equally pinnatisect, segments equidistant, acute, entire; the superior nerves solitary in the segments, the inferior nerves marginate, the equally dispersed nerves finer and stronger.

I now offer a translation of the definition of *Ptychosperma*, as given at p. 183 of the same work:—

Ptychosperma La Bill. Spadices 2-3-plicate-branched. Spathes two. Glomerules 3-flowered, arranged spirally towards the apex of the branches, or biflowered by abortion of the female flowers. *Male flowers* symmetrical. Stamens 20-30, exsert, anthers versatile, venation geniculate. The rudimentary ovary oblong styliform. *Female flowers*—Buds parietal. Fruit elliptical, scarlet; the terminal portion of the stigmas oblique. The fibres of the mesocarp rather fine, forked. The endocarp very fine and closely adhering to the seed. The seed with five long furrows; the broad raphis sending forth a few lateral branches, more from the chalaza; albumen deeply ruminant. Stems tall. Leaves equally pinnatisect, segments linear obliquely truncate at the apex, crose-denticulate, ciliate at the anterior margin, the lower nerves strongly marginal; sheath, petiole and midrib glabrescent.

On the north and east coast of Australia, in New Ireland and the adjacent island.

Botanical description.—Species, *Cunninghamiana* Wendland and Drude, in *Linnaea* xxxix, 214 (1875).

Following is a translation of the original description:—

2. *A. Cunninghamiana* H.W. and O.Dr. (H. Wendland sub *Ptychosperma*, Bot. Ztg. 1858, page 346. *Seaforthia elegans* Hooker, Bot. Mag. nec R. Brown!).

The length of the spadix about 6 dm., branches flattened ($\frac{1}{2}$ cm. thick and almost $1\frac{1}{2}$ cm. broad), and secondary branches also; flower-bearing branches terete, (4 mm. in diameter near the base, for the most part, 3 dm. long); glomeruli 3-flowered, arranged in a loose spiral (with intervals 5 mm.). No bracts under the ramifications, a few under the glomeruli. *Male flowers*, sepals sessile at the deeply cordate base, acutely marginate, $1\frac{1}{2}$ mm. long and $2-2\frac{1}{2}$ mm. broad. Petals free amongst themselves or cohering at the base inter se, and with the staminal column, ventricose, obliquely acuminate, 6 mm. long and 3-4 mm. broad. Stamens about 18 at the base, forming a column or thick disc, filaments 2-3 mm. long, thick, awl-shaped, flexuose at the apex, with a linear connective and blackish on both sides, articulate with the filament, anthers longer than 3 mm. The rudiment of the germen conical, thick attenuate towards the base and irregularly trifid, 3-4 mm. lg., $1\frac{1}{2}$ mm. thick at the base. Leaves very large, equally pinnatisect, segments (very often 8 dm. long, 7 dm. broad) separated by gradually decreasing intervals towards the base; superior nerves very prominent on both sides, besprinkled on the lower side with long black chaff; the inferior nerves very fine in the margins; nerves not conspicuous. Blades deep green, becoming brownish when dry, smooth, tough. Stems very tall, slender, 40-60 feet high. On the subtropical and extra-tropical coast of eastern Australia; "Rockhampton"! (leg. Nernst. "head of Moore's Creek"). On the coast of Australia Allan Cunningham noted it very frequently under a false species (name).

Botanical Name.—*Archontophoenix* from the Greek *archon*, *archontes*, a ruler or king, implying superiority; *phoenix* is the Greek name for the Date Palm. *Cunninghamiana* in honour of Allan Cunningham. For particulars as to Cunningham, see this work, Parts XXXV and XXXVI, pp. 59 and 92.

Vernacular Name.—"Bangalow" is the universal name in eastern New South Wales, and it is doubtless of aboriginal origin. In the catalogue of New South Wales exhibits at the Paris Exhibition of 1855, the alternative spelling of "Bangalay" is given, but that name has been for many years appropriated to *Eucalyptus botryoides*, the "Bastard Mahogany." Whether there is any real aboriginal difference between the two names I do not know.

Aboriginal Names.—"Piccabeen" or "Pikki," of Moreton Bay (Queensland) natives, and "Wal-garri" of those of Cairns (F. M. Bailey, following Nugent). Piccabeen is the universal Queensland name for this palm, which is even more common there than in New South Wales. Mr. J. F. Bailey informs me that it is not known as Bangalow in Queensland.

Synonyms.—1. *Ptychosperma Cunninghamii* Wendl. (already dealt with).

2. *Seaforthia elegans* Hook. Bot. Mag. t. 4961, not of R.Br.

Our Bangalow has been confused with a North Queensland palm, and Wendland and Drude first cleared the matter up. But the correct name has never yet been given by many nurserymen, who still have it that our Bangalow is *Seaforthia elegans*, of which *Ptychosperma elegans* Blume is a synonym. *Seaforthia elegans* does not extend to New South Wales, and is a much rarer palm than the Bangalow; but I still get inquiries from Europe and America for *Seaforthia elegans*, since nurserymen will persist in cataloguing it under that name, to the disappointment of connoisseurs.

As if enough confusion has not gathered round the Bangalow, it is often confused with the New Zealand "Nikau" in gardens, *Kentia sapida*. The perianth of the Nikau, often also known as *Rhopalostylis sapida*, has pink or purple bracts, which may cause confusion with the inflorescence of *Archontophoenix Cunninghamiana*, but the resemblance is only superficial, and applies only to the bracts. The fruit in *K. sapida* is cylindroid (as compared with globular in *A. Cunninghamiana*), the stamens in *K. sapida* are few (six), and the rachis is shorter and thicker. These two palms are very similar in general appearance.

Leaves.—The following measurements were recently taken by Mr. A. A. Hamilton from a tree in the Sydney Botanic Gardens:—

Leaf.—14 feet long (over all).

Sheathing base of leaf.—Length, 2 feet; diameter, 9 inches.

Leaflets.—These commence 8 inches from the top of the sheath. Length, 2-2 ft. 6 in.; breadth, 2-3 inches.

Mr. R. H. Cambage told me that the sheathing base was formerly used by the aborigines for carrying water near Milton, Illawarra, New South Wales.

Fruit.—These are globular and orange-scarlet in colour, but they vary somewhat. They are generally described as red, and certain birds, especially Flock Pigeons, are fond of them, these birds arriving on the coast simultaneously with their ripening, during the months of February and March (Forest Guard W. G. Cameron). “The seeds (fruits) apparently contain a small quantity of a fat-like oil similar to that from Copra.” (*Agric. Gazette N.S.W.* for 1891, p. 58.)

Timber.—Only used for rough and temporary purposes.

Size.—A tall, graceful palm. I have often seen it with an estimated height of 50 feet, and a measured diameter of 1 foot. Authentic measurements of the height would be desirable.

Habitat.—Eastern New South Wales at no great distance from the sea, requiring the shelter of brushes. It does not appear to be found farther south than the Milton district. It requires further investigation as to its southern boundary. The District Forester at Moruya has not seen it south of the Shoalhaven at Nowra. It has not been observed on the western slopes of the Great Dividing Range. It is much more common as one proceeds north. Following are illustrative localities :—

The District Forester at Wyong says in gorges and scrubby slopes this palm is plentiful between the Hawkesbury and the Hunter Rivers for a distance of 10 to 20 miles from the coast.

At the heads of the Paterson, Allyn and Williams Rivers, counties of Durham and Gloucester (40–60 miles from the coast), also in brushy gullies at the heads of rivers on the fall from New England and the Comboyne (20 to 50 miles); also fairly plentiful on Bangalow Creek, parish of Ballangarra, State Forest No. 48, and Forest Reserve 35,245, parishes of Boolamboyt and Bulladelah (District Forester, Taree).

In isolated patches from the Queensland border southerly to the falls into McLeod's Creek, about 18 miles east of Tenterfield. (District Forester, Glen Innes.)

Grows in most of the brushes near the coast. Very plentiful on Spickett's Creek, between Bellingen and Bowraville, where it grows to a great height; also plentiful between Coff's Harbour and Raleigh. At one time very plentiful in the brush between the Styx River bridge and Kempsey, on the Armidale road (District Forester, Tumberumba).

In the gorges about Telegraph Point in the Wilson River district, near what is known as Red Hill, chiefly in the Gum Scrub. Also to be found in the Camden Haven district, near Kendall. In the early days there must have been large forests of these palms, judging by the remains on settled areas. I have not noticed it more than 15 miles from the ocean on the North Coast. (Forest Guard W. G. Cameron.)

I have found it as far inland as the Myrtle Scrub, between Walcha and Port Macquarie, about 75 miles from the latter place. Not found west of the Dividing Range, and plentifully in the parishes of Waihou, Orara, and Moonee, county of Fitzroy (District Forester, Urunga).

Kerry and Jones, photo.

CLUMP OF YOUNG BANGALOWS (*Archontophoenix Cunninghamiana*) AT HOGAN'S BRUSH,
NEAR GOSFORD NEW SOUTH WALES.

ANOTHER CLUMP OF *Archontophoenix Cunninghamiana* AT BLACKALL RANGE, SOUTHERN QUEENSLAND.

Government Printer, photo.

PHOTOGRAPH OF A TREE (*Archontophoenix Cunninghamiana*) IN THE BOTANIC GARDENS, SYDNEY.

His Honor Judge Docker, photo.

A DENSE GROWTH OF YOUNG BANGALOWS (*Archontophoenix
Cunninghamiana*), TORRENS CREEK, PORT MACQUARIE,
NEW SOUTH WALES.

1923

M. Flockton del. et lith.

THE BANGALOW PALM.
(*Archontophoenix Cunninghamiana* WENDL. AND DRUDE.)

Propagation.—It does not readily transplant, and if this were better understood, some of the havoc which takes place in regard to the young trees of this most charming of the New South Wales palms would be avoided. It should always be propagated from seed.

EXPLANATION OF PLATE No. 244.

- A. Portion of leaflet two-thirds natural size, showing the main lines of venation.
- B. One of three spathes enclosing the panicle of flowers (drawing about one-fifth natural size).
- C. Portion of panicle bearing male and female flowers.
- D. Male flower.
- E. Male flower expanded, showing about 18 stamens.
- F. Female flower unopened.
- G. Pistils—purple line round pistil.
- H. Fruit.

PHOTOGRAPHIC ILLUSTRATIONS.

- 1. Clump of young Bangalows at Hogan's Brush, near Gosford, New South Wales. (Kerry and Jones, photo.)
- 2. Another clump at Blackall Range, Southern Queensland (Department of Agriculture, Brisbane).
- 3. Photograph of a tree in the Botanic Gardens, Sydney, showing the inflorescence in January. (Government Printer, photo.)
- 4. A dense growth of young Bangalows in land about to be cleared for agriculture. Torrens Creek, Port Macquarie, New South Wales. (His Honour Judge Docker, photo.)

I am much obliged to Mr. A. A. Hamilton, one of my botanical assistants, for much help in getting me specimens, and in other ways.

No. 245.

Eucalyptus dumosa A. Cunn.

The White Mallee.

(Family MYRTACEÆ.)

Botanical description.—Genus, *Eucalyptus*. See Part II, p. 23.

Botanical description.—Species, *dumosa* Allan Cunningham, in Oxley's "Journals of two Expeditions," p. 63 (1820). Bentham (B.Fl. iii, 230) quotes the date of the species as that of Schauer in *Walpers' Repertorium* ii, 925 (1843). I fix the date of the species at 1820. I am quite aware that such a slight description (although it was backed by specimens) would not be valid if published now, but we must be consistent, and if we apply the strict botanical rules of to-day to the loose practice of a century ago, a number of descriptions of Eucalypts will fall, together with innumerable non-Eucalypts, thus causing much confusion. Following explains the history of the species :—

Here is an extract from Allan Cunningham's Journal, under date 23rd May, 1817 :—

Eucalyptus dumosa. Leaves alternate, ovate lanceolate, fruit rough. This plant forms the principal shrub in a tract of confined bushy scrub.

A little later, Oxley made the entry :—

June 10th, 1817. Mr. Cunningham named those thick brushes of *Eucalyptus* that spread in every direction around us *Eucalyptus dumosa*, or the dwarf gum, as they never exceed 20 feet in height, and are generally from 12 to 15, spreading out into a bushy circle from their roots in such a manner that it is impossible to see farther than from one bush to another, and these are very often united by a species of vine (*Cassytha*), and the intermediate space covered with prickly wire-grass, rendering a passage through them equally painful and tedious. (*Journals of Two Expeditions*, Oxley, 1820, p. 63.)

About this time, say between 23rd May and 10th June, Allan Cunningham was mainly between 33° and 34° S. lat. and 146° and 147° E. long., *i.e.*, in the Wyalong-Booligal country.

Following is the first formal description of *E. dumosa* A. Cunn. The original will be found quoted at page 98, Part IV of my "Critical Revision of the Genus *Eucalyptus*," and here is a translation :—

A shrub, branchlets rather rigid, terete; leaves coriaceous, firm, oblong or lanceolate, somewhat oblique at the base, narrowed into a petiole, shortly acuminate, smooth on both sides, pale green, somewhat opaque, imperforate; umbels axillary, 3-5 flowered; peduncle terete or subangled, the same length as the petiole; pedicels angular, shorter than the cupula; operculum coriaceous, subdepressed-hemispherical.

apiculate, ribbed in rays, somewhat broader and a little longer than the cyathiform and slightly ribbed cupula and shining like it. Blades of the leaves 2-3 inches long and 6-9 lines broad, petiole 8 lines long; adult buds with the pedicel 5 lines long, operculum 2 lines long. In shrub lands on New South Wales in Central Australia. A. Cunningham. Herb, No. 206, 1817. Schauer in *Walp. Rep.* ii, 925.

Botanical Name.—*Eucalyptus*, already explained (see Part II, p. 34); *dumosa*, a Latin word for bushy. It, however, is usually a very big bush, and sometimes a small tree.

Vernacular Names.—It is often known as White Mallee, because it has white smooth bark to the ground; it is usually found growing in association with one or more other Mallees. It is the "Ribbon Tree" of the Eastern Goldfields, Western Australia. (C. E. Lane-Poole.)

Use of the term "Mallée."—Groups of the smaller species of *Eucalyptus* are known as "Mallee" (South Australia, North-western Victoria, and western New South Wales) and "Marlock" (Western Australia). In less favoured places, as in sandstone and granite areas, with shallow soils, the trees are more stunted and branched, while in alpine areas, but particularly in certain dry lands, there has been evolved this "Mallee" form, with a thickened woody root-stock, out of which springs, often radially, many thin, tough, bare stems of approximately equal diameter and length, the whole surmounted by a thin and uniform canopy. In the mountain districts, with sterile soil, the dwarf trees often take on a Mallee-like character, in which the thickened root-stock is almost more or less wanting.

Those who desire to study Mallee growths and tuberous swellings of young Gums generally should see an especially valuable and well-illustrated paper "On certain shoot-bearing tumours of *Eucalyptus* and *Angophoras*, and their modifying influence on the growth habit of the plants" (J. J. Fletcher and C. T. Musson, in *Proc. Linn. Soc. N.S.W.*, xliii, 191, 1918).

Aboriginal method of obtaining Water.—I have already touched upon this subject at Part LI, p. 14, of this work, and supplement these notes by one referring to *E. dumosa*.

"On the Weir Mallee, a water-yielding tree, &c.," by John Cairns, *Trans. Phil. Inst. Vict.*, iii, 32 (1859). This is one of the earliest uses of the term Mallee. There is an accent thus—Mallée; the modern accent would be Mallee.

It grows upwards of 20 feet high, and scarcely differs in appearance from those around to the eye of a stranger, but easily to be detected on the brownish tinge of its leaves being pointed out. Our black immediately proceeded to cut a yam stick about 5 or 6 feet long, which he pointed with his tomahawk, and then, tracing the roots by a slight crack discernible on the surface of the ground, he dug underneath it till obtaining space enough for the point of his stick, he pushed it under and then prized up the root as far as he could. Going further from the tree he repeated the operation until he had, perhaps, 15 or 20 feet of the root laid bare. He now broke up the roots into lengths of 3 to 4 feet; and, stripping off the bark from the lower end of each piece, he reared them against the tree, leaving their liquid contents to drop into a pannikin. On holding a piece of root horizontally no water is to be seen, but the moment it is placed in an upright position a moisture comes over the peeled part, until the pores fill with water which drops rapidly.

The natives when travelling in search of water, on finding the tree, usually cut off a large piece of the bark to serve as a dish, which they place at the foot of the tree, leaving the broken roots to drain into it, whilst they smoke a pipe or light a fire. The root, on being broken, presents to view innumerable minute pores, through which the water exudes most copiously; from a pint to a quart of pure water being procurable from a root of 20 to 30 feet long.

Other references to the subject are :—W. B. Clarke, *Proc. Roy. Soc. N.S.W.*, x, 179; Magarey, *Rep. Aust. Assoc. Adv. Science*, vi, 64.

Quite recently I have received herbarium specimens (including bark and timber) of this species from a trained observer, viz., Dr. Herbert Basedow, from Murat Bay, South Australia, where he says it is known as "Red Mallee," and the reddish cast of the bark specimens certainly justifies the name. He points out that the late Mr. Tom Brown drew attention to the water-bearing capacity of this Mallee in western South Australia.

Aboriginal Names.—"Gi-lja" of the natives of Murat Bay, South Australia (J. M. Black); "Mirret" of those of the East Goldfields (Kurrawang), Western Australia (C. E. Lane Poole). "Ngarra" and "Dillya" are aboriginal names in the same district, according to Dr. Basedow. The latter is the same name as that quoted by Mr. Black.

Synonyms.—*E. lamprocarpa* F.v.M., *E. Muelleri* Miq., *E. glomerata* Tausch, *E. incrassata* Labill. var. *dumosa* F.v.M.

For particulars of the first three, see my "Critical Revision of the Genus *Eucalyptus*," Part IV, p. 98.

The question as to whether *E. dumosa* is specifically different from *E. incrassata* Labill. is still, in my view, an open one, and botanists can reasonably hold different opinions on the point. At Part IV and Part XXXVIII of my "Critical Revision of the Genus *Eucalyptus*" I have stated the case both ways, and have submitted all the evidence available to me. Bentham looked upon the species as distinct; Mueller held a contrary view. The type of *E. incrassata* is missing, but it may turn up some day.

Bark.—Speaking of the photograph (reproduced) from the head of the Kurrawang Wood Line, 82 miles from Kurrawang, Kalgoorlie district, Western Australia, Mr. C. E. Lane Poole says :—"This tree is remarkable for the way in which its bark strips. As will be seen from the photograph, it detaches itself in ribbons from the bole, and thus hangs in long streamers from the upper branches. It grows to quite a large tree, but I was unfortunate in not being able to get it photographed in anything but young growth. In the large trees the ribbons of bark hang down from the crown and give the tree a very extraordinary appearance. The clean stem is of a very bright white colour, and, growing as it does in the Morrell country (Eastern Goldfields) is very conspicuous."

Timber.—This is usually not a timber tree, although its massive stock or "root" is a common article of fuel. Its stem or stems are too small to be used as timber. The sapwood is white, and the remainder of the wood is brown or reddish-brown of one shade or another, but usually toning down to a brown with age.

Size.—One must bear in mind that a Mallee may be of considerable size, say up to 50 feet in height, with a trunk diameter up to 2 feet. At the same time, as regards these outsizes, it is desirable that accurate measurements should be put on record. I have seen the present species not far less than 50 feet high (estimated), but usually it is much less, say 20–30 feet. Particulars of some trees will be found under “Habitat.”

Habitat.—The type came from New South Wales (Wyalong district) as already indicated. It is a species of comparatively low rainfall, and it extends westerly to coastal Western Australia.

I have already pointed out that A. Cunn.’s *E. dumosa* came from what is now the Wyalong-Booligal Mallee country. Much of it is in the county of Bland. The Mallee country (it is by no means all var. *dumosa*) probably covers 15,000 or 20,000 acres. Following are specimens in my care :—

Wyalong (H. Deane, W. S. Campbell). A type locality. The latter wrote :—“Light-coloured stems, rather narrow leaves and light-coloured bark.” The Mallee trees are up to, say, 20 feet in height, with a stem diameter of, say, 6 inches.

“Box Mallee,” West Wyalong (F. W. Wakefield). “Tall Mallees of 20–40 feet, the clumps usually have 6–8 stems all of equal size. Whole plant more or less glaucous in appearance.” Yalgogrin (J. L. Boorman). Barmedman to Wyalong. Timber pale-coloured to pale brown (Rev. J. W. Dwyer, No. 483).

Lake Cudgellico (Rev., now Bishop, J. W. Dwyer).

Nymagee (J. L. Boorman). “A large shrub or small tree of 8–15 feet. Much branched, but shows little of the Mallee habit, as it has a distinct stem, which is about a foot in circumference. Bark of a scaly nature and of a dark brown colour, falling off in irregular-shaped patches, the inner bark being bluish-white or straw colour. Tips of branches deep brown and shining. Coppices freely. Grows in dry, gravelly places.” Cobar (J. L. Boorman), Cobar (R. H. Cambage), Nyngan-road, Cobar (L. Abrahams), Mount Hope (J. L. Boorman).

Coolabah (J. L. Boorman), June, 1901. “Mallee. Small, stunted trees, growing on high ridges, stems thin, leaves large. Stems slightly ribbony at the base.”

Darling River (Burke and Wills Expedition).

Bygoo-road, Ardlethan (R. H. Cambage, No. 4247). North-west side of Lake View basin, 15 miles from Griffith (W. D. Campbell).

Balranald (G. S. M. Grant). “Bull Mallee,” 30 feet high. Gunbar (Hay to Hillston) (C. J. McMaster). “White Mallee.” Timber pale brown. Barham (G. S. M. Grant). “Red Mallee,” Barham, Murray River (Assistant Forester Chanter). (Another case of the use of the names White and Red Mallee to this species.) Gol Gol (A. W. Howitt). Subconical fruits with slightly exerted valves.

This brings us near to the Victoria-South Australia border.

It occurs in the Wimmera (North-west Victoria) generally. Kerang (J. Blackburne). "Tree about 30 feet high. Three or four stems from one root; stems up to a foot in diameter. Bark persists at bottom of tree. Remainder of stem clear greenish brown." Bumbang (J. Blackburne, September, 1908).

"Red (?) Mallee," Mount Wycheproof (Rev. W. W. Watts, No. 243). Kancira (Rev. W. W. Watts, No. 644). "White Mallee," Sea Lake (C. French, Jun.). "Forming with *E. oleosa* the major portion of the Mallee growth. Height up to 40 feet in favourable localities, diameter up to 8 inches and over. On the flats or flatter ground, rarely ascending the sand hills below their lower slopes, especially where the country is composed of a succession of sand hills, with flatter ground between. Fairly uniform in type." Narrung, Euston, Mildura (W. S. Brownscombe).

Lake Hindmarsh (Bosisto), Lake Bogan, River Murray (A. W. Howitt).

Nhill, with conical pointed operculum (W. S. Brownscombe); Dimboola (F. Reader).

South Australia.—River Murray, chiefly 15 miles east of Morgan (Dr. J. B. Cleland). Six miles north-east of Mannum, on Murray River. On limestone country in a dry, rocky creek (W. Gill). Monarto South (Dr. J. B. Cleland). Murray Bridge (J.H.M.).

The following are by J. M. Black, in *Journ. Roy. Soc. S.A.*, xliii, 19 :—Pinnaroo, Lameroo, Mulgundawa, Wellington. A small Mallee, 3-5 m. high, with white bark except near the base, from which the dark bark often peels off. Fruit ovoid-oblong or ovoid, 8-9 mm. long, when ripe glossy, the valves sunk, but the tips very slightly exerted. Cold-and-Wet Station (west of Coonalpyn) (H. W. Andrew). A good-sized tree; operculum reddish and ribbed.

Gawler River (Dr. Behr). Roseworthy College, near Gawler (Prof. A. J. Perkins).

"Chindoo Mallee." Minnipa, Eyre's Peninsula (W. J. Spafford).

The following are West Coast localities :—

North of Murat Bay (J. M. Black, Dr. Basedow). Murat and Denial Bays (Dr. R. S. Rogers). Fowler's Bay, approaching var. *angulosa* (Dr. R. S. Rogers). This is on the Great Australian Bight, and the nearest locality I have seen it to Esperance, in Western Australia.

Western Australia.—Head of the Kurrawang Wood Line, 82 miles from Kurrawang (C. E. Lane Poole). This is, of course, an interior or Eastern Goldfields locality.

Esperance (L. L. Cowen). Also at 9-mile Tank, near Hopetoun, and Desmond, near Ravensthorpe (J.H.M.). On the Kalgan Plains (J.H.M.). Growangerup, 30 miles east of Broome Hill (W. C. Grasby).

"Large shrub, grows on sand-plains. Called Whipstick Mallee." Cowcowing (M. Koch No. 990).

2021

Eucalyptus dumosa AT MEMORY COVE, NEAR PORT LINCOLN, SOUTH AUSTRALIA.

C. E. Lane Poole, photo.

TREES (*Eucalyptus dumosa*) AT HEAD OF KURRAWANG WOOD LINE, 82 MILES
FROM KURRAWANG, NEAR KALGOORLIE, WEST AUSTRALIA.

2022

E. A. King, lith.

THE WHITE MALLEE.
(*Eucalyptus dumosa* A. CUNN.)

Watheroo rabbit fence (M. Koch, No. 1608).

At Dongarra, not far from the beach, is a dense growth of slender White Gums, ribbony at butt, which reminds one of dense Mallee, but not true Mallee, 20-25 feet high, trunk 4 inches diameter. Wood very tough, a little brown at heart. Operculum a little ribbed. Broad, coarse suckers. Glaucous buds. It is very close to typical *incrassata*, certainly a connecting link (J.H.M.). These trees display a good deal of similarity to those in Mr. Lane Poole's photograph of the trees at Kurrawang.

"Shrub, 6-8 feet. Bark red. Limestone Hill, Lynton, Pt. Gregory, W.A." (Oldfield), Herb. Barbey Boissier. A small fruited form, *E. dumosa*. Port Gregory is a little further to the north of Dongarra and remains the most northern coastal locality.

EXPLANATION OF PLATE 245.

- A. Juvenile leaves from Wyalong, N.S.W.
- B. Flowering twig from near Wyalong, N.S.W.
- C. Buds from Emu Flat, Ninety-mile Desert, S.A.
- D. Front and back view of anthers, from Cobar, N.S.W.
- E. } Fruits from Wyalong, N.S.W.
- F. }

PHOTOGRAPHIC ILLUSTRATIONS.

1. A characteristic specimen as seen in the coastal districts of South Australia. This particular view was taken at Memory Cove, near Port Lincoln, S.A., with Flinders' inscription (restored) in memory of his boat's crew lost near Cape Catastrophe, 1802.
2. Trees at the head of the Kurrawang Wood Line, 82 miles from Kurrawang, near Kalgoorlie, W.A. Mr. C. E. Lane Poole, who photographed it, gives certain particulars concerning it, which will be found at page 200.

No. 246.

Acacia rigens A. Cunn.

Needle-bush Wattle.

(Family LEGUMINOSÆ: MIMOSÆ.)

Introductory.—Part XXX with Plate 114 has been devoted to the "*Nealie, Acacia rigens*," but further research has shown that the various plants there dealt with are not the true *rigens*. Additional material and further information has enabled me to say what these plants are, viz.:—New species, *Acacia cana* Maiden (erroneously *eremea* in the text), and *A. Loderi* Maiden, both described in *Journ. Roy. Soc. N.S.W.*, vol. liii, pages 206 and 209 respectively. I am now in a position to say what *A. rigens* really is.

Botanical description.—Genus, *Acacia*. See Part XV, p. 103.

Botanical description.—Species, *rigens* A. Cunn. (MSS. in *Loud. Hort. Brit.* p. 406.

This is not a complete description, being little more than a note that it is a "stiff" *Acacia*, and that it was introduced into England in 1824).

The first description is as follows:—

Stipulas almost wanting or deciduous; *phyllodia* filiform, compressed, ending in an oblique, callous mucrone at the apex, 3-nerved at the base, and furnished with a gland-bearing tooth on the upper-margin at the base; *branches* straight, angular, pubescent; *heads* axillary, solitary; *peduncles* clothed with rufous scales, much shorter than the *phyllodia*. Native of New Holland. *Phyllodia* 3-4 inches long. (G. Don, "Gen. Hist. Dichlamydeous Plants," ii, 403, 1832.)

The following description (a translation herewith) is the first occasion in which a definite locality is quoted:—

A. rigens (Cunn. in G. Don, *Gard. Dict.* ii, 404). When young puberulous, finally glabrous, branchlets angular, phyllodes erect-spreading, linear-subulate, terete-compressed rigid, awnless, indistinctly mucronate and about 3-nerved on each side, peduncles solitary or double, much shorter than the phyllode, heads many-flowered, calyx sinuate dentate. Phyllodes mostly 2-2½ inches long. Peduncles short, rigid. Pod narrow linear (1½ lines broad) twisted, slightly contracted between the seeds, puberulous, valves membranous-coriaceous. Lachlan River, Campbell's Cataract, interior of New South Wales, *Cunningham*. This species connects the Calamiformes with *A. elongata* var. (?) *humilis*. Phyllodes rather compressed, and scarcely exceeding an inch in length. South-west interior of New South Wales, *Fraser*. (Bentham in *Hook. Lond. Journ. Bot.* i, 342, 1842.)

Bentham describes it in the following words :—

A tall shrub, either quite glabrous or pale or hoary with a minute pubescence; branchlets somewhat angular. Phyllodia linear-subulate, rather rigid, nearly terete, straight or incurved, usually 2 to 3 inches long and very finely striate with three to five scarcely prominent nerves, with a short, innocuous, oblique or recurved point, but in some specimens three nerves on each side are prominent, at least at the base. Peduncles very short, bearing each a globular head of about twenty flowers, mostly 5-merous. Sepals spatulate, united to about the middle. Petals smooth. Pod linear, straight or curved, flat, about $1\frac{1}{2}$ lines broad, much contracted between the seeds, the valves coriaceous and convex at the seeds. Seeds ovate, longitudinal; funicle with several folds, the last dilated into a turbinate almost cup-shaped aril. *A. chordophylla*, F. Muell. in *Linnæa*, xxvi, 612, and *Pl. Vict.* ii, 11). (B.Fl. ii, 337.)

Variety.—"Var. *longifolia* Benth. Phyllodia slender, often 6 inches long. Heads almost sessile, with numerous flowers. In Leichhardt's collection." (B.Fl. ii, 338.)

Affinities.—1. "Distinguished from *A. leptoneura* only in the sepals rather more united." (B.Fl. ii, 338.)

2. Distinguished . . . "from the narrow-leaved forms of *A. elongata* in the phyllodia still narrower and less flattened." (B.Fl. ii, 338.)

3. Its affinities are, however, much closer with *A. Havilandi* Maiden; see below, page 208.

Botanical Name.—*Acacia*, already explained (see Part XV, p. 104); *rigens*, Latin, stiff, unbending.

Vernacular Name.—For obvious reasons it is one of the so-called Needle-bushes, but it shares this name with other Wattles, and with other plants not related to the Wattle.

Aboriginal Name.—I know of none.

Synonym.—*A. chordophylla* F.v.M. in *Linnæa* xxvi, 612, and *Pl. Vict.* ii, 11. (B.Fl. ii, 338.)

I quote the excessively rare description as given in *Pl. Vict.* :—

Acacia chordophylla F.M. accord. to Benth. in *Linnæa*, 1854, p. 612; F.M. in *Proceed. of the Linnean Soc.* iii, 122.

Shrubby; branchlets angular; stipules obliterated; *phyllodia compressed-filiform, finely streaked*, terminated in an oblique not pungent point; peduncles monocephalous, much shorter than the phyllodia, solitary or twin or rarely several corymbose-fasciculate; capitula globular, with about twenty somewhat glutinous flowers; lamina of the bracteoles rhomboid, narrowed into a long unguis; calyx to about the middle five-cleft, half or more than half as long as the corolla, with somewhat spatulate lobes; pods linear, convex, curved, bivalved, inside continuous, between the seeds somewhat constricted; seeds oval, placed lengthwise, dark-brown, shining, with large areoles and a basal conspicuous strophiole.

In the desert country along the Murray River and Wimmera; in South Australia towards Lake Alexandrina; in New South Wales in the Darling Desert, and towards the Barrier Ranges.

A shrub of several feet in height, covered with exceedingly short appressed almost imperceptible down, which imparts to the plant a slightly silky appearance. Phyllodia straight or somewhat curved, scattered, 1-4 inches long, about two-thirds line broad, slightly tapering into the base. Peduncles often shorter, never conspicuously longer than the capitula. Bracteoles about half line long, early dropping. Corolla nearly 1 line long. Legumen 2 inches or less long; at their greatest width about $1\frac{1}{2}$ lines broad; valves coriaceous, outside grey-brown. Seeds about $1\frac{1}{2}$ lines long.

This species is nearly allied to *A. leptoneura* and also to *A. ephedroides*, both from South-Western ustralia.

I have seen four specimens attributed to this species, but all seem to be *A. rigens* as far as the material goes. One specimen from the Melbourne Herbarium labelled *A. chordophylla* F.v.M., Port Lincoln (no collector nor date named, but probably Wilhelm, about 1859), has terete curved phyllodes up to 6 inches long with the usual long peduncle, and were it not for this latter character the specimen would be referable to var. *longifolia* Bth.

Leaves (Phyllodes).—There is a tendency in the phyllodes to be flattish, even in those very narrow.

Size.—It is a shrub or small tree, scarcely large enough to produce timber in the ordinary sense of the word.

Habitat.—The type came from Campbell's Cataract, Lachlan River, New South Wales, in the south-west of the State. As I could not find the Cataract, I appealed to Mr. R. H. Cambage, who replied :—"From the record you quote I should say the locality where Cunningham found it might be read :—'probably on the south side of the Lachlan in the Lake Cargelligo district.' I notice that near there Oxley mentions Campbell's Lake (23-7-1817) and speaks of *Acacias*, *Dodonæas*, &c. *A. rigens* occurs around Wyalong, also *Dodonæas*. This is the best I can do. I can find nothing about Campbell's Cataract. The flora from Wyalong towards Lake Cargelligo is very similar."

It is found in the drier parts of New South Wales generally, to and beyond the Darling and Murray, and in the north-western part of Victoria. In South Australia it extends to Spencer's Gulf and beyond.

New South Wales.—Following are some specimens in the National Herbarium, Sydney :—

Lachlan district (J. Duff, 1883) ; Riverina [Rev. J. Milne Curran], in flower and fruit. Both labelled *A. rigens* by Mueller.

Small bush, grows with Mallee on high sandy ground. Line 11, Ballandri Estate, Narrandera district (W. D. Campbell, L.S.). Strong, pungent-scented wood when freshly cut. Middle drain at 1,400 feet, Yenda, near Griffith, Narrandera district (W. D. Campbell, No. 45).

Kamarah, near Ardlethan (W. R. A. Baker). Very near the variety *longifolia* of Benth.

Sixteen feet high, scarce, spare of foliage, flowers in September, open country, rich soil. Bygoo Run, County of Cooper, say Barmedman district (Forest Ranger Taylor, E. 17).

Wyalong (Rev. now Bishop J. W. Dwyer, No. 997). Small tree, 10 feet high, brown crinkled bark ; Wyalong (R. H. Cambage, No. 262). "Needle-bush Wattle. 4-10 feet. Much branched from the ground upwards. Phyllodes rigid, with a sharp point, slightly hooked. Grows in fairly rich soil, usually in masses. An occasional solitary plant becomes more symmetrical and globular in outline." Not common. Wyalong (J. L. Boorman).

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R. H. Cambage, photo.

SMALL SPREADING TREE OF *Acacia rigens* IN THE CENTRE, WITH *Bertya Cunninghamii*
ON THE LEFT. WYALONG, NEW SOUTH WALES.

2062

NEEDLE-BUSH WATTLE.
(*Acacia rigens* A. CUNN.) (A-K)

HAVILAND'S WATTLE.
(*Acacia Havilandi* MAIDEN.) (L-S)

Lake Cudgellico (J. L. Boorman). Ragged, flaky, fibrous bark. 30 miles south of Condobolin (F. W. S. Cox).

Near Mount Hope (J. L. Boorman).

Broken Hill (E. C. Andrews). Very beautiful small tree or shrub. Broken Hill (A. Morris, No. 27).

Victoria.—A shrub, 3–4 feet, Victorian Expedition (to relieve Burke and Wills). Locality indecipherable and may be New South Wales. Murray River. Phyllodes narrow, yet flattish (Mr. Henry). Both these specimens from the Melbourne Herbarium.

Mallee district (A. J. Campbell). Mallee district (Norman Le Couteau, through Charles Walter). Near Sea Lake, Mallee district (Rev. W. W. Watts, Nos. 414, 431). Jeparit, Mallee district (St. Eloy d'Alton, No. 42).

South Australia.—Murray Flats (O. E. Menzel).

A large shrub, Quorn, Flinders Range (Max Koch, No. 510).

Gawler Ranges (Dr. Sullivan). Phyllodia 2 mm. broad. In bud only, which are gummy or resinous. Under *A. chordophylla*, Mueller speaks of "glutinous flowers." From Melbourne Herbarium, but not labelled by Mueller.

The following specimens from the Melbourne Herbarium were labelled both *A. rigens* and *A. chordophylla* by Mueller :—

1. "*Acacia rigens* A. Cunn., *A. chordophylla*. South-western shores of Spencer (?) Gulf. This is erroneously referred by Bentham in *Linnæa* to *A. elongata*."

The phyllodes (there are neither flowers nor fruits) resemble those from the Gawler Ranges, but are only little more than half the width.

2. Port Lincoln. Both this and the preceding specimen came probably from the same locality and were collected by Wilhelmi.

EXPLANATION OF PLATE 247 (IN PART).

- A. Flowering twig. Riverina, Curran.
- B. Flower head.
- C. Flower.
- D. Pistil.
- E. Floral bract.
- F. Fruiting twig. Riverina, Curran.
- G. Seed.
- H. Seed pods much twisted.
- I. Base of phyllode showing attachment and gland.
- K. Tip of phyllode.

PHOTOGRAPHIC ILLUSTRATION.

Small spreading tree of *A. rigens* in the centre, with *Bertya Cunninghamii* to the left. Wyalong, N.S.W. (R. H. Cabbage).

No. 247.

Acacia Havilandi Maiden.

Haviland's Wattle.

(Family LEGUMINOSÆ: MIMOSÆ.)

Botanical description.—Genus, *Acacia*. See Part XV, p. 103.**Botanical description.**—Species, *Havilandi* Maiden in *Journ. Roy. Soc. N.S.W.*, liii, 182 (1919).

Following is the original description :—

Frutex glaber pedes pauci altus. Phyllodiis fragilibus peculiis edulibus, lineare-subulatis, sub-rigidis, fere teretibus, reetis circa 4 cm. longis, tenuissime striatis, 8 nerviis vix prominentibus, apice obliquo pungente. Pedunculis tenuissimis, 5 cm. longis, capitulis globosis 25–30 floris pallide flavis plerumque 4-meris. Sepalis angustis, fere spathulatis, calyce irregulariter lobato, apice hirsuto, sepalis dimidio aequilongo. Petalis laevibus. Ovario densissime piloso. Legumine lineare, recto vel falcato, ad 7 cm. longo, 2 mm lato, inter semina valde constricto. Seminibus nigris, longitudinalibus. Funiculo longo pilo simile in arillum obliquum carinosum dilato.

A glabrous shrub of a few feet high with somewhat brittle foliage, edible by stock; the branchlets scarcely angular. The thin bark roughish.

Phyllodia linear-subulate, rather rigid, nearly terete, straight or nearly so, about 4 cm. long, and very finely striate with up to eight scarcely prominent nerves, with a pungent, oblique point, and a very small gland often 1.5 cm. below it or near the middle of the phyllode.

Peduncles thread-like, 5 cm. long, bearing each a globular head of about 25–30 pale-yellowish flowers, mostly 4-merous, but occasionally 5-merous. Bracts variable, boomerang-shaped to quadrangular.

Sepals narrow, nearly spathulate, the calyx irregularly lobed, united to a varying height, hairy at the apex and edges about half as long as the petals. Petals smooth. Ovary densely hairy.

Pod linear, straight or in one curve, up to 7 cm. long, 2 mm. broad, much contracted between the seeds, the valves embossed.

Seeds black, ovate, longitudinally arranged, with a long hair-like funicle, the last fold of which is dilated into an oblique, fleshy aril.

Type, Wong Suey's Paddock, Cobar, New South Wales (Rev. Archdeacon Haviland, 1917). Flowers September, fruit November.

Affinities.—1. With *A. rigens* A. Cunn. Its nearest affinity appears to be with this species, but the most obvious differences appear to be as follows :—*A. Havilandi* is a smaller plant, with more brittle phyllodes, which have more numerous, less prominent nerves and paler flowers, and a boomerang-shaped bract and a straight or curved pod, in contradistinction to the capitate one and the smaller twisted or curly pod of *A. rigens*. The flowers and flower details and seeds are very much alike.

2. With *A. juncifolia* Benth. In this species the phyllodes are up to 17 cm. in length, with a midrib, and with a bend about half an inch from the base, and subtended by a gland. The lobes of the calyx are divided to the base, and their edges are ragged. Ovary smooth and shiny. Very small arillus. There are other differences between this and *A. Havilandi*.

3. With *A. Menzeli* J. M. Black. Its affinities are less close.

Botanical Name.—*Acacia*, already explained (see Part XV, p. 104); *Havilandi*, in honour of Edwin Haviland (1823–1908), for notes and portrait see *Journ. Roy. Soc. N.S.W.*, xlii, p. 106, Plate 11; and of his son, Archdeacon Francis Ernest Haviland, now of Coonamble, formerly of Cobar, New South Wales. Both have specialised in the fertilisation of Australian plants, and have also worked at taxonomy and other branches of botany, and their contributions are mostly to be found in *Proc. Linn. Soc. N.S.W.* I was for long, in the early eighties, a weekly companion of the father in botanical excursions, chiefly in the Port Jackson district, while the son has been a generous contributor to the National Herbarium of New South Wales, and specially brought this species under my notice.

Vernacular Name.—I know of no name certainly applied to this species, and therefore have proposed one.

Leaves.—They are comparatively brittle, and offer a rough-and-ready test for the species.

Size.—A small shrub, under 10 feet high, so far as I know at present.

Habitat.—It has been found over a rather extensive range in the drier parts of New South Wales from the Lachlan to the Pilliga and Angledool (close to the Queensland border). It also extends to the Mallee country of Victoria, to the vicinity of Spencer's Gulf in South Australia.

New South Wales.—Lachlan district (J. Duff, 1882) (as *A. juncifolia*). Cudgellico, via Condobolin (G. Horan per E. Cheel). Upper Lachlan River (Rev. J. Milne Curran, in Herb. Melb.).

Harvey Range, near Peak Hill (J.H.M., 1898).

Small tree (shrub), 5 or 6 feet high. Leaves fairly brittle. Bark rather rough. Nymagee (R. H. Cambage, 6th June, 1900). So far as I know, Mr. Cambage was the first to draw attention to the brittleness of the phyllodes.

Mount Hope (J. L. Boorman). Height 4 feet, very bushy. Shuttleton (P. E. Lewis, No. 6). Flowers 4-merous. On Devonian quartzite ridge. Shuttleton (Archdeacon Haviland, No. 5).

"I have never seen an *Acacia* like this before." Wong Suey's garden, Cobar (L. Abraham, Nos. 47 and 141, 1911). Wong Suey's Paddock, Cobar (Archdeacon Haviland, 1917). Noted under *A. juncifolia* in *Proc. Linn. Soc. N.S.W.*, my error.

"A bush new to me. It is very like Puntii (*A. Burkittii*). Mr. R. Mackay, of Runnymede, says it is edible, and that all stock are fond of it. He calls it Needle-bush." Runnymede Station, between Glenariff and Coolabah (A. W. Mullen, L.S., No. 2).

Pilliga Scrub (Dr. J. B. Cleland). Forest Reserve 41,288, Pilliga Scrub, vicinity of Goona Creek, County of White (Forester T. W. Taylor, No. 57). Merimborough, Pilliga Scrub (E. H. F. Swain, No. 28). Shrub of 7 feet, Rocky Creek, Pilliga Scrub (W. A. W. de Beuzeville, No. 3). A tall, weak-growing shrub of 6-8 feet, having thin stems and a pendulous habit, growing in moist, sandy places near the banks of a creek, and at times in the small islands the results of floods. Cuttabri, Pilliga Scrub (J. L. Boorman).

Angledool (Miss Newcomen, in Rev. Dr. Woolls' herbarium).

Victoria.—Gerang (J. Lanyon, through H. B. Williamson).

South Australia.—Mount Livingston (Mr. Langley. Said to have been determined by Prof. Tate as *A. papyrocarpa* Benth.).

EXPLANATION OF PLATE 246 (IN PART).

- L. Flowering twig.
- M. Flower.
- N. Pistil.
- O. Floral bract.
- P. Fruiting twig.
- Q. Seed.
- R. Base of phyllode showing attachment.
- S. Tip of phyllode.

(All drawn from the type.)

Eremophila Mitchelli F.v.M.

The Buddah.

(Family MYOPORACEÆ.)

Botanical description.—Genus, *Eremophila* Robert Brown, *Prodromus*, 518 (1810).*Calyx* divided to the base into five segments or rarely 5-lobed, often but not always enlarged after flowering.*Corolla-tube* usually broad from the base or constricted above the ovary, more or less elongated and incurved, very rarely with the cylindrical base of *Pholidia*, the limb oblique or 2-lipped, 5-lobed.*Stamens* 4, didynamous, often exserted.*Ovary* 2-celled, with two or three superposed pairs of ovules in each cell, of which, however, the lower pairs remain usually unfecundated, or in a very few species only one pair in each cell at the time of flowering.*Style* filiform.*Fruit*, where known, a dry or succulent drupe, the putamens separating four 1-seeded pyrenes, or 4-celled with one seed in each cell, or fewer cells and seeds by abortion.

Shrubs.

Leaves alternate or scattered.*Flowers* solitary, or in a few species several together in the axils, usually pedicellate, without bracts. (B.Fl. v, 15.)**Botanical description.**—Species, *Mitchelli* Bentham, in Mitchell's "Tropical Australia," p. 31 (1848).

This species was described by Bentham as a footnote to p. 31 of Mitchell's "Journal . . . Tropical Australia" (1848). Mitchell says, under date 9th January (1846), "We here observed, for the first time, a fine new *Eremophila*, with white flowers, forming a tree 15 feet high."

Bentham's description is in Latin, which may be translated :—

E. Mitchelli (Benth. MS.), glabrous, rather viscid, leaves alternate, linear, smooth, corolla white, glabrous on the outer side, the opening large, the four superior lobes about the same size, the lowest one larger and blunted, stamens included.

Mitchell was then on the Bogan, New South Wales, about 26 miles south of Nynigan (Nyngan), New South Wales, which is, therefore, the type locality for the species. A portion of the type is before me as I write, and it bears the inscription in Sir Thomas Mitchell's handwriting, "Jan. 6, 1846. Mooda on the Bogan, height 15 feet. Flowers white."

In Mueller's "Report on the plants collected during Mr. Babbage's Expedition to South Australia in 1858," we have at p. 17 :—

Eremophila Mitchelli Benth. in Mitch. Trop. Austral., p. 31. Arborescent; branchlets furrowed, scarcely tubercled; leaves alternate, narrower linear-lanceolate, flat, recurved-acuminate; pedicels scarcely as long as the calyx; sepals oblong-cuneate; corolla white, outside slightly downy; lobes of the upper lip semi-ovate; middle lobe of the lower lip longer than the lateral ones, nearly ovate, above white bearded; stamens enclosed; ovary tomentose.

In the Brigalow Scrubs from the Gilbert River to the Upper Darling.

Bark black, leaves $\frac{3}{4}$ –1 $\frac{1}{2}$ inches long, opaque. Calyx 3–4 lines, corolla about $\frac{1}{2}$ inch long; throat of the latter with brown-yellow dots. Young fruit ovate.

Bentham himself more fully described it as follows :—

A tall shrub or small tree of 10 to 30 feet, glabrous, viscid, and strongly scented.

Leaves linear-lanceolate, obtuse or with a hooked point, entire, contracted into a petiole, 1-nerved, 1–2 inches long.

Flowers solitary in the axils, on pedicels of 3 to 4 lines.

Calyx-segments oblong or cuneate oblong, obtuse, membranous, veined, glabrous or pubescent on the edges, 4 to 5 lines long.

Corolla about $\frac{3}{4}$ inch long, the cylindrical part of the tube about 2 lines, the broad part above twice as long, the middle lower lobe broader than the others, shortly 2-lobed, woolly inside.

Stamens shorter than the corolla.

Ovary very woolly, with three or four superposed pairs of ovules in each cell.

Fruit ovoid, almost acuminate, half as long as the calyx, the exocarp thin and membranous, the endocarp separating into four nuts each with one or two superposed seeds. (B.Fl. v, 21.)

Botanical Name.—*Eremophila*, from two Greek words—*eremos*, a desert, and *philos* (a), fond of; *Mitchelli*, in honour of Colonel Sir Thomas Livingstone Mitchell, who was Surveyor-General of New South Wales from 1827 to his death in 1855. He collected this plant in his expedition to Western Queensland in 1846. Particulars of his life will be found in my "Records of Australian Botanists," in *Journ. Roy. Soc. N.S.W.*, xlii, 76 (1908).

Vernacular Name.—It is commonly known as "Budda," or, by those who appreciate the niceties of aboriginal pronunciation, as "Budtha." This aboriginal name has been preponderatingly taken up as a vernacular.

A supposed contradistinction has been attempted between "White-barked" and "Black-barked Budda." Some years ago Mr. Lachlan Campbell, of "Mount Brandon," Collarendabri, wrote to Mr. C. J. McMaster, the Chairman of the Western Lands Board, as follows :—"I am posting you some leaves and a little piece of bark off budda tree, by the same mail as this letter. I got the leaves and bark off the trees about 20 yards apart on the red ridge close to where I got some rung years ago, and all the blackish-barked budda I got ringbarked died, and nearly all the whitish-barked budda suckered, and what was cut down grew stronger than ever. They may be the same sort of tree, only the blackish-barked budda the older tree."

On examination it was found that the colour of the bark is caused by the more or less abundant presence of a sooty lichen, and has no connection with the life-history of the species or variety on which it grows.

Mr. R. H. Cambage points out that it is sometimes called Sandalwood from the fragrance of the wood, but that it is not to be confused with the Sandalwood of Western Australia, *Santalum cygnorum*. It is sometimes sent in as Rosewood, a name it shares with other small western trees.

Aboriginal Name.—"Budtha" is the aboriginal name.

Leaves.—In the *Government Gazette* appeared the following notice :—

Colonial Secretary's Department, Forest Branch, Sydney,
9th October, 1889.

Preservation of the Sandalwood Tree.—Notice is hereby given that, under the provisions of the 2nd and 63rd Timber Regulations of 18th August, 1885, the cutting of the Sandalwood tree within 5 miles of the Darling River, and within 5 miles of the Murray, below the junction of the Murrumbidgee River, is prohibited. When in time of drought this tree is required for feed, the lighter branches only should be lopped.

HENRY PARKES.

The matter was taken up by the Press at the time, and the following sensible letter appeared in the *Sydney Mail* of the 14th June, 1890 :—

Something has been said recently of Sandalwood as a sheep food. I would state that the tree known as sandalwood on the Darling and in the West generally, one of the *Eremophilas* called "Budtha" by the natives, is not eaten by sheep, and is only attacked by rabbits when nothing better is to be had. During the droughts of the last nine years our sheep have never touched this shrub. The "Quandong," "*Santalum acuminatum*," is good sheep food, but is not plentiful enough to be made much use of, and is not known by the name of Sandalwood. I would suggest that all Government notices referring to plants should give the botanical names of such as well as the (supposed) popular names, in order that the plant indicated may be identified. There are numbers of plants which in one district carry the same names by which in another quite a different plant is known.

(The sensible suggestion to, as far as possible, give botanical names in Government notices will, as far as possible, be carried out as a matter of course in a few years. The matter is not without difficulty, for ours is still a young country, and the botanists are few, and often carry out their work under great difficulties.)

It is, as the writer indicates, poor fodder, but the twigs are used in connection with strychnine baits for the destruction of rabbits.

Here is a chemical analysis of the leaves by Mr. F. B. Guthrie in the *Agricultural Gazette* for October, 1899 :—

Sandalwood—Water 41.84, ash 5.62, fibre 8.82, ether extract (oil, &c.) 1.73, albuminoids 8.62, carbohydrates 34.37, nutrient value 47, albuminoid ratio 1 : 4½, tannin (oak bark) 2.3.

Here are typical reports from men whose opinion on the western country everyone respects :—

Budda scrub is useless for stock (A. W. Mullen, Western Land Board, Bourke).

“ I send foliage and flowers of the so-called Sandalwood or Budtha (*Eremophila Mitchelli*). This is a very useless tree or scrub hitherto, as stock would not eat it, but the taste of the rabbit is different, as it is the first bark they go for when grass fails, and it is used for poison-sticks, steeped in strychnine.” (The late Forest Ranger Kidston, of Condobolin.)

Flowers.—Note the scarious enlarged calyx of *Eremophila*.

Bark.—Not thick, furrowed-flaky ; sometimes might be almost described as scaly.

The bark is very appetising to rabbits ; consequently they make for this shrub as soon as grass fails, and hence twigs of the “ Budtha ” are used (when treated with strychnine) as bait for rabbits. (See photo.)

Timber.—In diameters under 2 or 3 inches it shows no colour beyond that it is brown in colour, with a pleasing figure, and that it is surrounded by a comparatively considerable width of pale-coloured wood. The wood reminds one of that of the Olive somewhat.

It is figured in colour at Plate 110 of Mr. Baker’s “ Hardwoods of Australia,” and it is there shown as a dark brown timber with some figure. Fig. LXXII shows it magnified in cross, radial and tangential section. Mr. Baker gives its hardness as “ very hard,” and weight at 65 lb. per cubic foot, and recommends it for veneers. Owing to a strong aromatic odour, resembling that of sandalwood, furniture made of this timber is said to be free from the attacks of insects, according to the late Mr. Thozet, of Rockhampton, Queensland.

“ It is said that this wood will keep away the *Blatta*, or cockroach. I cannot confirm this statement. I had a good-sized billet cut and planed, and the odour from it was so strong as to perfume one of my trunks in which it was placed, but the cockroaches treated it with the utmost disdain. They ran over it and laid their eggs under it, just as if it had been put there for their accommodation. (Tennison Woods, *Proc. Linn. Soc. N.S.W.*, vii, 574.)

“ Budtha ” is one of the strongest scented woods of the western district, and the trees are commonly up to 9 inches in diameter ; but, unfortunately, when they attain that size they generally show a strip of decay up one side which seriously impairs their usefulness.” (R. H. Cambage.)

Mr. Gordon Burrow, District Forester, Narrabri, some years ago wrote :—

Another tree which seldom is accorded the recognition warranted by its qualities is the Buddha, *Eremophila Mitchelli*. Out west it is extensively used when procurable for fencing. Like Belah (*Casuarina lepidophloia*) it is little used where Pine and Ironbark is plentiful, but not with equally good reason. A small tree, rarely attaining a butt diameter of 12 inches, it can be used only in the round. It is light and practically white-ant resistant, a quality which it shares with Cypress pine. In heavy black soil, it is preferable, in my opinion, even to Ironbark, though it does not make such an attractive and solid appearing

fence, for the reason that it is so light. In heavy black clayey soil it is well known that a heavy fence soon gets out of line, its own weight tending to pull it over one way or the other as the ground gives. At the same time it may be claimed for it that it will last in the ground, despite its small size, as long as the best of Ironbark. In fact, its sole disadvantages appear to be its small size and its comparative scarcity. It is not a fodder tree. It is easily destroyed by ringbarking, and when dry supplies excellent fuel, which on being burnt gives off a very sweet odour, one that strangely enough seems more powerful at a distance than when close at hand. I have frequently, when walking down the street, smelt buddha burning in someone's kitchen fire some chains away. This fragrance is always in the wood, green or dry, and is as strong as that of Myall, though it differs slightly in perfume. It has a deep brown heartwood and yellow sapwood, polishes readily and should be a good cabinet timber where small sizes only are required. Apart from its utility, it is a handsome little tree, generally well shaped, with graceful light green foliage, and in spring bears a wealth of beautiful and sweet-scented blossom. It grows usually on sand ridges and most frequently in conjunction with round-leaved Box, *Eucalyptus populifolia*, when it is considered to indicate shallow ground with a clayey subsoil.

An interesting fact, locally, in connection with Buddha, is the large increase in the consumption of this timber during the last few years, a distinction which it shares with Belah.

Size.—This has already been referred to. It is a small tree, rarely attaining a larger size than 25 or 30 feet, with a diameter of 12 inches at the butt.

Habitat.—It frequents the drier parts of New South Wales and Queensland, but is by no means confined to the driest parts. The type comes from Muda, on the Bogan, 26 miles south of Nyngan. (See p. 211.) The former local Forester (E. F. Rogers) at Nyngan called it "Scented Sandalwood," and says that stock do not eat it. My friend, Mr. Rogers, took a special interest in the travels of Major Mitchell on the Bogan, and in the gradually diminishing traces of the blacks. He tells me that Muda is the modern "Mudall," and that the old station homestead was built near the waterhole on the Bogan referred to by Mitchell. It has a beautiful Box (*Eucalyptus bicolor*, I understand) near, but the hole is much more silted up than in Mitchell's time. The Mudall homestead was later on removed nearer Nyngan (22 miles).

It is represented by the following specimens in the National Herbarium, Sydney :—

New South Wales.—Near Nyngan (F. E. Rogers). Sandalwood, Coolabah (J. L. Boorman). Both of these specimens are from the type locality. Forbes (H. W. Garling). Wooyeo, Lake Cudgellico (G. Stirling Home). Coonamble (E. Breakwell). Coonamble (C. J. McMaster, see photo and note at p. 216.). Bourke (Mr. Henry). Brewarrina (C. J. McMaster, see photo and note). Paroo River district (E. Bêche). Tarella, Wilcannia (W. Baeuerlen).

Budtha. Up to 30 feet high and 1 foot thick, but 8 inches thick is a big tree. Pretty tree. Near Collarenebri (Sid W. Jackson).

Narrabri (Assistant Forester Gordon Burrow). Narrabri West (J. L. Boorman). Yarric Lake, 19 miles from Narrabri (Dr. H. I. Jensen, No. 22). Small trees of 8–20 feet, Pilliga (J. L. Boorman). Gunnedah to Coonabarabran (W. Forsyth). "Buddha," 20 feet, with 30-inch girth. Gunnedah, parish Brigalow, county Pottinger, on black soil (M. H. Simon, Forest Guard). "Dogwood," 20 feet, with 24-inch girth. Parish Leard, county Nandewar. Red soil (M. H. Simon, Forest Guard). Shrub 15 to 20 feet, about 14 inches in diameter. Dark brown furrowed bark on trunk. Parish Mihi, county Nandewar (M. H. Simon).

Gurley, near Moree (J. L. Boorman). Warialda (J. L. Boorman). Rosewood or Sandalwood. Warialda (Forest Guard E. Julius). Warialda (E. J. Hadley). Inverell Road and Fraser's Creek, near Ashford (J. L. Boorman).

The following specimen is probably New South Wales, but it may be a Queensland locality :—

“Between Coral and the Peel. A little tree. 7th April, 1843.” (Dr. L. Leichhardt.) Another of Dr. Leichhardt's autograph labels of the same locality reads, “The same tree in the Myall bush, near the Mokka (? Mooki), at Lang's Station.”

Queensland.—The following specimens are not very numerous, but they indicate a wide range :—

Texas (J. L. Boorman). Goondiwindi (R. B. McIntyre). “Sandalwood,” Chinchilla (Dr. J. Shirley). Wallumbilla, near Roma (C. T. White). Butha or Sandalwood. Gadwall, Alpha (G. T. Wood). Barealdine (H. Robinson). Sapphire (A. Morrison). Prairie, 30 miles east of Hughenden (R. H. Cabbage, No. 3954).

EXPLANATION OF PLATE No. 247 (IN PART).

- A. Flowering twig.
- B. Bud.
- C. Flower.
- D. Corolla laid open.
- E. Calyx.
- F. Pistil.
- G. Side-view of fruit.
- H. Lower portion of fruit. (Seen from beneath.)

(Drawn from the type, or from a specimen from the type locality.)

PHOTOGRAPHIC ILLUSTRATIONS.

1. Sandalwood tree, a very fine specimen. Enngonia, on the Warrego River, N.S.W. (Kerry & Co., Sydney, photo.)
2. Budda tree, with Spotted Bower Bird's nest at the top. Collarenebri district, N.S.W. (Sid. W. Jackson, photo.)
3. On “Brewarrina Common. The white patch showing on the butt was caused by rabbits removing the bark. Grows about 15 feet high.” (C. J. McMaster, photo.)
4. “Budda or Budtha, near Coonamble. This appears to me to be the same as the shrub locally called Budda in the Bourke and Brewarrina districts, but its habit of growth is different. In the Cobar, Walgett and Collarenebri districts it grows more like a small tree, with seldom more than two stems, and attains a height of about 20 feet, while in the other localities mentioned it is lower and has a great many stems. If they are the same the difference in growth may be accounted for in the higher rainfall and perhaps also in the nature of the soil. The smaller varieties grow in red soil with a low rainfall, while the others are in a dark alluvial soil with a higher rain register. It is regarded as a noxious growth. Stock will not eat anything but the flowers, and it is said to be very difficult to destroy—the attempt to do so often resulting in an enormous growth of seedlings or suckers. In hard times rabbits ringbark it, and trees on many thousands of acres have been destroyed in this way.” (C. J. McMaster, photo.)

E.A. King. lith.

THE BUDDAH.

(Eremophila Mitchelli F.v.M.) (A-H)

THE TURPENTINE BUSH.

(Eremophila Sturtii R.Br.) (I-O)

2162

2087. SANDALWOOD TREE

KERRY PHOTO SYDNEY

Kerry and Co., photo.

SANDALWOOD TREE (*Eremophila Mitchellii*), ENNGONIA, WARREGO RIVER, NEW SOUTH WALES.

S. W. Jackson, photo.

BUDDA TREE (*Eremophila Mitchellii*), WITH SPOTTED BOWER BIRD'S NEST AT TOP.
COLLARENEBRI DISTRICT, NEW SOUTH WALES.

C. J. McMaster, photo.

BUDDA (*Eremophila Mitchellii*), NEAR COONAMBLE,
NEW SOUTH WALES.

C. J. McMaster, photo.

TREE OF *Eremophila Mitchellii* ON BREWARRINA
COMMON.

2163

A. W. Mullen, photo.

TURPENTINE BUSH (*Eremophila Sturtii*), BOURKE DISTRICT, NEW SOUTH WALES.

No. 249.

Eremophila Sturtii R.Br.

Turpentine Bush.

(Family MYOPORACEÆ.)

Botanical description.—Genus, *Eremophila* Robert Brown. (See p. 211.)**Botanical description.**—Species, *Sturtii* R. Brown, in Appendix to Sturt's "Narrative of an Expedition to Central Australia," ii, 85 (1849).

In "Narrative of an Expedition into Central Australia" we have the original description of *E. Sturtii*, of which the following is a translation :—

Leaves alternate; sepals shortly unguiculate, without a gland; stamens included. To this section belongs *Eremophila Mitchelli* Benth.

Eremophila (Sturtii), pubescent, leaves narrow linear, apex recurved; corolla pubescent on the outer side, limbus bearded on the inner side, stamens included.

A shrub a fathom high. Calyx 5-partite, equal; sepals obovate-oblong, narrower at the base but scarcely narrowed into a claw, membranaceous, uninerved, veined. Corolla bilabiate, tube broad, straight, lips obtuse, pubescent on the outer side, on the inner (lower) bearded. Upper lip tripartite; middle lobe bifid (composed of two); the segments all obtuse; the lower obcordate, bilobed, lobes rounded, more densely bearded. Stamens 4, didynamous, entirely included. Filaments glabrous. Anthers reniform, cells confluent at the base. Ovary densely woolly. Style glabrous. Stigma undivided, hardly thicker at the apex of the style.

Obs. Species nearest *E. Mitchelli* Benth., in Mitchell's "Tropical Australia," p. 31.

In Mueller's "Report on the plants collected during Mr. Babbage's Expedition into the north-western interior of South Australia in 1858" (Vict. Parl. paper, 1858), p. 17, we have :—

Eremophila Sturtii R.Br. in Sturt's Central Australia, ii, Append. p. 85.

Viscous; branchlets thin and leaves glabrous, not tubercled; leaves narrow-linear, somewhat channelled, alternate with a recurved acumen; pedicels about as long as the calyx; sepals membranous, glabrous, blunt; the terminal ovate, the others oblong, of more than half the length of the corolla-tube; the latter white, outside slightly downy; upper lip with two short blunt lobes; lateral lobes of the lower lip semi-ovate; the middle lobe longer obcordate or ovate above densely woolly-tomentose, stamens not exserted; ovary woolly.

On the rivers Murray and Darling. Rev. Mr. Goodwin, Mr. Dallachy.

Leaves 1-1½ inches long, ½-1 line broad, narrower towards the base. Calyx 2-3 lines, corolla 4-6 lines long.

In *Proc. Roy. Soc. Tas.* iii, 294 (1859) the sole remark by Mueller is :—

Eremophila Sturtii R.Br. in Sturt's Central Austral., App. p. 85. Barrier and Grey Ranges, Murray River, Darling River. Mr. Dallachy and Rev. Thos. H. Goodwin.

Then Bentham described the species in the following words :—

An erect, very much branched strong-scented and viscid shrub of several feet, glabrous or very minutely hoary-pubescent. Leaves narrow linear, usually ending in a hooked point, entire, contracted at the base and often petiolate, rarely above 1 inch long. Flowers "purplish," numerous but solitary in each axil, on pedicels of 3 to 4 lines. Calyx-segments obovate or oblong, membranous and rather rigid, obtuse, coloured and veined, rather variable in shape and size but usually attaining 4 or 5 lines when the flowering is over. Corolla pubescent, about $\frac{1}{2}$ inch long, the narrow base of the tube short, the upper part broadly campanulate, bearded inside, the four upper lobes short, broad and obtuse, the two uppermost more united than the others, the middle lowest lobe larger and broader than the others, notched or 2-lobed and woolly inside. Stamens included. Ovary very villous, with two or three pairs of ovules to each cell. Fruit when young like that of *E. Mitchellii* but not acuminate, not seen quite ripe. (B.Fl. v, 21.)

Bentham further says :—

Ovary very woolly, with two to four pairs of ovules to each cell.

Leaves narrow, linear *E. Sturtii*.

Leaves linear-lanceolate *E. Mitchellii*.

Tate ("Flora of South Australia") contrasts them thus :—

Ovary woolly ; leaves entire ; corolla small ; leaves

linear ; sepals obovate *Sturtii*.

Corolla $\frac{3}{4}$ in. ; leaves linear-lanceolate ; glabrous-

viscid *Mitchelli*.

It is possible to look upon *E. Mitchellii* as a variety of *E. Sturtii*, distinguished from the type chiefly by the glabrous corolla. But there are other differences, some of them ascertained by country people, and, although there are transition forms, I am of opinion that botanical science is best served by keeping them apart.

Botanical Name.—*Eremophila*, already explained, p. 211; *Sturtii*, in honour of the intrepid explorer, Captain Charles Sturt, the pioneer in much of our dry country. Notes on his travels, with bibliographical references, will be found in the Report, Australasian Association for the Advancement of Science, Adelaide, 1907 (Vol. xi, p. 167), by the present writer.

Vernacular Name.—Because of the viscid exudation which pervades all parts of this plant, it often goes under the name of "Turpentine Bush."

Timber.—A tall shrub; wood of a grey colour, hard, close-grained, and nicely marked. It has been named "Scentless Sandal Wood" in a letter to me, but I am not aware whether the presence or absence of perfume is a real difference between it and *E. Mitchellii*.

Exudation.—This has already been alluded to, and a chemical investigation of the resinous matter remains to be made.

Habitat.—Speaking generally, it is found in drier country than *E. Mitchellii*. It not only occurs in western New South Wales (where the type came from), but also in South Australia and the Northern Territory. It also occurs in Queensland. It is represented in the National Herbarium, Sydney, by the following specimens (excluding Sturt's type).

NEW SOUTH WALES.

The Darling River is a vague locality, but reference to Sturt's map accompanying his "Narrative of an Expedition into Central Australia" shows that he was only on the Darling from a little above Wentworth, leaving it to go north by north-west in the vicinity of Menindie.

Tibooburra, at the north-west angle of the State (O. E. Couch).

Thackaringa, west of Broken Hill, near South Australian border (J. E. Carne).
 "Turpentine bush," Tarrawangee, north of Broken Hill (Assistant Forester W. B. Loder). Broken Hill (E. C. Andrews).

Paldrumatta Bore, *via* Wilcannia (P. Corbett).

"Turpentine Bush. Said to differ from the Budda on account of its mode of growth, colour of flowers, and non-palatability of it to stock. It appears much more bushy from its base and more twiggy in its branches. It has a smaller leaf, and is certainly distinct in its pale purplish flowers. It generally grows in dry places, usually in small clumps by itself, away from the common Budda, *E. Mitchellii*. It is easily recognised by its bushy habit, colour of flowers, and occurrence in dry situations." Nulty-Toorale (J. L. Boorman).

Warrego River (E. C. Close).

Mt. Oxley, near Bourke (E. Bêche).

"Turpentine Bush." Is full of turpentine. A low bush up to 8 or 10 feet high, with many stems branching or springing from one root. Useless as a fodder plant, but sheep eat the flowers when they fall. Has pretty pink and white flowers. Found only on red soil. (A. W. Mullen, Bourke.)

"Sticky-leaf shrub, like Budtha, 8 feet high." South Nymagee (R. H. Cambage).

NORTHERN TERRITORY.

"Narrow-leaved Berrigan." Idracowra Station, Finke River (G. F. Hill, No. 33, in Ewart and Davies' Flora).

EXPLANATION OF PLATE No. 247 (IN PART).

- i. Flowering twig from Paldrumatta, *via* Wilcannia (a locality as near to that of the type as I have got).
- κ. Bud.
- l. Flower.
- m. Corolla laid open.
- n. Pistil.

(κ—n from Paldrumatta.)

- o. Side view of fruit (from Mueller's "Atlas of Myoporinous Plants").

PHOTOGRAPHIC ILLUSTRATION.

Turpentine Bush, Bourke District. "The Turpentine bush is 1½ inches from the right-hand edge of the picture and 2 inches from the top edge. It is a little round bush of dense foliage and many stems from one root, and rarely grows higher than 8 feet. It and the 'Budda' are almost identical in leaf and flower, but different in appearance, as the Budda generally has only one stem. The Budda and Turpentine only grow on red sandy or loamy soil out of reach of flood, and are not edible for stock." (A. W. Mullen, L.S., photo.)

APPENDIX.

INSECTS AND TIMBER TREES,

PART I.

I would like to invite the attention of my readers to the fact that little has been done to bring together, in a comprehensive manner, the facts concerning the relations between insects and particular groups of trees in Australia. If we take the most economically important of our trees—the Eucalypts, we find the information much scattered and not readily available to the non-entomologist.

A long series of very valuable articles entitled “Insects injurious to our native Eucalypti,” by C. A. Wilson, will be found in the weekly, “The Farm and Garden” (Adelaide), Vol. I (1858-9) to Vol. V (1862-3).

As a very general rule, particularly in Entomology, if a zoological writer mentions Eucalyptus in connection with a species, I note it, but if he does not mention that genus I am ignorant that Eucalyptus is implied, and so what I have written is bound to be incomplete for that reason alone. I am further quite aware that it is perfectly impossible, and would serve no practical purpose, to enumerate all the insects which, at one time or another, are captured on Eucalyptus, but it is only an Entomologist who can make the necessary discrimination.

Our Government Entomologist (Mr. W. W. Froggatt) has written brief monographs on Insects and Wattles, Insects and the Kurrajong, &c. (*Agric. Gazette, N.S.W.*), which whet our appetite for more.

The work of bringing together the notes and papers on Insects and Eucalypts is so great that I could not ask one of our overworked entomologists to undertake it, and so I attempted to make a beginning myself; and my little effort is offered quite apologetically, by one who is quite ignorant of entomology, in the hope that it may be suggestive, and that it may lead, sooner or later, to the idea being developed by an entomologist, with suitable illustrations.

I am aware that the compilation of complete lists of insects found on our Eucalypts (many of them, alas! pests) would be too voluminous, and would not meet the present need. My treatment of the subject is a compromise.

I am sure my entomological friends will pardon me if I point out that their work will have enhanced value if additional pains be taken to apply to botanists for the names of the plants concerned. To merely say that an insect was taken on “Eucalyptus sp.” for example, is regrettable if it can be avoided.

The arrangement of the families of insects follows, as far as possible, that of Mr. Froggatt’s “Australian Insects.”

Destruction of Forests.—We are chiefly interested in Insects by reason of the mischief they work on our forests, but we can only cope with their visitations if we know about the insects themselves, and this is my apology in submitting this preliminary contribution to Forest Entomology. We want our foresters and the general public to take a greater interest in the subject, and improved knowledge will inevitably lead to better conservation of the forests.

Insects are difficult to deal with owing to the extensive and irregular areas of many of our forests. Preventive rules are noted at Schlich's "Manual of Forestry," iv, 144.

A few years ago it was not generally known that White Ants will attack living trees, but in New South Wales, at least, this is well ascertained now. Sometimes the first obvious evidence that anything is wrong with a particular tree is when, weakened by the insidious enemy, it has been blown down by a gust. A bushman's observation is that White Ants in a tree are to be found on the opposite to the "weather" side. Mr. E. H. F. Swain* has briefly written on the ravages of White Ants in a few of our northern timbers.

There are some notes on the ravages of insects in forests by Rev. Peter Macpherson,† and the late Dr. A. W. Howitt.‡

For information on Chafers (allied to our King Beetles) stripping trees in Britain, see White's "Selborne."

An extract from Dr. Howitt's observations on the destruction of trees by Lepidoptera in Victoria is worth repeating.

I have spoken just now of the destruction of Eucalypts by other means than the hand of man, for clearing his holdings, and the following are the facts I have gathered concerning the subject:—

About the year 1863–4 I observed that a belt of Red Gums (*E. rostrata*) which extended across the plains between Sale, Maffra and Stratford were beginning to die. Gradually all the trees of this forest, as well as in other localities, perished. At that time my attention was not drawn to the investigation of the cause. Later, however, probably about 1878, I observed the Red Gum forests of the Mitchell River Valley to be dying, just as those at Nuntin and elsewhere had died years before. I then investigated the subject, and found the trees were infested with myriads of the larvæ of some one of the nocturnal Lepidoptera. These devoured the upper and under epidermis of the leaves, thus asphyxiating the tree. Some 75 per cent. of that forest died that year, and subsequently almost all the surviving trees died also. Since then I have observed the same larvæ at work, some of which, when kept until they had passed through their several metamorphoses to the perfected insect, were pronounced by Professor McCoy to be examples of *Urubra lugens*. Whether this insect has in all cases been the agent in destroying the Red Gums I cannot affirm. Probably not wholly, but I am satisfied that the greater part of the Red Gum trees which have died in Gippsland from obscure causes have been killed by its agency.

The inference may be drawn from the above observations of forests having been killed by infesting insects, that each species of Eucalypt, or, at any rate, each group of allied species, will have attached to it some particular insect which preys upon it rather than upon any other Eucalypt. If this is so, we ought to find some one tree selected for destruction out of a number of species; and it is the case with the

* "The Forests of the Bellinger River," Bulletin No. 5, Forest Department, New South Wales.

† *Proc. Roy. Soc. N.S.W.* xix, 85, 86, 91 (1885).

‡ *Trans. Roy. Soc. Vict.*, ii, 112.

Red Gum, for it falls a victim to *Urubra lugens*, whilst its neighbours, the White Gum (*E. viminalis*), the Swamp Gum (*E. Gunni*) (*E. ovata*, J.H.M.), and the Yellow Box (*E. melliodora*) are untouched and in vigorous health.*

I feel little doubt that this will explain why it is that in many parts of the country, at all elevations above sea level, certain tracts of dead forest are to be found. Twenty-five years ago I noticed that during the course of three years all the White Gums (*E. viminalis*) in part of the Omeo district died, whilst *E. pauciflora* (*coriacea*) and *E. stellulata* remained alive.

I have said that in my opinion the increased growth of the Eucalyptus forests since the first settlement of Gippsland has been due to the checking of bush fires year by year, and to the increase thereby of the chance of survival of the seedling Eucalypts, and to the same cause we may assign the increase of the leaf-acting insects which seem in places to threaten the very existence of the Red Gum.

Bush fires, which swept the country more or less annually, kept down the enormous multiplication of insect life, destroying myriads of grasshoppers and caterpillars, which now devastate parts of the Gippsland district, spoiling the oat crops and eating the grass down to the ground.

The ravages of the larvæ of Lepidoptera are at present greatly aided by the sickly state in which many of the Red Gum forests in Gippsland now are. The long-continued use of the country for pasturage, and the trampling of the surface of the ground by stock, has greatly hardened the soil, so that rain which formerly, in which I may call the "normal state" as regards Eucalypts, soaked in, now runs off. In the course of successive droughty seasons the soil of such places becomes thoroughly dry and hard, so that the Red Gum is deprived of much moisture which it otherwise would have in reserve. The trees are wanting in vigour and thus unable to withstand the attacks of insect pests.

While at page 224 I give a list of insects frequenting (chiefly) our Gum-trees, I proceed to give a specimen of the way I should like an arrangement to be also made in the reverse direction, that is to say, with the plant singled out, and a list of the insects found on it. What I give was written out by me some years ago, without the aid of an entomologist, and it is neither complete nor brought up to date.

The Swamp Mahogany (*Eucalyptus robusta*).

F. A. A. Skuse recorded the finding of a gall of the coccid *Brachyscelis munita* Schrad., on this tree (*Proc. Linn. Soc. N.S.W.*, 2nd ser., v, 268). For a full account of this gall, found on the same tree, see *op. cit.* vii, 360, 361, where W. W. Froggatt, in his *Notes on the Family Brachyscelidæ*, remarks that the leaves of *E. robusta* appear to be attacked by many insect larvæ. In a further series of the same *Notes*, Froggatt (*op. cit.* viii, 344) records the finding of *Opisthoscelis pisiformis* (n.sp.) on *E. robusta*.

Mr. Froggatt exhibited a twig of this tree attacked by "lerp"-making *Psyllæ*, and observed that a large number of these trees had their foliage entirely destroyed by the countless numbers of the larvæ of these insects (*Proc. Linn. Soc. N.S.W.*, 2nd ser., vii, 380).

In the Sydney district this is one of the Eucalypts frequented by the noisy Cicada or "Locust," known to boys as "The Double Drummer," and to entomologists as *Thopha saccata* Amyot (Froggatt, *op. cit.* x, 528).

The Rev. T. Blackburn describes (*op. cit.* ix, 95) a new beetle, *Ceratognathus froggattii*, belonging to the family Pectinicornes, bred by Mr. Froggatt from *E. robusta*, collected at Botany Bay. Froggatt (*op. cit.* p. 120) gives the following notes in regard to this little stag-horn beetle:—"The larva lives in the bark of *E. robusta*, the trunk of which, when the trees are large, is covered with a thick, felty, fibrous outer bark, which shelters numbers of small insects and their larvæ. The *Ceratognathus* excavates oval chambers about half an inch below the outer surface, where it lies lightly curled round. At Botany I found the beetles and pupæ in these cavities early in November."

* I have observed, however, in some localities, *E. melliodora* and *E. piperita* have been slightly attacked by *Urubra lugens*.

The larvæ of the beetle *Mæchidius rugosus* live in the thick bark of *E. robusta*, where they pupate. (Froggatt, *op. cit.* x, 331.)

The soft young foliage of *E. robusta* is much frequented by many of the leaf-eating beetles such as *Anoplognathus* (several species) and the beautiful pale green *Xylonychus eucalypti* Boisd., which is often found feeding upon it in November and December. There is a large nut-like gall formed on the branchlets by the larvæ of an undescribed gall-fly (Cynipidæ); and the homopterous galls of the four-horned *Brachyscelis* (*B. munita* Sch.) sometimes form great masses as big as a man's head upon the branches.

Dactylopius eucalypti Mask., which was described by Maskell under the bark, was found by Froggatt burying itself in the young leaves and causing them to wither and become discoloured. Mr. Maskell records this fact from the former's notes in the *Trans. N.Z. Inst.*, vol. xxv, p. 233, 1892.

Mr. Froggatt has bred the beautiful wood-moth *Charagia splendens* Scott, from a tree of *Eucalyptus robusta* (*Proc. Linn. Soc. N.S.W.*, 2nd ser., ix, 382). "This species breeds annually, forming a thick felty bag all round the branch, and boring a hole several inches down the stem or branch, the larvæ pupating about the middle of December, and the moth coming forth three or four weeks later."

Galls.—Insects on plants suggest galls, and there is a charmingly illustrated, copious, general account of Galls in "Natural History of Plants" (Kerner and Oliver), ii, 527–554, from which the following notes (not, however, referring to *Eucalyptus*) have been taken :—

Certain members of the Arachnoidea, Diptera and Hymenoptera, which attack and penetrate the tissues of living plants and incite the formation of peculiar excrescences, are known as gall-mites, gall-gnats, and gall-wasps. . . .

It has been proposed recently to substitute the word *cecidium* for *gall*, and to distinguish the excrescences as myco-*cecidia*, nemato-*cecidia*, phyto-*cecidia*, diptero-*cecidia*, &c., according as they owe their origin to Fungi, Thread-worms (Nematodes), Gall-mites (Phytoptus), Gnats (Diptera), &c.

The authors go on to say : "A systematic classification of this sort, on the lines of the classification of animals, might be of use to Zoologists, but to the Botanist its value is only secondary. He must, as in other similar cases, keep to morphology as the primary ground of classification, and has to arrange the structures according to their agreement in development. Moreover, in a general review, it is necessary to consider whether a whole group of plant-organs or one alone undergoes metamorphosis; and the starting-point of the out-growth must also be ascertained, *i.e.*, whether it is the foliage-leaves, floral-leaves, stems or root structures, which are the headquarters of the excrescence."

When the gall originating as the nest or temporary habitation of a single animal or colony of animals is limited to a single plant-organ it is said to be *simple*; if, on the other hand, several plant organs are concerned in its production, it is said to be *compound*.

Simple galls may, for convenience of description, be divided into—

1. Felt galls.
2. Mantle galls.
3. Solid galls.

The *Felt galls* are chiefly due to hypertrophied epidermal cells growing out into hairy coverings of various sorts and shapes; *Mantle and Solid galls*, however, are rather more complicated. In both cases insects are present in swellings of various descriptions, but there is this essential distinction :—the *Mantle-gall* is a hollow structure which, although it may arise in various ways and assume a multiplicity of forms, always has a portion of the surface of the affected organ for its lining—in other words, it is a chamber formed by hypertrophied growth *around* the place occupied by the insect. In the *Solid gall*, on the other hand, some spot is pierced by an insect, and the eggs deposited in the tissues (not on the surface), the punctured spot forms a swelling with the larva inside, but the lining of the chamber is in no sense a portion or development of the original surface of the organ affected. Again, while in most *Mantle galls* the cavity of the gall is in open communication with the outside, and the insect can escape by this aperture (though this is not invariably the case), in the solid gall there is not such opening, and the insect has to bore its way out. Needless to say, of both these types there are numerous modifications, but they fall into the two classes (of Mantle and Solid galls) according to their mode of development.

The agents concerned in the production of galls are enumerated as follows in Connold's work (British Vegetable Galls):—

1. Acarina or Mites.
2. Anguillula or Eel-worms.
3. Coleoptera or Beetles.
4. Diptera or Flies with two wings.
5. Fungi.
6. Hemiptera-Homoptera or Aphides.
7. Heterocera or Moths.
8. Hymenoptera or Wasps (small).

Numbers 1, 2, 5, do not, of course, refer to insects.

But collections and notes on vegetable galls are required in Australia. Very few are engaged in the work. Will any one help?

"The Growth of Vegetable Galls," W. W. Froggatt (*Agric. Gaz. N.S.W.*, April and May, 1898), is a popular account of galls, together with a list of the principal galls interesting to us in Australia, and is a charming introduction for a beginner.

ORDER II (ORTHOPTERA).

Family Termitidæ (White Ants.)

In the year 1894, when Curator of the Technological Museum, I arranged with Mr. Froggatt, then Custodian of the Economic Zoology in that institution, and now Government Entomologist, to issue the enclosed circular, and I reproduce it because we still have so much to learn in regard to the relative powers of resistance of the various *Eucalyptus* timbers. We know, for example, that White Ants find the Ironbarks of New South Wales and Queensland (our most esteemed timbers) especially palatable, but we know very little of the White Ant question from the botanical side. I hope that steps will be taken to fill up that hiatus in our knowledge, which I hope may have some classificatory value in regard to species.

I am describing the Termitidæ of Australia, better known as "White Ants," a group of insects of which very little is known and whose destructive habits give them great economic interest. I forward this to you in the hope that if you cannot help me in obtaining specimens from your district you will pass it on to someone who can.

The following notes will be a guide to collectors:—

(1) The white ants should be collected from their nest, or wood they are infesting. Workers and soldiers can always be found, but the Queen, which is generally found in the centre at the bottom of the nest, is of great value in determining the species; she resembles a white grub with an ant's head, and is often as thick and as large as one's finger. The winged forms of the young Queens or males are only found in the nest at certain seasons, but should always be sent when found. Thus there are five sorts of ants in each nest,

2. A small bottle, well corked, containing spirits of wine (whisky, gin or any other spirit will do), is used in which to put the insects as they are picked up. One's fingers, a small stick, or a pair of forceps can be used to pick them up.

3. Care should be taken not to mix the species from different nests, for though much alike, very distinct species live close together.

4. Notes accompanying the specimens and numbered to match each bottle (which should also be numbered when more than one is sent) giving both the outward and inward form of the nest, or other notes on their habits, will be of great value, and all help will be gladly acknowledged and each correspondent will get full credit for assistance rendered when the work is printed.

5. Pack the bottles in a box or tin with a little wadding, so that they cannot shake about. Label it "Specimens of Natural History only," and send it by post. (W. W. Froggatt.)

It will be seen presently how valuable have been Mr. Froggatt's contributions to a knowledge of White Ants as the result of that campaign, but until we know the timbers affected by pests, and to what extent, we only know our lesson imperfectly.

Mr. Froggatt's work will be found in "Australian Termitidæ," Part I (*Proc. Linn. Soc. N.S.W.*, xx, 415, 1895). (This is a preliminary paper, quoting the literature, and setting out the problem generally.) Part II is found *op. cit.*, xxi, 510 (1896). This deals with Classification. *Glyptotermes eucalypti*, with Plate XXXV, figs. 5-5a, is found by cutting off the loose bark from *Eucalyptus robusta*. Part III, *op. cit.*, xxii, 721 (1897), is a continuation of Part II. Both Parts are illustrated.

Then we have some popular illustrated articles by Mr. Froggatt in the *Agric. Gazette, N.S.W.*, as follows:—

(a) "White Ants, with some account of their habits and depredations." Vol. viii, p. 297 (1897).

(b) "The White Ant City. A Nature Study." Vol. xiv, p. 726 (1903).

(c) "White Ants (Termitidæ), with suggestions for dealing with them in houses and orchards." Vol. xvi, p. 632 (1905).

Then comes the admirable general account of them in his "Australian Insects," but let me again suggest more attention to their association with species of *Eucalyptus*, both in the living tree and in timber.

There is a coloured plate of *Termes australis* Hagen, in French's "Destructive Insects of Victoria," Part II.

In *Agric. Gaz. N.S.W.*, xxiii, 237 (1912), is a reference to the report of a committee appointed by the Indian Railway Board on the effects of White Ants on Sleepers of Australian timbers (*Eucalyptus* practically entirely) imported into India.

The following popular account of White Ants (from a non-Australian source) was reprinted in my "Useful Native Plants of Australia" (1889):—

Termites, or White Ants.—Next to locusts, they may be reckoned the most destructive insects known to man. They live in societies, often prodigiously numerous, and, like the bee and ant, are composed of three sorts of individuals. In all stages of their existence, save that of the ovum, they are active, carnivorous or omnivorous; and are, beyond all doubt, the greatest pest of tropical (and subtropical)

climates, destroying all articles of furniture made of wood, clothes, &c., and even entering the foundations of houses and eating out the whole interior of the timbers, so that while they appear perfectly sound externally, they will fall to pieces under the slightest blow. . . . The Termites generally make their approaches to the nest under ground, descending below the foundations of houses and stores at several feet from the surface, and rising again either in the floors or entering at the bottoms of the posts of which the sides of the buildings are composed, following the course of the fibres to the top, and having lateral perforations or cavities here and there. While some of them are employed in gutting the posts, others ascend from them, entering a rafter or some other part of the roof, in search, as would seem, of thatch, which appears to be their favourite food; and if they find it, they bring up wet clay, and build galleries through the roof in various directions, as long as it will support them. In this manner a wooden house is speedily destroyed; and all that it contains is, at the same time, subjected to the ravages of these destructive insects.

In carrying on this business they sometimes find, by some means or other, that the post has a certain weight to support, and then, if it is a convenient track to the roof, or is itself a kind of wood agreeable to them, they bring their mortar; and, as fast as they take away the wood, replace the vacancy with that material, which they work together more closely and compactly than human strength or art could ram it. Hence, when the house is taken to pieces, in order to examine if any of the posts are fit to be used again, those made of the softer kinds of wood are often found reduced almost to a shell; and almost all of them are found transformed from wood to clay, as solid and as hard as many kinds of stone that are used for the purposes of building. (*Treasury of Natural History*.)

The above is taken from an account of *Termes bellicosus*, but the description more or less applies to other species. For an account of the life-history of *Termes* see the book above quoted, also *Cassell's Natural History*, vi, 137, which is adorned with some splendid illustrations of this genus. See also appendix to Carpenter's *Zoology*.

Since the above was written, the results of Dr. E. Mjöberg's Swedish Scientific Expeditions to Australia have been published (No. 19, *Isoptera*) in the *Arkiv för Zoologi* (Stockholm, 1920), which much extends our knowledge of Australian white ants.

Family Phasmidæ (Stick or Leaf Insects.)

The late William Macleay published a paper "On a species of the Phasmatidæ destructive to Eucalypts" (*Proc. Linn. Soc. N.S.W.*, vi, 536) and named it *Podocanthus Wilkinsoni*. The insect came from the vicinity of the Binda Caves, county of Westmoreland, N.S.W. . . . "he had found these insects in amazing numbers in that locality; that the trees for miles around were completely denuded of leaves, and that the dead and dying insects were lying beneath the trees almost in heaps." The question of the destruction of Eucalypts by this and allied insects was discussed, for "it is rare in any part of the country in the summer season to find a gum tree without a few of these insects grazing on it."

For a figure and further particulars, see Froggatt's "Australian Insects."

Family Gryllidæ.

Mr. W. W. Froggatt (*Proc. Linn. Soc. N.S.W.*, xvi, 8, 1891) exhibited some grasshoppers which had been taken near Sydney, frequenting the flowers of *E. corymbosa*, in order to capture the common honey bees (*Apis mellifica*) visiting the flowers.

ORDER IV (HYMENOPTERA).

(Which include Bees, Ants, Wasps.)

Family Tenthredinidæ (Sawflies).

The repulsive larvæ of *Perga dorsalis* Leach, sometimes called the Gum Saw-fly, wriggling and squirming in masses, are well known to every person in the bush. They squirt a dark-coloured liquid at you, and soon strip a Eucalyptus sapling of its leaves. See "French's "Handbook of the Destructive Insects of Victoria," Part III, Plate LII. Mr. Froggatt has a note on the life-history of *Perga* in *Proc. Linn. Soc. N.S.W.*, xv, 283 (1890). He states that he has not found them on any plants other than Eucalypts. The Steel-blue Saw-fly, *P. dorsalis*, he found on *E. obtusiflora* at Sydney, *P. latreillei* and *P. foersteri* on *E. corymbosa* at Sydney.

Phylacteophaga eucalypti is the subject of "A new genus and species of Saw-fly," see W. W. Froggatt, *Proc. Linn. Soc. N.S.W.*, xxiv, 130 (1899), with a plate. The larvæ feed on the foliage of *E. globulus*.

Family Cynipidæ (Gall-flies).

"The gall wasps belonging to the genus *Cynips* are responsible for most of the galls of commerce, chiefly produced upon the leaves or branchlets of many different oaks (*Quercus*.—J.H.M.). . . . These little creatures are well represented in Australia, being most plentiful upon *Acacia* and *Eucalyptus* trees, yet very little attention has been paid to this group by our Entomologists, and there is a rich field to work at . . ." (Froggatt in *Agric. Gaz. N.S.W.*, ix, 388, 1898).

Family Chalcididæ (Parasitic Wasps).

Following are some Eucalypts which I have submitted to Mr. Froggatt, and which he informs me have been attacked by various indeterminate Chalcid wasps:—

1. *E. capitellata* Sm. (Stringybark).

Galls on branchlets. Ourimbah State Forest, near Gosford (W. A. W. de Beuzeville).

2. *E. hemiphloia* F.v.M. (Grey Box.)

A specimen collected by Backhouse on the Upper Hunter, N.S.W., No. 9 (Herb. Kew) has the buds so swollen by the punctures of an insect that the specimen presents an appearance so peculiar that it has been referred doubtfully to *E. dumosa*. It, however, belongs to *E. hemiphloia* F.v.M., and this swelling of the calyx is not uncommon in the genus.

3. *E. maculata* Hook. (Spotted Gum.)

The larvæ of some microscopic Chalcid wasp have attacked the leaves, forming dots, both at Casino, Richmond River (G. E. Rummery), and at Theresa Park to Werombi, Camden district (J.H.M.).

4. *E. Moorei* Maiden and Cambage. A dwarf species from the Blue Mountains.

The calyx is sometimes swollen, while the operculum remains stationary in size. This malformation is figured at fig. 7, Plate 25 of Part V of my "Critical Revision of the Genus *Eucalyptus*" as *E. stellulata* (narrow-leaved form).

5. *E. oleosa* F.v.M. (a Mallee).

Large cylindroid gall, tip of branch. Lake View, near Griffith (Line 75). (W. D. Campbell, L.S.)

6. *E. pallidifolia* F.v.M.

The punctures forming galls on the leaves of this tropical species are caused by some small Chalcid wasp.

7. *E. piperita* Sm. (Sydney Peppermint).

I have seen buds of this species, from the Illawarra, malformed in precisely the same way as those referred to as *E. Moorei*.

8. *E. populifolia* Hook. (Bimble Box).

Warren (J. L. Boorman); galls on the leaves and twigs, East Mirrool (W. D. Campbell); also Pilliga Scrub (Dr. J. B. Cleland).

9. *E. Preissiana* is another species which has insect markings on the leaves.

(See fig. 4a, Plate 77, Part XXII of my "Critical Revision of the Genus *Eucalyptus*.")

10. *E. robusta* Sm. (Swamp Mahogany).

Chalcid wasp galls form small rounded protuberances on the buds and leaves of large trees in the Botanic Gardens, Sydney (J.H.M.).

11. *E. siderophloia* Benth., var. *glauca* (Broad-leaved Ironbark).

Spherical galls on leaves, State Forest near Dubbo (A. R. Samuels).

12. *E. Sieberiana* F.v.M. (Coastal Mountain Ash). Ourimbah State Forest, Gosford (W. A. W. de Beuzeville).

Mr. Froggatt says that *Eurytoma eucalypti* is a small black species, slightly over an eighth of an inch, which comes out of *Eucalyptus* galls at Uralla, N.S.W., and that *Dinoura auriventris*, a very curious, metallic-tinted species, a quarter of an inch in length, has been bred out of *Brachyseelid* galls.

Tepperella trilineatus Cameron was found on *E. melanophloia* F.v.M. (Silver-leaved Ironbark) at Warialda, N.S.W. *Tepperella* sp. was found on *E. miniata* A. Cunn. (?), at Kundala, Cloncurry district, N.Q., by Keith Kennedy.

In a paper on Parasitic Hymenoptera in *Proc. Linn. Soc. N.S.W.*, xxv (1900), William H. Ashmead has *Eurytoma eucalypti* bred from *Eucalyptus* galls (p. 336); *Systolomorpha thyridopterygis* on a Lepidopteron, *Thyridopteryx* sp. (p. 340); *Terobiella flavifrons*, from a lumpy gall on a *Eucalyptus* twig (p. 344); *Cælocyba nigrocincta*, from an Agromyzid gall on *E. corymbosa* (p. 344); *Pteroptrix Maskelli* from a Psyllid on *Eucalyptus* (p. 346); *Tetrastichodes froggattii* "from a small shot gall on *Eucalyptus*," (p. 347).

Family Thynnidae (Flower Wasps).

The males of *Thynnus* fly about the flowers of *Leptospermum* and *Eucalyptus*, and when captured bite and pretend to sting by turning up the tip of the abdomen, which ends in a horny, harmless process." (Froggatt, p. 100, "Australian Insects.")

Family Apidae (Bees).

In French's "Destructive Insects of Victoria," Part IV, is a coloured plate of "The Apple-tree Destroyer," *Prosops pedisequus* Buckton, which inflicts great destruction on the cultivated Apple. Mr. French says that it has been ascertained that the natural home of the insect is in the wood of young Eucalypts.

Mr. D. G. Stead exhibited specimens of a "Carpenter Bee," *Lestis aratus* Smith, from the stem of a young Eucalypt in which they had bored—a departure from the usual habit, in accordance with which choice is made of the flowering stalks of the Grass tree (*Xanthorrhæa*). (*Proc. Linn. Soc. N.S.W.*, xxiv, 476, 1899.)

ORDER V (COLEOPTERA).

(Beetles.)

See also Part LXIII, p. 115, under Manna.

Family Lucanidae (Stag Beetles).

Mr. Froggatt recorded that he obtained the Golden Stag-beetle (*Lamprima latreillei*) from a dead log of Peppermint (*Eucalyptus nova-anglica*) at Uralla, N.S.W.

Ceratognathus froggatti Blackburn. The larva lives in the bark of *E. robusta* at Botany. It excavates oval chambers about half an inch below the outer surface, where it lies lightly curled round (*Proc. Linn. Soc. N.S.W.*, xix, 120, 1894).

Family Scarabæidae (Digger and Chafer Beetles).

In a paper "On the habits and description of a destructive beetle (*Melonontha destructor*)," in *Trans. and Proc. Philos. Soc. Adelaide*, for 1877-78 (Vol. 1), p. 61, Otto Tepper discusses the destruction of Eucalypts (e.g., *E. viminalis* (?) and *E. odorata*) in the Monarto district of South Australia, through the stripping of the leaves by this new beetle.

Machidius rugosus.—The larvæ live in the thick bark of *E. robusta* (near Sydney), in which they pupate. The beetle is found in crevices or under loose bark (*Proc. Linn. Soc. N.S.W.*, xx, 331, 1895).

Xylonychus eucalypti is a large cockchafer-like beetle about an inch long; it is of a delicate pale grass-green colour, its under-surface and legs darker and thickly clothed with fine hairs. It feeds about Sydney on the foliage of *E. robusta* (Froggatt, p. 157).

Anoplognathus viridaneus, the King Beetle, is our largest cockchafer; *A. analis* is another, which destroys so many Eucalypts in the Sydney district and elsewhere.

Family Buprestidæ (Jewel Beetles).

Mueller named the Western Australian species *Eucalyptus buprestium* because buprestid beetles were attracted by its honey flow. He ("Eucalyptographia," under *E. buprestium*) quotes Tepper as finding large numbers of large and showy *Stigmodera* beetles of four species on *E. uncinata* in Yorke's Peninsula, S.A. Mr. Tepper quotes one species as frequenting the flowers of *E. oleosa*. These beetles do not eat the leaves of the Eucalypts.

Under the name of "She-oak Root Borer" (*Stigmodera heros*), Mr. C. French, Part V, Plate XXI (*op. cit.*), figures this species, which he says is very destructive and is commonly found in Eucalypts in the drier country.

Family Cloidæ (Powder-post Beetles).

These are pests in furniture. See a brief and general article entitled "Furniture and timber boring insects," by C. French, Jnr. (*Australian Forestry Journal*, Oct., 1919, p. 299). See also an article "The Powder-post Beetle, *Lycteus brunneus*," with a figure, by Froggatt, in *Agric. Gaz. N.S.W.*, April, 1920, p. 273.

Family Tenebrionidæ (Meal-worm Beetles).

In *Proc. Linn. Soc. N.S.W.*, xi, 520 (1887), Mr. William Macleay gave an account of a group of the Tenebrionidæ called "Helæides." The genus *Pterohelaus* consists of flat insects, of pitchy or black colour, found under the loose bark of living Gum trees.

Family Lagriidæ.

Lagria grandis feeds on the foliage of young Eucalypts; it is the common *Lagria* about Sydney. (W. W. Froggatt, *Proc. Linn. Soc. N.S.W.*, xviii, 42, 1893.)

Family Curculionidæ (Weevils).

The well-known Snout Beetles, one of the largest and best defined groups of the Coleoptera.

Cherrus ebeninus is one of the large stout weevils common in the bush around Sydney, where it is usually found clinging to the twigs of the Bloodwood (*Eucalyptus corymbosa*). (Froggatt, p. 183.)

Under the name "Red Gum-tree Weevil," C. French, in his "Destructive Insects of Victoria," Part IV, figures *Strongylarhinus ochraceus*. The "Red Gum" of Victoria is *Eucalyptus rostrata*, but this beetle has also been extensively found in *E. melliodora*. Mr. French says, "It will have been frequently observed by persons travelling in Victoria that many of the boles or stems of our Gum trees are disfigured by large excrecences, which, at a distance, have the appearance of a swarm of bees which had settled upon the stem of a tree. Upon closer inspection, however, it will be found that this disfigurement has been caused by the depredations of certain weevils, which form the subject of the present chapter."

The Gonipterinae section comprises a number of diverse forms. The genus *Oxyops* contains a number of stout moderate-sized beetles which are remarkable for the curious habits of their legless slug-like larvæ, which, covering themselves with a slimy secretion, crawl about over the surface of *Eucalyptus* leaves, feeding upon the epidermis and covering their backs with their excrement. (Froggatt, p. 185.)

Oxyops concreta larvæ feed on the leaves of *E. longifolia*, only eating the outer surface and often completely skeletonising each leaf. Flemington and Rookwood, Sydney. *O. Hopei* larva similar in habits to that of *O. concreta*, but seems to gnaw the leaves in a more patchy manner. It feeds on the leaves of the Ironbark, *E. sideroxylon* (given as *E. leucoxyton*), at Bendigo, Victoria. (*Proc. Linn. Soc. N.S.W.*, xix, 124, 1894.)

Aterpus cultratus is found generally on small Gum trees. Collected by Mr. Froggatt on *E. corymbosa* at Manly, Sydney. (*Proc. Linn. Soc. N.S.W.*, xx, 328, 1895.)

Bryachus squamicollis has a wide range over Australia, and is usually found clinging to the twigs of stunted Gum trees; it measures about half an inch in length; is of a uniform dark chocolate brown, but thickly mottled all over with fine grey and black scales. (Froggatt, p. 185.)

The genus *Læmosaccus* contains a number of short, flattened weevils. They are generally found feasting upon the bark of freshly fallen tree-trunks, particularly *Acacia* and *Eucalyptus*, in which they also bore holes and deposit their eggs. (Froggatt, p. 188.)

The genus *Haplonyx* contains a number of curious, short, broadly-rounded beetles generally found clinging to the twigs of *Eucalyptus*, but their larvæ breed in the fleshy galls of the Brachyscelid coccids, where they destroy the gall-makers and pupate in the cavity.

Family Cerambycidae (Longicorn Beetles).

The genus *Phoracantha* contains a number of typical dark yellow or mottled brown beetles which in the larval state feed between the bark and sapwood of different Gum trees when the trees are dead or dying; several species are common in firewood blocks around Sydney. *P. tricuspis* lives in Ironbark timber. (Froggatt, p. 192.) For attacks by these beetles on trees of *E. hemiphloia* var. *albens* in the Gunnedah district; see this work, Part LVIII, p. 232. Mr. C. French calls *P. tricuspis* and *P. recurva* "Yellow-box borers," and at Plate CXII, Part V of his "Destructive Insects of Victoria," they are seen making galleries in the timber of the Yellow-box (*Eucalyptus melliodora*).

The larvæ of *Scolecobrotus westwoodi* feed on the stems of *E. corymbosa* at Botany, near Sydney, attacking them about a foot above the ground; it bores upward, hollowing out the branches; it then turns downward and gnaws round the top of the stem where it first entered, thus killing the branch. (W. W. Froggatt in *Proc. Linn. Soc. N.S.W.*, xix, 114, 1894.)

Under the name of "Masters' Gum Borer," C. French, in "Destructive Insects in Victoria," Part IV, figures *Tryphocharia mastersi*. He states that the larvæ of this

beetle do considerable harm to the saplings of *Eucalyptus amygdalina* (probably *E. radiata*), and that it has done much damage to cultivated trees of *E. globulus* around Melbourne, boring into the wood.

Under the name "Apple Gum Binnia," Mr. French, in his "Destructive Insects of Victoria," Part IV, figures *Bimia femoralis* Saunders, which bores into the timber of *Eucalyptus Stuartiana* F.v.M.

Under the name "Feathery Horned Yellow-box Borer" the same author, Part V, Plate CXVII, figures *Distichocera macleayi* boring into the wood of *Eucalyptus melliodora*. It also occurs in other species of the same genus.

Family Chrysomelidæ (Plant-eating Beetles).

These are foliage-destroying insects, as a rule small. The genus *Edusa* contains a number of bright metallic coloured beetles of oval form, which are chiefly found among the foliage of Eucalypts. (Froggatt, p. 202.)

The genus *Paropsis* is the most extensive and characteristic of all our plant-eating beetles. They are found chiefly upon the foliage of young Eucalypts. (p. 203). The active larva of *Paropsis variolosa* crawls about on the leaves of *E. corymbosa*, on which it feeds. (W. W. Froggatt in *Proc. Linn. Soc. N.S.W.*, xviii, 38, 1893.)

The genus *Rhizobius* contains a number of small black beetles, finely punctured and clothed with pubescence that gives them a rusty tint. *R. ventralis* is very common in the bush on young Eucalypts that are infested with *Eriococcus coriaceus* (p. 211).

Family Bostrychidæ (Auger Beetles).

The larvæ of *Apati collaris* feed on the dead wood of various species of *Eucalyptus*, living chiefly on the sapwood, which is completely riddled with irregular parallel channels which often cross and run into each other, and are all filled in behind as the insect moves along. Collected from *E. hamastoma* at Hornsby, near Sydney. (*Proc. Linn. Soc. N.S.W.*, xix, 123, 1894.)

ORDER VI (LEPIDOPTERA).

(Butterflies and Moths.)

Rhopalocera (Butterflies). Heterocera (Moths.)

For a statement of the differences between Butterflies and Moths, see Froggatt, p. 230. The classification is, however, artificial, for there are "Connecting-link Moths" (p. 232).

Family Hepialidæ (Wood Moths).

They lay their eggs upon the bark of different forest trees; the little caterpillars, after feeding for a short time on the surface, tunnel into the tree-trunk, becoming fleshy naked grubs which bore cylindrical chambers of various forms in the timber, in which they sometimes remain for years, finally pupating in the burrows. The moths are

generally found clinging to the tree trunks, where they are easily captured (p. 239). The moths often attain a large size. The Wood-moths are of special interest to the botanist. Mr. Froggatt's paper, in which he acknowledges his indebtedness to Mr. R. Thornton, of the Newcastle district, N.S.W., "Wood Moths, with some account of their life-histories" (*Proc. Linn. Soc. N.S.W.*, xix, 375, 1894), may be referred to. In that paper he deals with the following species:—

Eudoxyla eucalypti (?). It is unfortunate that the name *Zeuzera* (*Eudoxyla*) *eucalypti* was given to the Wattle Goat-moth, as it never frequents any species of *Eucalyptus*, but confines itself to feeding on the timber of Wattles (*Acacia*). It is figured in French's "Handbook of the Destructive Insects of Victoria," Part III, Plate L.

Eudoxyla liturata is a moth which measures from 7 to 8 inches across the wings. The larvæ are found in the stems of several *Eucalypts*, but it shows a marked preference for that of the "Grey Gum" (perhaps *E. propinqua*).

Eudoxyla macleayi is the largest species of the genus, specimens measuring $9\frac{1}{2}$ inches across the forewings. The larvæ have been watched for four years in the trunk of the White Mahogany (*Eucalyptus acmenoides*).

Mr. Froggatt refers to Mr. Olliff's paper on the moth, called by Mr. Scott *Leto stacyi*, "Notes on *Zelotypia stacyi*, and an account of a variety." (*Proc. Linn. Soc. N.S.W.*, xii, 469, 1887). It feeds on the stem of the Grey Gum (*E. tereticornis*), but the usual name for the Grey Gum is *E. propinqua*.

Mr. Froggatt also describes *Charagia splendens*, and says the species breeds annually, forming a thick felty bag all round the branch, and boring a hole several inches down the stem or branch. Mr. Thornton gives the host as Grey Gum (*Eucalyptus tereticornis*) and Stringybark (*E. leucoxydon*). *E. leucoxydon* is quite wrong, and may be *E. capitellata*. The names of the host plants in Mr. Froggatt's paper (which is most interesting) should be revised. It is figured in Scott's "Australian Lepidoptera," and the author says it is found dwelling in juxtaposition with *C. lignivora*.

Charagia lignivora. It is figured on Plate II of Scott's "Australian Lepidoptera," and he states that the larvæ exist in considerable abundance in the interior of the saplings of *Casuarina*, *Callistemon*, *Eucalyptus*, *Dodonæa*, *Acmena* (*Eugenia*), and he figures it on *Evodia micrococca*. Under the name "Green Hanging Moth of the Apple," to which fruit tree it does much damage, C. French has figured it in his "Destructive Insects of Victoria," Part IV. He states that the moth had hitherto confined itself to native trees.

Family Psychidæ (Bag or Case Moths).

One often hears them called Case Moths, and they are well known in Australia, where there are thirteen described species according to Froggatt.

Æcobia frauenfeldi is figured by Scott in his "Australian Lepidoptera" on a flowering twig "of *Eucalyptus* which grows on the north shore of Port Jackson." I am somewhat doubtful as to the *Eucalypt* depicted.

Hyalacta huebneri is Huebner's "Case Moth," and the insect is figured feeding on a twig of *Eucalyptus polyanthemos* (Red Box) in C. French's "Destructive Insects of Victoria," Part IV. Froggatt calls it the "Leaf Case Moth," for obvious reasons.

Entometa ignobilis, the "Lictor Case Moth," because of the number of little sticks, is figured by McCoy (his plates are coloured and admirable), and is said by him to chiefly frequent Eucalypts. These moths use materials from different families of plants for their cases or bags. See Plate XXV of Froggatt's work.

The beautiful Ribbed Case Moth (*Thyridopteryx herrichii*) was, in its native state (Mr. Froggatt tells me), a rare Case Moth, but since Sugar Gums (*E. cladocalyx*) have been planted so extensively on the N.S.W. Irrigation Areas, it has spread to them in enormous numbers, and has done a good deal of damage.

Family Limacodidæ (Cup or Slug Moths).

In his "Destructive Insects of Victoria," Part IV, C. French figures "The Mottled Cup Moth" (*Doratifera vulnerans*) and the "Painted Cup Moth" (*Limacodes longerans*). The larvæ, and also the cocoons, resembling the eggs of a small bird, are known to everyone. The larvæ have done much damage to trees of *Eucalyptus rostrata*, and indeed of other species of the genus, feeding on the leaves. Froggatt (p. 247) says that *Doratiophora quadriguttata* destroys much of the foliage of Gum trees. He found it common near Gosford, N.S.W. Scott figures *D. lewini* "On the young foliage of a species of Eucalyptus."

Doratiophora casta is figured in Scott's "Australian Lepidoptera," with the larvæ feeding on *Eucalyptus longifolia* (*Woollsi*) in the Sydney district. Mr. Scott says we "have procured them both at the Turon and in our immediate vicinity on the Lower Hunter, the distance between the two places being fully 130 miles. They feed upon the leaves of various Eucalypti, principally confining themselves to the upper surface, which they speedily consume, leaving untouched the inferior epidermis and the nervures, so that from their congregated numbers, the boughs of the tree which they infest appear as if scorched by a hot wind, the leaves being shrivelled or rolled up." Mr. W. J. Rainbow, *Rec. Aust. Mus.* V, 253, Plate XXIX (1904), has a photo of the larvæ on a twig from the Bathurst district.

Family Arctiideæ (Tiger Moths).

The larvæ of most species are short hairy grubs, and are known as "Woolly Bears." Mr. Froggatt (*Agric. Gaz. N.S.W.*, xi, 647) figures *Nola metallopa* Walker, which he found was a pest in a Botany (near Sydney) nursery, amongst the seedlings of *Eucalyptus ficifolia*. It was said to be an established pest, frequently disfiguring numbers of the seedlings by stripping off their foliage. It is a silvery grey moth with the forewings marked with darker coppery tints (Froggatt, p. 250). This moth, which has been called the Seedling Gum Moth, has done extensive damage to Red Gum (*E. rostrata*) forests on the Murray River (Deniliquin district). See a description and a plate, W. W. Froggatt (*Agric. Gaz. N.S.W.*, March, 1919, p. 203).

The larvæ of *Termissa nivosa* are said to be found under the bark of Eucalypts about Melbourne (p. 250).

The "Gum-tree Moth," so called by Mr. French, *Ræselia lugens*, is figured by him at Part V, Plate CXXII. It is a small brown moth and its larvæ eat the green portion of Eucalyptus leaves, leaving little more than the network of veins.

Mr. (later Sir) William Macleay (*Proc. Linn. Soc. N.S.W.*, vi, 845, 1881) exhibited drawings (supplied by Mr. A. W. Howitt) of caterpillars very destructive to *Eucalyptus tereticornis* in Gippsland. These were provisionally attributed to *Orygia* (Family Arctiidae, and Division Pseudo-Bombyces). Mr. Macleay emphasised the importance of inquiries as to the causes of the destruction of our Eucalyptus by insects, and in this connection drew attention to his paper in the volume of the Proceedings, p. 536, "On a species of the Phasmatidae destructive to Eucalypti."

Family Liparidae (Brown Tails or Bag-shelter Moths).

Some of the gregarious larvæ of our Australian species form curious silken bags, in which they shelter during the day, and come out at night to feed on the foliage.

Chelepteryx collesi is one of our largest bag-like moths, often found round the street lamps in the Sydney suburbs. The caterpillars feed on small "White-stemmed Eucalypts" and are often found crawling on rocks and fences. They form long silken cocoons, and handling them induces skin-irritation because of the deciduous spines which force their way through the cocoons. (Froggatt, p. 254.) It is depicted in a charming plate in Scott's "Australian Lepidoptera," and is stated to confine itself to the Bloodwood (*Eucalyptus corymbosa*) in the Sydney district.

Family Bombycidae (Silk-worm Moths).

Antherea eucalypti is our commonest species, and the large green caterpillar, covered with scattered tubercles tipped with clusters of retractile red and blue spines, feeds upon the foliage of Eucalypts, but has acquired a taste for the foliage of the cultivated pepper tree (*Schinus molle*). (Froggatt, p. 259). Prof. Haswell pointed out the same fact to me at Woollahra Point, Sydney, where it used commonly to feed on *Eucalyptus robusta*. In the beautiful plate in Scott's "Australian Lepidoptera," the larvæ are feeding on *Eucalyptus tereticornis*. In French's "Handbook of the Destructive Insects of Victoria," iii, Plate LI, it is shown feeding on a twig of *E. viminalis*.

Family Selidosemidæ (Blue Gum Moth).

Mnesampela privata is a small brown moth which skeletonises certain of our Gum trees. It is figured by C. French in his "Destructive Insects of Victoria," Part III, Plate XLI. In the Report of the N.S.W. Forestry Commission for the year ending 30th June, 1919, p. 27, we find that this moth was found to be destructive to forest growth, and affects *E. globulus* chiefly by webbing up the foliage.

Family Geometridæ (Loopers).

So called because the larvæ form their bodies into a loop when progressing. All the caterpillars of this family are remarkable for their protective mimicry, both in colour and form.

Crypsiphona occultaria feeds on the foliage of Eucalypts and the whole caterpillar strongly resembles a *Eucalyptus* twig (p. 260). The caterpillar of *Gastrophora henricaria* also feeds on the foliage of Eucalypts (p. 262). Mr. Fletcher exhibited two moths (*Chrysiphora occultans*) bred from caterpillars forwarded by Mr. A. Simson, of Launceston, because of their striking resemblance to the leaves of the sprouting shoots of *E. amygdalina* on which they were found to be feeding (*Proc. Linn. Soc. N.S.W.*, xxii, 44, 1897).

Family Tineidæ (including the Clothes Moths).

The larvæ of *Tinea nectaria* make cases out of Eucalyptus leaves according to Meyrick, but Froggatt says he has bred the species out of blister-like excrescences or galls from the leaves of a non-Eucalyptus shrub in the Botanic Gardens, Sydney (Froggatt, p. 281).

Appendix.—We have “Scribbly Gums,” particularly *E. hæmastoma* and var. *micrantha* and *E. coriacea*, so called because of the scribbles to be seen on the smooth surface. These scribbles were originally formed under the flakes of deciduous bark to be seen on every Gum.

Mr. Froggatt tells me “we have never been able to satisfactorily define what insect or insects cause them. I believe that though there may be several ‘scribblers,’ most of them are caused by small moth larvæ, and not beetles.”

ORDER VII (DIPTERA).

Family Cecidomyidæ (Gall Gnats).

“All the members of this family are tiny little creatures, some of them microscopic in size, the males being remarkable for their beautiful feathered antennæ. Though many of them produce galls, there are others that do not . . .” The author quotes F. A. A. Skuse’s work on “Australian Diptera.” (Froggatt in *Agric. Gaz. N.S.W.*, ix, 389, 1898.)

A species of *Cecidomyia* causes thickening and bending of the young stem and fusion to the petiole in *E. hæmastoma* (White Gum), at Arncliffe, near Sydney (Miss Wilson), and a similar deformity in *E. tereticornis*, at Kendall, N.S.W. (Dr. J. B. Cleland).

Diplosis paralis forms blisters on the leaves of *E. corymbosa*, Waverley, Sydney. *D. eucalypti* forms woody swellings on the stems of *E. hæmastoma* at Botany, near Sydney (*Proc. Linn. Soc. N.S.W.*, xv, 373). *Diplosis paralis* forms curious little blisters upon the foliage of *E. corymbosa*, dotting the leaves all over with reddish spots

with a keyhole-like mark on the apex. *D. eucalypti* aborts the young Eucalypts into gouty swellings in which a number of larvæ feed and pupate. There are certain red rounded shot-like galls of the Eucalyptus, generally several in number on the midrib of the leaf, which, on account of the pupal skins always remaining in the holes in the sides of the galls through which the flies have escaped, can be easily distinguished from many very similar ones that are the work of micro-hymenoptera. These are formed by a large stout gnat named *Hormomyia omalanthi* by Skuse, who first obtained specimens from galls on the under side of the leaves of *Omalanthus populifolius*. *Lasioptera miscella* aborts the leaf stalks of *Eucalyptus hæmastoma*, one of our white-stemmed Gums growing about Botany, N.S.W., with its irregular swellings (Froggatt, p. 286).

It was bred from malformed coalescent leaf-stalks of *E. hæmastoma* at Botany. See Plate XVI, also "Diptera of Australia" (F. A. A. Skuse, *Proc. Linn. Soc. N.S.W.*, xv, 373, 1890).

Family Muscidæ Acalyptera (Agromyzidæ).

These are small yellow flies, sometimes marked with green; they puncture the tissue of plants and cause excrescences and galls upon the foliage and flower-buds.

One tiny species, *Agromyza* sp., attacks the midrib of the leaves of the Bloodwood (*E. corymbosa*) about Sydney, producing soft yellow spongy excrescences aborting all the young foliage (Froggatt, 309). And again, "A number of species of this genus produce fleshy galls upon the foliage of our Eucalypts. One is very common upon the foliage of the Bloodwood (*Eucalyptus corymbosa*), attacking the midrib of the young leaves, and causing them to be thickened swollen masses." (Froggatt, in *Agric. Gaz. N.S.W.*, ix, 390, 1898.)

Mr. R. H. Cabbage (*Proc. Linn. Soc. N.S.W.*, xliii, 687, fig., 688) shows the effect of Agromyzidæ on *Eucalyptus dealbata* buds. I have drawn attention to this swelling of Eucalyptus buds, and have so often seen it in buds belonging to the *E. tereticornis* group that it is to some extent characteristic of that group.

Agromyza galls swell the fruits of *E. hæmastoma* at Hornsby (W. F. Blakely). They swell the buds of *E. Moorei* at Leura, Blue Mountains (H. Bott).

A dipterous fly produces a spheroidal gall, $\frac{2}{3}$ -inch diameter, on the thin branches of *E. Parramattensis*. George's River, Cabramatta, near Sydney (W. F. Blakely).

On *E. Sieberiana* I have seen galls at Bumble Bay Trig. Reserve, 1,154 feet elevation, Ourimbah State Forest (W. A. W. de Beuzeville).

It commonly misshapes the flower-buds of *E. tereticornis* as already stated.

(To be concluded.)

Eremocitrus glauca Swingle.

The Wild Lemon.

(Family RUTACEÆ.)

Botanical description.—Genus *Eremocitrus* Swingle in *Journ. Agric. Research* (U.S.A.), ii, pp. 85-100, with text figures 1-7 and Plate 8 (1914).

Following is the original description:—

The genus *Eremocitrus* resembles *Citrus* in the structure and appearance of the fruits; it differs from it (1) in the leaves which have on both surfaces palisade cells, sunken stomates, and appressed few-celled hairs; (2) in the 4- to 5-merous flowers, with free stamens and a 4- or 5-celled ovary, with two ovules in each cell.

The leaves are gray-green, thick and leathery, and markedly pellucid punctate; they are nearly alike on both sides, having four ventral and two dorsal layers of palisade cells, sunken stomates, an epidermis with a thick cuticle, and scattered few-celled appressed hairs on both surfaces. The spines are usually long and slender, but are sometimes wanting, especially on fruiting branches of old trees. They occur singly in the axils of the leaves. The twigs are gray-green, slender, very slightly angled when young, with scattered stomates at the base of deep, narrow pits, and two or more layers of palisade cells below the very thick-walled epidermis. The flowers occur singly or two or three together in the axils of the leaves and are borne on slender pedicels about as long or slightly longer than the petals. (See Fig. 1.) The calyx is 3- to 5-lobed; the petals, four or five, rarely three in number, are more or less narrowed at the base; the stamens are normally four times as numerous as the petals, with the filaments free. The ovary is obovate, with a rather thick subcylindric, caducous style, 4- or 5-celled, with two ovules in each cell; the disk is small. The fruits are $1\frac{1}{2}$ to $2\frac{1}{2}$ by $1\frac{1}{4}$ to $1\frac{1}{2}$ cm.—smaller than those of any known species of *Citrus*—subglobose, oval or somewhat pyriform, with a thin fleshy peel, like that of a lime, covered with oil glands. The pulp is vesicular, sour, and juicy. The pulp vesicles, which separate easily in the ripe fruit (fig. 2, A-D) are subglobose, and are borne on slender stalks. The seeds are small (5 to 6 by 3 to 4 by $2\frac{1}{2}$ to 3 mm.), pointed ovate, yellowish gray with a hard testa, irregularly verrucose and furrowed in a longitudinal direction. (See fig. 2, E.) The cotyledons are plano-convex, remaining hypogeous in germination; the postcotyledonary leaves are slender cataphylls (fig. 3).

This monotypic genus is based on *Triphasia glauca* Lindl., native to the drier parts of north-eastern Australia.

See also L. H. Bailey's "Standard Cyclopedia of Horticulture," vol. ii, p. 1127 (1914), where there is an abbreviated description, accompanied by figures of a spiny twig of a young seedling, and of a fruit, entire and in cross-section.

Botanical description.—Species *glauca* Swingle, *op. cit.* p. 88.

Following is the original description:—

This species, the desert kumquat, desert lemon, or desert lime of the Australian pioneers, is a shrub or small tree, sometimes attaining a height of 15 feet and a diameter of 6 inches (Maiden,* 1889, p. 379). When young, the branches are very spiny and the leaves are very narrow. As the tree gets older, the leaves become broader and more abundant, and the spines are much reduced or entirely wanting (Campbell,† 1899, p. 1168, fig. 5).

The leaves of mature plants are oblong linear or elongate cuneate, bluntly rounded, retuse or emarginate at the tip, with undulate entire margins, 25 to 45 by 4 to 10 mm., mostly 30 to 40 by 6 to 8 mm. They show on both surfaces minute (about $\frac{1}{16}$ mm. long), scattered, appressed few-celled hairs, with a warty cuticle. The leaves are para-heliotropic (standing more or less on edge), very thick, prominently glandular dotted, and taper gradually into very short wingless petioles.

The spines, which are always single, are slightly to one side of the axil of the leaf and are usually very slender, 2 to 4 cm. long and only $1\frac{1}{2}$ to 2 mm. in diameter. On old trees, especially on fruiting branches, they are often wanting.

The flowers are borne either singly or in groups of two or three in the axils of the leaves on new growth as in *Citrus*. The pedicels are slender, 4 to 6 mm. long. The calyx is 3- to 5-lobed, sparsely hairy, the lobes acute. The petals are four or five (rarely three) in number, somewhat narrowed at the base, and broadly rounded or bluntly pointed at the tip, 4 to 6 mm. long. There are four times as many stamens as petals, usually sixteen to twenty, rarely twelve (in trimorous flowers); the filaments are slender, about 4 to 5 mm. long. The pistil is borne on a low disk and has an obovate ovary, with a rather thick sub-cylindric style (fig. 4); the ovary is 4-, or rarely 3- to 5-celled; each cell contains two ovules.

The fruits are small, globose, oblate, or sometimes pyriform, $1\frac{1}{2}$ to $2\frac{1}{2}$ by $1\frac{1}{4}$ to $1\frac{1}{2}$ cm., having four (rarely three or five) cells filled with subglobose stalked pulp vesicles. The seeds are oval, yellowish gray, 5 to 6 by 3 to 4 by $2\frac{1}{2}$ to 3 mm., with a tough, longitudinally furrowed, and verrucose testa (see fig. 2). The cotyledons are hypogeous in germination, and the young seedlings produce alternate slender cataphylls which only very gradually become broader and leaf-like. The young spiny plants, even when several years old, usually have only very narrow leaves, differing but slightly from the cataphylls of the young seedlings. (See fig. 3.)

In constituting a variety *inermis* (of *Atalantia glauca*), F. M. Bailey in *Queensl. Agric. Journ.*, Jan. 1915, p. 29, says, "Dr. Lindley, the first botanist to describe the species, speaks of the plant as spinous (Mitchell's *Trop. Austr.*, p. 353). Bentham, in the "*Flora Australiensis*," i, p. 370, however, speaks of the plant as 'often armed with straight or recurved spines,' and subsequent writers have united the spinous and spineless varieties, but I have received specimens of the latter from the above two localities and consider it advisable to attach to the latter a distinctive name. Hab.: near Dalby, Dr. T. L. Bancroft (September, 1913); Chinchilla, R. C. Beasley (December, 1914)."

It does not seem expedient, under the circumstances, to attempt to maintain the variety.

Eremocitrus, according to Swingle, is most nearly related to four aberrant species of *Citrus* (now *Microcitrus* Swingle), viz., *australasica* F.v.M., *Garrowayi* F.v.M., *australis* Planch., *inodora* Bailey (all from coastal New South Wales and Queensland). See Swingle in *Journ. Agric. Research*, ii, 87; *Washington Acad. Science*, v, 572; Bailey's *Standard Cyclop. of Hort.*, iv, 2047.

* "The Useful Native Plants of Australia."

† "Some western plants; useful, ornamental and curious." (In *Agric. Gaz.*, N.S.W., v. 10, pt. 11, p. 1167-1169, 10 fig.).

Botanical Name.—*Eremocitrus*, from the Greek *eremos*, desert, and *Citrus*; *glauca*, the Latin for grey or sea-green, in reference to the colour of the leaves and plant generally.

Vernacular Name.—"Wild Lemon," from the acid nature of its fruit, but it is a name which it shares with others. It has also been called "Desert Kumquat" and "Wild Lime," but these are less in use.

Aboriginal Names.—Dr. Roth gives two names used by Queensland aborigines, viz., "Wumbanyi" (Boulia) and "Kandutal" (Cloncurry).

Synonyms and Affinities.—1. *Triphasia glauca* Lindley, in Mitchell's *Journey into Trop. Australia*, p. 353.

Mitchell says (under date 17th October, 1846), p. 353, "The thermometer stood as low as the freezing point this morning, and the day was cooled by a wind from the north-east. In crossing Possession Creek . . . (this is a few miles from Roma, Q.—J.H.M.) . . . a small shrub, 3 feet high, with narrow, blunt, glaucous leaves, tasting like rum. A small fruit, with the fragrance of an orange, proved to be a new species of *Triphasia*."

2. *Atalantia glauca* Hook. f., in Benth. and Hook., *Genera Plantarum*, 305. See B. Fl. i, 370, where Bentham points out that as a species of *Atalantia* ". . . although anomalous in some respects, (it) has the foliage and inflorescence of *Atalantia*, and is allied in several respects to *A. Hindsii* Oliv., approaching like that species to *Citrus* in the increased number of stamens." (For a reference to Oliver's paper, which takes cognisance of some species of *Atalantia*, see *Journ. Linn. Soc. (Bot.)*, v, 23 (1861).)

Dr. Swingle separates *Atalantia* from *Eremocitrus* as follows:—

From true *Atalantias*, such as *A. monophylla* (Roxb.) DC. and *A. citrioides* Pierre, having 2- to 4-celled fruits with pulp vesicles, *Eremocitrus* differs in having the stamens four times as numerous as the petals instead of twice as numerous. It also differs markedly from *Atalantia* in the structure of the leaves.

Fruit.—Mr. F. S. Carne, Fairfield, Roma, Queensland (practically the type locality), in a letter to Mr. W. M. Carne (then on the staff of the National Herbarium, Sydney), dated 13th December, 1914, says, "I find it flowers in early spring, August, and the fruit is ripe in December and falls to the ground almost immediately. Odd trees fruit earlier and some also very much later, but these are very rare. I have never found the lemon and mandarin-shaped fruit growing on the same tree, and indeed only rarely are both kinds of fruits seen in the same clump."

The recipient of the letter adds, "As a result of examining three different samples of *Atalantia glauca* fruit, it is evident that—

1. The plants are shy-seeders. Over 50 per cent. (even 100 per cent.) of fruits do not contain seed. No more than two seeds yet found in each fruit.
2. Over 30 per cent. are affected by an insect—a moth—which appears to form galls on the placentas, probably resulting in the destruction of the ovules.

3. There are probably two distinct species, (*a*) having depressed globular fruit with a tendency to become lobed, and (*b*) having ovoid-oblong fruits three to four times as large."

Plate XLV, fig. 1, "Year Book U.S. Dept. Agric., U.S.A., 1911, shows variation in the fruits. There is indeed considerable variation in this species in this respect.

The fruit is commonly about half an inch in diameter. It produces an agreeable beverage from its acid juice. A fair preserve may be made of the fruit. The aborigines used to eat it. Sending some of a distinctly lemon shape, and about the above size, Mr. C. Marriott, of Dubbo, remarked, "The fruit should be a trifle larger than the specimens forwarded, but owing to the dry conditions they are not as large as usual. Jam is sometimes made from the fruit, and cool drinks."

In Swingle's exhaustive account of the species (*op. cit.*, p. 95) he gives an account of the "Uses of the fruits of the Desert Kumquat," and quotes Leichhardt ("Overland Expedition to Port Essington," p. 77):—

"Yesterday in coming through the scrub, we had collected a large quantity of ripe native lemons, . . . we made them into a dish very like gooseberry-fool; they had a very pleasant acid taste and were very refreshing. They are of a light yellow colour, nearly round, and about half an inch in diameter; the volatile oil of the rind was not at all disagreeable."

Timber.—The wood is close-grained, and takes a fine polish. It is of a bright yellow colour, with numerous brown streaks or veins.

Size.—It is only a shrub or small tree, and its average height may be given as 8 to 15 feet, and diameter 2 to 6 inches. Speaking of the Dubbo district, Marriott says it "grows to about 6 feet or 7 feet high, and is a bit bushy."

Habitat.—Following are the localities recorded in the "Flora Australiensis":—*Queensland*, Broad Sound (R. Brown); Maranoa River (Mitchell); Suttor and Burdekin Rivers (F. Mueller); Port Denison (Fitzalan).

It is a dry country species and hitherto not previously recorded out of Queensland and New South Wales.

New South Wales.—"Lower branches droop while the upper ones are upright." Mootwingie Ranges, 80 miles north of Broken Hill. (Dr. MacGillivray, through A. Morris, No. 228.)

The above is by far the most western locality known to me in New South Wales, and its discovery there should lead to search for it being made in other western localities, and also in South Australia.

"It is found growing in small patches scattered through the Western district. I know of it being found at the undermentioned places:—Buddah Lake, near Trangie, Burraway, Farrendale, Warren and Bullaguan." (District Forester C. Marriott, of Dubbo, writing in 1909.)

I have received it from Quambone, near Coonamble (O. E. Friend, who has been most kind in supplying material).

Wild Lemon, 6 feet high. Gilgandra (R. H. Cabbage, 1142).

Then we go north—

Cambo Cambo Station, 40–50 miles north-west of Collarenebri (Sid W. Jackson); Wee Waa (G. A. Withers); “Wild Lemon,” Eaton’s Ponds, Biniguy (Gordon Burrow); Moree (W. W. Froggatt).

Dense growth up to 15 feet. Fruit used by settlers for jam. “Wild Lime or Lemon.” Benarba Station, 18 miles south of Mungindi (C. T. Kerry—see photo).

Queensland.—Goondiwindi (H. J. Rumsey). Not far from Mungindi, New South Wales; Tambo (collected for James Pink, quoted by Swingle); on the Condamine River, 12 miles from Chinchilla Railway Station (John Williams, quoted by Swingle); Dalby (Dr. T. L. Bancroft).

Then we come to Mitchell’s type locality, which has been already described, and is near Roma.

The following localities are much further north:—

Warrego district (F. M. Bailey); “Brigalow Scrub,” south of Burdekin River, between lat. 20 deg. and 21 deg. S. (Mueller); head of Suttor River (correspondent of Kew).

Hardiness of the Desert Kumquat as regards cold.—At vol. ii, p. 91, *Journ. Agric. Research*, Swingle gives a most painstaking account of the extremes of climate given with records of the collection of this species in western Queensland. He adds, “It would not be surprising, in view of these scanty records taken at random, if temperatures as low as 5 deg. F., or even zero Fahrenheit, would be found to occur occasionally in the region where the desert kumquat grows wild. Such low temperatures might injure the leaves and perhaps the smaller twigs, but recovery would probably be rapid and complete. Certainly no other edible citrus fruit is native to any region where it is exposed to such severe cold weather.”

Drouth (Drought) Resistant Adaptations of the Desert Kumquat.—

This is emphasised in the very title of the paper, “*Eremocitrus*, a new genus of hardy, drouth-resistant citrous fruits from Australia,” by Walter T. Swingle in *Journ. of Agric. Research* (U.S.A.), vol. ii. From this paper the following notes are taken:—

“It is undoubtedly the most cold-resistant of all the evergreen citrous fruits.” (Sir Thomas Mitchell, who found this plant, spent a cold night when he discovered it, but the locality is only exceptionally cold.)

“It is the only member of the sub-family Citratae that shows marked adaptation to desert climates.

It is a gray-green shrub or small tree, looking not unlike a large thorny sagebush (*Artemisia*.—J.H.M.), having leaves centric in structure, with appressed hairs, stomates, and a very thick-walled epidermis on both surfaces and palisade tissue just beneath.

The slender, usually spiny twigs, are also gray-green, and have stomates situated at the bottom of deep pits. In all of these and in some other characters the plant shows the outward signs of a profound adaptation to withstand the extreme heat and dryness of a desert climate."

(There has been a good deal of argument as to the meaning of the term "desert." Where *Eremocitrus* grows is grand sheep country, and the employment of the term desert in regard to such country must be purely technical.)

At pp. 93-95 of the above paper the drought resistant properties of the species are carefully worked out. At p. 95 he concludes, "It is very probable that the ability of this plant to grow in dry soils exposed to hot, dry winds will render it of great value in breeding new types of citrous fruits better fitted than any we now possess to grow under semiarid conditions."

Utilisation of *Eremocitrus* in Breeding.—I make no apology for copying out what Dr. Swingle says (at p. 97) under this heading:—

"From the taxonomic study of *Eremocitrus*, it is clear that its nearest relationship is with the peculiar Australian species of *Citrus* (especially *C. australis* and *C. australasica*), with which it shows close similarities in many characters of fundamental importance, such as the flower and fruit structure and the method of germination.

"This close relationship, deduced from the botanical characters, is confirmed by the fact that *Eremocitrus glauca* grows vigorously when grafted on *Citrus australasica* (Pl. VIII, fig. 1), and that *Citrus australasica* grafts readily on *Eremocitrus glauca*. It has been found that *Citrus australasica* hybridizes freely with at least two cultivated species of *Citrus*,* and it is not only almost certain that *Eremocitrus glauca* will cross with *Citrus australasica* and the other Australian species of *Citrus*, but also very probable that it will hybridize with the commonly cultivated Asiatic species of *Citrus*.

"The desert kumquat, native to the semiarid Australian scrubs, able to withstand severe cold in winter as well as burning heat and extreme dryness both of the soil and air in summer, is the most promising species known for use in breeding new types of hardy citrous fruits. Every effort is being made to hasten its flowering, so that hybrids can be made, using it as one of the parents. The fact that the desert kumquat has edible fruits without any disagreeable acid oil in the peel or in the juice makes it far more promising than the Chinese trifoliate orange, *Poncirus trifoliata* (L.) Raf. (*Citrus trifoliata* L.), for breeding hardy citrous fruits for table use.

"The discovery of this markedly drouth-resistant species in the Australian scrubs opens the way to the breeding of a new class of citrous fruits, able to grow with much less water than is required by ordinary oranges, lemons or grapefruits."

Grafting and Budding *Eremocitrus*.—Dr. Swingle goes on to say:—

"The Australian desert kumquat can be readily grafted or budded on all of the commonly cultivated species of *Citrus*, such as the orange, grapefruit, lemon, &c., and also on the Australian finger lime (*C. australasica*). It grows very well on the tabog of the Philippine Islands (*Chaetospermum glutinosa* (Blanco) Swing.), and on the wood-apple of India (*Feronia elephantum* Corr.). (See Pl. VIII.)

"The various species of *Citrus* graft easily on *Eremocitrus*, which makes it possible to test this new hardy stock for types of soil to which the commonly used citrous stocks are not well adapted. It is not impossible that the desert kumquat, being adapted to grow in desert soils, which are usually more or less saline, will prove able to withstand more 'alkali' in the soil than the Asiatic species of *Citrus*, which are indeed very sensitive to salty soils or water.

"Being different from *Citrus* in so many visible characters, it is possible that *Eremocitrus* will also differ physiologically and prove resistant to some of the many fungous diseases that attack citrous stocks."

* Mr. George W. Oliver crossed *Citrus australasica* with *C. mitis* in 1909, and the writer crossed the same species with *C. aurantifolia*, the common lime, in 1913, in the greenhouses of the Department of Agriculture at Washington, D.C. Vigorous hybrids were secured from both of these crosses.

Sid. W. Jackson, photo.

GROUP OF NATIVE LIME TREES (*Eremacritrus glauca*), CAMBO CAMBO STATION, COLLARENEBRI DISTRICT, NEW SOUTH WALES.

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Kerry, photo.

WILD LIME (*Eremocitrus glauca*), BENARBA, NEAR MUNGINDI, NEW SOUTH WALES.

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WILD LEMON.
(*Eremocitrus glauca* SWINGLE.)

Mr. E. N. Ward, Superintendent of the Sydney Botanic Gardens, has made some experiments in grafting *Eremocitrus* on the common Lemon, and his experiments are in progress.

In pointing a moral as to the need for taxonomic study of the wild relatives of cultivated plants, Dr. Swingle admirably shows the way in regard to certain lines of investigation in the direction of plants belonging to the Orange and Lemon family. We in Australia, as compared with the United States, have little population and few botanists and horticulturalists at work on economic scientific investigations. But it would be an unworthy and an untenable position to take up to try and make ourselves and others believe that we are making the best of our opportunities. Let our fruit-growers get busy in improving their fruits and the hardiness of them, and Dr. Swingle's paper will give them many useful hints.

EXPLANATION OF PLATE 248.

- A Flowering twig, from Cambo Cambo Station, *via* Collarenebri.
- B. Bud.
- C. Flower.
- D. Portion of flower showing—
 - (a) calyx.
 - (b) disk.
 - (c) ovary.
 - (d) style.
 - (e) stigma.
- E. Portion of flower, showing calyx and disk (with stamens (2) attached).
- F. Fruiting twig, from Moree-Mungindi, N.S.W.
- G. Fruit (lemon shaped), from Dubbo, N.S.W.
- H. Twig of young plant, from New England.
- I. Portion of stem, from Dubbo, N.S.W.

PHOTOGRAPHIC ILLUSTRATIONS.

1. "Wild Lim," Benarba, near Mungindi, N.S.W. (Kerry, photo).
2. Group of native lime trees, Cambo Cambo Station, Collarenebri District, N.S.W. (Sid. W. Jackson, photo).

No. 251.

Eucalyptus tessellaris F.v.M.

The Carbeen.

(Family MYRTACEÆ.)

Botanical description.—Genus *Eucalyptus*. See Part II, p. 23.

Botanical description.—Species *tessellaris* F.v.M. in *Journ. Linn. Soc.* iii, 88 (1859).

Following is a translation of the original description :—

A tree, branchlets somewhat terete, on the lower side angled and smooth on the upper.

Leaves alternate, somewhat short, petiolate, narrow-lanceolate, subfalcate, faintly penniveined, imperforate; *umbels* axillary and terminal, double or many, paniculate, 2-4 flowered; *peduncles* angular, the common one longer than the other peduncles; *buds* ovate, almost twice as long as the pedicel; *operculum* patella-shaped, and obtuse; the calyx-tube slightly broader and much longer than the operculum; *fruits* truncate-ovate, ecostate, valves included.

Habitat in grassy places in the hills and plains, especially sandy-clayey areas from the district south-east of the Gulf of Carpentaria as far south as Moreton Bay. Flowered in November and December.

A medium or fairly large tree, the bark on the lower part of the trunk only persistent, the whole dirty-looking and ash-coloured, with numerous longitudinal and transverse cracks in the bark, forming unequal, somewhat tessellated, separable pieces. The upper part of the trunk, as well as the branches, is white and smooth. The branchlets and the leaves, as in many of the species, pendulous. Leaves for the most part 3-4 inches long, $\frac{1}{2}$ - $\frac{3}{4}$ inch broad, acuminate. The primary peduncles the same length as the petiole or twice as short. Fruit 4-5 lines long, slightly contracted towards the apex.

“Moreton Bay Ash,” *Leichhardt's Overland Expedition* in many places, and of the colonists.

It was described by Benthham in *B. Fl.*, iii, 251 (spelt *tesselaris*), and redescribed and figured by Mueller in the “*Eucalyptographia*.”

Botanical Name.—*Eucalyptus*, already explained (see Part II, p. 34); *tessellaris*, Latin after *tessella* (diminutive of *tessera*), a small square stone or piece of wood, &c., with which people make chequer work in tables or boards.

Vernacular Name.—“Moreton Bay Ash” is the name usually employed in Queensland. For the limitations of the name “Moreton Bay Ash,” usually applied to this tree, see below, p. 249. “Carbeen” is the name usually employed in New South Wales; I suspect it is of aboriginal origin.

Aboriginal Name.—The late P. O'Shanesy, Rockhampton district, Queensland, gives the aboriginal name as "Ghallgurria" or "Gallgurrie." "Wonkara" is the native name at Port Curtis (Hedley). It was called "Corang" by the aborigines of the Nogoia River, Queensland. Dr. Shirley gives me the name "Woonara" as in use by the Koolaburra tribe, between Taromeo and Nanango, Southern Queensland, in *Proc. Roy. Soc. Q.*, xii, 7.

Synonyms.—1. *E. viminalis* Hook., non Labill.

2. *E. Hookeri* F.v.M.

1. *E. viminalis* Hook., non Labill., in Mitchell's *Journ. Trop. Austral.*, 157 (1846).

Following is a translation of the original :—

Leaves alternate, glaucous, linear-lanceolate, with short, thin petioles, somewhat falcate, acuminate at both ends, reticulately veined, the lateral nerves near the margin, the racemes few-flowered and axillary, the calyx turbinate and narrowed into a short pedicel . . . A new *Eucalyptus*, which casts its bark in small angular pieces. . . .

I have seen a specimen of the type; it bore the following label :—

" May 9, 1846. No. 146. Camp XIV. Sub-tropical New Holland. Lieut.-Col. Sir T. L. Mitchell. *E. viminalis* Hooker. 138. Casts its bark in small angular pieces." This is the first reference to the tessellated appearance of the bark.

2. *E. Hookeri* F.v.M.

Following is the original reference in *Journ. Linn. Soc.*, iii (1859), 90 :—

Eucalyptus bicolor A. Cunn. To this also *E. gracilis* and *E. Hookeri* (*E. viminalis* Hook., in Mitchell's *Tropical Australia* non Labill.) are allied.

E. Hookeri is quoted by Bentham in B. Fl. iii, 251. This name ought never to have got into *Eucalyptus* literature at all, and the regret is the greater in that it makes it now more difficult to connect this honoured name with a species of *Eucalyptus*.

Bark.—Bark totally persistent on the lower part of the stem only, then dark-coloured, and by longitudinal and transverse fissures broken up into small angular masses; hence the specific name; the rest of the stem and branches ashy grey and smooth, rarely the whole stem so to the base. (" *Eucalyptographia*.")

A fairly large tree, with rough tessellated bark on the lower half of the trunk, but deciduous on the upper part and branches. (Cat. of Queensland Timbers.)

Bark is soaked in water, and drunk for dysentery on the Palmer (Middle) River, " r-gu-la." (N.Q. Ethnography Bull., No. 5, Roth.)

Timber.—The timber is not hard, but tough; it is excellent for building purposes (Hill). Comparing it with other *Eucalypts* it is not a durable timber; it is used for staves and flooring. It is of a dark-brown colour, except near the bark. Mr. C. Moore (Cat. N.S.W. Timbers, Paris Exh., 1855), states that this tree indicates poor, sterile

soil. He also states that the wood is of a perishable nature, though sometimes used in the erection of huts. Mr. John Duff states that in north-western New South Wales it is used but not highly valued for fencing, shafts, &c. It burns easily when quite green, and is dark brown in colour.

Oil.—The leaves yield a dark brown oil of an entirely novel odour, balsamobenzoic. Does not contain cineol; Queensland sample. Schimmel's Semi-Annual Report, Apr., 1893, p. 38.

Kino.—For an analysis of this kino collected by Mr. R. Helms of the Elder Exploring Expedition, see *Proc. Roy. Soc. S.A.*, XVI, 6, 1892. "At times one find a woolly mass in partially burnt logs, which is found to be a white crystalline body, like benzoic acid. This substance may be revolatilised and collected, of a pure white colour, under a cold bell-glass. It has the pleasant odour of benzoin, but has not been further investigated." (Dr. J. Bancroft.) Lauterer (in Bailey's Botany Bulletin, XIII, pp. 35-80, 1896) examines this kino at length.

Habitat.—In describing the species, Mueller unfortunately gave the range (for the type) as from the Gulf of Carpentaria to Moreton Bay, namely, from end to end of Queensland, instead of describing his type from a specific locality.

Later, in "Eucalyptographia," and it was his own species, he records it "From near the south-eastern shores of the Gulf of Carpentaria (F.v.M.) to the vicinity of Moreton Bay (Dr. Leichhardt), extending to some of the central regions of Australia, thus occurring near the Finke River (Rev. H. Kempe), traced north-eastward to Fitzroy Island (C. Moore)."

The Finke River specimen is *E. papuana*, and the others are Queensland localities. It will be seen that later on he extended the range northerly to Papua, while I show that southerly it is found over a considerable portion of New South Wales.

Western Australia.—Bentham quotes Careening and Vansittart Bays, N.W. Coast (Allan Cunningham). I have seen these specimens and they are *E. papuana*. I have not seen indubitable *E. tessellaris* from Western Australia.

Northern Territory.—Bentham quotes "Islands of the Gulf of Carpentaria" (R. Brown). I have not seen the specimens, and this locality seems too vague to base a record for the Northern Territory on; it might be off the North Queensland coast.

"Up to a height of 150 feet with a stem diameter of 3 feet," on the Finke River (Rev. H. Kempe). In "Eucalyptographia" as *E. tessellaris*, but it is *E. papuana*.

Papua.—" *E. tessellaris* extends to New Guinea, specimens fully responding to Australian ones having been received from the missionary, Rev. T. Chalmers." ("Eucalyptographia.") I have not seen them.

Use of the term "Moreton Bay Ash."

The term "Moreton Bay Ash," which was applied by Mueller to this species in the original description, following the use of the name in "Leichhardt's Overland Expedition" (to Port Essington), is not as exclusively devoted to *E. tessellaris* as was at one time supposed. At least three species go under this name, *E. papuana*, while it is applied even more frequently to *E. grandifolia* R. Br.

The following are Leichhardt's references to "Moreton Bay Ash," and in the course of time collectors who know the various localities will say which species of Moreton Bay Ash Leichhardt saw. Some of the northern ones might have been *E. papuana*.

October 3, 1884, p. 6. It is the prevailing tree with Bastard Box (probably *E. bicolor*) and Flooded Gum (probably *E. saligna* var. *pallidivalvis*=*E. Hillii*.)

At page 11 we have the same remarks. It does not appear to have been again noticed for over two months, when we have—

December 10, 1844, p. 63. Growing in great abundance with Flooded Gum, *Erythrina*, *Tristania*, &c.

December 15, p. 75. Vegetation from vicinity of Darling Downs common, Moreton Bay Ash very plentiful.

January 18, 1845, p. 112. Tributary of the Mackenzie. Moreton Bay Ash very plentiful.

January 25, p. 121. Flats with Moreton Bay Ash and Flooded Gum.

February 15, p. 154. Bastard Box and Poplar Gum (perhaps *E. alba*) on a stiff clay. Narrow-leaved Ironbark (*E. crebra* ?) and Moreton Bay Ash on lighter sandy soil.

March 27, p. 195. Flats with silver-leaved Ironbark (*E. melanophloia*), Rusty Gum, Moreton Bay Ash.

April 9, p. 208. Grew along the bergue of the river with *Grewia*, "its inseparable companion."

May 10, p. 250. Flats, Moreton Bay Ash and Poplar Gum.

June 6, p. 283. Small flats. Apple Gum (*E. clavigera* ?) with Moreton Bay Ash.

July 28, p. 348. Moreton Bay Ash and Bloodwood, in Saltwater Creek country.

August 25, p. 377. Apple Gum, Box and Moreton Bay Ash in a well-grassed forest between lagoon and river.

Usually on "flats"—this would indicate *papuana* (?).

"Lighter soil"—would indicate poor sterile sandstone soil.

Queensland.—Bentham quotes South-east coast of the Gulf of Carpentaria, *F. Mueller* (which would be Northern Queensland), and also Queensland (without locality), *Bowman*; Fitzroy Downs, *Mitchell* (this would be on the Upper Muckadilla or Cogoon River, a little to the west of Roma.—J.H.M.).

Port Denison, *Fitzalan*. (This is Edgecombe Bay.—J.H.M.)

Some localities by Mueller have been already quoted, and following are some Queensland localities in the National Herbarium, Sydney :—

“ A very graceful tree, fairly tall, bark persistent at butt and cracked irregularly, deciduous on tips of branches. Wood dark brown, tough, inlocked in grain, heavy, sapwood light yellow.” On ridges around Brisbane (J. L. Boorman).

Toowoomba North (Florence E. Yardley). Roma (Joseph Mayfield). Vicinity of Blackbutt Range (R. N. Jolly). Maryborough West (P. J. McGrath). Rockhampton (A. Thozet, A. Murphy, J.H.M.). Chillagoe (E. Doran). Reid River, near Townsville (N. Daley).

“ Practically smooth bark to ground. 40–50 feet. Called ‘ Cabbage Gum.’ ” Flinders River, 60 miles south of Normanton. (R. H. Cambage, No. 3938.)

New South Wales.—Following are some New South Wales localities represented in the National Herbarium, Sydney. We require many more records yet, before its range in this State can be properly stated, but at present it has not been recorded south of the 31st parallel nor much east of 151 deg. E. longitude.

It is known as “ Carbeen ” at Narrabri, and is especially common at Pian Creek, on the Walgett Road. It is an indication of good grazing country (Henry Deane, R. N. Lyne). Mr. Lyne says : “ I only know of its presence over large tracts of country where shallow water (say 80 feet) is obtainable.”

A tree of 70 feet, parish Bobbiwa, county Jamison (Forester Gordon Burrow).

“ Carbeen ” or “ Moreton Bay Ash.” Handsome tree. Smooth limbs, base rough-barked, 3 feet 6 inches thick, 90 or more feet high. In sandy places between 40 and 50 miles north-west of Collarenebri (Sid. W. Jackson).

“ Carbeen,” Mt. Mitchell, Warialda district (W. A. W. de Beuzeville).

Howell, near Tingha (E. C. Andrews), which seems its coldest and most southerly locality at present.

EXPLANATION OF PLATE No. 249.

- a. Sucker leaves. North of Rockhampton, Queensland.
- b. Flowering twig. Reid River, *via* Townsville, Queensland.
- c. Mature leaves. 40 or 50 miles north-west of Collarenebri, New South Wales.
- d. Fruits. Reid River, Queensland.

PHOTOGRAPHIC ILLUSTRATIONS.

- 1 “ Carbeen,” Collarenebri district, New South Wales. (Sid. W. Jackson, photo.)
- 2 “ Carbeen,” or “ Moreton Bay Ash,” Collarenebri district, New South Wales. Wedge-tailed eagle’s nest in tree. (Sid. W. Jackson, photo.)

Sid. W. Jackson.

CARBEEEN TREE (*Eucalyptus tessellaris*), SHOWING CARBUNCLE, COLLARENEBRI DISTRICT,
NEW SOUTH WALES.

Sid. W. Jackson.

CARBEEN OR MORETON BAY ASH (*Eucalyptus tessellaris*), SHOWING WEDGE-TAILED EAGLE'S NEST
IN TREE COLLARENEBRI DISTRICT, NEW SOUTH WALES.

E.A. King ill.

THE CARBEEN.
(*Eucalyptus tessellaris* F.v.M.)

No. 252.

Acacia cana Maiden.

Broad-leaved Nealie.

(Family LEGUMINOSÆ : MIMOSÆ.)

Botanical description.—Genus *Acacia*. See Part XV, p. 103.

Botanical description.—Species *cana* Maiden, in *Journ. Roy. Soc. N.S.W.*, LIII, 206 (1919). (*A. eremea* in the text in error.)

Following is the original description :—

An erect shrub or small tree with beautiful silvery foliage, the result of a very short tomentum, branchlets at first slightly angular.

Phyllodia straight, or slightly falcate, lanceolate, narrow, tapering to both ends, with a rigid point, 5–7 cm. long, 4 mm. broad, thick, very finely striate with parallel nerves only to be seen under a lens. An ill-defined gland at the base.

Peduncles in pairs or more, covered with golden hairs and about 5 mm. long, bearing globular heads of about thirty flowers, mostly 5-merous. Bracts conoid capitate.

Sepals spathulate, besprinkled with hairs, particularly towards the top, scarcely half as long as the corolla. Petals hairy all over, and ciliate at the edges, free. Ovary hirsute.

Pod of medium width, twisted (?), covered with a very short tomentum and very finely and reticulately veined, about 1 dm. long and 6 mm. broad, the valves moderately convex over the seeds, which are slightly contracted between them; seeds longitudinally arranged.

Affinities.—As this Wattle was confused by the late Baron von Mueller with the Yarran (*Acacia homalophylla* A. Cunn.) it may be useful to say that *A. homalophylla* is a medium-sized, erect tree. The phyllodia present considerable external resemblance, except that those of *A. homalophylla* are not silvery. The sepals of that species are truncate-undulate, not spathulate, while the pods (see Plate 189, fig. E of Part L) are straight, not twisted, and not reticulately veined as in *A. cana*.

It is, however, with *A. rigens* and *A. Loderi* that it has been oftenest confused, and therefore the following table will be useful :—

	1 <i>A. rigens.</i>	2 <i>A. cana.</i>	3 <i>A. Loderi.</i>
	A Needle-bush, up to 10 or 15 feet. Green.	Erect shrub up to 15 feet. Very silvery.	A hoary, or glaucous dense shrubby tree, up to 20 feet. Wood deep brown, bark flaky-fibrous.
<i>Phyllodia</i> ...	Filiform, compressed, nearly terete, rigid. "About 3-nerved." Finely striate. 3-4 inches (7.5-10 cm.) long, or 2-2½ (5-6.5 cm.) (Benth.)	Straight, lanceolate. Rigid, very finely striate. 5-7 cm. long, 4 mm. broad.	Linear, finely striate, with parallel nerves, besprinkled with short hairs. 10 or 11 cm. long, 2 mm. broad.
<i>Peduncles</i> ...	Very short	In pairs, covered with golden hairs. .5 mm. long.	In pairs, densely hairy.
<i>Number in head</i> ...	Twenty. More or less viscid.	Thirty	Thirty-six.
<i>Bract</i> ...	Conoid-capitate	Conoid-capitate	Fan-shaped at top.
<i>Sepals</i> ...	Spathulate, hairy, but chiefly upper half.	Spathulate, hairy, but chiefly upper half. More hairy than others.	Spathulate, hairy, chiefly at top.
	About half as long as corolla.	Scarcely half as long as corolla.	Half as long as corolla.
<i>Petals</i> ...	Glabrous	Hairy all over	Smooth.
<i>Ovary</i> ...	Hoary-pubescent	Hirsute	Densely hairy.
<i>Pod</i> ...	Narrow linear, twisted, 7.5 cm. long, 3 mm. broad. Slightly contracted between seeds. Puberulous.	Medium width, twisted into a double curve. Grey tomentum. Reticulately veined, 1 dm. long, 6 mm. broad.	Markedly moniliform, 8 cm. long, 4 mm. broad. Glaucous. Much contracted between seeds.
<i>Seed</i> ...	Ovate, black, longitudinal	Longitudinally arranged. (Not seen.)	Brownish-black, ovoid.
<i>Funicle</i> ...	Several folds, turbinate, almost cup-shaped aril.		Pendulous, with small arillus encircling seed for half its length.

Illustrations.—*A. cana* is figured at Part XXX, Plate 114 of this work (F-N) as *A. rigens*-A. Cunn., but that is a mistake.

Botanical Name.—*Acacia*, already explained (see Part XV, p. 104); *cana*, the Latin for hoary, grey, white with frost, words which convey the idea of the appearance of the foliage.

Vernacular Name.—See Part XVI, p. 130 of this work, where the question is asked, "The Nealie, Nelia, Nilyah. What is it?" As a matter of fact there are at least three Nealies, and the present one may be called the "Broad-leaved Nealie."

Size.—It is a tall bush or small tree, not attaining sufficient size to be used as timber, except for purely local purposes.

Habitat.—It is a dry country species, and, so far as we know at present, confined to the driest parts of New South Wales and Queensland. At the same time, I rather confidently expect it to be found in north-eastern South Australia or the Northern Territory, nearest to the New South Wales and Queensland localities.

New South Wales.—With the exception of the “Riverina” locality, which is too vague, the species is only recorded from the White Cliffs and Milparinka districts, trans-Darling localities on the route from Wilcannia to the extreme north-west of the State.

Riverina (L[ockhart] Morton). Labelled *A. homalophylla* by Mueller). In unripe curved pods; phyllodes rather broad.

“Nealie.” E. P. O'Reilly, Public School, White Cliffs. In flower. “Nilyah,” bushy, 14 miles south-west of White Cliffs. Inclined to follow damp courses (J. E. Carne through R. H. Cambage). Foliage only.

“Branches erect. The Nilyah has never been known to flower in this district. I am rather reticent as to whether this is the real Nilyah about here. It is pronounced Nilyah, Nelie, and Nelia.” (C. G. Ivey, Public School, Milparinka, 1905.) In flower. (This is the type.) Twelve feet high, branches pendent to the ground. *Acacia pendula*, Evelyn Creek, Sept. 1887 (Mueller's label). (The label of the collector, W. Baeuerlen, reads “Koorningbirry, Sept. 1887, William Baeuerlen, No. 176.) The locality is Lat. 30°, Long. 142° 7", a few miles south of Milparinka. In this specimen the flowers are from two to seven in a node.

Queensland.—“Locally called Boree. Has silvery appearance.” Thompson River, Longreach. (R. H. Cambage, No. 3971.) In early pod, slightly falcate. Recorded provisionally as *A. homalophylla*.

No. 253.

Acacia Loderi Maiden.

Medium-leaved Nealie.

(Family LEGUMINOSÆ: MIMOSÆ.)

Botanical description.—Genus *Acacia*. See Part XV, p. 103.

Botanical description.—Species *Loderi* Maiden in *Journ. Roy. Soc. N.S.W.*, LIII, 209 (1919).

Following is the original description:—

A hoary or glaucous, dense shrubby tree, up to about 20 feet high. Wood deep brown, bark flaky fibrous, and more or less furrowed, branchlets at first slightly angular.

Phyllodia linear, with a fine, hooked point, tapering towards the base, about 10 or 11 cm. long, 2 mm. broad, thick, besprinkled with short hairs, very finely striate with parallel nerves only to be seen under a lens, decurrent. A swollen gland at the base.

Peduncles in pairs or more, densely hairy, bearing dense globular heads of about thirty-six flowers, mostly 5-merous. In racemes as in *A. homalophylla*. Bracts fan-shaped at the top.

Sepals spatulate, free, hairy chiefly at the top, half as long as the corolla. Petals smooth, free. Ovary densely hairy.

Pod with a fine tomentum, narrow, markedly moniliform, up to 8 cm. long, 4 mm. broad, convex over the seeds and much contracted between them.

Seeds brownish-black, ovoid, with a distinct areole, with a long, thread-like pendulous funicle encircling the seed for half its length, and terminating in a slightly enlarged arillus at the top of the seed.

Affinities.—It has relations with *A. Cambagei* R. T. Baker, the common "Gidgee," which is figured in Part XXXII of this work. It has odoriferous foliage, but the phyllodes are broader and the pods very different.

At p. 252 I have already drawn attention to its relations with *A. rigens*, and with the Broad-leaved Nealie (*A. cana*).

Illustrations.—*A. Loderi* is figured at B, C, D, E, Plate 114 (Part XXX), under the name of *A. rigens*.

Botanical Name.—*Acacia*, already explained (see Part XV, p. 104); *Loderi*, in honour of Andrew C. Loder, Forester in charge of the Broken Hill district, N.S.W., for many years, who supplied specimens.

Vernacular Names.—It is one of the Wattles known as "Nealie," and, to distinguish it from others bearing the same designation, I propose the name "Medium-leaved Nealie."

Leaves (Phyllodes).—The phyllodes are often attacked by flattened galls which give them a knotted appearance. Mr. Froggatt informs me that they are apparently the work of a hymenopterous insect (a Chalcid wasp). Similar galls are to be found in other Wattles (*e.g.*, the Western Australian *A. triptycha*).

Timber.—Deep brown, but only available for local uses, on account of its small size.

Habitat.—So far as we know at present it is confined to New South Wales, and mainly to the Broken Hill district, but so close to the South Australian border that it is impossible for it not to occur in the latter State.

Thackaringa, west of Broken Hill, close to South Australian border. (J. E. Carne, October, 1907.) In flower.

"Nelia." Mulculca Creek, 20 miles south-east of Broken Hill. (Assistant Forester Andrew C. Loder, No. 29, same tree as No. 17, January, 1906.) Phyllodes only, attacked by galls. Also flowers, October, 1905.

Kars, some 40 miles south-east of Broken Hill. (A. C. Loder, January, 1907.)

"Nelia." Yancowinna, Broken Hill district. (A. C. Loder, November, 1905.) Flowers, wood and bark. (This is the type.)

"Broken Hill Gidgee." Dense shrubby tree, hoary or glaucous. Twenty to twenty-two feet in extreme height. (E. C. Andrews, November, 1918.) Fruits and late flowers.

Ivanhoe, *via* Hay (K. H. Bennett, 1886.) In flower only and det. Mueller as *A. rigens*. These specimens accompanied the bark analysed as *A. rigens* in the second edition of my "Wattles and Wattle-barks." The specimens in my possession are not very good, and I invite attention to the district as a probable, not absolutely certain, locality for the species.

No. 254.

Canthium oleifolium Hook.

A Wild Lemon.

(Family RUBIACEÆ.)

Botanical description.—Genus *Canthium* Lamarck, *Encycl. méthod.*, I, 602 (1783).

Calyx-limb short, more or less toothed. Corolla-tube short or cylindrical; lobes four or five, valvate in the bud. Anthers exserted or rarely included in the tube. Ovary 2-celled, with one ovule in each cell, laterally attached near or at the top. Style exserted, with a thick ovoid or mitre-shaped entire or 2-lobed stigma. Fruit a globular compressed or didymous drupe, with one or two 1-seeded pyrenes. Shrubs either unarmed or with axillary thorns. Stipules interpetiolar, pointed, with a broad base. Flowers in axillary cymes or clusters. (B.Fl. iii, 421.)

Botanical description.—Species *oleifolium* Hooker, in Mitchell's "Tropical Australia," p. 397.

The original reference is 11th December, 1846, ". . . a new *Canthium* was in fruit." The footnote is "*C. oleifolium* Hook., M.S. Foliis obovato-oblongis obtusis glaucis basi in petiolum gracilem attenuatis, stipulis parvis acutis, fructibus didymis."

Bentham described it more fully in the following words :—

A tall glabrous shrub, sometimes glaucous, a few branchlets occasionally degenerating into short spines.

Leaves oblong, obtuse, narrowed into a short petiole, rarely above 1½ inch long in the flowering specimens, larger in barren ones, thick and smooth but scarcely shining, the veins usually inconspicuous.

Flowers in short almost sessile axillary cymes, rather smaller than in *C. lucidum*, and varying in the number of parts four or five.

Corolla tube nearly as long as the lobes, the flowers otherwise the same as in *C. lucidum*.

Fruit also the same, didymous when both carpels ripen. (B.Fl. iii., 422.)

Mr. R. T. Baker and I described a variety *pedunculatum* as follows :—

"This variety differs from the normal species in having peduncles sometimes over an inch long, instead of 'flowers in short, *almost sessile*, axillary cymes.' This variety is from Condobolin, N.S.W." (Proc. Linn. Soc. N.S.W., XIX, 460.)

Botanical Name.—*Canthium*, from a Malabar (India) vernacular name Cantix; *oleifolium*, Latin, with leaf resembling that of an Olive (*Olea*).

Vernacular Name.—"Wild Lemon" is the only name I have personally heard applied to this shrub, but it shares it with other plants, *e.g.*, *Eremocitrus glauca* p. 241. Sometimes it is known as "Native Orange" for a change. Mr. Mullen says it is known as "Myrtle" in the Bourke district, which is to be regretted; and Mr. Boorman, also a good observer, says it is called "White Wood" near Wanaaring.

Leaves.—This is another of the western trees (compare *Flindersia maculosa* in Part X, p. 212) which has protective arrangements.

In the early stages (I am speaking of the Bogan, where I know it best) the young stem is protected by powerful thorns which disappear from the trunk as growth proceeds. The young trees have vertical stems and grow in clumps for protection.

Mr. R. N. Peacock says, "Sheep are very fond of it. It grows to the height of from 10 to 12 feet, providing a fair amount of fodder for its size. You will see the sheep standing upon their hind legs, like goats, eating all within reach. I have noticed large-framed, tall sheep in very much better condition owing to the advantage thus given to them."

Bentham says the leaves are scarcely shining and the veins are rarely conspicuous, but I have not infrequently seen specimens which contradict both of these statements.

Timber.—The trunk is mostly straight, and usually 5 or 6 inches in diameter, with branches at right angles, which contrast it with most of its neighbours. Wood hard, close-grained, and capable of a high polish.

Following are two representative specimens:—

"Bark thin, scaly, 6 inches diameter. 'Wild Lemon.' Timber *pale-coloured* white with a pale yellow tinge, hard, of very little figure." Cobar, N.S.W. (Archdeacon Haviland). Bark thin, scaly; timber *pale-coloured*, hard and apparently somewhat brittle, a quiet, small figure. Narrabri, N.S.W. (J.H.M.).

Size.—It is a small tree or tall shrub of 8–20 feet. Cobar, N.S.W. (J. L. Boorman). It rarely attains a diameter much more than 6 inches.

Habitat.—It is found in the drier parts of New South Wales and Queensland, and one specimen is recorded from Western Australia. The following localities are given in the *Flora Australiensis*:—

Queensland.—Burdekin River (F. Mueller); Suttor River (Sutherland).

New South Wales.—Plains of the Gwydir (Mitchell); Castlereagh River (C. Moore); Darling River to Cooper's Creek (Nielson).

It grows in small groups, and Thozet says, speaking of Central Queensland, that it is met with in poor soil. It is found in moderately dry situations. The dry New South Wales localities render the Western Australian locality reasonable, and we now should find it in the intermediate State of South Australia. The type locality is northern New South Wales, near the Queensland border ("Plains of the Gwydir," Mitchell, as already recorded).

NEW SOUTH WALES.

Following are some specimens in the National Herbarium, Sydney :—

Wooyeo Station, Lake Cudgellico (G. Stirling Home, Miss Clements). Condo-bolin-Euabalong Road (J.H.M.).

15–20 feet, with smooth bark, Blow Clear State Forest, 8 miles north of Bogan Gate (Forest Guard K. Walker).

Dubbo district (Forester C. Marriott).

Mt. Boppy (J. L. Boorman); Cobar (L. Abrahams); “Lemon,” Nyngan (Forest Guard E. F. Rogers); Coolabah (J.H.M., J. L. Boorman, R. W. Peacock); Bourke district (O. C. Macdougall).

“Myrtle.” “Edible but stock are not very fond of it. Grows only on red soil.” Bourke district (A. W. Mullen, L.S.).

“White Wood,” because of the white appearance of the growing plant. 8–20 feet. A useless timber seldom reaching maturity because of attacks of borers.” 37 miles from Wanaaring, beyond the Darling (J. L. Boorman).

“Locally, but I think incorrectly, called Mogil (this is usually applied to *Capparis*.—J.H.M.). Mr. C. Stewart, Manager of Weilmoringle, mixes the ripe berries with strychnine for the purpose of poisoning rabbits. Weilmoringle Sandridge, about 65 miles from Brewarrina on the Culgoa River (C. J. McMaster).

Brewarrina Common (C. J. McMaster); Yarrawin Station, Barwon River (W. W. Froggatt).

“Wild Lemon,” Wallangulla (opal fields) *via* Collarenebri (C. J. McMaster).

“Tree grows on sand ridges and always looks as if dying. Grows with a droop mostly and about 15 to 20 feet, with up to 6 inches thick. Flowers have a sweet perfume.” 40–50 miles north-west of Collarenebri (Sid W. Jackson).

Narrabri (J.H.M.); tree up to 15 feet growing on sandridges throughout the district. Near Turrawan (Assistant Forester Gordon Burrow); Plains near Baradine (W. Forsyth); Boggabri (R. H. Cambage, No. 2487); Gunnedah (E. Betcher).

Currabubula, at 2,300 feet (R. H. Cambage, No. 3555).

Moree (Miss E. F. Gilmore); Currygundi (Forest Guard W. M. Brennan); Gravesend (W. A. W. de Beuzeville); Warialda (J. L. Boorman); Ticketty Well (Forester A. Julius).

I have a specimen which is labelled “1846, No. 491, *Canthium oleifolium*, Lieut.-Col. Sir T. L. Mitchell.” In fruit. Part of the type. He was then between the Gwydir and the Barwon.

We now go south.

“Native Orange,” Gungal. “Large shrubs or small trees of 12–20 feet. Invariably found in close proximity to large rocks, usually on the lower spurs of ranges. Tall, weak growing.” (J. L. Boorman.)

A. W. Mullen, photo.

MYRTLE TREE (*Canthium oleifolium*), BOURKE, NEW SOUTH WALES.

R. H. Cambage, photo.

WILD LEMON (*Canthium oleifolium*), TOTTENHAM
NEW SOUTH WALES.

C. J. McMaster, photo.

TREE (*Canthium oleifolium*) AT WEILMORINGLE,
NEW SOUTH WALES.

A. W. Mullen, photo.

EMU BUSH (*Eremophila longifolia*), BOURKE, NEW SOUTH WALES.

W. Gill, photo.

TREE (*Eremophila longifolia*), AT MOUNT BROWN FOREST, NEAR
QUORN FLINDERS' RANGES. SOUTH AUSTRALIA.

A WILD LEMON.

(*Canthium oleifolium* Hook.) (A-F)

A CANTHIUM.

(*Canthium coprosmoides* F.v.M.) (G-O)

Murrumbo, Goulburn River (R. T. Baker); Karrabri, *via* Rylstone (J. Dawson, through R. T. Baker). We are now in the Mudgee district, and Rylstone is the locality furthest south known to me.

QUEENSLAND.

The first two localities now quoted join on to the Ticketty Well locality already quoted, in a general way:—

Inglewood, 73 miles south-west of Warwick (J. L. Boorman).

Texas, some 45 miles to the south-east of Inglewood, and close to the N.S.W. border (J. L. Boorman).

“Rubiaceous tree scrub, 2 Jan., 1847.” (In Dr. Leichhardt’s handwriting.) On that date I think he was on the Darling Downs.

Wallumbilla, 294 miles from Brisbane; Roma is 24 miles further on. (E. W. Bick.)

Duaringa, 66 miles west of Rockhampton (A. Beck).

Small tree of 12–16 feet, with rough, hard, corrugated bark; timber hard, yellow. Emerald, 166 miles west of Rockhampton (J. L. Boorman).

Saxby River (Miss F. Sulman).

WESTERN AUSTRALIA.

It was recorded by Mueller and Tate (*Proc. Roy. Soc. S.A.*, XVI, 364) for Western Australia. It had been collected in the Victoria Desert on 6th September, 1891, at Camp 42. “Desert Gums (*Eucalyptus eudesmioides*) numerous.” During the night it was “13 deg. below freezing.”

EXPLANATION OF PLATE 250 (IN PART).

- A. Flowering twig, north-west of New South Wales.
- B. Bud.
- C. Corolla opened out showing insertion of the stamens.
- D. Pistil—
 - a. Calyx.
 - b. Style.
 - c. Stigma mitre-shaped.
- E. Two-celled ovary.
- F. Fruit from Gungal, New South Wales.

PHOTOGRAPHIC ILLUSTRATIONS.

1. “Myrtle,” Bourke, New South Wales. (A. W. Mullen, photo.)
2. “Wild Lemon,” Tottenham, New South Wales. (R. H. Cambage, photo.)
3. Tree at Weilmoringle, New South Wales. Berries mixed with poison used to kill rabbits. (C. J. McMaster, photo.)

No. 255.

Canthium coprosmoides F.v.M.

A *Canthium*.

(Family RUBIACEÆ.)

Botanical description.—Genus *Canthium*, see p. 256.

Botanical description.—Species *coprosmoides* F.v.M. in *Trans. Phil. Inst. Vict.*, iii, 47 (1859).

Following is the original description :—

Glabrous; leaves thinly coriaceous, ovate, flat, entire, blunt at the apex, tapering into the petiole; peduncles none; pedicels axillary, solitary or two or three together, scarcely as long as the calyx; lobes of the corolla five, rarely four, half as long as the tube, above thin velvety; faux bearded; anthers ovate, almost sessile; stigma hemispherical; berry red.

In scrubs on ridges along the rivers Dawson, Mackenzie and Brisbane.

Shrub from 6–10 feet high. Leaves 1 to 2½ inches long, their stalk 1½–3 lines long, above dark-green and shining, beneath a little paler, finely veined. Stipules from a broad base subulate, 1½–2 lines long, deciduous. Calyx at first bell-shaped, scarcely longer than one line, with five acute and very short teeth. Corolla funnel-shaped, outside glabrous and yellowish; its tube ¼ inch long; its lobes ovate. Anthers ⅔ line long. Style bristlelike, glabrous, not exerted. Stigma slightly concave in the centre, half a line in diameter. Berry naked, 3–4 lines long, upwards a little broader, with two nuts.

Bentham subsequently described it as follows :—

A tall shrub or small tree, quite glabrous.

Leaves obovate, ovate or broadly elliptical, obtuse, shortly contracted at the base, in some specimens all under 2 inches, in others 3–4 inches long, coriaceous but scarcely shining, the veins distant and not prominent.

Flowers 4-merous or 5-merous, very shortly pedicellate, in sessile axillary clusters of three to six.

Corolla-tube slender, fully 4 lines long, bearded inside at the orifice, the lobes about half as long as the tube.

Anthers slightly protruding.

Style exerted, with a broad, thick peltate stigma.

Fruit sometimes ½ inch broad, on a pedicel of 2 to 4 lines. (B.Fl. iii, 422.)

Bentham adds “ This species is very closely allied to *C. barbatum* Benth., from the Pacific Islands, but the leaves are more coriaceous and obtuse, the petals shorter, and the corolla-lobes more obtuse.”

Botanical Name.—*Canthium*, already explained (see p. 256); *coprosmoides*, reminding the describer of plants of the genus *Coprosma*.

Synonyms.—*C. barbatum* Seem.; *Plectronia barbata* Hook. f.; *Chiococca barbata* G. Forst.; *C. odorata* Hook. et Arn. in "The Botany of Captain Beechey's Voyage," by Hooker and Arnott (1831). The plant figured as *C. barbata* at Tab. XIV was collected in the Society Islands (Elizabeth Island).

Leaves.—Dry, dark, and sometimes even blackish.

Flowers.—Fragrant.

Fruit.—Red (Mueller).

Timber.—Bark ashy grey, smooth. Wood dark yellow, streaked with a brown colour, very prettily marked or grained; a useful wood for turnery and cabinet-work (*Cat. Queensland Woods, Col. and Ind. Exh.*, 1886).

Size.—It attains the size of a medium-sized tree, but is usually a shrub or a small tree.

Habitat.—The following localities are given in the *Flora Australiensis*:—

Queensland.—Port Denison (Fitzalan); Edgecombe and Rockingham Bays (Dallachy, W. Hill); Rockhampton (Thozet); Dawson and Brisbane Rivers (F. Mueller).

New South Wales.—Port Jackson to the Blue Mountains (R. Brown and others); Hastings and Clarence Rivers (Beckler).

The original description was drawn up from a mixture of plants from the Dawson, Mackenzie and Brisbane Rivers, Queensland.

Following are specimens in the National Herbarium, Sydney:—

"River Brisbane, 6 Jul., 1843." (Dr. Leichhardt's handwriting.)

"At the creek near the 3-mile scrub. Mor(eton) Bay, 13 Jul., 1843." (Dr. Leichhardt's handwriting.)

Near Brisbane (J. L. Boorman). Mooloolah River, about 50 miles north of Brisbane (C. T. White).

Doubtless collected at Botany Bay (Banks and Solander, *Illust. Bot. Cook's Voy.*, tab. 144, p. 46).

"Port Jackson," R. Brown, 1802-5; Port Macquarie (Forester G. R. Brown); Hastings River (Dr. H. Beckler). Shrub of 6-10 feet, Lennox Head, Ballina (W. Baeuerlen); tree 40-50 feet, 9-15 inches, Lismore (W. Baeuerlen).

EXPLANATION OF PLATE 250 (IN PART).

- g. Flowering twig (cult. Botanic Gardens).
- h. Bud.
- i. Flower seen from above showing—
 - a. Corolla-lobes.
 - b. Anthers.
 - c. Stigma.
- k. Flower opened out showing—
 - a. Corolla-tube.
 - b. Anthers.
 - c. Corolla-lobes.
 - d. Style with capitate stigma.
- l. Part of flower showing two lobes of the corolla not yet separated, with anthers alternating with the lobes and long hair-like scales between them.
- m. Pistil—
 - a. Calyx adnate to the ovary.
 - b. Style.
 - c. Stigma.
- n. Two-celled ovary.
- o. Fruit.

Besides the two figured, we have the following species:—

1. *C. latifolium*.
2. *C. attenuatum*.
3. *C. lucidum*.
4. *C. buxifolium*.
5. *C. didymum*.
6. *C. vacciniifolium*.

1. *C. latifolium* F. Muell. Herb.

A glabrous and apparently glaucous shrub, nearly allied to *C. lucidum*.

Leaves broadly ovate, very rigid, the pinnate veins and reticulations much more prominent than in *C. lucidum*.

Flowers much smaller than in that species, and in looser cymes, otherwise their structure as well as the inflorescence the same. (B.Fl. iii, 421.)

Variously called "Mogil-Mogil," "Wild Orange," or "Wild Lemon." A small tree; the timber is hard and close-grained, but seldom used. It is, nevertheless, somewhat ornamental, being pinkish, with streaks of a darker colour. Diameter, 3-6 inches; height, 16-20 feet.

Habitat.—*New South Wales*.—In the interior towards the Barrier Range (Nielson ?) in Herb. F. Mueller.

South Australia.—N.W. interior (M'Douall Stuart).

The above are Bentham's localities. It is found in the Macdonnell Ranges (Northern Territory), and has since been found in Kin Kin Queensland (C. T. White).

2. *C. attenuatum* R. Br. (B.Fl. iii, 421).

This is found in northern Queensland and the Northern Territory.

3. *C. lucidum* Hook and Arn.

In *Botany of Beechey's Voyage*, p. 65 (1831).

The brief description is in the following words:—

Ramis inermibus, foliis breviter petiolatis ellipticis obtusis, basi paululum attenuatis coriaceis supra lucidis subtus pallidis, cymis pedunculatis axillaribus, bacca subglobosa.

This plant has the calyx 4-5-toothed, the corolla 4-5-lobed, and either four or five stamens. The character accords with that of the genus in De Candolle's Prodr., v. 4, p. 473, and our species appears closely allied both to *C. glabrum* and *C. nitens*.

Bentham more fully describes it as follows:—

A tall shrub or small tree, quite glabrous.

Leaves ovate, obovate or elliptical oblong, obtuse or scarcely acuminate, narrowed into a short petiole, scarcely exceeding 2 inches in some specimens, 4 to 6 inches long in others, coriaceous, very smooth and shining, with distant very oblique veins scarcely prominent.

Cymes axillary, shortly pedunculate, often large and many-flowered but shorter than the leaves.

Pedicels short or sometimes the flowers sessile, except those in the forks.

Corolla glabrous outside, slightly hairy inside, the tube about 1 line; lobes about 2 lines long.

Anthers exserted.

Stigma thick, ovoid, more or less mitre-shaped (hollowed at the base round the style).

Fruit, when both carpels ripen, somewhat compressed and didymous, 3 to 4 lines broad, but often 1 seeded and nearly globular. (B.Fl. iii, 421.)

Roth, in his North Queensland Ethnography, gives the following particulars:—
Berries eaten raw. Red Island, Pennefather and Batavia Rivers, called "Warra-anji."

Synonyms.—*C. lamprophyllum* F.v.M.; *C. odoratum* Seem.; *Plectronia odorata* F.v.M.; *Coffea odorata* G. Forst.; *Ixora odorata* Spreng.; *Pavetta dubia* Endl.

Wood of a yellow colour, close-grained, tough and nicely marked; likely to prove useful for cabinet-work. (*Cat. Queensland Woods, Col. and Ind. Exh.*, 1886.) Diameter 6 to 12 inches; height 20 to 30 feet.

Habitat.—The following localities are given by Bentham:—

North Australia.—Gulf of Carpentaria (R. Brown).

Queensland.—East coast (R. Brown); Dawson and Burnett Rivers (F. Mueller); Port Denison (Fitzalan); Edgecombe Bay (Dallachy); Rockhampton (Thezet); Brisbane River, Moreton Bay (A. Cunningham, F. Mueller and others).

New South Wales.—Clarence River (Beckler); Tweed River (C. Moore).

Other Queensland localities are given by Bailey, and the following specimens from the Richmond River to the Queensland border are represented in the National Herbarium, Sydney :—

“ Bricklow (?) Scrub, Kent's Lagoon and Bokkara Creek, 26th December, 1846.”
(Dr. Leichhardt.)

Kyogle (E. G. McLean No. 25); Woodburn, Richmond River (J. L. Boorman and J.H.M.); Lismore (W. Baeuerlen); Ballina (W. Baeuerlen); Richmond River (C. Fawcett).

Bark smooth—lichen stained—the timber of a wavy outline with the very thin bark naturally following this outline and having a peculiar appearance. Timber hard, pale, little figure. Acacia Creek, Macpherson Range (Forest Guard W. Dunn). The herbarium specimens are interesting and seem to indicate a form intermediate between *C. lucidum* and *C. buxifolium*.

4. *C. buxifolium* Benth, in Bl. Fl. iii, 422 (1866).

Glabrous and much-branched.

Leaves ovate or broadly elliptical, obtuse or obscurely and obtusely acuminate, narrowed into a short petiole, rarely exceeding 1 inch in length, coriaceous, very smooth and shining, the veins few, very oblique and scarcely conspicuous.

Flowers 4-merous, very small, rather numerous in pedunculate cymes about as long as the leaves, the pedicels short except those in the forks.

Corolla not 2 lines long, the tube exceedingly short, glabrous inside, the lobes much longer.

Stamens exserted.

Stigma mitre-shaped.

Fruit of *C. lucidum* or rather smaller. (B.Fl. iii, 422.)

The wood is of a light colour, close in the grain, and useful for turnery work.

Habitat.—According to Benth, we have it from Queensland—Burnett and Dawson Rivers (F. Mueller); also in Leichhardt's collection.

I have seen it from Killarney (C. T. White), which is near the New South Wales border, and it is extremely unlikely that, with very similar conditions extending for a considerable distance, it does not occur in New South Wales. It should be searched for.

5. *C. didymum* Roxb.

This is an Indian species, not known for Australia until Mueller recorded it from Rockingham Bay, Queensland, in *Fragm.*, IX, 186.

6. *C. vacciniifolium* F. Muell.

In *Trans. Phil. Inst. Vict.* iii, 47 (1859).

A shrub attaining 16 feet or more, with very numerous slender divaricate branches, the smaller branchlets sometimes spinescent.

Leaves petiolate, from broadly obovate to oblong, obtuse, $\frac{1}{4}$ to nearly $\frac{1}{2}$ inch long, the veins scarcely conspicuous.

Flowers usually 4-merous, two or three together in little axillary cymes, the common peduncle and pedicels very short and slender.

Corolla about 3 lines long, the lobes narrow, acute, rather shorter than the tube.

Stamens exserted.

Stigma ovoid, divided to the base into two thick lobes.

Fruit, when ripening both carpels, a little more than 2 lines diameter, the pyrenes not so hard, as in *C. lucidum*, and especially as in *C. coprosmoides*. (B.Fl. iii, 422.)

Synonyms.—*C. microphyllum* F.v.M.; *Plectronia vacciniifolia* Hook. f.

Timber.—It has a stem of very irregular outline; timber pale. Hill speaks of it as close grained; used for walking sticks. It has but a small girth. The largest specimen I have ever seen was a cultivated specimen in the Botanic Gardens, Sydney, which died a few years ago. Allowing for the irregular outline, it was about 2 feet in girth. The height was about 15 feet.

Habitat.—*Queensland.*—Cairncross Island and Suttor River (F. Mueller); Mount Wyatt (Bowman); Kent's Lagoon (Leichhardt); Brisbane River, Moreton Bay (F. Mueller, C. Stuart).

New South Wales.—Macleay River (Beckler).

The above records are from the *Flora Australiensis*. I have seen it from Beechwood, Hastings River (with pale yellow flowers), which brings it a little further south.

No. 256.

Eremophila maculata F.v.M.

A Wild Fuchsia.

(Family MYOPORACEÆ.)

Botanical description.—Genus *Eremophila*, see Part LXV, p. 211.

Botanical description.—Species *maculata* F.v.M. in *Proc. Roy. Soc. Tas.* 297 (1859).

According to Bentham (B.Fl. v, 29), who gives the synonymy, the first reference to the plant is as—

- (a) *Stenochilus maculatus* Ker., the “Spotted flowered *Stenochilus*,” in *Bot. Reg.*, t. 647 (1822).

Here we have a charming coloured drawing, most fully described, both in Latin and English. It was drawn at the Nursery of Messrs. Colvill, King’s-road (Chelsea) London, and “originally observed, we are told, on a late expedition beyond the Colony in New South Wales.” This would refer to one of Allan Cunningham’s collecting trips, probably the celebrated pioneer one in 1817, as recorded in Oxley’s “Journals of Two Expeditions into the Interior of New South Wales” (1820).

Then we have, in historical succession :—

- (b) *Stenochilus racemosus* A.DC. *Prod.* XI, 715 (1847). Here we have the description, together with a new variety *ochroleucus*, based on Allan Cunningham’s *S. ochroleucus*, collected by him in the Lachlan River district in 1836, the name being in MSS.
- (c) *Stenochilus racemosus* Endlicher, *Nov. Stirp.*, Dec. 50. This was probably published in the year 1839; I have not seen it.
- (d) Bentham, in Mitchell’s *Tropical Australia*, p. 221 (1848), says, “I observed a new species of *Stenochilus* with large tubular flowers :—*S. curvipes* (Benth. MS.).

Following is a translation of the description :—

“Glabrous, leaves lanceolate, entire, narrowed at the base into the petiole, pedicels recurved, calycine leaflets broad, acuminate, the acute segments of the ventricose glabrous corolla having the lower one free below the middle.”

Then he adds, in English, “Flowers large and thick on recurved pedicels, 4–6 lines long. Calycine leaves broader than in all the other species.”

(e) R. Br., App. Sturt Exped., 22 (not 23). This is p. 86 of Vol. II of Captain Sturt's work, published in 1849.

Here Robert Brown, under *Stenochilus maculatus*, quotes Ker, and also Allan Cunningham's MSS. 1847 (? 1817.—J.H.M.).

He adds that *S. curvipes* Benth. is a variety of *S. maculata*, with the point of the sepals a little shorter.

He goes on to say that while A. De Candolle refers *S. ochroleucus* A Cunn. (MSS 1817) as a variety of *S. maculatus*, "it is, however, very distinct, having a short erect peduncle like that of *S. glaber*, to which it is much more nearly related, differing chiefly in its being slightly pubescent."

Following is all we find at the place cited—*Proc. Roy. Soc. Tas.*, 297 (1859):—

"*Eremophila maculata* F.v.M., *Stenochilus maculatus* Ker, *Bot. Reg.*, 647. *S. curvipes* Benth., in *Mitch. Trop. Austr.*, p. 221. Gulf of Carpentaria, Eastern, tropical and extra-tropical Australia, Australia Felix, Central and South Australia."

The full description by Bentham is :—

A tall shrub, with rigid divaricate branches, more or less hoary-tomentose or pubescent, the adult foliage usually glabrous. Leaves mostly lanceolate, varying, however, from elliptical-oblong to linear, acute or obtuse, entire, contracted into a petiole, rarely above one inch long, flat and green on both sides or hairy when young. Pedicels solitary, often above $\frac{1}{2}$ inch long, very spreading or reflexed but turned up again under the flowers. Calyx-segments much imbricate and ovate at the base, acuminate, 2 to 3 lines long or more. Corolla glabrous outside, "red, more or less variegated with yellow or quite yellow," 1 inch long or more, the broad tube constricted above the ovary, the upper part slightly incurved and not much dilated, the four upper lobes short and acute, the lowest one narrow, recurved, separated to below the middle of the corolla. Stamens usually but perhaps not always exserted. Ovary glabrous, with two or three pairs of ovules to each cell. Fruit ovoid-globular, shortly acuminate, above $\frac{1}{2}$ inch diameter, very succulent, with a hard bony putamen, completely 2-celled and less perfectly 4-celled. Seeds small, without so much albumen as in some species. (B.Fl. v, 30.)

Botanical Name.—*Eremophila*, already explained, Part LXV, p. 212; *maculata*, spotted, on account of the blotched markings of the corolla.

Vernacular Name.—It often goes by the name of "Wild Fuchsia" on account of a fancied resemblance of the flowers to those of the common Fuchsia.

Aboriginal Name.—"Wedgera" of those of Hungerford, beyond the Darling, N.S.W.; "Tchuldani" of those of Cooper's Creek, near Lake Eyre (A. W. Howitt); "Pitula" of the aborigines; "Pitula bumbu" is the flower, "Kati" is the seed (fruit). Lake Eyre (Prof. W. Baldwin Spencer).

Synonyms.—The synonyms or reputed synonyms of this species have already been referred to.

Leaves.—There are a good many reports by drovers and stockowners on the effect of the leaves on stock. There is no doubt now that they may contain a cyanogenic glucoside in certain seasons, and so may be poisonous to stock, but the plain man is puzzled in the case of all part-time poison plants, and hence he sometimes denies

its poisonous character altogether, perhaps suggesting it may have been confused with some other plant, or he may advance the theory that "it does not appear to be dangerous to stock accustomed to eat it." At the same time it is sometimes a useful fodder plant. "Sheep eat it sparingly," Mt. Lyndhurst (Max Koch).

Following are specimens of reports made in the days before we knew anything of cyanogenetic glucosides :—

It does not appear to be dangerous to stock accustomed to eat it, but to others, travelling stock particularly, Mr. Hutchinson, of Warrego (Q.), considers it to be deadly. The effects of this plant are always worst after rain. It appears to be most dangerous when in fruit. (Bailey and Gordon.)

"Native Fuchsia" (*Eremophila maculata*). The leaves and fruit of this plant have been credited with having poisonous properties, but, from information obtainable here, I must conclude that it is quite innocuous, stock being very fond of it; so much so that on many of the runs no plants can be found excepting in the horse paddocks, sheep being particularly fond of it. The shrubs I have seen attained no great height, being kept down by stock. When in bloom it is most attractive. (R. W. Peacock, then of the Coolabah Experiment Farm.)

The following reports were published by me in the *Agricultural Gazette of New South Wales* during the year 1898 :—

The Stock Inspector from Bourke district reports that a large number of travelling sheep died from eating fuchsia bush in the Bourke district. The sheep were in good condition, and not hungry. After having watered them, of those that ate the plant some 300 died, fifty of them almost immediately, the remainder in three hours afterwards. He opened several of the sheep, and found that the last food they had eaten was this fuchsia bush. In the reply sent to the Inspector it was suggested that the sheep might have died from hoven, and that I was not aware that a toxic principle had ever been extracted from the natural order of plants to which it belongs. Shortly afterwards the Inspector of Stock, Hungerford, north-west of Bourke, reported that a number of cattle had been poisoned when travelling over the country where the plant grows, which only seems to poison stock in the winter (p. 741).

"Mr. T. W. Mackie, Inspector of Stock for Hungerford, wrote to the Chief Inspector of Stock stating that he had made a thorough trial of the plant *Eremophila maculata* on two sheep, which were starved for ninety-six hours before the plant was given them to eat. They ate the plant, and were then held in the pen for thirty-six hours, but the plant did not seem to have any bad effect on them, so they were turned out."

This plant was accused of killing sheep at Listowel Station, Queensland. Around this particular bush, from which specimens were sent to me for investigation, no less than eight wethers were found dead, I pointed out that this plant is esteemed in some districts as a useful fodder plant. As regards deaths attributed to it, it must be ascertained that the animals did not die from anthrax or from hoven (p. 381, 1899).

F. B. Guthrie (*Agricultural Gazette*, Oct. 1899) published an analysis as follows :—

Wild Fuchsia.—Water 33.32, ash 3.88, fibre 5.13, ether extract (oil, &c.) 1.49, albumenoids 9.06, carbo-hydrates 47.10, nutrient value $59\frac{1}{2}$, albumenoid ratio 1 : $5\frac{1}{2}$, tannin (oak bark) 3.0.

In the *Queensland Agricultural Journal* for December, 1910, p. 291, J. C. Brünnich and F. Smith published a paper, "The poisonous principle of Native Fuchsia (*Eremophila maculata*)."

The latter author, continuing his researches, published "Notes on the cyanogenetic glucoside of *Eremophila maculata* (Native Fuchsia)," (*Proc. Roy. Soc. Q.*, XXV, 13 (1914)).

Resin Glands.—The aborigines in the Hungerford district, New South Wales, use the leaves as a blister when suffering from a cold. As it may therefore contain an acrid principle, it might be worth while subjecting it and other species to chemical examination for that substance alone.

At this place may be cited a paper, "On the Structure of the Resin-secreting Glands in some Australian Plants," by Marjorie I. Collins, *Proc. Linn. Soc. N.S.W.*, XLV, 329 (1920). Those of *Eremophila latifolia* F.v.M. are dealt with, amongst others.

Habitat.—The type came from the Lachlan River, New South Wales, but it is found in the drier parts of all the mainland States.

The following specimens in the National Herbarium, Sydney, are arranged as follows, beginning with Western Australia :—

Western Australia.—Israelite Bay, south coast (J. P. Brookes).

The following three specimens are var. *brevifolia* :—Comet Vale (J. T. Jutson, Nos. 40 and 41); Coolgardie (R. Helms, L. C. Webster); Nannine, "18 inches high, branches rigid, spreading, flowers magenta" (W. V. Fitzgerald).

South Australia.—"Native Fuchsia," Mt. Lyndhurst (Max Koch).

Moolooloo Station, between Beltana and Blinman (Mrs. R. S. Rogers); Lake Eyre (Prof. Baldwin Spencer); Killalpanina, Cooper's Creek, near Lake Eyre (A. W. Howitt).

Northern Territory.—Recorded from Attack Creek and other localities.

Victoria.—Benjeroop, Murray River (C. Walter). (Doubtless occurs a good deal in the Mallee.)

New South Wales.—Tulmah, Mellool, near Murray River, a few miles north-west of Moama (Miss J. Hanna).

Murrumbidgee River (K. H. Bennett).

In this district (Broken Hill) I only know it as a small shrub, much eaten down by stock (Albert Morris); Broken Hill (E. C. Andrews).

Paldrumatta Bore, *via* Wilcannia (P. Corbett); Paroo River district (E. Betehe); Wanaaring-Uriseno (J. L. Boorman); Bourke, named by Mueller, collector "Henry"; Pera Bore, Bourke (J. J. Hammond).

Mudall Station, Bogan River (R. H. Canbage); Nyngan (J. L. Boorman).

Barwon River, near Collarenebri (Gordon Burrow); "Fuchsia," 40–50 miles north-west of Collarenebri (Sid W. Jackson).

Pilliga (J. L. Boorman); Gurley, near Moree (E. Breakwell).

Queensland.—Goondiwindi (J. L. Boorman).

"Emu-bush," 4–6 feet. Stock eat it sparingly. It has the reputation of being poisonous at certain periods of the year. But slightly cropped off." Jericho (J. L. Boorman).

Geera, Central Queensland (Sir William Cullen, through R. H. Cambage, No. 14).

Nogoa River at Gindie (C. T. White).

"A species of *Stenochilus* in the scrubs north of Expedition Rge. (Range); a little shrub, big rather spongy seed-vessel. Febr., 1847." (Leichhardt's handwriting.)

Lakes Creek, Rockhampton (J. L. Boorman).

EXPLANATION OF PLATE 251 (IN PART).

- A. Flowering twig, Nyngan, New South Wales.
- B. Bud.
- C. Corolla opened out, showing insertion of the four stamens.
- D. Calyx with pistil.
- E. Fruit from Wanaaring-Uriseno, New South Wales.
- F. Leaf, from Pilliga, New South Wales.
- G. Leaves (var. *brevifolia* Benth.). Comet Vale, Western Australia.

No. 257.

Eremophila longifolia F.v.M.

An Emu Bush or Berrigan.

(Family MYOPORACEÆ.)

Botanical description.—Genus *Eremophila*, see Part LXV, p. 211.

Botanical description.—Species *longifolia* F.v.M. in *Proc. Roy. Soc. Tas.*, iii, 295 (1859).

The history of the species is as follows (the first botanist to recognise it was Robert Brown):—

Stenochilus longifolius R. Br., *Prod.* 517 (1810). May be translated as follows:—

“Leaves linear-lanceolate, elongate, 3-5 inches long, entire, hooked at the apex; glabrous when fully grown, branchlets tomentose, stem erect. The flowers had fallen. Habit and fruit of the preceding species (*S. glaber*).”

S. longifolius is referred to in “Edwards’ Botanical Register” (Lindley), 1839 volume, Supplementary or Miscellaneous Notices, p. 69 (dated September, 1839). It is there given as “A Cunn. MSS.” which is doubtless correct enough, and the Latin description is doubtless from the pen of Allan Cunningham. The author of the description is, however, Robert Brown.

Lindley goes on to say, “A shrub, discovered many years ago by Mr. Allan Cunningham, in the interior of New Holland, and latterly again met with by Major Sir Thomas Mitchell, by whose people it was called ‘Lemon Haws,’ on account of the odour of its fleshy fruit. It forms a small bush, flowering in its native country in March, but here in the month of August. The leaves are long, very narrow, coriaceous, conspicuously marked with glandular dots and apparently smooth, until they are examined by a microscope, when they are seen to be covered with fine, short close-pressed hairs. The flowers are about an inch long, single or in pairs in the axils of the leaves, downy, and of a dull greenish-red colour, with the stamens a little projecting. In both this and the next the ovary is bilocular. The corolla of *Stenochilus*, although formed upon the same plan as that of other labiate flowers, differs in this, that the four upper lobes grow into an upper lip, and that which is usually the middle lobe of the lower lip forms by itself the whole lower lip, which is rolled back upon itself.”

Mitchell (“Tropical Australia,” 251, 1848), says, “A dwarf shrub was found here” (29th July, 1846, Lat. 22° 55′ 35″ S., on the Belyando River, Queensland). In a footnote, Bentham describes it as *Stenochilus salicinus*, and says, “very near *S. pubiflorus*, but much whiter, the flowers smaller with the lobes much more equal, the lower one much broader.”

S. pubiflorus Benth. was described in a footnote at p. 273 (under date 11th August), and he adds—“This agrees pretty well with Brown’s short diagnosis of

S. longifolius, as well as Cunningham's specimens so named (see Lindley); but those have no corolla, which Brown also had not seen, and his is a south coast plant" (meaning south coast of the continent—Western to South Australia).

Bentham's (B.Fl. v, 23) reference to "App. Sturt Exped." 23 is to vol. ii, p. 86 (1849), and is by Robert Brown himself. It merely, under *Stenochilus longifolius*, quotes the references in Mitchell's work to *S. pubiflorus* and *S. salicinus*.

In A.DC. "Prod." XI, 714 (1849) we simply have an ampler description of *S. longifolius*.

Then we come to the first recognition of the plant as an *Eremophila*, viz.:—*E. longifolia* F.v.M. in *Proc. Roy. Soc. Tas.*, iii, 295 (1859). This consists of a very brief statement, viz., "*Eremophila longifolia* Ferd. Mueller (*Stenochilus longifolius* R. Br., "Prod." p. 517; *S. salicinus* Benth. l.c.; *S. pubiflorus* Benth. l.c., from Spencer's Gulf, Lake Torrens, and the Murray River, to the deserts of Tropical Australia)."

Then we have Bentham's full description in the following words:—

A tall erect shrub, the young shoots minutely hoary-tomentose, the older foliage nearly glabrous and often drying black. Leaves scattered, linear or almost linear-lanceolate, obtuse or tapering into a recurved point, rather thick but flat, 2 to 4 or even 5 inches long, contracted into a short petiole. Pedicels solitary or two together, varying in length from 2 or 3 lines to $\frac{1}{2}$ inch, stout or slender, erect or spreading. Calyx-segments triangular or lanceolate, acute or acuminate, rarely 2 lines long, united at the base and scarcely overlapping, usually woolly-ciliate on the margins. Corolla velvety-pubescent outside, $\frac{3}{4}$ to 1 inch long, the tube gibbous at the base, contracted over the ovary, the remainder much dilated and slightly incurved, the lobes all ovate and obtuse, the two uppermost rather smaller and the lowest often, but not always, more deeply separated than the others. Stamens shortly exserted. Ovary thick and fleshy, with two pairs of ovules in each cell. Fruit ovoid or globular, very succulent, with a thick hard putamen, completely 4-celled and not separating into pyrenes. (B.Fl. v, 23.)

Botanical Name.—*Eremophila*, already explained, see Part LXV, p. 212; *longifolia*, Latin, long-leaved, which is a very useful name as a rule.

Vernacular Name.—It is often called "Emu Bush."

Aboriginal Names.—"Berrigan" is an aboriginal name over a very wide area, but it is now a well established Australian vernacular. "Dickoo" of those of the Hay district, New South Wales. It is the "Kinyamurra" of the Mount Lyndhurst, South Australia, blacks (Max Koch). The late Dr. A. W. Howitt gave me the name of "Kunyamara" as in use by the aborigines of Killalpanina, Cooper's Creek, Lake Eyre which seems very like Mr. Koch's name, but as my dear friend Dr. Howitt's handwriting was not of the same high quality as his scientific knowledge, the name should be confirmed.

Synonyms.—These have been already dealt with.

Leaves.—This is a useful fodder plant, and although it has been ascertained that the leaves of three or four members of the genus are more or less poisonous during some years, and for a part only of such years, I cannot certainly trace a poisoning case to this plant. The following statement concerning it was published by Mr. R. W. Peacock, of the Coolabah Experiment Farm, some years ago, and is a fair statement:—

“Berrigan, or Emu Bush” (*Eremophila longifolia*). This small shrub attains a height of from 10 to 15 feet. Its foliage is rather sparse, and is fed extensively to stock. This shrub belongs to the same order as the Budtha (*Eremophila Mitchelli*) as well as to the “Native Fuchsia,” which is reputed to be poisonous. It is in this district thought highly of, no injurious results having accrued from the use of it.

Mr. F. B. Guthrie published the following analysis of it in the *Agricultural Gazette* for October, 1899 :—

Emu Bush—Water 51·59, ash 3·70, fibre 5·43, ether extract (oil, &c.) 0·75, albumenoids 8·87, carbo-hydrates 29·66, nutrient value $40\frac{1}{4}$, albumenoid ratio 1 : $3\frac{1}{2}$, tannin (oak bark) 2·6.

Mr. Max Koch informed me that, in the Mount Lyndhurst district, South Australia, the branches and leaves are used by the blacks to make a bed for the dead.

Timber.—It is usually only a shrub, and following is an early report concerning it :—“The timber is brittle and not used. Specific gravity ·925. (Report, Victorian Exhibition, 1861.)” It has a pleasing dark-brown timber, with a relatively wide, pale-coloured sap-wood. The bark is scaly.

Size.—Height up to 10–15 feet; diameter 4 to 8 inches, as a rule, but I have seen it nearly 12 inches in diameter.

Habitat.—It is found in the drier parts of all the mainland States. The type came from the south coast of Western Australia.

Following are some localities represented in the National Herbarium, Sydney :—

Western Australia.—Nannine (W. V. Fitzgerald); Comet Vale (J. T. Jutson, No. 284).

In the Elder Expedition on 26th October, 1891, Mr. R. Helms found it at Fraser Range (Station). The label says, “Tree of 20–30 feet. Arborescent. Clayey sand on greensand formation.” (See also *Proc. Roy. Soc. S.A.*, XVI, 376.) This is the largest plant of the species I have heard of.

Northern Territory.—It is recorded from a few scattered localities.

South Australia.—Overland Corner (Dr. J. B. Cleland); Mt. Lyndhurst (Max Koch). Moolooloo Station, between Beltana and Blinman (Mrs. R. S. Rogers); Killalpanina, Cooper’s Creek, near Lake Eyre (corresp. of A. W. Howitt); collected by R. Helms, Elder Exploring Expedition, 8th July, 1891, at Camp 17. This was near Mt. Watson, in granite country in about lat. $27^{\circ} 40'$, long 130° . It is recorded in *Proc. Roy. Soc. S.A.*, XVI, 376, as from Arkaringa Valley, near Everard Range.

New South Wales.—Thackaringa (J. E. Carne, No. 12); “Willow,” Kinchiga Holding, 45 miles south-east of Broken Hill (Forester A. C. Loder); Broken Hill (E. C. Andrews).

“Emu Bush.” Small trees or large shrubs, 10–15. Usually very branching. Often flowers and fruits at the same time. Toorak-Goonery (J. L. Boorman).

Emu Bush, Dunlop Station, western side Darling River (R. Etheridge); Bourke district (Stock Inspector D. W. Hatten).

"Emu Bush." A valuable fodder tree or shrub—up to 15 feet (A. W. Mullen).

Twenty feet. Four miles from Tumut (W. A. W. de Beuzeville). Rannock, *via* Coolamon (G. Turner).

"Smoke of the wood burning smells like tobacco." Narrandera (A. Mackinnon).

"Dogwood." Native name, "Dickoo." "A small ornamental tree, 12 to 14 feet in height, with dark green foliage and red trumpet-shaped blossoms. Cattle and sheep are fond of its leaves." Ivanhoe, *via* Hay (K. H. Bennett). Wanganella, *via* Hay (Miss Edith Officer); "Berrigan," Temora (Rev. J. W. Dwyer, No. 243); Grenfell (Forest Guard W. S. Ryall); Forbes (Forester H. W. Garling); Wooyeo, Lake Cudgellico (G. Stirling Home); "Berrigan," or "Emu Bush," Girilambone (R. W. Peacock); Bogan River (J.H.M.); "Emu Bush," Nyngan (E. F. Rogers); "Emu Bush." Large shrubs of 6-10 feet, in stony places, not necessarily dry. Grows preferably on banks of rivers or on alluvial deposits. Narromine (J. L. Boorman; E. Breakwell, as a fodder plant). Minore (J. L. Boorman).

Gilgandra (R. H. Cambage, No. 1143).

"Emu Bush," Mt. Harris, near Warren (J. L. Boorman); Dubbo (A. R. Samuels); "Emu Bush," Harvey Range (J. L. Boorman).

Six feet, rare, 40-50 miles north-west of Collarenebri (Sid W. Jackson).

Backyamma State Forest No. 253, Ph. Ashburton (Forester A. H. Laurence); at edge of plains, Warrumbungle Ranges (W. Forsyth); eight feet, Ph. Moema, county of Jamison (Gordon Burrow).

Narrabri West (J. L. Boorman); Wee Waa (Forester G. A. Withers); Boggabri (R. H. Cambage, No. 3645); Terry-hie-hie, Moree (Forest Guard W. M. Brennan); Warialda (W. A. W. de Beuzeville).

Queensland.—Roma (J. H. Simmonds, E. W. Bick).

"Sandalwood," Emerald, Timber No. 9857 (J. L. Boorman).

"Emu Bush," Jericho (J. L. Boorman).

Bogantungan, 220 miles west of Rockhampton (R. H. Cambage, No. 3981).

Geera, Central Queensland (Sir William Cullen, No. 11, through R. H. Cambage).

Near Saxby River, North Queensland (Miss F. Sulman, No. 12).

EXPLANATION OF PLATE 251 (IN PART).

H. Flowering twig, from Killalpanina, Cooper's Creek, near Lake Eyre, South Australia.

I. Bud.

K. Corolla opened out showing insertion of the four stamens.

L. Calyx with pistil.

M. Fruit, from Mount Lyndhurst, South Australia.

N. Leaf, from Bourke, New South Wales.

PHOTOGRAPHIC ILLUSTRATIONS (FACING PAGE 253).

"Emu Bush," Red soil, Bourke. (A. W. Mullen, photo.)

Tree at Mt. Brown Forest, near Quorn, Flinders Range, South Australia. (W. Gill, photo.)

WILD FUCHSIA.

(*Eremophila maculata* F.v.M.) (A-G)

AN EMU-BUSH OR BERRIGAN.

(*Eremophila longifolia* F.v.M.) (H-N)

APPENDIX.

INSECTS AND TIMBER TREES.

PART II.

ORDER VIII (HEMIPTERA).

Family Coreidæ (Gum Tree Bugs).

The majority are dull-coloured insects that have no distinctive common name in Australia, and Mr. Froggatt proposes to call them "Gum-tree Bugs," as many typical forms feed upon the young shoots of Eucalypts. The genus *Amorbus* feeds on the foliage of young gum trees, and individuals of the species give out a strong odour when touched.

SUB-ORDER HOMOPTERA.

Family Cicadidæ (Cicadas, or so-called "Locusts" of the Australian small boy.)

See Froggatt, p. 346. At Part LXIII, p. 109 of the present work, Cicadas are dealt with at some length in connection with the Manna question.

Family Cercopidæ (Frog Hoppers).

Froggatt, p. 355, says that the members of this family are not numerous, though world-wide in their distribution. Our most characteristic species belong to the genus *Eurymela*, of which seventeen species have been enumerated from all parts of Australia. They lay their eggs under the bark of young gum trees, slitting it in regular rings with their stout ovipositors, and leaving a white, papery substance along the punctures. Many of them are much sought after by ants, which come to them for the honey-dew they secrete. I have referred to them at p. 112, Part LXIII of the present work, in connection with the Manna inquiry.

A character has been described as follows, at my request, by Mr. E. Mackinnon. He has also made illustrative drawings, which have not been reproduced.

Small tubercles appear irregularly distributed along both margins of the leaves of *Eucalyptus nitens*. The base is approximately 1 mm. in diameter, and the centre of the tubercle is generally depressed and black. Microscopic examination of the tissue in this area and in the ordinary margin of the leaf shows that the abnormality is probably due to injury by some insect, as the leaf has been stimulated to produce

cork-tissue to surround and close off the injured part from the rest of the leaf. The phenomenon has been noticed both in the longest leaves and also in the small mature leaves, and gives the leaf an undulate appearance, while the margin becomes irregularly toothed, as shown on 9b and 9c of Plate 81 of my "Critical Revision of the Genus *Eucalyptus*." Mr. Froggatt is of the opinion that the insects responsible belong to the family *Coreideæ* (Gum-tree Bugs), or the family *Cercopidæ* (Frog Hoppers).

The phenomenon has also been noticed in *Eucalyptus vernicosa* and *E. incrassata* var. *angulosa*, and doubtless observation will lead to its being found on many other species.

Family Membracidæ (Tree Hoppers).

This group is chiefly confined to the tropical parts of the world. Reference may be made to "A Monograph of the Australian Membracidæ," by F. W. Goding, *Proc. Linn. Soc. N.S.W.*, XXVIII, 2 (1903), with a Plate. Most of the food plants appear to be Wattles, and Dr. Goding quotes with approval Mr. Froggatt's "Insects of the Wattle-trees" (*Agric. Gaz. N.S.W.*, XIII, 701, 1902), for a note on their life-history. *Eufroggattia tuberculata* is a rare insect, usually found resting on a twig of a *Eucalyptus* sapling (Froggatt, p. 358).

Family Jassidæ (Leaf Hoppers).

A very pretty little unidentified species, bright-red and yellow, with the fore wings marked with dark brown, is common upon the broad soft leaves of *Eucalyptus robusta*, where the curious little larvæ rest in families of three or four. The larvæ of another species have been observed to form large colonies on the surface of the leaves of low *Eucalyptus* bushes on the hills near Capertee, N.S.W. They suck up the sap, discolouring the centre of the leaves (Froggatt, p. 361).

Family Psyllidæ (Lerp Insects).

See Froggatt, p. 361. These have been dealt with, to some extent, at p. 113, Part LXIII of the present work. Following is a list of the sub-families which affect *Eucalyptus*, with the genera in brackets :—

1. Sub-family Liviinæ (*Crewiis*, *Lasiophylla*).
2. Sub-family Aphalarinæ (*Aphalaria*, *Cardiaspis*, *Cometopsylla*, *Dasypsylla*, *Rhinocola*, *Spondyliaspis*, *Thea*).
3. Sub-family Psyllinæ (*Eriopsylla*, *Eucalyptolyma*, *Psylla*).
4. Sub-family Triozinæ (*Trioza*).

These are popularly known as "lerp or leaf-manna" insects, from the habit that many of them have in the larval state of protecting themselves with a scale-like covering, composed of their surplus food, attached to the leaf by a hinge, under which they feed until ready to change into the perfect insect, which is very like a cicada in miniature, but furnished with hopping hind legs, with which they can spring to a considerable distance when disturbed.

A number of *Psylla* larvæ produce galls, chiefly on the foliage of the Eucalypts. These are sometimes hard, woody galls, covering and often aborting the leaf attacked into a wrinkled woody mass, with the opening on the under surface of the leaf generally plugged up with a bit of waxy secretion to keep out intruders. Another forms thin, bladder-like galls upon the leaves, when the walls of the galls are as thin as the leaf, and in which the larva can move about. Sometimes these galls are brightly tinted with reds and yellows, but their general colour is that of their leaf." (Froggatt in *Agric. Gaz. N.S.W.*, IX, p. 488, 1898).

We are indebted to Mr. Froggatt for the best account of Australian Psyllidæ. See his first paper under that title in *Proc. Linn. Soc. N.S.W.*, XXV, 250 (1900).

He says, "Many species form regular galls and blisters upon leaves, chiefly those of Eucalypts. These first appear as little pits, which swell into either bubble-like excrescences or thickened, rounded masses, enclosing the larva. This emerges from an opening either on the upper or under surface of the leaf. Others again hide under loose bark on the trunk or branchlets of a tree, enveloping themselves in a mass of flocculent matter, which exudes and forms white spots, dotting the trunk all over. These species are so diligently looked after by several kinds of ants, which sometimes form galleries over them, that it is difficult to collect specimens.

"Most of the naked species are more common upon Acacias and other scrub trees than upon Eucalypts, and swarm in such numbers on the under surface of the leaves or over the young branchlets as at first sight to be easily mistaken for aphides.

"Some of the true lerp-producing species present very curious examples of insect architecture.

"All the lerp-scales are fabricated by the larvæ and pupæ from the excess of sap or juice sucked up through their sharp bills from the food plant. This is ejected in small globules from the anus, but it is quite different from the excrement. It is another form of honey-dew, which, when drawn out into fine threads by the feet and spun into the net-like sugar lerps, solidifies and hardens in the sun."

Under Sub-family Liviinæ he enumerates :—

Crewiis longipennis Walker (p. 259). Forms a lerp on the leaves of *Eucalyptus* sp.

Lasiopsylla rotundipennis Froggatt (p. 261). Forms a lerp on the leaves of *Eucalyptus melliodora* (Melbourne), *E. polyanthemos* (Bendigo, Vic., and also Bathurst and Tumut, N.S.W.), and several other allied species. *Lasiopsylla bullata* Froggatt (p. 264). Forms bubble-like galls or excrescences upon the upper surface of the leaves, produced by the attacks of the larvæ on the under surface. On *E. capitellata*, Sydney; *E. dives*, Mittagong. I have received it from *E. maculosa*, Trunkay (J. L. Boorman).

Under Sub-family Aphalarinæ, we have :—

Rhinocola eucalypti Maskell, described by Maskell in *Trans. N.Z. Inst.* XXII, 160 (1889), with Pl. X, figs. 3-16. Common on the foliage of *E. globulus*, growing in New Zealand; also found by Mr. Froggatt on seedlings in Sydney, see p. 267. *R. revoluta*

Froggatt (p. 267). On *E. leucorhylon* at Bendigo, Vic., and on *E. macrorrhyncha* and *E. hemiphloia* at Tumut, N.S.W. *R. assimilis* Froggatt (p. 269). On *E. viminalis* at Cooma, N.S.W. *R. corniculata* Froggatt (p. 270). On *E. gracilis* at Bendigo, Vic., and at Wagga, N.S.W., on *E. gracilis* (sic.). Mr. Froggatt suggests that specimens on *E. largiflorens* (bicolor) from Bourke, N.S.W., and from *E. rudis*, Western Australia, may belong to this species. *R. ostreata* Froggatt (p. 272). On *E. gracilis* at Bendigo, Victoria. *R. pinnaformis* Froggatt (p. 273). At Yass, N.S.W., on an undetermined Eucalypt. *R. liturata* Froggatt (p. 274) on *E. robusta* in the Sydney district, also Tumut (but ? *E. robusta* there). *R. viridis* Froggatt (p. 276). On *E. robusta*.

Aphalaria tecta Maskell (p. 279). On *E. Stuartiana* from Victoria. *A. carinata* Froggatt (p. 279). The larvæ attack the extreme tips of the leaves of *E. capitellata*, at Sydney, forming half-rounded galls through the tips of the leaves swelling out and curving round.

Cardiaspis artifex Schwarz (p. 282). On foliage of *E. robusta* at Manly, Sydney, and Termeil, N.S.W. On *E. leucorhylon*, South Australia. *C. plicatuloides* Froggatt (p. 284). On *E. rostrata* in Botanic Gardens, Melbourne, and in the Sydney district and at Mittagong, Yass, and Tumut, N.S.W., on undetermined Eucalypts.

Cardiaspis sp. Re Lerp insects or Psyllidæ destroying ironbark trees in the Taree district, Mr. Froggatt reports on 26th April, 1916 :—

The insects infesting the foliage of the trees are the larval forms of an unnamed species of *Cardiaspis*, one of the lerp insects. The minute adult insects lay their eggs all over the surface of the leaves, the larvæ hatch out, and puncturing the surface, suck up the sap, and with the surplus secretion spin lace-like coverings of lerp, under which they remain sucking up the sap until ready to emerge as perfect insects. Wherever the larva forms a lerp and there are millions of these lerp insects on every bush or sapling, a brown patch appears, and through a severe infestation every leaf becomes brown and dies. As this infestation, which was first noticed some seven years ago, has been rapidly spreading all through the ironbark on the Northern Rivers, it is now a constant thing; not only have all the leaves continued to die, but the branches have died back until the whole tree dies, and thus, through these minute insects, many valuable trees are already dead, while many others are following in their wake. At the rate this is going on this lerp insect seems to be a very serious thing for the future. It was reported that the Grey Gum was also attacked by this pest, but examination shows that it was another species of the same family, a species described by the writer from specimens obtained in the Botanical Gardens at Sydney on the foliage of a smooth-barked gum, and named *Eucalyptolyma Maidenii*. This covers the foliage in the same way that the ironbark lerp does.

There seems to the writer to be no practical way of dealing with these minute psyllidæ, which cover the foliage of trees up to 50 or 60 feet in height, as the leaves are simply encrusted with the lace-like tests of the larvæ. Opening up the forests will probably help in clearing out useless timber and letting in the sun and air to the trees. Many Chalcid wasp parasites infest the larvæ, and they may increase with the enormous increase of the lerp insects, and become a factor in the future in keeping down this pest.

It seems to me an allied species is referred to by R. T. Baker in *Proc. Linn. Soc. N.S.W.*, XXIV, 297, (1899).

At certain seasons of the year the leaves of this tree alone (*Eucalyptus Dawsonii*, the Slaty Gum), are affected by a species of *Psylla*; the insects eat off the cuticle of the leaves, giving the whole countryside (Goulburn River to Pilliga) an appearance in the distance as if a bush fire had passed over it.

Cometopsylla rufa Froggatt (p. 286). At Liverpool, N.S.W. (on *E. sp.*); at Wagga, N.S.W. (on *E. melliodora*).

Spondyliaspis eucalypti Dobson (p. 289). (Syn. *Psylla eucalypti* Dobson).

Found on undetermined Eucalypts in Tasmania, Victoria, New South Wales, and Queensland. "This species is our commonest 'sugar-lerp,' which has a very wide range over Eastern Australia. It does not confine its attention to one species of Eucalyptus, but is found on *E. capitellata*, *piperita*, *leucoxylen*, *gracilis*, and several other species. As children we used to gather and eat the scales of this species, but it is those of the larger species that were collected and eaten by the natives in the Mallee Scrubs, and which were described as 'Manna.'" (Froggatt.)

Spondyliaspis mannifera Froggatt (p. 291). At Tumut, N.S.W., on *E. polyanthema* and *E. hemiphloia*; Wimmera, Victoria, on *E. gracilis*. *Dasyipsylla brunnea* Froggatt (p. 293). Tumut, N.S.W., on *E. polyanthemos*. *Thea formicosa* Froggatt (p. 295). At Thornleigh and Botany, near Sydney, also Mittagong, N.S.W., on *E. piperita*. *T. opaca* Froggatt (p. 297). On undetermined Eucalypts in the Sydney district. *T. Leai* Froggatt (p. 298). On an undetermined Eucalypt at Tamworth, N.S.W.

"Australian Psyllidæ," Part II, by W. W. Froggatt (*Proc. Linn. Soc. N.S.W.*, XXVI, 242, 1901). This paper takes cognisance (amongst others) of some additional genera. The genera and species are arranged alphabetically herewith.

Aphalaria fuscipennis Froggatt (p. 291). On *E. robusta* Sm., Botanic Gardens, Sydney.

Cardiaspis textrix Froggatt (p. 296). On *E. melliodora* A. Cunn. Adelong, N.S.W. (I have received a species of *Cardiaspis* on *E. populifolia* from Goondiwindi, Queensland (R. B. McIntyre).

Eriopsylla gracilis Froggatt (p. 267). On *E. capitellata* at Hornsby, Botany, &c., near Sydney.

Eucalyptolyma erratica Froggatt (p. 264). On *E. corymbosa* at Mosman's Bay and Sydney. *Eucalyptolyma maideni* Froggatt (p. 262). On *Eucalyptus* sp. in the Sydney Botanic Gardens.

Spondyliaspis granulata Froggatt (p. 293). On *E. robusta*, Botany, near Sydney.

Thea olivacea Froggatt. On *E. capitellata*, Mittagong, N.S.W. *Trioza carnosa* Froggatt (p. 275). *Eucalyptus* sp., Sydney, Mittagong, N.S.W.; *E. obliqua*, New Norfolk, Tasmania. *Trioza circularis* Froggatt (p. 279). On *Eucalyptus* sp., Wyong, N.S.W. *Trioza eucalypti* Froggatt (p. 277). On *E. Sieberiana*, Mosman, Sydney. (I have received an undetermined species of *Trioza* on *E. piperita* from Neutral Bay, Sydney (Dr. J. B. Cleland).) *Trioza multitudinea* Tepper (p. 280). *Eucalyptus* sp., Marino, S.A. *Trioza orbiculata* Froggatt (p. 274). On *Eucalyptus* sp., Bungendore, N.S.W. In addition, I have *Trioza solida* Froggatt on *E. capitellata* at Popran Trig. Reserve, Gosford (W. A. W. de Beuzeville), on *E. hemiphloia* var. *microcarpa* from Yalgogrin (J. L. Boorman), and on *E. leucoxylen*, Beaumont, near Adelaide (J. B. Cleland).

"Australian Psyllidæ," Part III, W. W. Froggatt (*Proc. Linn. Soc. N.S.W.*, XXVIII, 315 (1903)).

This paper contains a note of *Rhinocola eucalypti* Maskell that it is to be found in every plant nursery or garden about Sydney where *E. globulus* is growing, and that it has been found commonly on that species in South Africa. Mr. Froggatt describes two new species of *Rhinocola*, but does not say they are found on Eucalypts.

Aphalaria flavilabris Froggatt (p. 318). Imago caught in sweeping low Eucalyptus scrub. *A. obscura* Froggatt (p. 319). On an undetermined species of *Eucalyptus* at National Park, Sydney. *Cardiaspis rubra* Froggatt (p. 322). On *E. coccifera* at Mt. Wellington, Tasmania. *Spondylaspis hirsutus* Froggatt (p. 323). On leaves of *E. robusta* at Thirroul, N.S.W. *S. nigro-cincta* Froggatt (p. 324). At Mt. Wellington, Tasmania, on *E. coccifera*. *Thea Wellingtoniæ* Froggatt (p. 325). Summit of Mt. Wellington, Tasmania, on *E. coccifera*. *Trioza tasmaniensis* Froggatt (p. 329). At Hobart, Tasmania (galls on *E. amygdalina*). *T. Dobsoni* Froggatt (p. 331). Mt. Wellington, Tasmania (on foliage of *E. amygdalina*).

Family Aleurodidæ (Snow-flies).

See Froggatt (p. 370). At fig. 4a, Plate 77, of my "Critical Revision of the Genus *Eucalyptus*" will be found a representation of depressions or pits on the leaves of *E. Preissiana* (seen also in *E. pallidifolia*), caused by the larvæ of insects of the genus *Aleurodes*.

Family Coccidæ (Scale Insects).

For a general account of the Coccidæ interesting to us in Australia, see Froggatt (p. 371). They are divided into a number of Sub-families, including the following, and a few genera, which will be later referred to, are given in brackets :—

1. Diaspinæ (*Mytilaspis*, *Chionaspis*, *Aspidiotus*, *Maskellia*).
2. Lecaniinæ (*Ctenochiton*).
3. Dactylopinæ (*Eriococcus*, *Dactylopius*).
4. Tachardiinæ (*Tachardia*).
5. Idiococciinæ (*Sphærococcus*).
6. Brachysceliinæ (*Brachyscelis* or *Apiomorpha*, *Opisthoscelis*, *Ascelis*, *Carteria*).

Eucalyptus coccifera Hook., a Tasmanian plant which Hooker, in *Bot. Mag.*, t. 4637, calls the "Coccus-bearing Gum-tree," was named because it was infested by some coccid insect, which Mr. Lawrence drew attention to at the time. But this may have arisen from some confusion, for Mr. Leonard Rodway tells me that he has failed to find a coccus on this species.

I now proceed to give notes on Scale Insects, so far as they affect Eucalypts :

1. Sub-family Diaspinæ.

Aspidiotus eucalypti Maskell, in *Trans. Roy. Soc. S.A.*, XI, 102 (1887-8), in a paper "On some South Australian Coccidæ," with Plate xii, fig 1. Found on various species of *Eucalyptus*.

At *Trans. N.Z. Inst.*, XXIV, ii (1891), Maskell says, "I regret that the figure 1d of Plate xii in the *S.A. Trans.* does not sufficiently exhibit the deep transverse groove in the adult female, which is so marked a feature of it."

Chionaspis assimilis Maskell, in *Trans. Roy. Soc. S.A.*, XI, 102 (1887-8), with Plate xii, fig. 2. Found on various species of *Eucalyptus* (often intermingled with *Aspidiotus eucalypti*). *Chionaspis ferosa* Green (*Proc. Linn. Soc. N.S.W.*, XXIX, 462, 1904). On the underside of the leaves of *E. tereticornis* at Young, N.S.W., and also on an undetermined species in the Goulburn Valley, Victoria.

Maskellia globosa. Under the title "A Gall-making Diaspid," Mr. Claude Fuller, *Agric. Gaz. N.S.W.*, VIII, 579 (1897), with a plate, describes a new genus as above, found on the twigs of *E. gomphocephala*, the Tewart of Western Australia. It is, however, by no means solely a Western Australian insect, and the fact that I have received it from the following Eucalypts in New South Wales, shows that intermediate localities only require to be looked for :—

On *E. crebra* and *E. dealbata*, Pilliga Scrub, near Narrabri (Dr. J. B. Cleland). On *E. oleosa*, Line No. 11, Ballandri Estate, near Narrandera (W. D. Campbell). On *E. populifolia*, Pilliga Scrub, near Narrabri (Dr. J. B. Cleland). On *E. quadrangulata*, Nundle district, "where it often destroys large masses of branchlets." (Forest Overseer Mattsson). On *E. resinifera*, Oatley, near Sydney (J. H. Camfield). On *E. rostrata* (young trees), Darlington Point, Leeton (W. D. Campbell).

2. Sub-family Lecaniinæ.

Ctenochiton eucalypti Maskell on Eucalypts. (Froggatt in *Proc. Linn. Soc. N.S.W.*, XXI, 382, 1896).

3. Sub-family Dactylopinae.

Under the title "Notes on Australian Coccidæ (Scale Insects)" Mr. Froggatt, *Agric. Gaz. N.S.W.*, XI, 99 (1900), gives a popular account of *Eriococcus*. He says that the species confine their attacks to native trees, chiefly young *Eucalyptus*, *Casuarina*, *Leptospermum*. They rarely (so far) attack garden plants in Australia. *E. Tepperi* Maskell was first collected on *Eucalyptus globulus* and *Bursaria spinosa*. Mr. Froggatt, *op. cit.*, p. 106, says that he has found it as rather a common species upon the bark of the larger branches of several species of Eucalypts about the coastal districts of New South Wales and also at Albury.

Then in Froggatt's "Australian Insects," p. 376 and figure 167, we have "The cosmopolitan genus *Eriococcus* has seventeen Australian species. Several species, enclosed in their egg-shaped, white-felted sacs, are very common in the forest, clustering over and often killing the young trees. *E. coriaceus* varies from white to yellow in colour; the sacs are oval, with a distinct anal opening on the summit; they infest the foliage

and twigs of many young Eucalypts." Bulletin No. 13, of the New Zealand Department of Agriculture, under the title "The Gum-tree Scale" (by T. W. Kirk), is devoted to it. It has caused much havoc on New Zealand Eucalyptus plantations, and remedial methods are suggested. See also Froggatt, *Agric. Gaz., N.S.W.*, XI, 101. He has found it on at least half a dozen species of Eucalyptus.

A "common gum scale," *E. coriaceus*, is figured by French in "Handbook of the Destructive Insects of Victoria," III, Plate cxvi. He mentions that he has seen it on saplings of almost every Eucalypt, including the leathery foliage of *E. alpina*, and the Snow Gum (*E. coriacea* var. *alpina*).

"Further Coccid notes, with descriptions of new species, and remarks on Coccids from New Zealand, Australia, and elsewhere," by W. M. Maskell, *Trans. N.Z. Inst.*, XXIV, 1-67 (1891). At p. 26 we have *Eriococcus confusus* Maskell, with figs. 5-8 of Plate iv, on bark of *E. viminalis* from Victoria. On p. 27 we have *Eriococcus eucalypti* Maskell, with figs. 6-14 of Plate v. Stated to have been found on the W.A. *E. diversicolor* at Adelaide by Mr. Crawford, but more commonly on *Bursaria spinosa*, and Maskell suggests the inappropriateness of the specific name. At p. 29 we have *Eriococcus tepperi* Maskell, with figs. 15-17 of Plate v. Found on *E. globulus* and *Bursaria spinosa*. *Eriococcus simplex* Maskell will be found described in *Trans. N.Z. Inst.*, XXIX, 317 (1896), Plate xxi, fig. 3. On an undetermined species of Eucalyptus. Var. *dealbata* Maskell is from *E. calophylla*, Western Australia. Mr. A. M. Lea says, "Seems to prefer the butts of Red Gum trees which have been cut down, and from which young shoots are growing." *Eriococcus spiniger* Maskell (described in *Trans. N.Z. Inst.*, XXVIII, 398 (1895), Plate xxi, figs. 9-11), on *Eucalyptus*, was exhibited by Froggatt (*Proc. Linn. Soc. N.S.W.*, XXI, 382 (1896)).

Dactylopius eucalypti Maskell in *Trans. N.Z. Inst.*, XXIV, 35 (1891), with Plate vii, figs. 9-13. Collected "in Australia" (Maskell often did not quote the State) on bark of *E. amygdalina* (? *radiata*).

4. Sub-family Tachardiinæ.

Froggatt says we have five species from Australia. At Plate xxxvi of Mr. Froggatt's work, *Tachardia decorella* Maskell, found on *Eucalyptus*, is figured.

5. Sub-family Idiococciinæ.

Sphærococcus Maskell. "The Australian species attack *Eucalyptus*, *Melaleuca*, *Leptospermum*, and *Casuarina*." For a figure of one of them, see *S. ferrugineus* Froggatt on *Melaleuca* sp. (*Proc. Linn. Soc. N.S.W.*, XXIII, 378).

6. Sub-family Brachysceliinæ.

All the members of this Sub-family are found only on Eucalyptus, and are hence intensely Australian. The distribution of the Brachysceliinæ has been merely touched, and I am hopeful that my present compilation will show how little we know of this Sub-family, and will lead to additional information being secured, which will result in generalisations as to the relations between the insects and their hosts.

1. In *Trans. Entomol. Soc. N.S.W.*, I, 1 (1862), is a pioneer paper, "Observations on certain Gall-making Coccidæ of Australia," by H. L. Schrader. He founded the genus *Brachyscelis*, and remarked that the greater number of the galls are found on *Eucalyptus hæmastoma*, but that other species, as *E. corymbosa*, together with *Angophora lanceolata*, are also infested by them.

Op. cit. p. 6, is a second paper by the same author entitled, "Further Communication on the Gall-making Coccidæ," in which he divides these Coccidæ into the genera *Brachyscelis*, *Opisthoscelis*, and *Ascelis*. The first paper is illustrated by two plates and the second by a third.

It may be convenient to deal with what he says about *Brachyscelis* (now called *Apiomorpha*) in alphabetical order of species names, with supplementary notes by other entomologists. Part of what he says about *Opisthoscelis* will be found at p 291, and *Ascelis* at p 292.

B. duplex Schrader. Fig. *h*, Plate II, shows the female gall of this species. Fig. *s* is the male gall (Schrader). See also Froggatt (*Proc. Linn. Soc. N.S.W.*, xvii, 358, 1892). The species of *Eucalyptus* on which it was originally found does not appear to be known. Froggatt says, figuring it at Plate XXXV of his work, that it produces the largest gall in the world. Following are some records, arranged in alphabetical order, of the species on which they are found :—

E. apiculata or *E. stricta* (leaves only), Hill Top (E. Cheel). *E. eugenioides*, Asquith, near Hornsby (W. F. Blakely). *E. hæmastoma*, Hornsby (E. F. Swain, W. F. Blakely). *E. obliqua*, Glen Elgin, via Glen Innes (J. Dorrington). *E. pilularis*, Gosford (A. Murphy), *E. piperita*, Katoomba (E. G. Jarrett).

B. munita Schrader. Fig. *x*, Plate II, shows a female gall of this species. The author said he found a specimen where the length of the whole gall was 11 inches, and the thickest part 8 lines wide. The largest he saw was on *Eucalyptus hæmastoma*, but he found them on other species (Schrader). See also Froggatt (*Proc. Linn. Soc. N.S.W.*, xvii, 359, 1892). There are two forms, "evidently variations caused by the stems being attacked by only a few coccids or else by a larger number; the large typical form is not common about Sydney, and is more on inland species, while the small variety seems to be much the commonest in the neighbourhood of Sydney."

I have seen it on the following *Eucalypts* :—

E. alba Reinwardt. Mr. Froggatt informs me that the winged galls figured by me at fig. 2*a*, Plate 106 of my "Critical Revision of the Genus *Eucalyptus*," under *E. alba*, are the female galls of *Brachyscelis munita* Schrader, and that the dots on the leaves (fig. 2*b*) are made by parasitic hymenoptera (Chalcidæ). See Part XXV, p. 93. *E. capitellata*, Neutral Bay, Sydney (Dr. J. B. Cleland). *E. dumosa*, Murray Bridge, S.A. (J.H.M.). *E. fruticetorum*, Wyalong (J. L. Boorman). *E. melliodora*, Lockhart, N.S.W. (W. W. Froggatt). *E. oleosa*, East Mirrool (W. D. Campbell). The gall is found chiefly on *Eucalyptus robusta*, and is not uncommon about Botany Bay and other localities near Sydney. Found also at Newcastle and Wellington (N.S.W.), and near Melbourne. *E. sideroxylon*, Wyalong (J. L. Boorman).

Tepper figures the species (*op. cit.*, Plate III, fig. 1), proposes to call a small form found on Mallee Eucalypts var. *reducta*, and gives the habitat of the species as southern and eastern Australia. He says it is found on *E. leucoxyton* and *E. gracilis* in South Australia. I do not know if this is the same as *B. reducta*, abortive galls of which are figured (Plate IV, fig. 2h), see also p. 275. See also p. 286, present work.

Mr. Froggatt says that *Apiomorpha cornifex* Rübs., is a synonym, and that the agglomerations of male galls have been received not inaptly labelled, "Vegetable Coral." See *Agric. Gaz. N.S.W.*, ix, 490.

B. ovicola Schrader (*B. ovicoloides* Tepper). Fig. a, Plate II of Schrader, shows a branch of *Eucalyptus hamastoma* with several male galls and one young female gall of this species (Schrader). This is one of our commonest species, has a wide range over the southern parts of Australia, and is found on at least a dozen very different sorts of Eucalypts. Mr. Froggatt, at *Proc. Linn. Soc. N.S.W.*, xvii, p. 368 (1892), specifically quotes it on *E. gracilis* and *E. leucoxyton* at the Whipstick Scrub, Bendigo, Victoria, and on an unknown species at Wellington, N.S.W. These (*Agric. Gaz. N.S.W.*, ix, 492) are said to be "large White Box Gums," and are presumably *E. hemiphloia* var. *albens*.

I have received it from the following additional species:—

E. amplifolia, George's River, Cabramatta, near Sydney (W. F. Blakely). *E. bicolor*, Paldrumatta bore, via Wilcannia, N.S.W. (P. Corbett); Bourke (J. L. Boorman); Kaneira, Victoria (W. W. Watts). *E. dealbata*, Mount Elliott to Binya, E. Mirrool (W. D. Campbell), *E. dumosa*, East Mirrool (W. D. Campbell). *E. melliodora*, Warren (J. L. Froggatt). *E. oleosa*, East Mirrool (W. D. Campbell). *E. populifolia*, Warren (J. L. Froggatt). *E. propinqua*, Raymond Terrace (E. Cheel).

B. pharetrata Schrader. Fig. 2, Plate I (Schrader). See also Froggatt, (*Proc. Linn. Soc. N.S.W.*, xvii, 370, 1892).

"This is known as the Cockscomb Gall, from the cock's comb-like appearance of the male gall mass. It is not an uncommon gall about Sydney . . . Schrader in his paper gives a drawing of the male galls of this species on the twigs, but there must be some mistake, as I am certain that the male galls are always produced upon the females." (Froggatt, *loc. cit.*). Found at Botany on *E. Sieberiana*, at Berowra on *E. corymbosa*, and at Mosman's Bay on *E. capitellata*; these are all Sydney localities; also at Cambewarra and Newcastle, N.S.W., on an undetermined species. Found also on *E. capitellata*, Popran Trig. Reserve, near Gosford (W. A. W. de Beuzeville), Neutral Bay, Sydney (Dr. J. B. Cleland). On *Eucalyptus* sp. at Kendall (Dr. J. B. Cleland).

B. pileata Schrader. Fig. 1, Plate I shows a branch of *Eucalyptus hamastoma* with "excrecences" (galls) made by this species (Schrader). This is further described by Froggatt (*Proc. Linn. Soc. N.S.W.*, xvii, 362, 1892, and xxiii, 372, 1898, with a figure). He records it from *E. piperita* (Rose Bay), *E. Sieberiana*, and *E. capitellata* (Mosman's Bay), both Sydney localities. It is found also at Newcastle.

Mr. Froggatt (*Agric. Gaz. N.S.W.*, ix, 491) says there is another form, thicker, shorter, and more broadly oval, also found in the neighbourhood of Sydney, but on *E. robusta*.

I have also seen it on the following species :—

E. acmerioides, Comboyne Mountain (Dr. J. B. Cleland). *E. piperita*, Concord, Sydney (Miss A. F. Walker). *E. resinifera*, Gosford (W. A. W. de Beuzeville). *E. robusta* at Port Macquarie (Forester G. R. Brown). *E. Sieberiana*, Cordeaux Dam (W. W. Froggatt). *E. umbra*, Hawkesbury River, N.S.W. (near railway gates), (W. F. Blakely). *E. virgata*, Hornsby, near Sydney (W. F. Blakely).

2. Mr. W. W. Froggatt contributed a paper "Notes on the Family Brachyscelidæ, with some account of their parasites and descriptions of new species," *Proc. Linn. Soc. N.S.W.*, xvii, 353, 1892 (1893).

The author states that at one time he was under the impression "that each species of Coccid had a partiality for a particular species of Eucalyptus, but observations extending over several years have proved that, though some of the rarer species may keep to one tree, most of them thrive on various Eucalypts."

He then described the life history of these gall-making insects. He points out that if the Eucalypts do not actually die from their attacks, the insects injure the trees, and therefore become of economic importance. I regret that Entomologists do not more frequently follow up the host plant and obtain its species-name. This is difficult in some cases, but in many cases not insuperable. There ought to be closer relations between the entomologist and the botanist. I do not like to see the references, "Found on *Eucalyptus* sp." or "found on a Eucalypt." Indeed, these statements are unnecessary as Brachyscelids are not found on any other trees.

Mr. Froggatt gives notes on Schrader's species, and describes the following new ones :—

B. bacuerlenii (p. 369, with Plate VII, fig. 4). Found on an undetermined species at Ballina, N.S.W.

B. conica (p. 365, with Plate VI, fig. 3). *B. regularis* Tepper, *B. subconica* Tepper and *B. (Apiomorpha) similis* Rübs.). Found at Yass, Goulburn, and Cooma, N.S.W., on *E. viminalis*, and in Gippsland, Victoria, on an undetermined species. "This gall is very plentiful in the Goulburn and Yass districts, growing upon several of the White Boxes." The synonymy is as given by Froggatt in *Agric. Gaz. N.S.W.*, ix, 493, where it is stated "Common in Victoria and New South Wales." If the synonymy is correct, then South Australia must be added, as Tepper's specimens come from thence. It occurs on *E. viminalis*, Bellerive to Rokeby, Tasmania (J.H.M.). It has been found on *E. tereticornis*, on a spontaneous tree in the Botanic Gardens, Sydney, by the late Mr. E. Betcher and myself. It has been found on *E. oleosa* on Line 7200, Griffith, N.S.W., also at Yenda, near Griffith (W. D. Campbell). Found on *E. dumosa*, Wyalong (J. L. Boorman).

B. minor, p. 363, with Plate VI, fig. 1). Found on *E. hæmastoma* at Botany and Berowra (both near Sydney), and also at Wollongong (on the hillside opposite the railway station) on an unknown species. "This is a rather small gall that might be taken for a small variety of *B. ovicola*." It has since been found on *E. eugenioides* at Hornsby (W. F. Blakely).

B. pomiformis (p. 367, with Plate VII, fig. 7). This is a well-known species, always found on a Bloodwood of some kind. Mr. Froggatt originally got it from King's Sound, North-west Australia, under the Barrier Range, about 100 miles inland. The natives there eat the large gall, which when fresh is soft and acid, not unlike a sour apple, and they look upon the fat white Brachyscelid as a very dainty morsel. He also quotes Mr. Chisholm, of Torrens Creek, near Charters Towers, North Queensland, who says, "It is known as the Bloodwood Apple, and the blacks are fond of eating it." Dr. H. Basedow has also collected it in the same general area.

B. rugosa (p. 369, with Plate VII, fig. 5). Found at Allalong (? Ellalong) in the Maitland district, N.S.W., on an undetermined species.

B. Thorntoni (p. 371, with Plate VI, fig. 6). (*B. nux* Olliff). Found at Newcastle on an undetermined species of Eucalyptus. "It is closely allied to *B. pharetrata* and *B. nux* Olliff, but differs considerably from both. The female galls often spring out in clusters of five or six at the base of the leaves, and when immature look like a bunch of finger-shaped excrescences." See a note, *op. cit.*, xx, 204 (1895), in which Mr. Froggatt states that he confounded two very distinct species in the description. It has been found on *E. capitellata* at Sydney by Mr. J. L. Boorman.

B. tricornis (p. 361). It has a triangular gall, and was found on *E. siderophloia* at Rookwood, between Sydney and Parramatta. It is closely allied to *B. munita*. It has not often been collected.

B. variabilis (p. 364, with Plate VII, fig. 2). Found at Thornleigh, near Sydney, on *E. piperita*, and also at Cambewarra, Newcastle, and Lismore (all N.S.W.) on undetermined species. Since found on *E. pilularis*, near Gosford (A. Murphy).

"Notes on the Family Brachyscelidæ, with descriptions of new species," Part II, by W. W. Froggatt (*Proc. Linn. Soc. N.S.W.*, xviii, 209, 1893 (1894), with Plate VIII. This part is confined to *Opisthoscelis* and *Ascelis*, which see.

Part III, *op. cit.*, p. 335, with Plates XVI, XVII. This paper deals with one species of *Brachyscelis* and eight of *Opisthoscelis*. Following is the *Brachyscelis* :—

B. umbellata (p. 336, with figs. 1-2 of Plate XVI). It has affinity to *B. subrotunda*, and was collected at Cobar, N.S.W., on an undetermined species of *Eucalyptus*. It has been sent from *E. oleosa* F.v.M. from Lake View, Griffith, by W. D. Campbell. Also found on *E. dumosa*, Cobar (J. L. Boorman).

3. "Observations on certain undescribed gall-making Coccidæ of the sub-family Brachyscelinæ," by A. Sidney Olliff. A paper with the above title was offered to the Linnean Society of New South Wales, and in *Proc. Linn. Soc. N.S.W.*, xvii, 378 (1892), it was stated that it would appear in the forthcoming Macleay Memorial Volume (1893), but it did not so appear. See Claude Fuller, below (1896).

4. "Descriptions of South Australian Brachyscelid Galls," by J. G. O. Tepper, *Trans. and Proc. Roy. Soc. S.A.*, xvii, 265 (1893), with Plates III-V.

Mr. Tepper worked mainly with South Australian material, mostly in the South Australian Museum, and collected by himself. He gives a useful general account of the Brachyscelids prior to dealing with the species in detail.

Following are his species :—

B. calycina (p. 275, with Plate V, fig. 1a-d). On stunted bushes of *E. dumosa* and *E. oleosa*, at Murray Bridge, Goolwa and Kangaroo Island, South Australia.

B. glabra (p. 278, with Plate III, fig. 4). Found on Mt. Lofty Ranges, Lyndoch, &c., S.A. "On stout branches of *E. rostrata*, but rather rare, and always solitary. The outer texture resembles that of the bark of the branches very remarkably."

B. neumanni (p. 275, with Plate V, figs. 2a-d). Found on *E. dumosa* at Murray Bridge, S.A.

B. ovicoloides (p. 277, with Plate III, fig. 2a-f). Found at Moonta, Yorke's Peninsula, S.A., on *E. incrassata* and perhaps *E. odorata*. "They appear to differ from *B. ovicola* Schrader, by being symmetrical instead of regular in form, much more curved, and the apex almost flat . . ." Froggatt, however (*Agric. Gaz. N.S.W.*, ix, 491, 1898), considers the two species to be identical. Both this species and *B. calycina* Tepper, have been found on *E. dumosa* A. Cunn, at Coolabah, N.S.W. (J.H.M. and J. L. Boorman).

B. regularis (p. 273, with Plate III, figs. 3 and 3a). It is found at Murray Bridge, Lyndoch, &c., in S.A., on *E. rostrata*. Mr. Froggatt says that this is identical with *B. pedunculata* Olliff. See also Fuller, *op. cit.*, p. 212. Mr. Froggatt also (*Agric. Gaz. N.S.W.*, ix, 493), says it is identical with his *B. conica*.

B. strombylosa (p. 277, with Plate IV, fig. 3a-c). Found sparingly on the stouter branches and branchlets of *E. incrassata* at Murray Bridge. For a note on the synonymy see Froggatt (*Agric. Gaz. N.S.W.* ix, 492), who says that it is identical with *B. crispa* Olliff, while Fuller, *op. cit.*, vii, 212, does not disagree. The matter might be looked into again, for the N.S.W. specimens are common on *E. siderophloia*, while that tree is not found in South Australia, the home of *B. strombylosa*.

It has been found on *E. punctata* in Ourimbah State Forest, N.S.W. (W. A. W. de Beuzeville); and on *E. paniculata* at Kendall (Dr. J. B. Cleland).

B. subconica (p. 274, with Plate IV, fig. 1). Found at Murray Bridge on *E. uncinata*. It is not uncommon in the Mallee scrub in the locality. "In its erect habit, and more elongated, slender form, it differs from *B. conica* Froggatt, which, according to his figures, is more or less dependent."

B. urnalis Tepper (p. 274, with Plate IV, fig. 2). Figured also in Plate XXXIV, Froggatt. Found at Murray Bridge. "These are the most beautifully shaped galls known to me, and occur on a stunted species of *Eucalyptus* allied to *E. uncinata* and *E. gracilis*, but differing from either, and not agreeing precisely with any described kind."

Mr. Froggatt, *Agric. Gaz. N.S.W.*, ix, 494, says this species is identical with *B. schraderi* Olliff, but see Fuller, *op. cit.*, p. 212 (*unalis* in error). *Urinalis* in error in Froggatt, *Agric. Gaz. N.S.W.*, ix, 493. Olliff had it from Sydney, while Mr. Froggatt had some beautiful masses, containing hundreds of galls, from Uralla, N.S.W. I have received it on *E. calycogona*, which goes locally under the name "Gooseberry Mallee," because of the shape of the galls, from Parilla Forest reserve, South Australia (Walter Gill). On *E. hemiphloia* var. *microcarpa*, East Mirrool, N.S.W. (W. D. Campbell). On *E. melliodora*, Goulburn (Froggatt, *op. cit.*, p. 371). On *E. Moorei*, Wentworth Falls (D. W. C. Shiress). On *E. polyanthemos*, Uralla (W. W. Froggatt, *op. cit.*, p. 371). *E. Sieberiana*, Middle Harbour, Port Jackson (Dr. J. B. Cleland). *E. spathulata*, Cunderdin, W.A. See bottom of p. 124, Part XXXV, *Crit. Rev.* (W. V. Fitzgerald).

5. "Notes on the sub-family Brachyseelinae with descriptions of new species," Part IV, by W. W. Froggatt (*Proc. Linn. Soc. N.S.W.*, xx, 201, 1895).

Following are the new species:—

B. dipsaciformis (p. 202, with Plate XIX, fig. 1). "This name was given to a small, regular, oval gall, covered with little tufted bracts, or curved spines, that gave them a striking resemblance to a teasle. North Queensland—exact locality unknown." Froggatt, in *Agric. Gaz. N.S.W.*, ix, 493. On *E. paniculata*, Ourimbah State Forest, N.S.W. (W. E. A. McPherson).

B. sessilis (p. 203, with Plate XIX, fig. 2). Found on the branchlets of an undetermined rough-barked species at Wallsend, near Newcastle. The female gall is described as turret-shaped (Froggatt in *Agric. Gaz. N.S.W.*, ix, 493).

B. rosiformis (p. 205, with Plate XIX, fig. 3). "In this Cockscorb gall the female ones are long and slender, attenuated at the base, and truncated at the tip, 9 lines in length, and not more than $1\frac{1}{2}$ lines in diameter. The male galls forming an irregular mushroom-like mass containing up to 1,000 pale pink tubes, and sometimes the whole mass pale red." (Froggatt in *Agric. Gaz. N.S.W.*, ix, 495).

6. There is an interesting illustrated article by Claude Fuller, entitled "Forest Insects; some Gall-making Coccids," in the *Agric. Gaz. N.S.W.*, vii, 209 (1896) four plates. After speaking of the family Coccididae as an anomalous group, he goes on to say, "It is not, therefore, surprising that in such a land of anomalies as Australia the greatest anomalies are found to exist. Such an irregularity is the genus *Brachyseelis*, the members of which live exclusively upon trees and shrubs of the genus *Eucalyptus*. These insects cause woody galls of many interesting shapes to grow upon the tree, in the heart of which they live; in the case of females till death, and of the males until the adult stage is reached." Then follow detailed accounts of the male insect, female insect, and larvæ.

He then gives an account of the male and female galls—the external evidences of the attacks of the insects on the Eucalypts—and these will be of most interest to the botanist.

The male galls are invariably small cylindrical tubes, 2 to 6 lines in length, generally growing on the leaves. The female galls vary from one-half to 6 or 7 inches in length, and often display most remarkable forms.

At the end of the first paragraph on p. 212, and also p. 217, the author speaks of an unnamed gall, named afterwards *Brachyscelis excupula* Fuller. I have seen this gall on a young Ironbark (*E. paniculata*) at the Ourimbah State Forest (W. E. A. McPherson).

Mr. Fuller's article is especially valuable because of its descriptions and figures of the species left in MS. by A. S. Olliff, but the host plants were not ascertained.

The following species are described:—

B. pedunculata Olliff ex Fuller in *Agric. Gaz. N.S.W.*, vii, 212 (1896), with figs. i to v of Plate I. On several Eucalypts in the neighbourhood of Sydney. Since found on *E. propinqua*, South Grafton (J.H.M.). On *E. amplifolia* at Lansdowne River, N.S.W. (Dr. J. B. Cleland).

B. crispa Olliff ex Fuller in *Agric. Gaz. N.S.W.*, vii, 213 (1896), with figs. i to iiig, Plate II. The gall resembles a cone-like fruit, and it is common around Sydney. The specimens figured came from Booral, N.S.W. Mr. Froggatt says it is identical with *B. strombylosa* Tepper, but at p. 287. I have suggested further enquiry.

B. nux Olliff ex Fuller in *Agric. Gaz. N.S.W.*, vii, 214, with figs. i to iii, Plate III. Found at Bungendore, N.S.W. Mr. Froggatt (*Agric. Gaz. N.S.W.*, ix, 495) says this equals his *B. Thorntonii*.

B. Schraderi Olliff ex Fuller in *Agric. Gaz. N.S.W.*, vii, 214, with figs. vi to viii, Plate I. Collected at Tamworth, N.S.W. See a note on the synonymy under *B. urnalis* Tepper, p. 288.

B. Fletcheri Olliff ex Fuller in *Agric. Gaz. N.S.W.*, vii, 215 (1896), with figs. i to xiv, Plate IV. Affecting the branches of two trees at Ham Common, Richmond, N.S.W. Found also at North Willoughby, Sydney, and on several species in the Parramatta district. Mr. Froggatt (*Proc. Linn. Soc. N.S.W.*, xli, 191, 1916) noted it from Hay, but does not state the species of tree. I have got it from *E. bicolor*, Murrumbidgee River, near Darlington Point (W. D. Campbell). On *E. amplifolia*, Gulgong, N.S.W. (J.H.M. and J. L. Boorman).

Mr. Fuller also figures (figs. iv to vii, Plate III) a gall received from the Port Stephens district, which he does not describe, but he suggests the provisional name of *B. excupula*.

7. "Notes on the Coccidæ of Western Australia." (*Journ. Bureau of Agric. of W.A.*, 1897, by Claude Fuller (no figures).

Amongst other species are described *Apiomorpha maliformis* and *A. Helmsii*. I have received galls of the former (which are like a small apple) on *E. Todtiana* from Perth (Dr. J. B. Cleland), and on *E. patens*, foot of Mt. Frankland, S.W. Australia (S.W. Jackson), and galls of the latter on *E. redunca* at York, W.A. (J. Staer).

8. Mr. Froggatt has an article entitled "The growth of Vegetable Galls," in the *Agric. Gaz. N.S.W.*, ix, 385, 488 (April and May, 1898), which deals in a popular manner with galls of various kinds. At p. 488 he gives a general account of the Coccidæ (Sub-family Brachyscelinæ), and takes cognizance of *Brachyscelis*, *Ascelis*, and *Opisthoscelis*.

He points out that Schrader's name, *Brachyscelis*, has been changed by E. Rübsaamen (*Berliner Entom. Zeitschrift*, 1894) into *Apiomorpha*, and that this change of name has been adopted by T. D. A. Cockerell in his "Check-list of Coccidæ," published by the Illinois State Laboratory of Natural History. He, however, follows Maskell in retaining the old name, and invites attention to his protest in *Trans. N.Z. Inst.*, xxix, p. 294, 5 (1896) against "such arbitrary alterations." It seems, however, that entomologists have since decided to sink *Brachyscelis* in *Apiomorpha*.

Mr. Froggatt's article deals ((*inter alia*) with *B. (Apiomorpha) Karaschi* Rübs. "This appears to be somewhat allied to the previous species (*B. Fletcheri*), only the masses are more regular, and only one gall-cell enclosed." (Froggatt in *Agric. Gaz. N.S.W.*, ix, 494).

9. "Notes on the sub-family Brachyscelinæ, with descriptions of new species," Part V, by W. W. Froggatt, *Proc. Linn. Soc. N.S.W.*, xxiii, 370 (1898).

It takes cognizance of the following species:—

1. *B. urnalis* Tepper (*B. Schraderi* Olliff). See pp. 288 and 289.
2. *B. pileata* Schrader (with a figure). Also see p. 284.
3. *B. Sloanei* n. sp. (with a figure). Clear Hills, Wagga district, N.S.W., on a White Gum (T. G. Sloane).
4. *B. variabilis* Froggatt. See p. 286.
5. *B. attenuata* n. sp. (with a figure). On *Eucalyptus* sp. South Australia (A. Molineaux). I have received it on *E. tereticornis*, Stanthorpe, Q. (J. L. Boorman).
6. *B. floralis* n. sp. (with a figure). On *Eucalyptus* sp. Central Australia (C. French). I have received it from the Roper River, Northern Territory, on *E. pruinosa*. (W. Baldwin Spencer).
7. *Opisthoscelis nigra* n. sp. (with a figure). Sydney and Port Macquarie, both on *Eucalyptus* sp.
8. *Sphærococcus ferrugineus* n. sp. (with a figure). See p. 282.

See also notes on Brachyscelidæ by W. M. Maskell in *Trans. N.Z. Inst.*, xxiv, 52 (1891).

10. "Further Coccid Notes: with descriptions of new species, and discussion of points of interest," by W. M. Maskell, *Trans. N.Z. Inst.*, xxix, 293 (1897), with Plates XVIII-XXII.

He refers to R. H. Rübsaamen's paper on certain Australian Homoptera and Diptera, to which allusion has already been made. "Much of this is taken up by rather rough criticism of some observations of Mr. J. G. O. Tepper, of Adelaide, as to which it may be sufficient to say that the critic would have done well to acquire some greater knowledge of Coccids than he appears to possess before he proceeded to vilify others." He then discusses Rübsaamen's proposed supersession of *Brachyscelis* for *Apiomorpha*, and emphatically supports the use of *Brachyscelis*.

Let us now return to Schrader's paper, quoted at p. 283. Following include his references to *Opisthoscelis* and *Ascelis*.

"The galls of the insects of the genus *Opisthoscelis* are often found, male and female, under the same leaf (fig. i, Plate III). The female gall is in the shape of a pea, but somewhat larger, the male gall very small and conical" (Schrader, *op. cit.*, p. 7).

I have seen undetermined galls of *Opisthoscelis* on *E. melliodora* at Warren (J. L. Froggatt). On *E. oleosa*, No. 5 line, near Griffith (W. D. Campbell). On *E. propinqua* (?) at Raymond Terrace (E. Cheel).

O. subrotunda Schrader, in *Trans. Entomol. Soc. N.S.W.*, i, 7, with a figure (n. Plate III) of a female gall. This species is fully described by Froggatt (*Proc. Linn. Soc. N.S.W.*, xviii, 211, 1893), who found the female galls very plentiful at Sutherland, near Sydney, on *E. capitellata*. They are found on the leaves of young trees, either growing singly or in twos or threes. In *Agric. Gaz. N.S.W.*, ix, 497, Froggatt gives the synonyms as *O. Schraderi* Rübs. and *O. globosa* Rübs.

It also occurs on the large-fruited form of *E. resinifera*, Milton, N.S.W. (R. H. Cambage), and on the normal species at Sutherland (J. L. Boorman).

O. gracilis Schrader, *Trans. Entomol. Soc. N.S.W.*, *op. cit.*, p. 7. The following species have been described by Mr. Froggatt:—

Opisthoscelis n. sp. On *E. oleosa*, Cobar (J. L. Boorman).

O. fibularis Froggatt, *Proc. Linn. Soc. N.S.W.* xviii, figs. 17-21, Plate XVI. Found at Bendigo, Victoria, and Bathurst, N.S.W., on undetermined species of *Eucalyptus*.

O. maculata Froggatt, *Proc. Linn. Soc. N.S.W.*, xviii, 345, with figs. 22 and 23 of Plate XVII. Plentiful in the Whipstick Scrub, Bendigo, on *E. leucosylon* and *E. gracilis*.

O. mammularis Froggatt, *Proc. Linn. Soc., N.S.W.*, xviii, 344, with figs. 15 and 16 of Plate XVI. Found at Bendigo, Victoria, on an undetermined species of *Eucalyptus*.

O. Maskelli Froggatt, *Proc. Linn. Soc. N.S.W.*, xviii, 340, with figs. 6-9, Plate XVII. Common at Flemington, near Sydney, on *E. siderophloia*, but also "at Maitland, Cooma, Newcastle, and from a dozen localities within a radius of 20 miles of Sydney." In *Agric. Gaz. N.S.W.*, ix, 497, Froggatt says that this species is confined to *E. siderophloia*.

O. nigra n. sp. (with a figure), is described by Froggatt in *Proc. Linn. Soc. N.S.W.*, xxiii, 376 (1898).

O. serrata Froggatt, *Proc. Linn. Soc., N.S.W.*, xviii, 346, with figs. 24–26, Plate XVII. Galls very similar to those of *O. subrotunda*. Found at Pendigo on an undetermined species of *Eucalyptus*.

O. spinosa Froggatt, *Proc. Linn. Soc. N.S.W.*, xviii, 341, with figs. 10–12, Plate XVI. Plentiful in several localities about Sydney, and common at Flemington on *E. siderophloia*.

O. verrucula Froggatt, *Proc. Linn. Soc. N.S.W.*, xviii, 338, with figs. 3–5, Plate XVII. Found on the young foliage of a *Eucalyptus* near a mine at Napoleon Reef, at 15 miles from Bathurst, N.S.W. *Verrucula* in *Agric. Gaz. N.S.W.*, ix, 498.

O. pisiformis Froggatt, *Proc. Linn. Soc. N.S.W.*, xviii, 343, with figs. 13 and 14 of Plate XVII. This species is remarkable from the fact that it has been recorded from no less than four species of *Eucalyptus*, viz., *E. melliodora* at Bathurst, *E. robusta* at Manly, *E. piperita* at Thornleigh, and *E. resinifera* at Sutherland. I have also seen it on *E. corymbosa* from Kendall (Dr. J. B. Cleland).

Ascelis præmollis Schrader. In this genus the female larvæ alone form galls. Figs. *q* and *r*, Plate III, show the gall and section. “The opening of the gall is not, as with *Brachyscelis*, in the top of the gall, but on the other side of the leaf (see fig. *r*). (Schrader.) Described more fully by Froggatt (*Proc. Linn. Soc. N.S.W.*, xviii, 211, 1893, with fig. 1, Plate VIII), who found them common in the neighbourhood of Sydney on *E. corymbosa*, and, in his experience, only on this species; the galls vary much in size. He also found them in abundance at Sutherland, near to *Opisthoscelis subrotunda*. On *E. corymbosa*, Ourimbah State Forest, Gosford (W. A. W. de Beuzeville). On *E. hemiphloia* var. *albens* at Coolamon (Dr. J. B. Cleland).

A. attenuata Froggatt, *Proc. Linn. Soc. N.S.W.*, xviii, 214, with figs. 4 and 4a of Plate VIII. The galls are very small, and found on the leaves of *E. piperita* at Thornleigh, near Sydney.

A. Schraderi Froggatt, *Proc. Linn. Soc. N.S.W.*, xviii, 213, with fig. 2, Plate VIII.

“Gall an irregular rounded blister half inch in diameter.” . . . “This *Ascelis* gall was known to Schrader, who mentions them as ‘large flat swellings on both sides of the leaves’; but he evidently considered it to be another form of *A. præmollis*. Though both grow on *E. corymbosa* in the same localities, yet I have never found both growing on the same tree.”

Ascelis (?) *multitudinea* Tepper, *op. cit.*, p. 278, with Plate V, fig. 4, is a Psyllid. Collected at Marino, south-eastern district of South Australia, on a leaf “of one of the Stringybark Gums” (presumably *E. capitellata*).

Carteria melaleuca W. M. Maskell, in *Trans. N.Z. Inst.*, xxiv, 55 (1891), with Plate XII, figs. 1–10. On an undetermined species of *Eucalyptus*, probably from Victoria.

ORDER IX (THYSANOPTERA).

Family Thripidae (Thrips).

See "Studies on Australian Thysanoptera: the genus *Idolothrips* Haliday," by W. W. Froggatt (*Proc. Linn. Soc. N.S.W.*, xxix, 54, 1904). He figures and describes some large Australian thrips. These insects are to be found in all stages of growth by beating or shaking the dead foliage of *Eucalyptus* bushes, where the trees have been cut down, and the leaves have remained attached to the twigs, forming a close shelter for them. See also Froggatt, p. 393.

Arachnideae (Mites).

In addition to Insects, we have the Arachnidæ, which include spiders, mites, ticks, and scorpions. Here are some notes on mites, because they often exhibit their destructive behaviour on the leaves of Eucalypts. But their effect on our forest vegetation has been but little recorded in Australia.

Mr. E. Cheel showed (*Proc. Linn. Soc. N.S.W.*, xl, 117) the effects of a Mite (*Phytopus* or *Tetranychus* probably), on the leaves of a number of plants, *e.g.*, *E. saligna* from Moona Plains, Walcha (collected by the late A. R. Crawford), and *E. sp.* Jellore Creek (collected by himself). The pathological effect is to produce a beautiful crimson granular appearance on the underside of the leaf.

The phenomenon is known as Erinosis, and besides those mentioned I have seen beautiful specimens in *E. stricta*, Blackheath, Blue Mountains, New South Wales, *E. Muellermana*, Dumaresq, Armidale, New South Wales, and *E. obliqua*, Bunyip Creek, Victoria.

Damage on leaves of *E. saligna*, Killara, Sydney (W. F. Blakely), is stated by Mr. Froggatt to have been apparently caused by mites.

In discussing galls, Goebel ("Organography of Plants," i, 1900, footnote, p. 196), says, "Moreover: there are cell-forms which are non-existent if the development is undisturbed, for instance, the hair-formations of 'Erineum galls'; and these hair-formations, which are induced by the attack of mites, are serviceable to the parasite, and diverge altogether in structure from the normal hairs of the plants on which they occur."

Following is a note from Kerner and Oliver's "Natural History of Plants," ii, 529. The various kinds of galls have been discussed.

"The majority of *felt-galls* are produced by gall-mites. They form cottony or felted growths on limited and sharply defined areas of green leaves and stems, the surface of which is otherwise smooth, or possesses but few hairs.

The colour of the felted hairs varies according to the plant, . . . the stimulus being afforded by a minute gall-mite (*Phytopus*)."

It should be mentioned that formerly these velvety and felted coverings were regarded as Fungi, and were described as distinct genera under the names *Erineum* and *Phyllerium* (*e.g.*, the gall known as *Erineum quercinum* on the leaves of *Quercus (erris)*).

 

Duboisia myoporoides R.Br.

A Corkwood or Duboisia.

(Family SOLANACEÆ.)

Botanical description.—Genus *Duboisia* R. Br., in *Prod.*, 448 (1810).

Calyx five-toothed. Corolla ovate campanulate, the lobes broad, induplicate in the bud. Stamens four, didynamous, included in the tube, the upper ones the longest, the fifth uppermost one reduced to a minute rudiment; anthers reniform, turned outwards at least when fully out, the cells confluent at the apex. Stigma slightly dilated and two-lobed. Fruit an indehiscent berry. Seeds few, curved, with a crustaceous tubercular-rugose testa; embryo curved, the albumen not copious. Small glabrous tree. Leaves alternate, entire. Flowers small, in terminal centrifugal panicles. (B. Fl. iv, 473.)

Botanical description.—Species *myoporoides* R. Br., in *Prod.*, 474 (1810).

A tall shrub or small tree, quite glabrous. Leaves alternate, from obovate-oblong to oblong-lanceolate, obtuse or rarely acute, entire, contracted into a petiole, 2 to 4 inches long. Panicles terminal, sometimes leafy at the base, usually much branched, broadly pyramidal or corymbose. Bracts minute. Calyx broadly campanulate, with broad obtuse teeth. Corolla about 2 lines long, white or pale lilac, the lobes rather short and obtuse. Stamens included in the tube. Berry small, nearly globular. (B. Fl. iv, 474.)

Botanical Name.—*Duboisia*, after Louis Dubois, author of a work on the botany of Orleans, France, published in the year 1803; *myoporoides*, from two Greek words, signifying Myoporum-like, owing to the similarity of leaves, flowers and general appearance of this tree to a coast-districts *Myoporum* (*M. acuminatum*).

Vernacular Names.—This plant is called Cork-tree as well as Corkwood, on account of its bark, and perhaps also of the lightness of the wood. It must not be confused with other indigenous so-called cork-trees or cork-woods, such as *Endiandra Sieberi* and *Ackama Muelleri* of the coast districts. It is also occasionally called Elm, though the name is not appropriate.

Aboriginal Names.—It was formerly known as “Onungunabie” by the aborigines of the Clarence, N.S.W. (C. Moore). “Ngmoo” was its aboriginal name in the Illawarra (Macarthur), a name it shared with *Myoporum acuminatum*.

Leaves.—The leaves form the most valuable part of the tree. They are carefully dried in the shade, and when they have been deprived of as much moisture as possible, they are packed in sacks or boxes, care being taken not to break up the

leaves unnecessarily. The market for them used to be chiefly in Germany, and the price in pre-war times varied according to quality and the state of the market, from about 4d. to 1s. a pound, packed for shipment. It is not yet known what the extent of the demand for this drug is, mainly, I believe, because of the difficulty which manufacturers in Europe have had in procuring regular shipments of uniform quality. This matter of supply of the leaves is referred to later on. Just a word of warning. The leaves are poisonous (though not violently so), but accidents from them are very rare. Some years ago, two children in the Richmond River district chewed them, and suffered from general nervous and muscular derangement, accompanied by delirium. They recovered.

The aborigines were long since aware that the leaves of this tree possess narcotic properties, but to the late Rev. Dr. Woolls belongs the credit, I believe, of first publishing the fact. It remained, however, for Dr. Joseph Bancroft, of Brisbane (at the suggestion of Baron von Mueller), to first work at the plant, to discover its value as an agent in ophthalmic surgery, and to introduce it to the profession.

In the Rev. Dr. Woolls' "A Contribution to the Flora of Australia," p. 206, occurs the following passage (written soon after the year 1860):—" *D. myoporoides* . . . probably possesses deleterious properties. I have been informed by Miss Atkinson that the aboriginal natives used to prepare some stupefying liquid from it, and also the branches of the tree, when hung up in a close room, have had the effect of producing giddiness and vomiting in delicate persons." At another place he gives a rather fuller account:—"It has an intoxicating property. The aborigines make holes in the trunk and put some fluid in them, which, when drunk on the following morning, produces stupor. Branches of this shrub are thrown into pools for the purpose of intoxicating the eels and bringing them to the surface." The smell is faint and sickly, but with nothing like the intensity of pituri (*D. Hopwoodii*).

Such I believe to be the first published account of any properties of the leaves of this plant, and this is practically all that was known of its uses before the researches of Dr. Joseph Bancroft. Following are extracts from a paper published by that gentleman in October, 1877, after injection of an extract of the leaves under the skin:—"Dogs and cats walk about in a helpless, blind manner, falling over the least irregularity of surface, and struggle, in the case of the dog, to get through and over all sorts of impassable obstacles. If let alone, they go to sleep. They seem blind, or nearly so, with a widely dilated pupil. . . . I now tried it on some of my ophthalmic cases, and found an action of great rapidity. A very slight irritation is mentioned by patient; after a drop is placed in the eye, but this passes away in a few seconds. In from five to fifteen minutes an ophthalmoscopic examination can be made. . . . I use the Duboisia now regularly in place of Atropia, and in several extraction cases found it to act satisfactorily."

The late Dr. Fortescue, of Sydney, has given an account of an experiment with watery extract of Duboisia upon the normal eye, but it is too technical for reproduction here.

Later, Dr. Bancroft says :—" I have given *Duboisia* in asthma and photophobia. It causes much dilatation of the pupil, and indistinct vision, also confusion of intellect, particularly at night, a thirsty dryness of the throat, and loss of taste. At present no valuable results, except the mydriatic, are apparent."

In a paper read by Dr. Bancroft before the Queensland Philosophical Society, 10th October, 1878, entitled " Further remarks on the Pituri group of plants," are some further notes on *Duboisia myoporoides*, or " Duboisia." He describes the active principle as a yellow, oily-looking substance, which refuses to crystallise, either alone, or with the common acids. It mixes with water readily, and is not volatile at 212 deg. F.

The leaves owe their active properties to the presence in them of an alkaloid called duboisine, which Ladenburg pronounces identical with *hyoscamine*; albeit there are minute differences between them. The method adopted by Mueller and Rummel to obtain the alkaloid, and a short account of the latest researches of Ladenburg in regard to its position, are given herewith. (See also Liversidge, *Proc. Roy. Soc. N.S.W.*, 1880, 125.)

" Duboisine is a volatile (non-volatile according to Bancroft—J.H.M.) alkaloid of the leaves and twigs of *Duboisia myoporoides* R.Br., and probably identical with the piturine found by Staiger in *D. Hopwoodii* F.v.M. Prepared like nicotine, it is a yellowish, oily liquid, lighter than water, of a strong narcotic odour, resembling that of nicotine and also cantharides, of a very strong alkaline reaction; neutralises acids completely; dissolves in any quantity of water, alcohol or ether; throws down ferrous oxide from ferrous sulphate; dissolves in concentrated acids, forming a colourless solution. Its hydrochloride, in a weak aqueous solution, is precipitable by iodide of potassium, some double iodides, and by tannic acid, not by other alkaloid reagents. Nicotine, which *duboisine* resembles, is distinguished from the latter by its specific gravity, its less powerful odour, and by its hydrochloride in a diluted aqueous solution being precipitated by phosphomolybdate of soda, picric acid, and chloride of platinum." (Mueller and Rummel, in Wittstein's *Organic Constituents of Plants*.)

In 1880, Professor Ladenburg (*Comptes Rendus*, xc, 874) during his investigation of the mydriatic alkaloids, arrived at the conclusion that duboisine, the base obtained from *D. myoporoides*, was identical with hyoscine* (*Pharmaceutical Journal* (3), xi, 351), though, as generally met with, probably contaminated with some impurity. This opinion was subsequently challenged by Herr Harnack, who affirmed that duboisine exercised a much stronger physiological action than hyoscine. Professor Ladenburg has, therefore, been induced to reinvestigate the subject, working upon a sample of duboisine supplied by Herr Merck. The base, as received, was a yellow-brown sirupy mass, which was dissolved in hydrochloric acid and precipitated with gold chloride. The gold salt had at first a resinous appearance, but after four recrystallisations it became homogeneous, melting constantly at 197 degrees to 198 degrees, and showing all

* Hyoscyamine in the abstract, through inadvertence.

the properties and having the same elementary composition as the gold salt of hyoscine. Neither hyoseyamine nor any other alkaloid could be detected in the first mother liquor from the gold salt. Professor Ladenburg is of opinion that the explanation of this different result probably lies in some variation in the method of preparing the duboisine, but confesses he cannot say in what respect. It will be remembered that the name "hyoscine" was appropriated for a base found in the mother liquor after the removal of hyoseyamine in preparing that alkaloid from henbane; it is isomeric with atropine and hyoseyamine, but is split up by alkalies into tropic acid and pseudotropine. (*Pharmaceutical Journal* (3), xvii, 1049.)

In the same *Journal* (3), xiii, 706, is a concise account by Mr. E. M. Holmes of the plant, digested from a paper by Dr. Bancroft.

For an account of Gerrard's experiments with the alkaloid of this plant, together with some physiological experiments with it, *vide Pharm. Journ.* (3), viii, 787, *et seq.*

In practice the sulphate of the alkaloid, which forms golden-yellow scales, is usually preferred. The dose is from $\frac{1}{120}$ to $\frac{1}{30}$ of a grain. The extract is said to have been given with great benefit in cases of the night sweats of phthisis, without producing any bad effects on the appetite. It produced entire relief from pain in a severe case of vesical tenesmus from inflammation of the urethra and neck of the bladder.

The following references to the alkaloid are taken from Martindale and Westcott's *Extra Pharmacopæia* (see also *Pharm. Journ.* (3), viii, 787, for an account of the experiments of Drs. Ringer and Murrell, most of which are separately referred to below). It dilates the pupil, dries the mouth, checks perspiration, causes headache and drowsiness, antagonises muscarine. On the eye it acts more promptly than atropine. (*Lancet*, i, 1878, 304.) Eight cases of toxic symptoms—giddiness, delirium, and dryness of the mouth—from use of eyedrops, four grains to the ounce. (*Lancet*, ii, 1879, 353.) As a mydriatic, it is much stronger than atropine. Its use requires care—it is apt to produce giddiness, and even delirium. (*Lancet*, ii, 1879, 441.) Its action relative to atropine, physiologically, &c. (*Practitioner*, xxiii, 246.) Therapeutic and physiological effects; differs from atropine by the persistence and greater rapidity of its action on the muscle of accommodation; is a useful calmative in maniacal delirium; as a sedative ointment, 1 in 500 of vaseline applied night and morning is useful in inflammation of the cornea. (*Practitioner*, xxv, 294.) In exophthalmic goitre, $\frac{1}{120}$ grain, two or three times a day, gives great relief. (*British Medical Journal*, i, 1883, 958.) Resume of its physiological properties. (*Lancet*, ii, 1881, 806. *British Medical Journal*, ii, 1879, 362; ii, 1881, 529. *Trans. Medical Congress*, 1881, i, 511.) Dr. H. Gellhorn (*Deutsche Medizinische Wochenschrift*, 1891, No. 30, quoted in *Merck's Bulletin* for October, 1891, p. 144), recommends duboisine sulphate as a prompt sedative, having no dangerous by-effects, in the excitations of psychoses. The hypnotic action of duboisine sulphate in simple agrypnia has not yet been fully gauged. Perhaps sulphonal is prompter in this respect. In excited patients, duboisine sulphate generally induces sleep. Dr. Gellhorn then proceeds to give the dosage for such patients.

An interesting paper on "Duboisine and its uses in the Colonies" will be found in the *Pharmaceutical Journal of Australasia* for May, 1891. As regards its use, the author remarks :—"It is possible that pure duboisine might yet get some name as a mydriatic were it cheap, but naturally the extract, &c., is not able to hold its own against hematropine and atropine. The future of duboisia undoubtedly depends either on its yielding duboisine very cheaply (for ophthalmic surgery) or in more extended trials therapeutically establishing uses not yet suggested for it, but which its pharmacological peculiarities give a foundation for."

A trade report, dated May, 1891, issued by Gehe & Co., of Dresden, stated :—"Though certainly not quite at a standstill, the employment of duboisine is decreasing. Considering the high price of the compound, necessitated by the expensiveness of the raw material, this is not surprising, particularly in ophthalmology; it does not possess the slightest advantage over atropine sulphate."

In Merck's Index for 1889 the price of the pure crystallised alkaloid (duboisine) is quoted at 16s. 8d. per 15 grain tube; the price of the amorphous sulphate is quoted at about 7s. 6d. for the same quantity. The hydrochlorate is also in the Index, while in iii, Nachtrag (August, 1891), the hydrobromide is added. (An account of this substance is given in *Merck's Jahresbericht*, January, 1892, p. 34.) While these prices are high and almost prohibitory, I do not say they are excessive, considering the difficulties importers have had to contend with in getting supplies of the raw material. While the raw material is plentiful enough in some districts, it is not inexhaustible, and collectors of the leaves should never cut down the trees, but prune the limbs or twigs, an operation which will be advantageous to the tree rather than the reverse. Chopping down the trees unnecessarily is killing the goose with the golden eggs, and such conduct will bring its own punishment.

Herr Merck, of Darmstadt, in Germany, has been working a good deal at the chemistry of duboisia leaves during the past few years. He has just found a new alkaloid in it, *Pseudhyoscyamine*. The substance is hardly of interest to the general reader, but as it is the very latest research in regard to these interesting leaves, Australian organic chemistry students may wish to know that it is published in his *Bericht*, 1892, p. 11, while brief English abstracts are to be found in the *Pharmaceutical Journal* (3) xxiii, 606, and the *Journal of the Society of Chemical Industry* for 1893, p. 491.

Even if, like *Alstonia constricta*, the crude drug does not realise all the hopes which the ophthalmic surgeon had placed on it, we have the satisfaction of knowing that to the organic chemist it has proved of the highest scientific interest and it is not likely that even yet we have come to the end of our knowledge in regard to it.

* * * * *

I had written the above historical account, after much research, for the *Agricultural Gazette* of New South Wales, for December, 1893, and the account has some value even now.

A few years later, in the same journal, I added the following bibliographical notes :—

A paper by *Gordon Sharp*, "On our present knowledge of the Mydriatic Group," in *Pharm. Journ.* of 14th August, 1897, p. 161.

Gregory, J.—Pituri and Tobacco. Brisbane, 1879, 8vo. Chiefly on *Duboisia*, Pituri and *Anthocercis tasmanica*.

Ladenburg, A.—Identity of Duboisine and Hyoscyamine. *Ber.* xiii, 357. *Year Book Pharm.*, 1880, 26.

Ladenburg, A.—Identity of Daturine with Hyoscyamine and Duboisine. *Ber.* xiii, 380. *Year Book of Pharm.*, 1880, 27.

Ladenburg, A.—The Mydriatic Alkaloids. *Chem. Zeitung*, 1881, No. 9. *Year Book of Pharm.*, 1881, 20.

Ueber Pseudhyoscyamin. Ein neue Alkaloid aus *Duboisia myoporoides*. *Bericht*, 1892, p. 11. *Pharm. Journ.* (3), xxiii, 606.

Merck, E.—A new alkaloid, contained in *Duboisia myoporoides* R.Br., together with hyoscyamine and hyoscyne. *Arch. Pharm.*, 231, 117. *Journ. Chem. Soc.*, lxiv, 491.

There is also a useful paper on "Duboisine and its uses in the Colonies" in the *Pharm. Journ. of Australasia*, May, 1891. Dr. Finselbach makes the statement that the leaves of *D. myoporoides* contain rather less alkaloid during the flowering period than later, and recommends them to be collected in November or December.

* * * * *

More than twenty years later, Dr. J. M. Petrie took the matter up, and we have two valuable papers from his pen, viz. :—"The chemical investigation of some poisonous plants of the N.O. Solanaceæ;" Part IV, "The Chemistry of the Duboisias," (*Proc. Linn. Soc. N.S.W.*, xlii, 118); and Part V, "The alkaloids of *Duboisia Leichhardtii* F.v.M.," (xlii, 137, 1917).

The attention of my readers is invited to these two papers, which cannot be usefully briefly extracted.

Leaves Poisonous to Stock.—I think there can be no doubt of this, as suggested by Mueller many years ago. From time to time one hears of it as a suspected plant, but very rarely is evidence forthcoming. Mr. Blakely says that it is looked upon as poisonous in the Dungog district.

Flowers.—They are white, with parallel purplish stripes inside the corolla-tube (the lower part of the bell of the flower). The flowers are small, and not very conspicuous.

Fruit.—The tree bears a profusion of small black berries.

Bark.—Greyish superficially, but the mass of it of a yellowish or pale brown colour. Corky, soft to the touch, furrowed, thick, breaks off readily. The name Cork-tree is partly in allusion to the bark. I know of no use for it, except to a very limited extent for rustic work.

Timber.—The first published account of this tree, from an economic point of view, was in regard to its timber, the late Mr. (afterwards Sir) William Macarthur having sent a log of it to the Paris Exhibition of 1855. It was numbered 81, and was accompanied (as most of his specimens were), by herbarium specimens. These enabled the illustrious Bentham to identify the timber as that of *D. myoporoides*, although, such were the difficulties of obtaining Australian botanical information sixty-five years ago, it had been labelled *Santalum obtusifolium*. With *Myoporum acuminatum* it shared the aboriginal name of “Ngmoo,” but the following information, supplied by Sir William, makes no allusion to the properties of the leaves :—“Diameter, 10–16 inches; height, 15–20 feet. A low-branching small tree, with rough cork-like bark; the wood very white, close, and soft, but firm; excellent for wood-carving, and not without beauty for inlaying and cabinet-work.” Sir William Macarthur was a cyclopædia of knowledge in regard to the uses to which the blacks put the indigenous vegetation, so that the omission of any allusion to the properties of the leaves shows that he was most likely unaware of them.

The late Mr. Macpherson, teacher of wood-carving in the Technical College, informed me in the early nineties that he was using large quantities of this wood, and was much pleased with it. Its colour is pleasing, and it has no figure to speak of. Like many other pale-coloured softish timbers, it is apt to be discoloured by “bluing,” the work of a fungus, of whose life history we know very little. When a tree has to be cut down, the timber should always be preserved, in order that it may be utilised for carving. It is light in weight (hence one of its names, Corkwood), being only about 30 lb. per cubic foot when dry.

In my former official positions as Curator of the Technological Museum and Superintendent of Technical Education, I never let an opportunity slip of testing native timbers in the wood-working classes at the Technical College, and such propaganda work has never been more wanted than now.

Size.—Usually a small tree with a height of 15 to 25 feet, and a diameter of 6 to 10 inches. Baron Mueller, however, quotes a Mr. Ralston (*Select Extra Tropical Plants*) as stating that it attains a height of 60 feet in deep forest glens, but I have not seen it so high.

Habitat.—From the Shoalhaven River in New South Wales, along the coast belt, in brushes chiefly, to Northern Queensland. It also extends to New Caledonia.

Following are New South Wales localities quoted in the *Flora Australiensis*. It was not known from Queensland when that work was published. Port Jackson to the Blue Mountains (R. Brown, Sieber, No. 259, and many others); Sydney woods, Paris Exhibition, 1857 (Macarthur, No. 81); Hastings and Clarence Rivers (Beckler); Port Macquarie (Fraser); Richmond River (Henderson); southward to Illawarra (A. Cunningham, Ralston).

Following are some localities represented in the National Herbarium, Sydney :—

Southern.—Badgery's Crossing to Nowra (W. Forsyth and A. A. Hamilton). Shell Harbour (E. Cheel). Kangaroo River (J.H.M.). Broughton Vale and Kiama (Rev. T. V. Alkin).

Western.—Grose River and banks of Nepean River. Robert Brown collected here in May, 1803, and January, 1805. (R. H. Cambage and J.H.M.)

Northern.—On edge of salt-water, Hawkesbury River (W. F. Blakely). Port Stephens (J. L. Boorman). "Regarded as a poisonous plant in the district," Dungog (W. F. Blakely). Bowman and Barrington Rivers (J.H.M.). Byron Bay (J. L. Boorman and J.H.M.). Urunga (A. H. Lawrence). South Grafton (Ralph Blacket). Grafton (H. V. Wenholtz). Richmond River (C. Fawcett). Acacia Creek, Macpherson Range (William Dunn).

Queensland.—Ennogera (collector of F. M. Bailey). Eumundi (J. Staer). Near Herberton (S. Dixon).

Propagation.—From seeds or cuttings, the latter being probably the better, as the well-ripened wood strikes readily.

EXPLANATION OF PLATE 252 (IN PART).

- A. Flowering twig.
- B. Flower.
- C. Interior of flower showing stamens (four) didynamous.
- D. Pistil ; stigma white, papillose.
- E. Front and back view of anthers.
- F. Fruits.
- G. Seed, curved, with a "crustaceous rugose-testa hardly tuberculate."

PHOTOGRAPHIC ILLUSTRATION.

Photograph of a small tree in the Botanic Gardens, Sydney. (Government Printer, photo)

No. 259.

Duboisia Hopwoodii F.v.M.

The Pituri.

(Family SOLANACEÆ.)

Botanical description.—Genus *Duboisia* R. Br., see p. 295.

Botanical description.—Species *Hopwoodii* F.v.M., in *Fragm.* ii, 138 (1861).

A glabrous tree or shrub. Leaves narrow-linear, acutely acuminate, with the point often recurved, entire, rather thick, narrowed into a short petiole, 2 to 4 inches long. Flowers in short terminal cymes or leafy pyramidal panicles. Bracts minute. Calyx small, broadly campanulate, with obtuse teeth. Corolla-tube campanulate, 3 to 3½ lines long; lobes broad, very obtuse, shorter than the tube. Anthers one-celled. Fruit unknown. (B. Fl. iv, 480.)

Botanical Name.—*Duboisia*, already explained (see p. 295); *Hopwoodii*, in honour of H. Hopwood, of Echuca, Victoria, a liberal supporter of the Victorian expedition in search of Burke and Wills (*Fragm.* ii, 139).

Vernacular Name.—"Pituri, spelt also "Pitchiri," "Pitchery," "Pedgery," "Bedgery," &c. It is of aboriginal origin. "Moda" of the Kalkadun aborigines, "Tarembola" of those of Boulia (Roth).

Pituri as Poisonous to Stock.—The following is an extract from a letter to me, dated 10th June, 1901, by the late Mr. R. Helms, who was botanist to the Elder Expedition, and who had much experience with this plant in Western Australia :—

"Glancing through your list of 'Poison Plants of Australia' in the *Agricultural Gazette* for this month, I notice the omission of *Duboisia Hopwoodii*. It is certainly poisonous to camels, and, therefore, probably also to other animals. Camels rarely feed on the ground, and where *Nicotiana suaveolens* grew to a height of 4 to 6 feet, as at the Everard and Blyth Ranges, these animals eschewed this plant. I cannot, therefore, believe that they should have picked the scantily occurring dwarf specimens later on, when several severe cases of illness occurred amongst the caravan. However, young succulent shrubs of *D. Hopwoodii*, whenever these almost disastrous events occurred, were always met with. For these reasons I attributed the severe attacks of several camels occurring within a few weeks to *D. Hopwoodii*, and I am convinced that a very small quantity is sufficient to bring about serious results. None of the camels I observed died, but they staggered for several days, after recovering from the severe paroxysms, and were useless for upwards of a week."

Timber.—Wood very light, close-grained, of a lemon colour, and when freshly cut has a decided smell of vanilla. (Sylvester Browne.)

Size.—Stem up to 6 inches in diameter and 8 feet high. (Sylvester Browne.) This would be on the Mulligan River, in Western Queensland.

Pituri and the Aborigines.—This is the masticatory of the aborigines of Central Australia, corresponding in this respect to the “Coca” of Peru, the Hashish of India, the Betel Nut of the Eastern Archipelago, the “Taezi Kaat” (*Catha edulis*) of Arabia, &c. The drug is in the form of leaves, more or less powdered, mixed with finely broken twigs, forming altogether a brown herb. So fine is the powder, and so irritating, that the most careful examination of a specimen is attended with sneezing. The plant is, as far as known, extremely patchy in distribution, and the blacks prize it so highly that they travel enormous distances to procure it; besides, it is a most valuable commodity for tribal barter. They gather the tops and leaves when the plant is in blossom, and hang them up to dry. They are sometimes sweated beneath a layer of fine sand (W. O. Hodgkinson), dried, roughly powdered, and then packed in netted bags, skins, &c., for transport. In Northern Australia the bags are made from the split young leaves of *Pandanus aquaticus* F.v.M., according to a specimen in the Kew Museum. I have examined dozens of packages of Pituri at different times, and they have all been made of netted work or canvas. Every bag appeared to be precisely the same both in size, pattern and material. The material I believe to be obtained by the aborigines from gunny-bags or wool-packs; these are unpicked, woven into circular mats about 6 inches in diameter, and folded over the contained Pituri like a jam-tart. The bag is then sewn up with fibre of the same material.

Sometimes pituri is chewed in company, a quid being passed round from one native to another, and when they have had sufficient, one politely plasters it behind his ear. It is also smoked, and to prepare the leaves for this purpose they are damped, mixed with potash prepared from the ashes of suitable plants (the leaves of a plant called “Montera” are burnt for this purpose, according to Mr. Sylvester Browne), and rolled up in the shape of a cigar. This is often chewed and the saliva swallowed. In small quantities it has a powerful stimulating effect, assuaging hunger, and enabling long journeys to be made without fatigue, and with but little food. It is also used by the aborigines to excite them before fighting. Mr. Sylvester Browne verbally informed me that he has never noticed any abnormal result from the habit, though he has heard that a black unaccustomed to the weed becomes intoxicated thereby. The observations of travellers as to the effects vary much. It is used to poison emus.

Wills' diary from Cooper's Creek (p. 283) has the following, under date 7th May, 1861 :—

“In the evening, various members of the tribe came down with lumps of nardoo and handfuls of fish, until we were positively unable to eat any more. They also gave us some stuff they call ‘bedgery’ or ‘pedgery’; it has a highly intoxicating effect when chewed even in small quantities. It appears to be the dried stems and leaves of some shrub.”

“The pituri consists of leaves broken into small particles and mixed with acacia leaves, small dried berries containing reniform seeds (these are pituri seeds—J.H.M.) and unexpanded flower buds of the shape of a minute caper.”

In March, 1872, Dr. Joseph Bancroft, of Brisbane, read a paper before the Queensland Philosophical Society on "Pituri." He obtained specimens from Sub-Inspector Gilmour, who had procured them from the neighbourhood of the Kulloo waterhole, eight miles beyond Eyre's Creek. He stated that the use of the pituri is confined to the old men of a tribe called Malutha, all the males of which are circumcised. The pituri caused a severe headache in Europeans who used it. The blacks about Eyre's Creek appeared to use it preparatory to undertaking any serious business, *i.e.*, as a stimulant generally. As an example, one old man Mr. Gilmour and party fell in with, refused to have anything to say or do until he had chewed the pituri, after which he rose and harangued in grand style, ordering the explorers to leave the place. Mr. Wiltshire, however, states that it is not used for exciting their courage, or for bringing them up to fighting pitch, but to produce a "voluptuous dreamy sensation."

The following interesting letter from Rev. Thomas Hungerford, Ashfield, Sydney, dated 27th February, 1891, to the late Sir Alfred Roberts, connects the names of two distinguished men :—

"The vegetable matter enclosed herewith has come from Central Australia, grows on the Mulligan River, and is an article of barter amongst the aboriginal tribes inhabiting Central Australia. It is called 'Pitchery' by the natives, has the peculiar property of intoxicating, and is greatly prized by the blacks. The bag containing the Pitchery is manufactured by the aboriginals and is that kind of bag or net in which it is sent from tribe to tribe.

"The Mulligan River is several hundreds of miles north-west of Innaminka, on Cooper's Creek, where the explorers Burke and Wills perished. I brought this curiosity with me from Central Australia a few weeks ago, and thought you would like to see and analyse it. The natives chew this Pitchery and become intoxicated from its effects."

The following account of the pituri-chewing customs of the blacks is from the pen of a well-known North Queensland writer, Mr. J. R. Chisholm :—

"In the pituri country (the watershed of the Mulligan) the indigenous blackfellow has none of the questionable comforts of the white man. His revenue is derived from the pituri tree growing on the summit of his sandhills. He gathers it, chaffs it, and then bags it and makes his trade with his nearest neighbours, taking in exchange such as they have to offer—perhaps weapons made from the timber of another towrie—notably the heelman or shield made from a species of currajong; or perhaps he takes flint knives or the white brush tails of a species of marsupial rat used in lieu of cockatoo feathers at corroboree decorations; or, if he can get it, some article of wearing apparel is very dear to his heart. I once gave a myall tribe a pair of moleskin trousers. I think within the two days I stayed near them, every blackfellow had a turn out of them, and no doubt among that tribe, even to this day, those trousers are a pleasing reminiscence, and so the trade goes on. What opium is to the Chinaman, what whisky is to the Scotchman, so is 'pituri' to the western blackfellow. It is his very soul—without it he has no life almost. As I have said, in these trading transactions profit is lost sight of; they seek none. The intermediate tribes are 'on velvet' minus cost of carriage. Thus—I trade my blanket for a bag of pituri to you. You take from it your own requirement for the year; you carry it across your towrie of 100 miles, more or less, and there you trade *what is left*, for similar value, to your neighbours; they in turn do likewise, and so on, and on, until there is none left.

The tribe on the borders of the trade never get enough, and with them it is a chronic state of crave, crave. Once, years ago, I carried for novelty a small sack full of pituri 'inside,' as far as the Landsborough River. I showed it to the blacks there, and although I had intended it for my scientific friends in Sydney, I parted with it; I could not stand the continual begging of the Landsborough blacks. I was besieged for it, they offered me all they possessed—weapons, piccaninies, gins.

"The pituri, when ready for use, resembles a coarse grass chaff, and is carried in bags containing about a bushel—bags neatly woven from strings of human hair or vegetable fibre, that are carried by a shoulder strap after the manner of a schoolboy's satchel, the only difference being that the pituri bag is carried close up under the arm. Making this bag is a work of many months. The pituri is chewed similar to tobacco, but the 'quid' is larger. No. 1 chews it awhile, discharging the result meantime at vagrant flies, through crevices left by lost milk-teeth (invariably he is a dead shot at short range); then he passes it on to No. 2, and so on, the round of the party, and then the quid is carefully stowed—behind the ear—until further stimulant is required. Occasionally, when in short supply, the quid is flavoured and made to spin out by dipping in the ashes of gidya leaves at intervals of the chewing; and for the present let it rest there."

The following notes are by Dr. Roth, a former protector of the North Queensland aborigines (see his Bulletin No. 3 of North Queensland Ethnography) :—

"The principal indigenous narcotic is pituri, which, if all is well, arrives in the Boulia district, in the rough, about the beginning of March. By 'in the rough' is meant the condition—very much like half-green, half-yellow tea with plenty of chips—in which it is conveyed in special dilly-bags for barter; the construction of these particular bags has been described in Bulletin No. 1, sect. 28. The pituri shrub (*Duboisia Hopwoodii* F.v.M.) flowers about January. . . .

"Arrived at its destination, the pituri is prepared for use as follows:—After roasting in the ashes the pituri chips become pliable, so as to be easily bent, and are then wetted with water if in large quantity, or with sputum if in small, and teased up with the fingers so as to remove all the bigger pieces. Some leaves of the *Acacia hakeoides* A. Cunn. (Boulia, 'pukartika'), or of the *Acacia homalophylla* A. Cunn. when the former is not obtainable, are next heated over the fire, and then burnt, the ashes being retained. The pituri in its moist state is now mixed with these ashes on some smooth surface, wooden trough, &c., and worked with the fingers into small rolls about $2\frac{1}{2}$ inches long by $\frac{1}{8}$ inch diameter, which 'quids' are now ready for chewing. Sometimes the quid is teased up with some shreds of native flax (*Psoralea*) to give it compactness and intercoherence. When not being chewed these rolls are carried worn above and behind the ear. Amongst the aborigines there appears to be as great a craving for pituri as amongst Europeans for alcohol, a fact which is put into practical and economic use by drovers, station managers, and others; local blacks will usually give anything they possess for it—from their women downwards—'not for the purpose of exciting their courage or of working them up to fighting pitch, but to produce a voluptuous, dreamy sensation.' Pituri may sometimes be smoked in pipes, as reported to me by Mr. Reardon, of Carlo, when the Mulligan blacks run short of their tobacco supply. The Kalkadum blacks speak of the drug as 'moda,' the Boulia natives call it 'tarembola'—a different name in each district."

Physiological and Chemical Investigations.—Dr. Bancroft, *Journ. Queensland Phil. Soc.*, 1872, gives a detailed account of his experiments, with extracts of different strengths on various animals. He thus summarises the effect of an infusion :—

1. Period of preliminary excitement from apparent loss of inhibitory power of the cerebrum, attended with rapid respiration; in cats and dogs, with vomiting and profuse secretion of saliva.
2. Irregular muscular action, followed by general convulsions.
3. Paralysis of respiratory function of medulla.
4. Death, or
5. Sighing inspirations at long intervals.
6. Rapid respiration and returning consciousness.
7. Normal respiration and general torpidity, not unattended with danger to life.

The poison given by the mouth acts with less vigour; when it is injected into the intestines the results are more certain. The animal has a longer stage of excitement, the convulsive fit is not so severe, and recovery is more certain. Torpidity remains for some hours.

A quarter of a drop injected under the skin of a rat causes excitement; the animal starts with slight noises, may fall over a few times from very strong muscular irregularities; remains excitable for some time, then gradually becomes torpid.

In small medical doses we may expect to find the period of the excitement and the torpidity to be the only marked symptoms. In cats and dogs the excitement is not marked, but vomiting of a violent kind occurs.

Dr. George Bennett, of Sydney, has some notes on the drug in the *N.S.W. Medical Gazette*, iii, 8 May, 1873. His pituri was obtained from the same source as that used by Dr. Bancroft, but was in a damaged condition.

See also Dr. J. M. Petrie's bibliography of pituri in *Proc. Linn. Soc. N.S.W.*, xlii, 133 (1917).

Habitat.—Interior of all the States except Tasmania and Victoria; in other words, from the Darling and Barcoo Rivers to Western Australia.

Mr. Sylvester Browne, in a letter in the *Queenslander* early in 1880, quoted by Dr. Bancroft, ridicules the reports as to the scarcity of the plant, and states that "it grows on the ridges of high spinifex sand-hills, and which sand-hills contain many cool springs and lakes, which will hold water much better than the fabulous stories told of pituri."

Two pituri bags obtained by me for the Technological Museum were obtained the one from Mount Margaret station, Wilson River, south-west Queensland, to which place it had been brought by the blacks from the Herbert River; the other also from the Herbert River, lat. 23° S., long. 139° E., near the Pituri Creek. In neither case can more precise localities of the place from which the Pituri was procured be obtained, perhaps partly because the blacks do not wish the locality to become generally known and partly because the packages have passed through so many hands.

Most of the material used by physiologists and others comes from Western Queensland. The late Mr. Sylvester Browne told me that there is no pituri east of the Mulligan. There is a patch about 60 miles north and south, and, say, 20 miles east and west, between the Mulligan and the border.

The following valuable account of the distribution is from the pen of Dr. Roth :—

"The supply for the Boulia district is obtained in the neighbourhood of Carlo (*vel* Mungerebar), on the Upper Mulligan. As a matter of fact, the plant grows further eastward than this, though in scattered patches only, *e.g.*, about 16 miles westwards of Glenormiston head station; a patch of it was also said (in 1895) by the Mai-takudi aboriginals to be growing in one of the gullies at Cloncurry on the Rifle Mountain where the old target-range used to be. According to notes taken about the same time from Boulia and Marion Downs, from Herbert Downs and Roxburgh, messengers are sent direct to the Yulecolonya tribes

at Carlo with spears, boomerangs, blankets, nets, and especially red-coloured cloths, ribbons, and handkerchiefs, to exchange and barter for large supplies of the drug. On its advent at Roxburgh, the pituri may travel partly up the Georgina and partly along the ranges to the Kalkadun, who may supply the Mai-takudi with it, but very little gets further eastward. From Boulia it is sent up the Bourke, and so through the Yellanga and Kalkadun, again carried to the Mai-takudi, or may be forwarded on to Warenda and Tooleybuck. Marion Downs sends it *via* Springvale, &c., to the (middle) Diamantina, where it may go up as far as Elderslie and Winton, very little, if any, ever reaching the Thomson River. It may be stated, without fear of contradiction, that the export of the drug from the Mulligan opens the annual market, with all its ramifications of trade and barter, for the north-west central districts.

Following are some localities represented in the National Herbarium, Sydney :—

Queensland.—Mulligan River (F. A. Barrington, H. Clarke). The ashes of the plant chewed with it are of the “Munteera,” a name given by the blacks for hundreds of miles round. Evidently the Montera of p. 304.

New South Wales.—In a sheltered position with Eucalypts, in black soil on the bank of a permanent flowing creek to the river, in company with *Myriogyne*, 20 miles south of Bourke (L. Abrahams).

On ridges, 100 yards to the rear of Pulpulla homestead, 50 miles west of Cobar in company with *Eucalyptus Morrisii* and *Alstonia constricta* (Archdeacon F. E. Haviland).

South Australia.—“Poison Bush,” “Kooramurro.” Sand-hills east of Ooldea (Henry Deane).

Elder Exploring Expedition, Camp 10, 27th June, 1891, approximately in lat. 27° 47', long. 130° 60' (R. Helms).

Western Australia.—Comet Vale, 60–70 miles north of Kalgoorlie (J.H.M.).

Elder Exploring Expedition, Camp 43 (lat. 27° 30', long. 126° 60'), 6th September, 1891 (R. Helms). Under date 8th September, in the official journal, is the entry, “Two of the young camels sick—evidently a poison plant.”

Camp 59 (Camp 58 in the Journal; 22nd September, 1891. The expedition was then near Queen Victoria Spring.

EXPLANATION OF PLATE 252 (IN PART).

- h. Flowering twig from 20 miles south of Bourke.
- i. Bud.
- j. Flower opened out, showing four stamens.
- l. Pistil.
- m. Fruits.
- n. Seed, curved, with a crustaceous rugose testa.
- o. Larger leaf from same plant.

Government Printer, photo.

SMALL TREE (*Dubotsia myoporoides*) IN BOTANIC GARDENS, SYDNEY.

A CORKWOOD.

(*Duboisia myoporoides* R.Br.) (A-G)

PITURI.

(*Duboisia Hopwoodii* F.v.M.) (H-O)

No. 260.

Eucalyptus globulus Labill.

The Tasmanian and Victorian Blue Gum.

(Family MYRTACEÆ.)

Botanical description.—Genus *Eucalyptus*, see Part II, p. 23.

Botanical description.—Species *globulus* Labillardière, in “Relation du Voyage à la Recherche de la Perouse,” &c., i, 153 (1799), with Plate 13 of the Atlas (1811).

See Labillardière's interesting original account of the tree, as given at Part XVIII, p. 249, of my “Critical Revision of the Genus *Eucalyptus*.”

Following is Bentham's description :—

A lofty tree, sometimes exceeding 200 feet, but in many situations flowering when not above 10 feet high, the young shoots and foliage often glaucous-white, the bark somewhat fibrous but deciduous, leaving the inner bark on the trunk smooth (F. Mueller). Leaves of the young tree opposite sessile and cordate, of the full-grown tree lanceolate or ovate-lanceolate, acuminate, falcate, often $\frac{1}{2}$ to 1 foot long, the veins rather conspicuous, oblique and anastomosing, the intramarginal one at a distance from the edge. Flower large, axillary, solitary, or two or three together closely sessile on the stem, or on a peduncle not longer than thick. Calyx-tube broadly turbinate, thick, woody, and replete with oil-receptacles more or less ribbed and rugose or warty or rarely smooth, $\frac{1}{2}$ to $\frac{3}{4}$ inch diameter, the border prominent, and the four teeth sometimes conspicuous. Operculum thick, hard and warty, depressed-hemispherical with an umbonate or conical centre, shorter than the calyx-tube. Stamens above $\frac{1}{2}$ inch long, inflected in the bud, raised above the calyx by the thick edge of the disk; anthers ovate, with parallel cells. Ovary as long as the calyx, slightly convex. Fruit semiglobular, $\frac{3}{4}$ to 1 inch diameter, the broad, flat-topped disk or rim projecting above the calyx, the capsule nearly level with it, the valves flat, not protruding. (B. Fl. iii, 225).

It was subsequently figured and described in Mueller's “Encalyptographia.”

Botanical Name.—*Eucalyptus*, already explained (see Part II, p. 34); *globulus* in Latin is a little round bowl, and also the fruit of a certain Cypress tree. It is the describer's way of referring to the fruit, “which very much resembles a coat button in shape.”

Vernacular Name.—The “Blue Gum” of Tasmania and Victoria, and to a less extent in use in New South Wales. The term Blue Gum is locally given to a large number of trees which have a bluish cast of the trunk, or of the foliage, or both. Sometimes the term is a comparative one. One tree may give a man an idea of greater blueness than another. The application is sometimes puzzling, because some Blue

Gums may, at certain seasons of the year, have no noticeable bluish cast at all. If I were to make a list of the Blue Gums, so called, the list would be a very big one, but I will only confine myself to the principal ones. The tree to which the name of Blue Gum was originally given is *E. saligna* Sm. This is the Blue Gum of Sydney, and I need scarcely say that Sydney was the first settled part of Australia. It gave its name to numerous Blue Gum flats at the head of the Parramatta River and Hawkesbury River district. Subsequently, the name spread further north. *E. saligna's* blueness (not very marked) chiefly applies to the trunk. Later on, the name Blue Gum was applied to *E. globulus* Labill., which is the Tasmanian and Victorian Blue Gum, although there is some of it in cold New South Wales localities a considerable distance from Sydney. The blueness (glaucousness) of *E. globulus* is greater than in the case of *E. saligna*, and as the tree will stand very much more cold than *E. saligna*, and is very ornamental, the seed was largely exported to Europe, and also to the United States, chiefly through the influence of the late Baron von Mueller, who was the Government Botanist of Victoria, in which State the tree attains remarkable development. The Blue Gum of Queensland is *E. tereticornis* Sm., which is the Forest Red Gum of New South Wales. Now, instead of going north, let us turn west. *E. leucoxydon* is the Blue Gum of South Australia, while Western Australia has one principal Blue Gum, viz., *E. rudis* Endl. Australia is a continent of three millions of square miles. Politically we are all united, and people of the various States are like brothers, but as regards the naming of trees, every State, and, indeed, every district, clings with greater or less tenacity to its own vernacular names.

Leaves.—The mature leaves of this species sometimes attain a remarkable length. For example, Mr. C. French, some years ago, measured leaves at Beechworth, Victoria, 28 inches in length.

Timber.—The timber of *E. globulus* is of a rather pale colour, hard, heavy, strong, and durable, more twisted than that of *E. obliqua* and many other fissile kinds, but not so interlocked as that of *E. rostrata*, *E. melliodora* and most of the species called "Box Trees." Its specific gravity varies between .698 and 1.108. In transverse strain its strength is about equal to English Oak; in durability, it occupies a medium position amongst Eucalypts.

The following was the number of years assigned to the sound wood of *E. globulus* when wooden ship-building was a more important industry than at present:—For floors of ships, first and second futtocks, main and rider-keelson, beams and hook, ten years; for third futtocks and top-timbers, stem and stern-posts, transomes, knight-heads, hawse-timbers, apron, deadwood, knees, rudder, windlass, timber and bilge-strakes, and ceilings between, clams, stringers, shelf-pieces and lower deck-waterways, nine years; for light water-mark to wales, top-sides, sheer-strakes, upper deck-waterways spirkiting and planksheers, eight years; keel to first futtock heads, thence to light watermark, twelve years. This wood is also very extensively used by carriage-builders (in the report of the Victorian Carriage Board it is recommended as one of four colonial timbers suited for railway carriage building), and manufacturers of implements; for

instance, for poles and shafts of light and heavy vehicles, for undercarriage work, swivel-trees, spokes and rims, axle beds, plough-bars, handles of axes, picks, shovels, forks, hoes and hammers, and all other similar purposes. It is further used for telegraph poles, for planking of bridges and jetties, and for structures in water. For railway sleepers it was formerly largely employed, but during late years it has given way to the wood of *E. rostrata* for this purpose. Settlers used the wood of *E. globulus* for fencing, especially for rails, where it is readily obtainable (Mueller).

The following table taken from Rankine's *Manual of Civil Engineering*, shows the comparative durability of some kinds of timber for ship-building (in the old days), as estimated by the Committee of Lloyds:—

Twelve years: Teak, British Oak, Mora, Greenheart, Ironbark, Saul. Ten years: Bay Mahogany, Cedar (*Juniperus virginiana*). Nine years: European Continental Oak, Chestnut, Blue Gum, Stringybark (*Eucalyptus obliqua*), down to four years, which is the length of time assessed to Hemlock Pine (North America).

In Tasmania, this timber is usually procured by hand-sawyers, who cut up the trees where they fall in the forest. It makes the very best planking for ship's bottoms. It has the property of swelling under water to such an extent that it becomes a matter of some difficulty to find the seams when the vessels are put on the slips for coppering. But much judgment is required in selecting the timber. All pieces that contain heart-wood or sap-wood must be rejected. These are both worthless, and soon decay. The true serviceable Blue Gum must come from the circumference of the tree, about midway between the bark and the centre (Tenison Woods).

In 1865 there was taken out of the old Hobart Courthouse a beam of this wood which had remained there for forty-five years. It was as sound as when fresh felled. Planks from Tasmania, between 80 and 90 feet in length, were shown at the London International Exhibition of 1862.

A sample of this timber, sent from Victoria to the Colonial and Indian Exhibition, was tested by Mr. Allan Ransome. He reported: "By way of testing the sample sent, a sleeper was adzed and bored, and a panel planed. Both experiments proved very satisfactory, the latter especially so, as the wood was found to plane as well against the grain as with it."

The following account of this timber, written in the old ship-building days, by an English expert (Laslett) will be of interest:—

Eucalyptus globulus is a tree of straight growth, and attains a height of 200 to 300 feet, with a diameter of from 6 to 25 feet. Like the Jarrah (*E. marginata*), it is characteristic of the larger trees that, while they appear to be healthy and vigorous, and continue to increase in height and bulk, the centre wastes away near the root, and, when felled, they are often found hollow for some considerable distance up from the butt. The dimensions of the serviceable logs which the trees yield will, therefore, depend much upon its soundness; but unquestionably very large scantlings can be procured from it if required. The wood is of a pale straw colour, hard, heavy, moderately strong, tough, and with the grain twisted or curled. In seasoning, deep shakes occur from the surface, and it shrinks and warps considerably.

I remember to have seen in one of the Royal Dockyards some extremely long and broad planks, or thick stuff, of this description of timber, which had been apparently fitched from some of the hollow trees before referred to. These, after being kept to season for a while, warped and split to such an excessive degree that it was impossible to use them for any planking purpose whatever. In consequence of this defect it was found necessary to reduce the planks to very short lengths, in order to utilize them at all, and so they passed to quite inferior services.

A specimen log of Blue Gum, 31 feet by 24 by 28 inches, was forwarded with other woods to the London Exhibition of 1862 by the Tasmanian Commissioners, and this, at the close of the Exhibition, was transferred to the Woolwich Dockyard for trial, experimentally, in ship-building. It came in, however, too late, just when wood was giving place to iron in this branch of architecture, so that no favourable opportunity ever offered for its employment. This log, although of very large dimensions, had been cut clear of the centre, and very probably had formed part of one of the hollow trees before alluded to, consequently the tree to which it belonged must have been at least 6 to 7 feet in diameter. A plank 6 inches thick was cut from it, which quickly warped or twisted 2 inches, and ultimately went to 3 inches, and stood at that in 1870. Upon examination then, it was found to be full of deep, fine shakes, but otherwise it was not much changed, and there were no signs whatever of decay, although it had for a long time been exposed to the weather. It seems, therefore, likely to be a durable wood.

In the Tumberumba district of New South Wales it is valued highly and largely used in tail-races for mining purposes, also for bridge decking and girders. It is not quite so free in the grain as the Victorian timber, which opens up from the heart in a surprising manner. I have seen a round log in the Otway Forest, Victoria, 20 feet long and 3 feet through, split open from end to end after the first 3 feet of it had been entered with a circular saw.

Except in the district where it grows it is but little known in New South Wales, and once it fell into disrepute owing to its being mistaken for the local Messmate (*E. obliqua*), a timber lacking strength and durability, but resembling it in colour.—(J. V. de Coque.)

A Tasmanian official report says, "It produces a hard and heavy timber, very durable, and taking a high polish. It is stronger than English Oak, and may be used advantageously for any purpose for which Oak is used, *i.e.*, for building ships, jetties, bridges, house-frames, wagons, carts, plough and tool handles of all kinds. The grain is interlocked, so that it makes good felloes for wheels and railway sleepers. The young wood is straighter in the grain, and very suitable for cart-shafts and anything that requires toughness, spring, and elasticity."

Mr. John Bradley, a Tasmanian expert, says, "Abounds in the south of Tasmania only, and can be delivered in any of the colonies at a reasonable cost. It can be got of any reasonable length and size, and if fairly well seasoned before being used, is one of the strongest and most durable woods in the world. It is of great value in connection with ship-building, bridges, and railway works generally. One good quality especially may be mentioned, *viz.*, that if seasoned and used as ship-planking the bottoms of vessels in which it has been so used seldom or never require re-caulking. The timber must, however, be cut clear of the heart. Keels for wooden vessels, or girders for bridges, can be obtained about 150 feet long if required. Tree-nails made of Blue Gum were formerly much sought after in England for use in the construction of wooden ships."

Following is a Victorian report, and incidentally it may be pointed out that the reputation of *E. globulus* timber has often suffered through substitution:—

The Blue Gum (*E. globulus*) is so well known that it would appear at first sight that no mistake could well be made in regard to it. Yet this tree has undeservedly come to be in bad repute, probably by reason of the substitution of inferior timber. In the Warragul district I have seen the Swamp Gum (*E. ovata*), which is one of our most worthless timbers, cut for sale as "Blue Gum." *E. viminalis* (the River White Gum) has also within my knowledge been similarly substituted. Very commonly the Spotted

Gum (*E. goniocalyx*) has been and may be still disposed of under the names of "Blue Gum" or "Bastard Blue Gum" for the true Blue Gum (*E. globulus*). The Blue Gum areas probably afford a larger supply than any of the other areas of first-class timber. At Mirboo North I have observed quantities of wheel spokes split from Spotted Gum (*E. goniocalyx*) sent away as Blue Gum. (An official report (? published) of A. W. Howitt, dated 1895.)

For railway sleepers we consider *E. hemiphloia*, *E. leucoxydon*, and *E. rostrata* to be most valuable and of equal value; we do not consider the Blue Gum (*E. globulus*) of such value as the others, but we should not object to take it if the price were a little lower, that is to say, assuming that we were in a position to get it. But it is always difficult to get it. The Blue Gum, when it is cut and has been sawn, is very difficult to tell from other timbers which are not of such great value, but if we were assured that we got Blue Gum we should have no hesitation in using it in association with the other three timbers I have mentioned for sleepers. (Evidence of Mr. Richard Speight, Chairman of Railway Commissioners, before the Victorian Vegetable Products Commission, 1889.)

The next tree in order of importance is the Blue Gum (*E. globulus*). This well-known timber tree is a free grower, and runs up to 250 feet in favourable localities. It is the chief timber tree of Tasmania, and is there used for all constructive work, wharves, piles and bridges. The Blue Gum of Tasmania and Victoria are identical.

The Blue Gum of Cape Otway is a better class of timber than that of Korumburra, the latter in certain parts of the district being softer in grain and subject to gum veins, and in consequence of the cellular tissues being larger in the wood on wet or swampy lands, it is necessarily softer, and hence is much more liable to shrink, warp, or twist when procured in such localities than in the drier forests of Cape Otway and Mount Cole. It is for this reason that trees grown on the top of a range or on the dry or sunny side of a hill or range are found to be more sound, harder and better in quality, than the same tree grown on the shady or sheltered side, or in the low swampy or wet lands of lower altitudes.

I am aware that a prejudice exists against the use of Blue Gum in marine works here, and that in this matter I am quite sure an error has been made. I am distinctly of opinion, after close investigation of the magnificent wharves of Hobart and other constructive works in Tasmania in which Blue Gum of best quality has been used, that in this tree we have in Victoria and Tasmania a timber tree of enormous value for piles, decking, beams and other large timbers, also for railway sleepers. It is extremely probable that Blue Gum has been condemned in the early days of marine construction, and that inferior trees have been used in these works which were not Blue Gum at all; or if Blue Gum, then inferior timber has been taken for the works.

Blue Gum, if properly prepared for the saw some three months beforehand by ringbarking, is found to cut quite mellow on the bench, and is vastly improved by the process. The timber should never be ringbarked except at such times and places as will permit all trees so treated not to stand too long and thus get extensive sun-cracks and fissures, which seriously damage the wood. About three months is a fair time to reckon to enable the tree to get rid of the sap. . . . It would prevent in a large measure the shrinking and twisting of the wood of the Eucalypt, which is such a great drawback to this tree. (Report of C. S. Perrin, Victorian Conservator of Forests, dated 1895.)

The following account is of New South Wales *E. globulus* ("Eurabbie") :—

Considerable confusion has arisen between the Eurabbie and Mountain Ash (*E. gigantea*), but the former is a more valuable timber, as it will last longer in the ground and is not so likely to be attacked by white ants. The Mountain Ash is a rougher butted tree, found growing side by side with the Eurabbie, but, though very useful above ground, it very soon decays below the surface. The Eurabbie timber, when well seasoned, is tough and valuable for coach and buggy material, and, as the supply is not too plentiful, it should as far as possible be protected. Gazetted large forest reserves such as the Burra, Bago, and Talbingo, have afforded some protection in the past; and I think that in granting improvement or other leases of these rough mountain lands, the advisableness of protecting all valuable and promising Eurabbie and Mountain Ash trees should not be overlooked. When reporting on certain snow leases about seven or eight years ago, I called attention to the valuable Mountain Ash and Eurabbie thereon, and, as a matter of fact, this question has received consideration. (Staff Surveyor A. H. Chesterman, Tumut, April 26th, 1898).

Mr. A. MacPherson, then of Umbango, Tarcutta, wrote under date 4th October, 1897:—

This wood is used locally for wheelwrights' purposes, and whenever strength and toughness are of importance I am disposed to think that for carriage building it would prove equal to most of the timbers imported from America for that purpose. It is said not to last well in the ground, though in this respect I have had very contradictory accounts. Mr. Ramsay informs me that last year he sent to the Roads Department in Sydney part of a plank taken from a miner's sluice-box which has been in a situation such that the wood had been continually moist for a period of twenty-five years without sensible deterioration. The Eurabbie attains a great size, both in point of height and thickness, and can be procured in very long and wide planks, free from gum veins. It grows in considerable quantity over a large area on the western slopes of the Great Dividing Range from the Victorian boundary northwards to the latitude of Binalong. As it generally grows in steep gullies in places where, for climatic reasons, the land has now no value for agricultural purposes and but little for grazing purposes, I think a careful examination of its habitat might with advantage to the public interests be made, so as to ensure the preservation of a valuable timber where it may be found still existing on Crown lands. Unfortunately, near Tumbarumba many thousands of acres of Eurabbie timber have been destroyed by ringbarking on conditional leases, yielding little revenue to the State and perhaps less profit to the lessees.

Size.—A tree of this species, measured at Tolosa (Tasmania) in 1848 had an *estimated* (my italics—J.H.M.) height of 330 feet, and the actual measurements were:—Circumference at ground, 78 feet 9 inches; at 6 feet above the ground, 71 feet 9 inches (*Proc. Royal Society, Van Diemen's Land*, 1851). In moist and rich ground in Tasmania this tree attains a diameter of 24 to 30 inches in twenty years. The diameter of the tree is greatly increased near the ground by the spreading of the bole, and, in consequence, the sawyers and splitters have to erect stages 10 feet and more above the ground, and then chop and saw it through where the diameter is much less, say 10 or 12 feet.

Habitat.—Originally discovered in Tasmania, it has been found to occur pretty extensively in Victoria, and it is by no means rare in New South Wales, chiefly in southern alpine regions. A favourite tree for planting, it now often occurs even in South and Western Australia and Southern Queensland, but it is not indigenous there. As regards Tasmania, Victoria, and New South Wales, it is important for observers to carefully distinguish between localities in which it is planted and those in which it is spontaneous.

As regards Tasmania, it is fairly well diffused over many parts of the island, except in the west. It is more common in the south than in the north.

In Victoria it occurs chiefly in Gippsland, and detailed localities will be found in my "Critical Revision of the Genus *Eucalyptus*," Part XVIII, p. 251.

At pages 252-5 will be found a detailed account of its occurrence in New South Wales, which should be referred to, since it is far too voluminous to repeat here.

In Tasmania it is quite common to find it practically on the sea-level. In Victoria it occurs on the sea-level to not much over 2,000 feet. (Harry Hopkins.)

In New South Wales it is not surprising to learn that it is found at higher elevations.

"I have it here, growing on the roadside (foot of Talbingo) 23 miles from Tumut, at an elevation of about 1,200 or 1,300 feet." (W. A. W. de Beuzeville.)

J. W. Beattie, photo.

BLUE GUM (*Eucalyptus globulus*), GOVERNMENT HOUSE GROUNDS, HOBART, TASMANIA.

J. W. Beattie, photo.

BLUE GUM FOREST (*Eucalyptus globulus*), GEEVESTON, TASMANIA.

TASMANIAN BLUE GUM.
(*Eucalyptus globulus* LABILL.)

It is common on the Upper Murray and Tumut Rivers, and in the counties of Selwyn, Wynyard, Buccleuch, and Cowley generally. Further north, we have it from Burrinjuck, Jenolan Caves, &c. Going still further north, it is found on the Nulla Mountain, Rylstone (Mudgee) districts, and in New England (Nundle and Walcha districts). The northern specimens have for the most part a smaller fruit. As evidence that some of the northern trees are a good size, I published the following note in *Journ. Roy. Soc. N.S.W.*, vol. xlviii, p. 428 (1914):—"Tall trees of 60-80 feet, thick straight stems of 20-40 feet up to the first branches, sound and of first-class quality, are fairly plentiful in many of the gullies running down from the high tablelands south at Upper Meroo, between Hargraves and Mudgee. (J. L. Boorman.)"

EXPLANATION OF PLATE 253.

- A. Sucker leaf from Burrinjuck, New South Wales.
- B. Flowering twig from Burrinjuck.
- C. Smaller buds from Cann River, Gippsland, Victoria.
- D. Smaller fruits from Jenolan Caves, New South Wales.
- E. Larger bud (R. Gunn, Flinders Island, 1842. No. 1070).
- F. Larger fruit from Port Arthur, Tasmania.

PHOTOGRAPHIC ILLUSTRATIONS.

- 1. Blue Gum, Government House Grounds, Hobart, Tasmania. (J. W. Beattie, photo.)
- 2. Blue Gum Forest, Geeveston, Tasmania. (J. W. Beattie, photo.)

No. 261.

Acacia sentis F.v.M.

(Family LEGUMINOSÆ: MIMOSÆ.)

Botanical description.—Genus *Acacia*. See Part XV, p. 103.

Botanical description.—Species *sentis* F.v.M., in *Proc. Linn. Soc.*, iii, 128 (1859).

Mueller recognised it as a distinct species, but Bentham, who edited his paper for the press, placed it under *A. decora* Reichb.

Then Mueller more fully described it in his “Plants Indigenous in the Colony of Victoria,” a regrettably rare work, p. 18, as follows. He rightly adhered to the opinion that it and *A. decora* are distinct.

Shrubby or arborescent, branchlets slightly seldom densely downy, sometimes smooth, soon terete; *stipules conspicuous, subulate-acicular or obliterated*; *phyllodia oblique linear- or lanceolate-oblong or linear, one-nerved*, pale- or grey-green, opaque, subsessile, slightly curved, finely or indistinctly veined, nearly or entirely glabrous, minutely recurved-apiculate; their marginal gland close to or not very distant from the base or obliterated; *capitula on rather long, slender, slightly downy peduncles, axillary, solitary or frequently paired or by absence or fall of phyllodia forming terminal racemes*; bracteoles short, spatular; sepals free, narrow-linear, dilated and bearded towards the summit, nearly half as long as the five-cleft corolla; *Pods chartaceous, broad, flat, oblong*, bivalved, inside continuous, often repand at the sutures; funicle stout, with exception of the plicate summit straight; *seeds placed transversely, very turgid, variegated, ovate-globose or broad-ovate*, with small lateral, oval, or circular areoles, much longer than the somewhat cymbiform brown basal strophiole. [The italics are Mueller's—J.H.M.]

On low sand-hills or arid salt-bush plains towards the junction of the Rivers Murray and Darling. Extends over the whole of Central Australia and the arid depressed interior of tropical Australia, reaching to near the north coast on the Plains of Promise and in the interior of Arnhem's Land; in South Australia on the base of the Flinders Ranges and on Spencer's Gulf and in the far interior.

A rich-flowering shrub, advancing to the size of a small tree. Stem-bark blackish. Branches mostly divaricate and generally grey-green, thus imparting together with the usually glaucous foliage, a striking colour to this species. Branchlets in age sometimes spinescent. Stipules when developed persistent, pungent, 4 lines or less long, or much reduced in size, at their earlier stage almost bright-fulvous. Leaflets of the young plant oblique-oval. Phyllodia thinly coriaceous, 1-2 exceptionally 3 inches long, 1-4 lines broad, sometimes scantily short-downy, oftener blunt than acute. Peduncles $\frac{1}{2}$ -1 inch long. Capitula consisting of twenty to thirty flowers, pale-yellow, rather small. Corolla synpetalous, more or less deeply five-lobed. Pods reminding of those of our desert Cassiæ, pale brown, 1-2 inches long, 7-10 lines broad, usually not repand at the sutures. Funicle 2-3 lines long. Strophiole measuring hardly 1 line. Seeds about 2 lines long, black- or pale-brown, with grey spots, shining; their areoles elevated.

This remarkable species is almost transferable to the section *Armatae*. It exudes gum, and is in flower during the greater part of the year. The dromedaries, according to the remarks of the officers of Mr. Howitt's expedition, are extremely fond of browsing on this harsh, stiff, prickly plant.

The generally paired much longer peduncles distinguish *A. sentis* at once, even in its exstipular state, from the figure of *A. decora* furnished in Reichenbach's Iconographia, Bot. Exotic tab. 199, to which species it has been referred, though not quite without doubt, by Bentham in the Linnæa and in the Proceedings of the Linnean Society. It appears, however, more likely that the true *A. decora* is neither an inland—nor a desert—species. In the plant from Liverpool Plains, briefly characterised in *Hook. Lond. Journ.* is *A. decora*, the young pods are noted as linear. Reichenbach's figure represents, moreover, ovate-spatulate, therefore much broader, sepals, and these not very conspicuously bearded, and fewer stamens; the very important carpological characters by which *A. sentis* may at once be recognised from all known species of this, the most extensive of all Australian genera, having remained unknown to Bentham and Reichenbach.

A. decora has long been recognised as a distinct species. It is figured and described in Part XLV of the present work, and the general similarity of some northern New South Wales specimens and those of *A. sentis* has been gone into.

It is described by Bentham as follows :—

A divaricately-branched rigid shrub or small tree, branchlets nearly terete, glabrous or pubescent when young. Phyllodia lanceolate-oblong or linear, mostly oblique falcate or curved, one-nerved and more or less penniveined, in some specimens $\frac{3}{4}$ inch long and 2 or 3 lines broad, in others more than 2 inches long and about 1 line broad, usually glabrous, the marginal gland near the base or none. Stipules either subulate-spinescent or very small or none. Peduncles rather slender, solitary or in pairs, axillary or by the abortion of the phyllodia in terminal racemes, bearing each a small globular head of twenty to thirty flowers, mostly 5-merous. Sepals linear spatulate, free. Petals smooth. Pod thin, flat, $\frac{1}{2}$ to $\frac{3}{4}$ inch broad. Seeds broadly ovate, longitudinal, along the centre of the pod; funicle transverse, gradually thickened from the base upwards, straight or shortly folded under the seed.

Botanical Name.—*Acacia*, already explained (see Part XV, p. 104); *sentis*, Latin, a briar or bramble or thorn. Often the plant is very prickly, but not invariably so.

Vernacular Names.—"Thorny Wattle," "Prickly Wattle."

Aboriginal Names.—"Kalyoo" of the aborigines of Mount Lyndhurst, S.A. (Max Koch). (The seed is Kalyoo-thandra, according to the same observer.) It is one of the Wattles known as Gundabloui.

Leaves.—Good fodder, especially for camels. Mount Lyndhurst, S.A. (Max Koch). Mueller had already drawn attention to the partiality of Howitt's "dromedaries" for the foliage.

Fruits.—Blacks eat the seed at Mount Lyndhurst, S.A. (Max Koch). This is also the case at Mount Narryer, Murchison district, W.A. (Isaac Tyson), where sheep are also fond of the seeds. Apparently the pods are eaten.

Bark.—A specimen of a dirty-grey, scaly bark, $\frac{3}{8}$ of an inch thick, from Ivanhoe, N.S.W., yielded me 18.02 per cent. of extract, and tannic acid 6.32 per cent. (*Proc. R.S. N.S.W.*, 1887, p. 29). A second sample from Cobham Lake, Milparinka, N.S.W., was analysed by me, August, 1888. (*Ib.*, 1888, 268.) Tree, height 15 to 20 feet, diameter 4 to 6 inches; collected August, 1887. It yielded tannic acid 10.26 per cent., extract 33.82 per cent. This bark would scarcely be taken for the product of a dry-country

wattle. It is from a younger tree to that already described, and it is almost perfectly smooth and of a light-brown colour. The collector reports: "When fresh it is of a beautiful bright-green colour, much like the bark of *A. decurrens*. I have found it easier to strip than any other bark I have stripped yet out west." It is very compact. Average thickness, $\frac{1}{8}$ inch.

Timber.—Usually a small, low, spreading tree. The timber is soft, but very tough, and the young twigs are armed with slender, acute spines or thorns.

In western New South Wales the presence of this tree in any locality is always considered a sure indication of underground water. Mr. W. Scott, of Whittabranah, Grey Ranges, New South Wales, informed me, over thirty years ago, that in sinking wells he has traced the roots of this *Acacia* down to a depth of 80 to 90 feet, and it certainly looked the freshest green of all the plants in the district.

Size.—Height up to 30 or 40 feet.

Habitat.—The type came from the Northern Territory (Victoria River), but as usual, Mueller had the bad habit of quoting more than one locality for his species, e.g., "Plains of Promise," Gulf of Carpentaria, in addition. It is found in the drier parts of all the States of the mainland. It is commonest in the tropics.

Following are some specimens in the National Herbarium, Sydney:—

Western Australia.—Isdell River, West Kimberley, tropics. (W. V. Fitzgerald, No. 1189). Mount Narryer, Murchison district (Isaac Tyson, per R. Helms). 5 feet high, Nannine (W. V. Fitzgerald). Cue (J.H.M.).

South Australia.—Collected by Mueller about 1851, and communicated by Dr. F. W. Stoward from Melbourne Herbarium. Probably from "Low sand-hills or arid salt-bush plains towards the junction of the rivers Murray and Darling" (as already quoted in *Pl. Vict.*, and also quoted by Bentham in *B. Fl.*, ii, 360).

Murray River (J. Staer). "Prickly *Acacia*," Mount Lyndhurst (Max Koch). Moolooloo Station, between Blinman and Beltana (Mrs. R. S. Rogers). Hergott Springs (Walter Gill).

Northern Territory.—The type came from the Northern Territory, as already quoted.

Hell Gate, Roper River (W. Baldwin Spencer). The following four specimens were collected by Gerald F. Hill:—

- 34. "Idracowra Station, Finke River, 6th March, 1911. Host of No. 35." Phyllodes and pods.
- 109. "37 miles east of Hermannsburg, Finke River, 21st March, 1911. Up to 15 feet." Phyllodes and pods.
- 505. "35 miles south-east Newcastle Waters, stunted bush on plains. 9th August, 1911." In flower.
- 558. "Head of Macarthur River, Northern Territory, small tree. 3rd September, 1911." In flower.

PRICKLY WATTLE.
(*Acacia sentis* F.v.M.) (A-I)

BURROW'S WATTLE.
(*Acacia Burrowi* MAIDEN.) (K-S)

New South Wales.—Broken Hill (Forest Guard A. C. Loder; E. C. Andrews).

"Is of an upright growth, and the branches are covered with small, sharp thorns. I fancy if kept clipped it would make a very good hedge. Only found on the plains and near the rivers." *Ivanhoe, via Hay* (K. H. Bennett).

Considered a sure indication of underground water. Tibooburra (W. Baeuerlen). Spineless, as it sometimes is. Milparinka (C. G. Ivey). These two localities are in the extreme north-west corner of the State.

A "Gundablui." Small trees of 12-15 feet high, and about the same in spread. Thurloo Downs to Berranwinia Downs, Paroo River District; also Nulty to Toorale; Toorale to Goonery; Uriseno to Thurloo Downs (J. L. Boorman). Indeed it is common on trans-Darling country.

North Bourke (A. Murphy). Parish Doradillo, county Cowper, about 30 miles east of Bourke (Mining Surveyor John Thomas, per R. H. Cambage).

Brewarrina (J. L. Boorman). Brewarrina Common, with photo (C. J. McMaster).

About 25 feet high, on open plains, 50 miles north-west of Collarenebri (Sid. W. Jackson).

Queensland.—I have specimens of the following :—

Boomara, Cloncurry (R. H. Cambage, No. 4110). Woolgar, Northern Queensland (E. W. Bick). "Grows on blacksoil plains. No weep in foliage." *Prairie, Northern Queensland* (J. R. Chisholm).

Blackall (collector of F. M. Bailey). Dirranbandi, 132 miles from Goondiwindi (Dr. J. Shirley).

Bentham, p. 360, records it from the Bargoo (Barcoo River). Cambage specifically quotes Normanton to Cloncurry, Cloncurry to Hughenden, Hughenden to *Prairie*. These were the first precise tropical Queensland localities known to me.

EXPLANATION OF PLATE 254 (IN PART).

- A. Flowering twig from Broken Hill, New South Wales.
- B. Flower head.
- C. Bud.
- D. Flower.
- E. Bract.
- F. Corolla opened out.
- G. Pistil.
- H. Seed-pod.
- I. Seed.

PHOTOGRAPHIC ILLUSTRATION.

Acacia sentis, Brewarrina, New South Wales. (C. J. McMaster, photo.)

No. 262.

Acacia Burrowi Maiden.

Burrow's Wattle.

(Family LEGUMINOSÆ: MIMOSÆ.)

Botanical description.—Genus *Acacia*. See Part XV, p. 103.

Botanical description.—Species *Burrowi* Maiden, in *Proc. Roy. Soc. N.S.W.*, liii, 227 (1919).

Following is the original description:—

A medium-sized tree, up to 30 or 40 feet high, with a stem diameter up to a foot. Bark thin, furrowed, tough-fibrous; timber fissile, deep brown, and probably a useful furniture wood. The branchlets angular.

Phyllodia narrow lanceolate to lanceolate, falcate or straight, narrowed at both ends but tapering more towards the base, mostly 4 to 8 cm. long, .15 to 1 cm. in the middle, coriaceous, striate with numerous very fine uniform nerves, three rather more prominent, all free from the lower margin from the base.

Spikes shortly pedunculate, often clustered in the upper axils, 2–2.5 cm. long, rachis almost glabrous. Flowers rather densely packed, mostly 5-merous. Bract capitate.

Calyx truncate or sinuate-toothed, pubescent near tips of the lobes, about half the length of the corolla. Petals glabrous, each marked with a faint line. Ovary hirsute.

Pods shortly stipitate, linear 5–6 cm. long, 2–3 mm. wide, straight or nearly straight, valves deeply embossed to receive the seeds, which are longitudinally arranged.

Seeds shiny, black, oblong, with a deep central areole, with a narrow funicle folded on itself several times, forming a thickish arillus slightly enveloping the top of the seed.

Affinities.—Its closest relations are *A. argentea* and *A. glaucescens*.

1. With *A. argentea* Maiden in *Proc. Roy. Soc. Q.*, xxx, 41. *A. argentea* is a slender shrub up to 10 feet high; *A. Burrowi* is a small or medium sized tree; the petals of the former species are reflexed and the calyx completely hairy; the seeds in the former are brown, in the latter black. While the species are undoubtedly different, there may be a good deal of similarity in the phyllodes and also in the pods.

2. With *A. glaucescens* Willd. This is figured at Plate 145, vol. iv, of the present work. The species are allied, but in *A. glaucescens* the phyllodes are, as a general rule, larger and more glaucous, the calyx is smaller in proportion to the petals, both calyx and petals are more hairy, the floral bract is different, the spikes are larger, and the valves hairy.

3. With *A. Kempeana* F.v.M. This species is figured in Mueller's "Iconography of Acacias." The phyllodes of the two species are a good deal similar, particularly the bluntly lanceolate Girilambone specimens of *A. Burrowi*, but the calyx in *A. Kempeana* is much smaller in proportion to the petals, the ovarium is smooth, while the broad pod and arrangement of the seeds in *A. Kempeana* are sharply different from those of *A. Burrowi*. In the absence of pods, the western New South Wales specimens have gone under the name of *A. Kempeana*.

4. With *A. homalophylla* A. Cunn. This species is figured at Plate 133, Part XXXV, of the present work. (The pod is wrong, but is corrected at Plate 189, Part L.) *A. homalophylla* is the true Yarran (a name under which *A. Burrowi* sometimes passes); it will be seen that *A. homalophylla* belongs to the Plurinerves, while *A. Burrowi* belongs to the Julifloræ. The two species differ in every important particular.

Botanical Name.—*Acacia*, already explained (see Part XV, p. 104); *Burrowi*, in honour of Gordon Burrow, District Forester, Narrabri, who collected the species in the Pilliga district. Mr. Burrow has frequently given me assistance in the elucidation of the forest flora of his district.

Vernacular Name.—It is known as "Yarran" in parts of New South Wales, being looked upon as a broad-leaved form of the common Yarran (*Acacia homalophylla*, see Part XXXV of the present work). I do not encourage the use of the name for *A. Burrowi*, and therefore propose the name "Burrow's Wattle."

Flowers.—The Queensland form displays the following interesting morphological character:—The flower falls from the rachis without a calyx; in other words, the corolla comes out "clean." This appears to be caused by a fusion of the truncate calyx with the floral bract. This forms a ferruginous honeycomb-like membrane (*membrana favosus*), which surrounds the flowers on the rachis, and separates into irregular pieces, becoming deciduous some time after the flower (corolla) has fallen.

Size.—It attains a height of 30 feet and perhaps more.

Habitat.—The type came from the Pilliga, New South Wales (Gordon Burrow). The species is known so far from moderately dry parts of New South Wales and Queensland. It is known from the Bogan district (Nyngan to Coolabah), and it is plentiful in the Pilliga district. In Queensland the typical form is only known from Inglewood.

The slightly anomalous form from Chinchilla, Taroom, and Eidsvold brings it more northerly. I have no doubt that search will find many other localities, particularly in Queensland.

New South Wales.—Coolabah and Girilambone (R. W. Peacock). "Small trees of 12–20 feet, growing in rough stony places at the foothills, near the Railway Station. Much resembles Yarran (*A. homalophylla*) in general appearance." Girilambone (J.H.M. and J. L. Boorman). "Currawang." "A scrub, short leaf, Mallee-like growth, Nyngan" (Forest Guard E. F. Rogers).

Parish Euligal, &c., County Baradine (Forest Guard T. W. Taylor, No. 77, also No. 34). "Small tree, up to 20 feet, generally grows in dense scrubs; trunks from 1-5 inches in diameter and about 15 feet high. Known in Pilliga as Yarran." (Assistant Forester Gordon Burrow, No. 3). "Known in Pilliga as Yarran, though it does not much resemble *A. homalophylla*. It usually grows in dense scrubs, but I have seen trees of from 30-40 feet in height, and up to 12 inches in diameter." Pilliga district (Forest Guard Simon through Mr. Gordon Burrow, No. 1c). Pilliga Scrub (Dr. J. B. Cleland). "Yarran, on Broom Plain, Coormore Creek, Central Pilliga (E. H. F. Swain, No. 28). Yarran or Curracabah, forming dense thickets on ironbark ranges (Central Pilliga (E. H. F. Swain, No. 31).

Queensland.—"Tall plants of 12-20 feet, fibrous bark, distinctly arboreal in habit." Inglewood, on the South-western Line between Warwick and Goondiwindi (J. L. Boorman).

The following specimens I refer to this species, although they differ somewhat from the type. They have longer phyllodes, the more prominent nerves of which are usually five or six. Only three of the nerves are more prominent than the others in typical *A. Burrowi*.

"Small tree, somewhat resembling Lancewood, Eidsvold" (Dr. T. L. Bancroft, with photo, No. 15). Eidsvold is west of Maryborough, and a few miles north of Mundubbera Railway Station. Taroom to Chinchilla (Dr. J. Shirley, Nos. 2 and 3, October, 1917).

EXPLANATION OF PLATE 254 (IN PART).

- K. Flowering twig from Narrabri.
- L. Flower head.
- M. Flower.
- N. Corolla opened out.
- O. Bract.
- P. Pistil.
- Q. Seed pod, from Baradine and Narrabri.
- R. Seed.
- S. Phyllode, from Pilliga Scrub.

PHOTOGRAPHIC ILLUSTRATIONS.

Photographs (two) by Dr. T. L. Bancroft, of Eidsvold, Queensland, of a Wattle not quite typical, as stated. I am very grateful to Dr. Bancroft for excellent specimens and valuable notes.

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C. J. McMaster, photo.

Acacia sentis, BREWARRINA, NEW SOUTH WALES.

Dr. T. L. Bancroft, photo.

TWO PHOTOGRAPHS OF A WATTLE (*Acacia Burrowi*) FROM EIDSVOLD, QUEENSLAND.

No. 263.

Tarrietia Argyrodendron Benth.

The Buyong.

(Family STERCULIACEÆ.)

Botanical description.—Genus *Tarrietia* Blume (*Argyrodendron* F. Muell.).*Flowers* unisexual.*Calyx* 5-cleft.*Petals* none.*Staminal column* short, adnate to the gynophore, bearing at the summit ten to fifteen anthers irregularly clustered in a head.*Carpels* of the ovary three to five, nearly distinct, 1-ovulate, rarely 2-ovulate.*Styles* as many, shortly filiform, stigmatic on the inner edge.*Fruit-carpels* or samaras distinct, spreading, indehiscent, produced at the back into a wing.*Seed* oblong, albumen splitting in two, cotyledons flat.

Tall trees.

Leaves digitately compound, glabrous or scurfy.*Flowers* small and numerous, in axillary or lateral panicles. (B. Fl. i, 230.)**Botanical description.**—Species *Argyrodendron* Benth., in B.Fl. i, 230 (1863).

A tall tree, glabrous except minute scurfy scales on the young shoots and inflorescence, and often on the underside of the leaves.

Leaflets three, or on the younger trees often five, petiolulate, oblong or lanceolate, obtuse or acuminate, 3 to 4 inches long, coriaceous.*Panicles* dichotomous, the upper ones sometimes exceeding the leaves. Flowers very numerous.*Calyx* broadly campanulate, about 3 lines diameter.*Carpels* with a semiorbicular wing about 1 inch long.

The difference between this and another species may be stated:—

Leaflets, three or four, silvery or coppery

on the underside *T. Argyrodendron*.Leaflets, three to nine, glabrous *T. actinophylla*.

Varieties.—Bentham recognised (then) but one variety, viz., var. *grandiflora*. Calyx 4 lines diameter. Stigmas short and broad. Port Denison, Queensland. Fitzalan). (B.Fl. i, 231.) But Bailey, in his "Queensland Flora," p. 140 (1899) recognised no less than four additional ones, viz. :—

2. *angustifolia*, "Cat. Queensland Woods," and No. 1 "Occasional Papers on the Queensland Flora," 1886. From Endeavour River.
3. *macrophylla*, *Botany Bulletin*, ix, 5. (See also *Queensland Agric. Journ.*, Oct., 1899, p. 393).
4. *trifoliolata* (see below).
5. *peralata*, *Occ. Papers on Queensland Plants*, No. 1. The "Red Beech" of the Johnstone River.

None of these forms appear to be found in New South Wales, except the typical form and var. *trifoliolata*. This has leaves with three leaflets, and it is *T. trifoliolata* F.v.M. of *Fragm.*, ix, 43.

Botanical Name.—Besides the Australian species of *Tarrietia*, there is one other, viz., *T. javanica*, a Javanese tree, as its name denotes, and the one on which the genus was founded. The word *Tarrietia* has a French look about it, but it is not derived from such an origin, but from the Javanese word "Tarritie," the local name for the tree in question. *Argyrodendron* consists of two Greek words, meaning silver-tree, and has reference to the silvery appearance of the under-side of the foliage.

Vernacular Name.—The name Ironwood has also been given to this tree, but the appellation is neither distinctive nor is it specially appropriate. Its timber is hard, but many of our native trees have harder timber still. A number of trees belonging to the Family Myrtaceæ (which includes what are popularly known as Gum-trees, Myrtles, &c.) go by the name of Ironwood in different parts of Australia, e.g., *Eugenia Ventenatii*, sometimes also known in this colony as Drooping Myrtle, and other *Eugenias*. Closely related are some species of *Myrtus* or Myrtle, *Melaleuca* or Tea-tree, and *Syncarpia leptopetala*, a tree very closely allied to our common Turpentine. A few western Wattles yield such hard timber that they occasionally also go by the name of Ironwood. Allied to these is the so-called leguminous ironbark of Leichhardt, *Erythrophloeum Laboucheii*, which goes by the name of Ironwood on the Flinders River, Queensland. A third Family, i.e., the Jasmine or Olive Family, contains a number of small trees whose wood is so hard that they go by the names of Axe-breaker, Ironwood, &c.; such are *Notelæa ligustrina*, one of our native Olives; *Olea paniculata*, better known as Marblewood.

It also goes by the name of Silver-tree, owing to the silvery whiteness of the underside of the leaves. Black Stavewood is another name applied to it. Indeed, it often goes under the name of Stavewood, which is testimony to its fissile character. Because of the general resemblance of its wood to that of Elm, it has obtained the local

name of "Crow's Foot Elm." According to Bailey, this is the name given at Atherton, Northern Queensland, to his variety *peralata*. At all events this name is commonest in use about Atherton.

Aboriginal Name.—The name of the aborigines has several spellings, and I give five of them, without presuming to say which should stand. I may, however, remark that the first spelling is the one most generally accepted:—Buyong, Boyung, Byong, Boiong, and Booiong.

Synonyms.—*Argyrodendron trifoliolatum* F.v.M. in *Fragmenta*, vols. i, p. 2; ii, p. 177. *Tarrietia actinodendron*—*Tarrietia trifoliolata* F.v.M.

Fruit.—It seeds freely. The fruit affords an instance of what is known as a "Samara," i.e., in which the nut is continued into a flattened expansion or wing, as shown in the figure. This form of fruit is more familiar to most people in the Maple, Ash, and Elm.

Timber.—Buyong timber bears a general resemblance to Elm. According to the general report of the Sydney International Exhibition of 1879, it is useful for piles in water. It is a useful cooper's wood, but locally it does not appear to be much used, except for firewood and building purposes. But in view of the fact that it has been recognised that it has a pretty grain resembling, but smaller, that of some "Silky Oaks," it is tardily coming into its own as a cabinet-wood. Mr. R. T. Baker, in his work "Cabinet Timbers of Australia" (1913) has a charming coloured plate of this wood.

Tarrie'ias belong to the Family Sterculiaceæ, the best known member of which is the Kurrajong. Buyong timber appears to be one of the best in the whole of the Family, which is not, however, remarkable for the quality of the timber yielded by any member of it. They are better known, of course, on account of their fibrous inner barks, which were utilised by the aborigines.

A Queensland report says, "Wood of a light-pink colour in the south, but darker in the north. It is prettily grained, moderately soft, and produces a very fine polish.

"The good qualities of this timber are not yet generally known, and it has consequently not been much used. It is doubtless very suitable for cabinet-work, picture frames, staves for casks, and probably for general building purposes where not exposed to the weather. Should be felled only during the winter when the sap is down."

The following paragraph was published in Australian newspapers in November, 1907:—

"Crow's Foot Elm." Some time ago the Director of Forests in Queensland strongly recommended to the Federal authorities "crow's foot elm" as material for the manufacture of rifle stocks, in the contemplated small-arms manufactory. The director enclosed the opinion of a rifle manufacturing expert, also samples of the rifle-stocks at present in use manufactured from the timber. The director learns from a correspondent in Melbourne that there is every probability of his recommendations being

adopted. The Victorian Railway Department is now calling tenders in Queensland for 10,000 feet of "crow's foot elm," of which there are large quantities in North Queensland."

Exudations.—I have received small quantities of a whitish tragacanthoid gum both from the Buyong and from the Axe-breaker (*Tarrietia trifoliolata*). Both specimens were obtained from the Richmond River. The gums are scarce, and of no apparent commercial use, so that they are likely to remain curiosities, merely.

Ash.—An analysis of the ash of the "Crow's Foot Elm" from Atherton, Northern Queensland, will be found by Mr. J. C. Brunnich in the *Queensland Agric. Journ.* for November, 1915, p. 289. The ash contains in per cent. :—

Lime ...	...	...	...	...	46.91
Potash ...	...	...	...	...	5.75
Phosphoric acid ...	...	...	...	...	6.24

and he adds, "Such ash would be a highly valuable fertiliser for crops like maize, potatoes, vegetables, &c."

Size.—It attains its greatest dimensions as North Queensland is reached, but in New South Wales it may attain a great size. For example, growing 1,800 to 2,000 feet above sea-level on Bulga Mountain, head of Ellenborough River, Mr. George S. Hill, of Bungay, Wingham, measured (in 1906) a tree for me 16 feet in girth at 3 feet from the ground. Although this is an exceptional size, it is often large.

Habitat.—It is a native of the brushes of coastal New South Wales and Queensland, extending from the Manning River to Northern Queensland.

Following are some specimens represented in the National Herbarium, Sydney :—

New South Wales.—Clarence River (Wilcox). Richmond River (C. Fawcett). 30 feet high, at river-bank, Boat-harbour, Richmond River (H. Tanner). Lismore (W. Baeuerlen). Naughton's Gap, Casino (D. J. McAuliffe). Burringbar (E. Betehe).

Queensland.—River side, Brisbane, 6th February, 1843 (Dr. Ludwig Leichhardt). "Brush of Tschentshellum" near Archer's Station, 7th September, 1843 (Dr. Ludwig Leichhardt). Brisbane River (Prof. W. H. Harvey, about 1850). Eumundi (J. Staer). Kin Kin (W. D. Francis, through C. T. White). Rathdowney (J. L. Boorman).

"*Tarrietia Argyrodendron* Benth. (Ferd. Mueller part). *T. trifoliolata* F.v.M." (all in Mueller's handwriting). Rockingham Bay (J. Dallachy).

50 to 60 feet. Plentiful on Cumberland Islands. Timber very like Beech, good for building purposes (Collector ? Labil. in C. Moore's handwriting). Specimen labelled by Mueller "*Tarrietia Argyrodendron* Benth. pars; *T. trifoliolata* F.v.M." This specimen was seen by Benthham for B.Fl. i, 230.

Found in the playground of the Tooth-beaked Bower-bird. Atherton (Sid. W. Jackson).

Government Printer, photo.

TREE (*Tarrletia argyradendran*) IN BOTANIC GARDENS, SYDNEY

BUYONG or IRONWOOD.
(*Tarrietia argyrodendron* BENTH)

Propagation.—To those who wish to encourage the growth of our native trees, I would recommend this one, amongst others. It likes good soil and a sheltered situation, and it takes up a good deal of room if allowed to grow to its full size. It will help to give us a little variety from the everlasting Pepper-tree, Camphor, Lophostemon (*Tristania*), and *Pinus insignis*. Any good nurseryman will get it for you; if not this season, next. I would like to make a remark about the demand for Australian plants. Some people think they have only to turn up the census of Australian plants (with its thousands of species), pick out any name, and require the nurseryman to supply it at once. This is unreasonable, for very few Australian plants, whether trees or shrubs, are in such demand that a nurseryman can safely propagate a number of them. We cannot expect all the enterprise to be on his side, and I would suggest that if the increasing number of amateurs who like to have some Australian plants in their gardens would make known their wants (in the case of species not in regular cultivation) at least one season in advance, they would find that if cuttings or seeds were to be obtained the nurseryman would obtain them. I throw this out as a practical suggestion. As a rule, I know that our nurserymen are only too anxious to foster a taste for the cultivation of native plants, but the difficulty of regulating demand and supply is, in this case, very great. The horticulturist will be pleased by observing the habit and inflorescence of plants whose capabilities for horticultural development are untested, and the botanist will be able to study the flowers, fruit, and foliage of plants which are usually only available in a dried and flattened-out shape in the boxes of a fusty herbarium. Small and big, I have getting on for a couple of hundred species of Australian plants under cultivation in my private property (this was written in 1891); so I practise what I preach, and I can testify to the pleasure one gets out of the pursuit. Of course, the satisfaction is the greater if one collects oneself the seeds and cuttings of the native plants and propagates them.

This tree often has huge buttresses, but this applies only to trees of great age.

EXPLANATION OF PLATE 255.

- A. Flowering twig. Botanic Gardens.
- B. Bud.
- C. Flower.
- D. Corolla torn away, showing (a) monadelphous stamens, (b) style.
- E. Anthers.
- F. Winged fruits.

ILLUSTRATION.

Photograph of a tree in the Botanic Gardens, Sydney, by the Government Printer, March, 1908.

APPENDIX.

A TENTATIVE BIBLIOGRAPHY OF EUCALYPTUS OIL.

ANCIENT HISTORY.

(1788-1797. 1830.)

I present some scanty references from the earliest years of settlement. Then comes an important reference (Fraser, 1830). I do not submit these bibliographical references as complete, by any means. But they are sufficiently so for my present purpose, which is to draw attention to the principal works prior to the flood of literature during the last few years. Some of the references are comprehensive, and suggest others.

1788.—The original description of *Eucalyptus* by L'Heritier in 1788 does not refer to the oil. It was based on material in Sir Joseph Banks's herbarium collected in Tasmania (not then known to be an island), collected by Anderson and Nelson in Captain Cook's Second Voyage. It is quite a coincidence that while the genus *Eucalyptus* was being founded by a Frenchman in London, Surgeon Considen was during the same year, distilling the first *Eucalyptus* oil in Port Jackson.

The *nomen nudum* for *Eucalyptus* (*Aromadendrum* Anderson) of course referred to the oil in the leaves. (See p. 20, vol. 1 of my "Critical Revision of the Genus *Eucalyptus*.")

I wrote some years ago, "I name this species (*E. Consideniana*) in honour of First Assistant Surgeon D. Considen, one of the founders of Australia. In reviewing the 'Historical Records of New South Wales,' (vol. i, Part 2) in the *Sydney Morning Herald* of 23rd July, 1892, I drew attention to the fact that Considen's letter, dated 18th November, 1788, to Sir Joseph Banks, is perhaps the most interesting one in the collection to the student of economic botany. From the following passage it would appear that Considen was the founder of the *Eucalyptus* oil industry: 'We have a large peppermint tree, which is equal, if not superior, to our English peppermint. I have sent you a specimen of it. If there is any merit in applying these and many other simples to the benefit of the poor wretches here, I certainly claim it, being the first who discovered and recommended them.' At this time a bottle of *Eucalyptus* oil was sent to Sir Joseph Banks by Governor Phillip. I further wrote in the review: 'I think that some effort should be made to rescue the name of the first user of Australian plants from oblivion. I trust that at least a species will be named after the pioneer before many months are over.' I regret that the matter slipped my memory on more than one occasion, but I now dedicate to his memory a species very closely allied to that from which he distilled the first Australian *Eucalyptus* oil." (*Proc. Linn. Soc. N.S.W.*, 475, 1904.)

It will be observed that, in this earliest report on *Eucalyptus* oil, its medicinal value was drawn attention to.

1793.—"A fine essential oil, much like that of Peppermint, is obtained from this species (*E. piperita*), and every part of the dried plant exhales the same odour when rubbed. We are now convinced this is distinct from the following (*E. obliqua*), having compared the flowers of both. At the same time we have observed the minute white spots on the leaves (*White's Voy.*, 228) in *E. piperita*, as well as in the other."—*Zoology and Botany of New Holland*, by G. Shaw and J. E. Smith, 1793, vol. i, p. 42.)

1793.—In his original description of *E. capitellata* (see my "Critical Revision of the Genus Eucalyptus" Part VIII, p. 211) it will be observed that Smith, in the year 1793, speaks of the leaves as "not very aromatic."

1793.—Under *E. obliqua* we have "Leaves . . . aromatic, but without the flavour of peppermint." (Smith, *op. cit.*)

Smith, in his original description of *E. corymbosa* (1793) says, "Leaves scarcely at all aromatic."

1797.—*E. piperita*. "The latter is very common (in English gardens) and may be known by its smell, resembling that of peppermint." Smith, in *Trans. Linn. (Soc., iii, 288, 1797.)*

1830.—Following is the first reference, known to me, of the oil of *E. globulus*, Under the heading "Discovery of oil from the *Eucalyptus globulifera* (*globulus* is meant, J.H.M.) by Mr. Fraser, Colonial Botanist, in the *Sydney Gazette*, 28th August, 1830, is one of the early references to Eucalyptus oil.

Valuable Discovery.—A discovery has been recently made by our Colonial Botanist, Mr. Fraser, which promises to be of great importance. Having extracted by distillation a superior oil from the Gum tree, *Eucalyptus globulifera*, it occurred to him that it might possibly afford relief in cases of rheumatism, from which disorder he was himself suffering severely. He accordingly rubbed the part affected with the oil and not only experienced almost instantaneous relief, but in a few hours the rheumatic pains were entirely removed. Mr. Fraser has recommended this novel specific to several of his acquaintances, and in every instance the experiment has succeeded. It is deserving of the attention of our medical gentlemen.

This passage shows that, whatever the extent to which Eucalyptus oil was put in the earliest years of settlement, its use had nearly died out.

MODERN HISTORY.

(Say 1860 to date.)

It is appropriate to deal with Eucalyptus oils in general with *E. globulus*, described in this Part.

It is true the first oil was distilled from a Sydney species in 1788, and it could not therefore be *E. globulus*. It was probably from more than one species, and doubtless included *E. piperita*. References to the oil seem to have died out in a few years, and then we have a reference in 1830 to Charles Fraser, who was Superintendent of the Botanic Gardens at Sydney. He used the leaves of *E. globulus*, whether from Sydney cultivated trees, or from Tasmania, which he had visited on more than one occasion, I do not know.

The leaves of this species reek with oil, and must have attracted the attention of the very earliest colonists accordingly. Partly because of its extensive cultivation in North Africa (Algiers) and California in the sixties, and the remarkable way in which it acclimatised itself, the words "Eucalyptus Oil" became largely a synonym of "Oil of *Eucalyptus globulus*," at all events, from say 1865 and twenty years onwards. It

is only during the last twenty-five years that many of the taxonomic problems left unsolved since Mueller's death have been earnestly worked at, and, in a similar complementary way, we have had the valuable chemical work of H. G. Smith extending the knowledge laid down by previous chemists.

In the following list of papers, &c., arranged chronologically, it is of course possible, in a number of cases, to point out those which refer to *E. globulus*, but in some others this cannot certainly be said, and, in many papers, more than one species are referred to.

1861.—*Bosisto, J.* Exhibited the oils of twelve species of *Eucalyptus* in the Victorian Exhibition of 1861 (a sort of dress rehearsal of the Victorian Court of the London Exhibition of 1862). This was a, I may say *the*, pioneer *Eucalyptus* oil exhibit.

1862.—*Osborne, J. W.* "On the Essential Oils and Resins from the Indigenous Vegetation of Victoria," by J. W. Osborne, *Rep. Brit. Assoc. Adv. Science* for 1862, p. 48. The writer of the note was a juror at the London Exhibition of 1862, and the oils were stated to have been distilled under the auspices of Mueller. The species of *Eucalyptus* oils purported to be *amygdalina*, *oleosa*, *sideroxylon*, *goniocalyx*, *globulus*, *corymbosa* (sic), *fabrorum* (*obliqua*), *fissilis* (*regnans*), *odorata*, *Woollsii* (*longifolia*), *rostrata*, *viminalis*.

Following are compilations in regard to the oils produced by Mr. Bosisto at the 1862 Exhibition:—

Simmonds, P. L. "Essential oils from the genera *Eucalyptus* and *Melaleuca*, suitable for general application in the Arts." *The Technologist*, iii, 11. An abstract of the catalogue of Victorian products at the London Exhibition of 1862.

Jackson, J. R. "On the products of the genus *Eucalyptus*." *Intellectual Observer*, ix, 241 (May, 1866). Notes on miscellaneous products, oils, mannas, timbers, &c. Allusion is chiefly made to *E. oleosa*, *E. globulus*, *E. viminalis*, *E. tetraptera*, *E. gigantea*. The paper has drawings of a flowering twig of *E. tetraptera*, and a magnified section of its leaf, which have no bearing on the economic questions.

1865.—*Bosisto, J.* "Abstract of a paper on the yield and uses of Volatile Oils from native and imported plants in the Colony of Victoria." *Trans. R. S. Vict.*, vol. vi, p. 52 (1865).

This (*E. globulus*) oil ranks foremost in value among those obtained from the *Eucalypti*, on account of its solvent powers, its illuminating properties, and its power of fixing the aroma of allied oils. (*Bosisto*, p. 55).

The solvent power of these oils is also great, varying somewhat in the different types; that of the *globulus* or Blue Gum type being superior to that of all other oils hitherto discovered. (*Offic. Rep. Intercol. Exh. Melb.*, 1866-7, p. 319).

It will be observed that in these passages, referring to the recrudescence of the interest in *Eucalyptus* oils developed by Mr. Bosisto in the early sixties, emphasis was drawn to their value as solvents, rather than to their medicinal properties. We have here the first prominent modern scientific declaration as to the importance of the oil of *E. globulus*.

1867.—There is a brief account of Mr. Bosisto's Eucalyptus oils in the Official Record of the Intercolonial Exhibition, Melbourne, of 1866-7, p. 318-9. Reading between the lines, there had evidently been something said as to the apportionment of the credit between the chemist and the botanist as to this new work in Eucalyptus oils, and at p. 318 the reporter says :—

It is not always an easy task to adjudicate with justice concerning claims to priority. It may, however, be stated in reference to these essential oils, that it was Dr. Mueller who first directed the efforts of Mr. Bosisto, by pointing out the probability of the Myrtaceous vegetation of the country affording valuable volatile oils, and that the exhaustive investigations of the latter gentleman have been further assisted and fortified by information from the source indicated.

The rest of Mr. Gossage's report on these oils is worthy of attention by the scientific historian.

Mr. W. S. Brownscombe remarks on this point :—

While Mr. Bosisto here gives his opinion of *E. globulus* in industrial uses, his main work was from the beginning always concentrated upon the use of Eucalyptus in medicine. His own experience was gained as a chemist at Richmond, Victoria, prescribing the oil and the various preparations from the leaves to those who came to him for advice. He also stimulated trials of their efficacy wherever he could find someone sufficiently interested in original investigation.

I proceed to give, chiefly in chronological order, references of more or less interest in regard to Eucalyptus oil. The papers of the research chemist, of the pharmacist (often a researcher), and of the compiler (often a useful worker) will be found. The notes and abstracts are only intended to be suggestive, and are by no means exhaustive. In course of time works on the bibliography of Eucalyptus oils, leading to an adequate account of them, by a competent chemist, will be made available. I have not been able to obtain access to all the papers referred to, and do not know the dates of some of them.

Bentley, R. "*Eucalyptus globulus*." Notes, chiefly botanical. *Pharm. Journ.* (3), iv, 450. "The characters, properties, and uses of *Eucalyptus globulus* and other species of *Eucalyptus*." Abstract of a lecture given before the Royal Botanic Society of London. *Pharm. Journ.* (3), iv, 872. "*Eucalyptus globulus*." A lecture before the Pharmaceutical Society, embodying the latest information on the subject up to that time. *Pharm. Journ.* (3), viii, 865.

1865.—Tristani, M. "El Compilador Medico." Janv., 1865. The first research in Europe on the properties of *Eucalyptus globulus*, according to Flückiger and Hanbury (*Hist. de Drogues*, i, 513.)

The French soon took up the exploitation of *E. globulus* because of the material readily obtainable from their fine plantations in Algiers and the south of France.

1868.—Sicard, A. Refers to *E. globulus* in *Bull. de la Société Zool. d'Acclimatation* (Paris), Janv., 1868.

1869.—*Carlotti, R.* "Notes on *Eucalyptus globulus*." *Mém. lu à la Soc. de méd. d'Alger*. (Corse, 1869). See also 1872.

Lorinser, F. W. *Wiener med. Wochenschrift*, xix, 43, 1869; xx, 27, 1870.

1870.—*Miergus (de Bouffarik)*. An article refers to *E. globulus*, in "La Science pour tous." 15th Janv., 1870.

Clôez, S. "Etude chimique de l'Eucalyptol." *Compt. Rend.*, lxx, 687 (1870). *Ann. Ch. Pharm.*, cliv, 372. *Liebig's Annalen*, 154, 372. *Watts' Dict.*, vii, 493. *Pharm. Journ.* (3) i, 78. Contains an abstract from *Répertoire de Pharmacie*. A chemical investigation of the oil of *E. globulus* from the leaves of trees grown on the shores of the Mediterranean. Defines Eucalyptol and Eucalyptene.

This is important as the first modern investigation of Eucalyptus oil. He obtained by fractional distillation a body which he called Eucalyptol, but it was evidently contaminated with terpenes. *E. Clôeziana* was named in his honour by Mueller. See my "Critical Revision of the Genus Eucalyptus," Part XIV, p. 156.

Gimbert, M. (of Cannes). "*L'Eucalyptus globulus*, son importance en agriculture, en hygiène, et en médecine. Avec trois planches." (Paris, Adrien Delahaye, 1870, 8vo, 100 pp.)

Debray, M. "De l'Eucalyptus globulus." (Paris, Adrien Delahaye, 1870, 8vo.)

1871.—*Duguesset*. (*Eucalyptus globulus*.) *Bull. gén. de Thérapeut.*, lxxxi, 12, 556 (1871).

Gubler, M. A. "*Eucalyptus globulus* et son emploi thérapeutique." (The *Eucalyptus globulus* and its use in medicine.) *Bull. gén. de Thérapeut.*, Aout et Sept., 1871; *Pharm. Journ.* (3), ii, 703. *Abstr. from Journ. de Pharmacie et de Chimie*, Dec., 1871. Refers to Clôez' researches, and discusses the value of the oil in diseases of the respiratory organs.

Edwards, M. Betham. "The *Eucalyptus globulus*." *Popular Science Review*, ii, 383.

Macleane, Dr. "*Eucalyptus globulus*." *The Practitioner*, Nov., 1871.

(No author quoted.) *Eucalyptus globulus*; its use in medicine. *Pharm. Journ.* (3), i, 156, from *Phil. Med. Rep.* See also *Year Book of Pharm.*, 1871, p. 68.

1872.—*Bohn*. "*Eucalyptus globulus*." *Berlin Klin. Wochenschrift*, No. 9, p. 110, 1872.

Brun, M. "Observ. chim. sur l'Eucalyptus globulus. Paris, 1872. Finds an alleged alkaloid in the leaves called Eucalyptine.

Campion, J. "*L'Eucalyptus globulus* et l'Eucalyptol." Paris, 1872.

Carlotti, R. "*L'Eucalyptus globulus*, son rang parmi les agents de la matière médicale." Ajaccio, 1872. Peretti, Libraire. 8vo, pp. 51. "*L'Eucalyptus globulus* (may be a reprint of the preceding). Paris, 1872. 8vo.

Cochet. "De l'emploi de l'accolature et de l'eau distillée de l'*Eucalyptus globulus* pour le pausement et la désinfection des plaies." *Bull. gén. de Thérapeutique*, 9 Liv., 422, 1872.

Duquesnel, H. "Adulterations of the Essential Oil of *Eucalyptus globulus* and their detection." *Union Pharm.*, xiii, 69. *Year Book of Pharm.*, 1872, 47. Tests with Alcohol, Fixed Oils, Turpentine and Balsam of Copaiba.

Martin, Stanislas. *Eucalyptus globulus*. *Bull. gén. de Thérapeut.*, lxxxiii, 453 (10th Nov., 1872).

Koehler, H. *Eucalyptus globulus*. *Archiv. d. Pharm.*, 3, iii, 126.

Rabuteau, A. "Recherches chimiques sur les feuilles de l'*Eucalyptus globulus*." *Comptes Rendus*, lxxv, 1031. *Abstr. in Pharm. Journ.* (3), iii, 463, and *Journ. Chem. Soc.*, xxvi, 403 (1872). Examination of leaves of *E. globulus* for a basic principle with negative result.

Strube. "*Eucalyptus globulus*." *Berlin Klin. Wochenschrift*, xxix, No. 52, 628 (1872).

(No author quoted). *Eucalyptus globulus* (Syrup of). *Union Pharm.*, xiii, 164. *Year Book of Pharm.*, 1872, 355.

Gladstone, J. H. "On Essential Oils." Part I, *Journ. Chem. Soc.*, xvii, 1. Part II, *op. cit.*, xxv, 1, includes *Atherosperma moschata*, *Eucalyptus amygdalina*, *E. oleosa*, *Melaleuca ericifolia*, *M. linariifolia*. Part II in *abstr.*, *Pharm. Journ.* (3), ii, 704, 745. See also *Watts' Dict.*, vii, 871.

1873.—*Eucalyptus globulus*. The microscope in pharmacy. Colouring matter of leaves and bark. *Pharm. Journ.* (3), iv, 549, 1873.

Aron, J. "Recueil de memoires de méd. et pharmacie militaire." No. 152, Janv., 1873. (References to *E. globulus*).

André, E. "*Eucalyptus globulus*," 8vo, Paris, 1873.

Broughton. "*Eucalyptus globulus*." *Pharm. Journ.* (3), iv, 150. Abstract of a report to the Chief Secretary of Government, Fort St. George, dated 1873, in which Mr. Broughton says:—"I have examined the bark and leaves, and have the honour to state that neither quinine, quinidine, cinchonidine, nor cinchonine is contained in the plant in any proportion."

1874. Faust A., and Homeyer, I. "Ueber Eucalyptol." *Deuts. Chem. Ges. Ber.*, vii, 63 (1874). *Journ. Chem. Soc.*, xxvii, 475. *Watts' Dict.*, viii (1), 761. Proving the Eucalyptol of Clöez to consist of a terpene mixed with cymene.

"Ueber Eucalyptusöl." *Deuts. Chem. Ges. Ber.*, vii, 1429. *Journ. Chem. Soc.*, xxviii, 371. *Watts' Dict.*, viii (1), 761. The Eucalyptol of Clöez has already been shown to consist of a terpene mixed with cymene, and the authors noticed the presence of two other fluid substances in the crude oil. One is a terpene boiling at 150–151 degrees, and the other is an oily liquid, probably a camphor-like substance.

They do not state the botanical source of the oil examined by them, but it could not have been *E. globulus*. The research is very important.

Homeyer, I. "The essential oil of *Eucalyptus globulus*." *Archiv. Pharm.* (3), v, 293. *Journ. Chem. Soc.*, xxix, 244. *Pharm. Journ.* (3), vi., 786. Finds 20-25 per cent. of cymene in it, and also a terpene boiling at 150-151 degrees.

(No author stated). "*Eucalyptus globulus*." *Pharm. Journ.* (3), viii, 26 (1874). Contains formulæ of *Eucalyptus* preparations as adopted by the Paris Pharmaceutical Society.

Bosisto, J. "Is the *Eucalyptus* a fever-destroying tree?" *Proc. Roy. Soc. Vict.*, xii, 10, (1874). *Pharm. Journ.* (3), v, 270.

The influence of these trees from a hygienic point of view is discussed, with especial reference to their oil-yield, and he concludes his paper with the observation:—"May we not say with some authority that the evidence set forth in this paper on our own vegetation is in favour of the *Eucalyptus* being a fever-destroying tree?" (This seems to be the first general claim of *Eucalyptus* to be a fever-destroying tree. Subsequently the literature on the subject became enormous.) He proceeds, "Properly this (Mallee) scrub consists of three species—the *oleosa*, the *dumosa*, and the *socialis*, but I have brought them under consideration as one, the *oleosa* (p. 15)." In the early days, before the *Eucalypts* were worked out as carefully as has been done of recent years, it was quite easy to mix species of Mallee, and *E. oleosa* was made to include a great deal.

Grimwade, E. H. "*Eucalyptus* Oil." Letter in *Pharm. Journ.* (3), xiv, 836, pointing out the two species used by Mr. Bosisto (*amygdalina* and *dumosa*).

1875 (?).—Hartzen, F. A. de. "Recherches sur l'*Eucalyptus globulus*." *Compt. Rend.*, lxxxi, 1, 248. *Journ. Chem. Soc.*, xxix, 615. Chemical examination of the alcoholic extract of the leaves. (In abstract.)

Hartzer, P. A. "Untersuchungen über *Eucalyptus globulus*." (Mit Bemerkungen über das Wesen der Harze.) *Deuts. Chem. Ges. Ber.* ix, 314. *Journ. Chem. Soc.*, xxix, 942. *Watts' Dict.*, viii, (1), 762. Resinous extract of the old leaves of *E. globulus*.

Vidal, M. "*Eucalyptus* as a Vermifuge." *Pharm. Journ.* (3), v, 474. Note on one case brought before the Paris Société de Pharmacie.

1876.—Irmisch, Th. "Einige Beobachtungen an *Eucalyptus globulus* Lab." *Zeitsch. Gesamm. Naturwiss.*, Berlin, xlvi, (1876), p. 1.

Bentley, R., and Von Hamm, W. "Die Fieberheilbaum." Vienna, 1876, 8vo.

Taylor, T. "Report on the Antiseptic Properties of *Eucalyptus* Oil." *U.S. Agriculture Report*. 1876, p. 82; *Pharm. Journ.* (3), viii, 545. Results of a number of practical tests by the microscopist to the Department of Agriculture.

1877.—"*Eucalyptus globulus* not anti-malarial." *Kew Report*, 1877, p. 30.

1879.—Carpi, A. "*L'Eucalyptus globulus* dal punto di vista igienico e terapeutico." Milan, 1879.

1880.—*Kingzett, C. T.* Nature's Hygiene : a series of essays on popular scientific subjects, with special reference to the chemistry and hygiene of the Eucalyptus and the Pine. London, 1880, *Nature*, xxii, 142. *Pharm. Journ.* (3), vii, 449, 547, 608.

1881.—*Schultz, H.* "Das Eucalyptus Oel, pharmakologisch und klinisch dargestellt." Bonn, 1881. The author was Professor of Pharmacology in the University of Bonn, subsequently of Griefswald.

1883.—*Mueller, F. v.* "On the Therapeutical value of Eucalyptus Oil." *Australasian Med. Gaz.*, Sydney, 15th November and 15th December, 1883. An account of the experience of medical practitioners throughout the world with Eucalyptus oil. Based on Schiff's work. It contains a valuable bibliography.

1884.—*Schiff, H.* "Excerpts from Professor Hugo Schiff's Treatise on Eucalyptus oil." Translated and supplemented by Baron Mueller. Sydney, L. Bruck, 1884. Prof. Schiff's work was published in 1883 or earlier; I have not seen it.

Jahns, E. "Ueber Eucalyptol." *Ber.*, xvii, 2941 (1884). *Journ. Chem. Soc.*, xlviii, 394. *Archiv. d. Pharm.*, 223, 52. *Pharm. Journ.* (3), xv, 615.

He believes that the Eucalyptol ($C_{12}H_{20}O$) obtained by Clöez (*Comptes Rendus*, 1870, lxx, 687) still contained terpenes, whilst that described by Faust and Homeyer (*Ber. der deutsch. chem. Ges.*, vii, 63) as being free from oxygen, was probably obtained from another species. Herr Jahns worked on oil obtained from *E. globulus* leaves distilled in Germany. He found that pure Eucalyptol appeared to correspond completely, chemically, and physically with cineol and cajeputol, and he first established its correct composition as $C_{10}H_{18}O$.

Wallach, O. "Ueber die Bestandtheile einiger ätherischer Oele." (Mittheilung aus dem chemischen Institut der Universität Bonn, 1884). *Annalen der Chemie*, ccxxv, 314. The essential oils of cajeput, bergamot, lemon, orange-peel and Eucalyptus are dealt with. Wallach's papers are scientifically most valuable. See p. 336 below.

1885.—*Kesteven, Leighton, Dr.* "The Practitioner," May, 1885, and some subsequent articles. He pointed out the special action of Eucalyptus oil in typhoid. He was then practising in Australia.

MacEwan, P. "Eucalyptus Oils." *Trans. Brit. Pharm. Conf.*, 1885, 402. *Pharm. Journ.* (3), xvi, 272. An attempt to answer the question, No. 279, of the "Blue List," "In what respects, other than cost, do the various commercial oils differ?" A valuable investigation of the various Eucalyptus oils found in commerce.

1886.—*Bosisto, J.* "The Materia Medica of the Eucalyptus." *Aust. Journ. Pharm.*, 1886. *Pharm. Journ.* (3) xvi, 802. Chiefly refers to oils and kinos. "Preparations of Eucalyptus." *Austral Journ. of Pharm.*, Jan., 1886. *Pharm. Journ.* (3), xvi, 802. "The indigenous vegetation of Australia, with special reference to the Eucalypti." *Pharm. Journ.* (3), xvii, 13.

1887.—Noel, M. "A paper on the means of testing the purity of Essential Oils." *L'Union Pharmaceutique*, p. 103 (1887). *Pharm. Journ.*, (3), xvii, 803. He states that Eucalyptus oil often contains a large proportion of oil of turpentine. In four samples examined by him, he found 20 per cent. or more of this adulterant.

"Eucalyptol in Phthisis." *Chem. and Drugg.*, 19th March, 1887.

Wallach, O. "A Summary of Wallach's Work on the Essential Oils." *Pharm. Journ.*, (3), xviii, 480, 521; abstr. from *Pharm. Zeitung* of 10th September and 15th October, 1887. Valuable for the light it throws upon the constitution of Eucalyptus oils.

1888.—Wallach, O., and Gildemeister, E. "Zur Kenntniss der Terpene und der ätherischer Oele." *Annalen der Chemie*, cexlvi, 265 (1888); *Journ. Chem. Soc.*, liv, 1205.

1889.—Bancroft, T. L., M.B. "Distillation of native essential oils from a commercial aspect." *Proc. Roy. Soc. Qd.*, vii, p. 6, 1889. This brief practical paper has special interest for me, as I followed it up with the author, and he gave me some useful details which I communicated to Mr. Owen Blacket, the Lecturer in charge of the Engineering Department, Technical College, when I determined to establish a still for Eucalyptus oils at the Technological Museum, Sydney, in 1895.

1887 onwards.—Schimmel & Co. "Bericht von Schimmel & Co." (Inhaber Gebr. Fritzsche), in Leipzig.

From October, 1890, also published in English, under the title of "Semi-Annual Report," issued in April and October of each year. Treats of essential oils almost exclusively, mainly with the results of scientific investigations.

The following articles in Eucalyptus oil may be pointed out :—October, 1892, 21; April, 1893, 36; October, 1893, 20; October, 1894, 26; April, 1896, 33; April, 1897, 22; October, 1897, 27; April, 1898, 26; October, 1898, 26; April, 1899, 22; October, 1899, 30; April, 1900, 26; October, 1900, 32; April, 1901, 33; October, 1901, 27; April, 1902, 38; October, 1902, 40; October, 1903, 35; April, 1904, 51; October, 1904, 31; April, 1905, 37; October, 1905, 33; April, 1906, 30; October, 1906, 25; April, 1907, 52; October, 1907, 45; April, 1908, 50; November, 1908, 67.

Following are some arranged in alphabetical order of species names :—

Eucalyptus alba. October, 1891, p. 53, April, 1893, p. 77.

E. amygdalina (probably *E. radiata*). October, 1887; April, 1888; October, 1888; April, 1889; April, 1891; October, 1890, 31; October, 1895, 51.

E. Baileyana. April 1888; April, 1889; April, 1891.

E. cneorifolia. April, 1891; 33; April, 1892, 60.

"Extraordinarily rich in Eucalyptol, is well rectified, and therefore can be placed on an equal footing with the best Eucalyptus oils in the market." (From Kangaroo Island, South Australia). "The oil of this bush-like Eucalyptus species, growing on Kangaroo Island in South Australia, has only lately appeared in the market. Its

accompanying odour reminds one of dill and caraway (*Proc. Roy. Soc. Vict.*, 1893, p. 195). "A firm in Adelaide, which had introduced the oil into the market, at first designated it as coming from *Eucalyptus oleosa*. This is due to the fact that *E. cneorifolia* is now considered as a separate species, whereas it was formerly considered as a variety of *E. oleosa*." (*Bericht von S. & Co.*, April, 1892, p. 44. See also April, 1891, p. 33.)

An early report says :—

"Messrs. Helbing and Passmore have just concluded an investigation on the properties and constituents of certain Eucalyptus oils, including Cuming's brand (the produce of the narrow-leaf Eucalyptus, *E. cneorifolia*), and publish their results in the form of a "Pharmacological Record." In brief, these indicate that Cuming's oils are free from aldehydes, and contain : second quality, 44 per cent., first quality 50 per cent., and the re-distilled oil, 58 per cent., of eucalyptol—thus corroborating the high opinion already formed of this oil. The report contains many interesting figures regarding these and other oils examined, which will repay attention. The authors conclude with a proposal to alter the Pharmacopœia "characters and tests" in such a way that only Eucalyptus oils above sp. gr. 0910 would be recognised. We do not think their evidence sufficiently justifies this recommendation, which would virtually exclude the amygdalina oil, and chemical experiments alone do not enable investigators to decide that a Eucalyptus oil is of "no medicinal value." (*Chem. and Drugg.*, 11th June, 1892, p. 837). See also 13th May, 1893.

E. dealbata. April, 1888; April, 1889; October, 1890, 31.

E. dumosa. October, 1889; April, 1891.

E. globulus. October, 1887; April, 1888; October, 1888; April, 1889; October, 1889; April, 1891; April, 1892; October, 1892, 23; October, 1893, 49; April, 1894, 30; October, 1895, 62.

The German "Bericht" of April, 1888, p. 18, contains the following statements :—
"The hydrocarbon accompanying the Cineol, and formerly called Eucalyptene, is d-Pinene. It is probable that Eucalyptus oil contains other terpenes besides Pinene.
. . . "The unpleasant, penetrating, and irritating odour of crude Eucalyptus oil is occasioned by different aldehydes, principally valeric aldehyde, besides butyric and capronic aldehydes."

The Report of October, 1892, p. 23, speaking of *E. globulus*, says :—"Now included in *Pharmacopœia Japonica*. Requirements :—'Essential oil of the leaves of *Eucalyptus globulus* distilled with addition of water, limpid, colourless or light yellow, reacts neutral, is of peculiar odour, gives no detonation with iodine. Mixes in equal parts of alcohol. Sp. gr. .900 to .925.'"

Schimmel's guarantee of their oil 60 per cent., Eucalyptol and absence of Phellandrene. The latter constituent, by way of a warning, to be stated to be in Australian oil. . . At p. 23 they say, after an examination of six oils, "Considering these facts and also taking into account (what is probably no longer contradicted), that Eucalyptol is the therapeutically active and therefore the most important

constituent of Eucalyptus oil, it is not surprising that public favour in most countries, outside the United Kingdom, has again inclined in a larger measure towards the pure and reliable distillate of the *Eucalyptus globulus*. This oil, when rectified, and deprived of its evil-smelling and cough-producing constituents (which are the first to distil over), deserves the preference on account of the uniformity of its quality, if for no other reason." ("Bericht," October, 1893.)

Schimmels' preference for *globulus* oil must always be read in view of their commercial interests. Their statement as to the "fact no longer contradicted" about Eucalyptol, while not being strictly accurate, implies that, at that time, most work was being done in original research, with Eucalyptol oils of *globulus* origin. Possibly the same or better results might have been obtained had oils containing little or no eucalyptol been used. The matter will be referred to later.

E. hæmastoma. April, 1888; April, 1890.

E. maculata var. *citriodora* (*E. citriodora*). April, 1888; October, 1888; April, 1889; April, 1890; October, 1890, 24, 31; April, 1891, 34; October, 1891, 24; April, 1892, 31; October, 1893, 22; October, 1894, 26.

E. microcorys. April, 1888; April, 1889; April, 1891.

E. odorata. April, 1889; October, 1889; April, 1890.

E. Risdoni. April, 1894, 30.

E. rostrata. October, 1890, 31; October, 1891, 51.

E. Staigeriana. April, 1888; October, 1888; April, 1889.

Here end the Schimmel references for the present.

1890.—Squire, P.W. "A note on Eucalyptus Oil." *Chem. and Drugg.*, xxxvii, 380, 13th September, 1890.

Examination of a number of oils invoiced as "amygdalina." Tests applied:—(1) Specific gravity; (2) rotation shown by a Zeiss polarimeter; (3) phellandrene test.

Voiry, R. "Sur l'essence d'Eucalyptus globulus." *Compt. Rend.*, cvi, 1,419; *Journ. Soc. Chem. Ind.*, vii, 516, 585, 764; *Bull. Soc. Chim.*, l, 106. The author describes a process for the preparation of pure Eucalyptol.

Rennie, E. H. Presidential Address, Chemistry Section, *Aust. Ass. Adv. Science*, 1890.

1891.—Thoms, Dr. "Oil of *Eucalyptus maculata*, var. *citriodora*." *Pharm. Centralb.*, 13th August, 1891, p. 469; abstract in *Pharm. Journ.* (3), xxii, 165. Expresses the opinion that the oil possesses no therapeutic properties not equally shared by citronella oil. Quotes Schimmel's Report on the oil.

Stockwell, G. A. "Eucalyptus Oil and Eucalyptol." *Bulletin of Pharm.* (Detroit, U.S.A.), v. 447 (October, 1891). Contains valuable information in regard to Eucalyptus oil—chiefly in regard to the Eucalyptol question, and a certain oil marketed at that time.

Davies, R. H., and Pearmain, T. H. "Some notes on oil of Eucalyptus and Eucalyptol." *Trans. Brit. Pharm. Conf.*, 1891; *Pharm. Journ.*, (3), xxii, 235 (19th September, 1891). An exhaustive chemical and physical examination of a large number of Eucalyptus oils of various species.

1892.—"Eucalyptol and Eucalyptus Oil." *Chem. and Drugg.*, 27th August, 1892, p. 315. Also under the title "Further notes on Eucalyptol" in *Pharm. Journ.*, (3), xxiii, 205, 10th September, 1892. (Paper read before *Brit. Pharm. Conf.*) The authors obtained pure Eucalyptol by freezing oils of *Eucalyptus oleosa* and other species. They give the boiling-point and rotatory power of Eucalyptol, and also confirm its identity with Cineol.

Buro, Peter. "Treatment of Malaria with Eucalyptol injections." *Therapeutische Monatshefte*, v, 595. *Schimmel's Bericht*, April, 1892, p. 65.

Helbing, H., and Passmore, F. W. "The Constituents of Eucalyptus Oils." *Bull. Pharm.*, vi, 301 (July, 1892). An admirable résumé of modern investigations under the following headings:—Terpenes, Camphors, Aldehydes and Ketones, Alcohols and Esters.

"Investigation of Oil of *Eucalyptus cneorifolia*." *Chem. and Drugg.*, xl, 837 (11th June, 1892). Already referred to at p. 337.

"A contribution to our knowledge of Eucalyptus oil." *Helbing's Pharm. Rec.* June, 1892. *Journ. Soc. Chem. Ind.*, October, 1892, p. 837.

Anthoine. "Chemical and Physiological Properties of a crystalline dihydrochloride derived from Eucalyptus Oil." *Journ. Pharm. Chem.*, 1892, (5), 26, 391. *Chem. Zeit.*, 16 (1892). *Journ. Soc. Chem. Ind.*, xii, 462. *Journ. Chem. Soc.*, lxiv, 223.

"Eucalypteol." *Bull. Gén. de Thérap.*, exxii, 316, 433. *Pharm. Journ.* (3), xxiii, 685 (25th February, 1893).

I have only seen the brief *Pharm. Journ.* Abstract. The substance "Eucalypteol or Hydrochlorate of Eucalyptene" is in white micaceous scales. Its physical characters and therapeutic properties are discussed. Compare Merck, this page.

(No author quoted.) "Toxic effect of large doses of Eucalyptus Oil." *Chem. and Drugg. of Australia*, May, 1893, p. 86, 103.

Williams, W. L. "Note on Oil of Eucalyptus." *Chem. and Drugg.*, xl, 412 (1892). Result of experiments with Eucalyptus oil, illustrating the law of "compensation" as applied to the effect of bodies on polarised light.

Merck, E. "Terpinhydrat aus Eucalyptusöl." *Merck's Jahresbericht*, January, 1892, p. 12 "Terpene Hydrate from Eucalyptus Oil." *Archiv. der Pharmacie*, quoted in *Chem. and Drugg.*, xl, 837 (11th June, 1892). *Journ. Soc. Chem. Ind.*, January, 1893, 60; *Journ. Chem. Soc.*, lxii, 1235.

Holmes, E. M. "The Eucalyptus Oils of Commerce." *Pharm. Journ.*, (3), xxii, 877 (23rd April, 1892). Portion of a paper on "Recent donations to the Museum," read before the Pharmaceutical Society. Drawing attention to the unsatisfactory state of our knowledge of the Eucalyptus oils of Commerce.

1893.—*Merck, E.* "Eucalypteol (Eucalyptene Hydrochloride)." $C_{22}H_{18}(HCl)_2$. *Merck's Annual Report* for 1893, p. 47. Compare Antoine, p. 339.

(No author given.) "What is the active constituent of Eucalyptus oil?" *Chem. and Drugg. of Australia*, February, 1893, p. 42.

Jowett, H. A. D. "The Botany and Chemistry of Essential Oils." *Pharm. Journ.*, (3), xxiv, 6 (1st July, 1893). Deals with the botany very briefly as regards Eucalyptus, and the chemistry a little more fully, although it is not a lengthy paper. There are notes on Phellandrene, Cineol, Citral, Geraniol and its acetate.

Helbing, H., and Passmore, F. W. "Minor points in fractional distillation, with special reference to Eucalyptus Oil." *Chem. and Drugg.*, 29th July, 1893, p. 162. "Tests for Eucalyptus Oil." *Chem. and Drugg.*, xviii, 898 (23rd December, 1893).

Bouchardat and Olivier. "Sur l'Essence d'Eucalyptus (*E. globulus*)." *Bull. Soc. Chim.*, (3), ix, 429 (1893). *Journ. Chem. Soc.* lxiv, 726 (1893). Quoted in Schimmel, October, 1893, p. 22.

Spizzichino, E. "Sull' Essenza di *Eucalyptus globulus*." Essence of *Eucalyptus globulus*. *L'Orosi*, xvi, 1 (1893). *Journ. Chem. Soc.*, lxiv, 726 (1893). Quoted in Schimmel, October, 1893, p. 61.

Dott, D. B. "The Tests for Eucalyptus Oil." *Pharm. Journ.*, (3), xxiv, 510 (23rd December, 1893). He criticises the various tests for the oil as laid down in the old B.P., and he refers in terms of praise to the researches of R. H. Davies and Pearmain, and Helbing and Passmore. In the discussion Mr. Coull recommended increased use to be made of the botanical designation of an oil. Mr. Coull was simply ahead of his time, and Australian botanists have long pleaded in this direction, but the time is not yet.

Kingzett, C. T. "Tests for Eucalyptus Oil." *Chem. and Drugg.*, xliii, 929 (30th December, 1893).

1894.—*Wilkinson, W. Percy.* "Preliminary survey of Eucalyptus Oils of Victoria." *Proc. Roy. Soc. Vic.*, vi, (New Ser.), 195, (1894). Gives the values of the physical constants of eighty-seven botanically named Eucalyptus oils. The paper has a useful bibliography, and it is the first scientific investigation of Eucalyptus oils in Australia.

Sawer, J. Ch. "Odorographia" (2nd series). (1894). Touches on Eucalyptus Oils.

Holmes, E. M. "Eucalyptus Oil" *Pharm. Journ.*, (3), xxv, 501 (12th December, 1894). He points out that the reputation of this oil as a therapeutic agent rests upon an unsatisfactory basis. On the one hand, Eucalyptol is claimed to be the active ingredient, whilst on the other, Phellandrene is the constituent in the oil on which its reputation is partly based. Nor is it known at present how far the antiseptic action is due to Ozone, to Eucalyptol, to Phellandrene, or to some of the aldehydes present in the oil. He quotes Mr. E. E. M. Payne for a description of the method employed in distilling Eucalyptus oil at that time.

1895.—*Bouchardat, G., and Tardy.* "Alcohols derived from a Dextrorotatory Terpene. Eucalyptene." *Compt. Rend.*, 1895, 120, 1417. *Journ. Chem. Soc.*, lxxviii, 673. Very important paper.

Wallach, O., and Herbig, A. "Terpenes and Ethereal Oils. Phellandrene." *Annalen*, 1895, 287, 371; *Journ. Chem. Soc.*, February, 1895, p. 101. Very important paper.

Barbour, S. "Pharmacopœia suggestions." *Chem. and Drugg. of Australia*, February, 1895, p. 31.

Umney, J. C. "Essential oils in their relation to the British Pharmacopœia and trade." This is a paper which is spread over three numbers of *Pharm. Journ.*, but the account of Eucalyptus Oil is contained in *Pharm. Journ.*, (3), xxv, 978 (4th May, 1895). Also *Chem. and Drugg.* of same date, p. 620.

He draws attention to the fact that Eucalyptus oil obtained from various species and possessing different composition and therapeutic properties is imported into Britain, and that until we arrive at more definiteness in regard to it, it is undesirable to recommend the oil of any particular species into a new Pharmacopœia, or to frame any sufficiently comprehensive characters and tests. Yet he and Hill recommended to the General Medical Council the exclusion of oils containing Phellandrene (see W. J. Brownscombe in *Chem. and Drugg.*, lxxvi, 669, 1910).

1897.—*Smith, H. G., and Baker, R. T.* "On the Essential Oil and the presence of a solid Camphor or Stearoptene in the "Sydney Peppermint," *Eucalyptus piperita* Sm." *Proc. Roy. Soc. N.S.W.*, xxxi, 195. This is the first announcement of the principal stearoptene of Eucalyptus oils (Eudesmol). It was discovered during this investigation.

The same. "On Grey Gum, *Eucalyptus punctata* DC., particularly in regard to its Essential Oil." *Proc. Roy. Soc. N.S.W.*, xxxi, 259. An extensive investigation into the properties of the oil of this species.

1898.—*Helbing, H., and Passmore, F. W.* "Examination of Eucalyptus Oil." *Zeit. Anal. Chem.*, 1898, 37, 404. From Helbing's Pharmacol. Record, viii. *Journ. Chem. Soc.*, lxxiv, 543.

Ockenden, E. "Eucalyptus Oil. B.P." *Chem. and Drugg.*, 30th April, 1898, p. 713.

Smith, H. G., and Baker, R. T. "On the Stringybark trees of New South Wales, especially in regard to their Essential Oils." *Proc. Roy. Soc. N.S.W.*, xxxii, 104. An investigation into the economics of this group of Eucalyptus trees.

Smith, H. G. "On the Pinenes of the Oils of the Genus Eucalyptus. Part I." *Proc. Roy. Soc. N.S.W.*, xxxii, 195. A somewhat extended investigation of this terpene. The occurrence of the lævo-rotatory form in Eucalyptus oils is here demonstrated, as well as the dextro-rotatory pinene.

1899.—“On the crystalline camphor of Eucalyptus oil (Eudesmol) and the natural formation of Eucalyptol.” *Proc. Roy. Soc. N.S.W.*, xxxiii, 86. A chemical investigation of this new substance from Eucalyptus oils.

Gildemeister, E., and Hoffmann, Fr. “Die Ätherischen Oele.” 8vo, p. 919; Berlin, 1899. Also the English version:—

1900.—“The Volatile Oils,” by E. Gildemeister and Fr. Hoffmann, under the auspices of Schimmel & Co. Translation by Edward Kremers (Milwaukee, U.S.A., 1900, of above). Pages 524–541 are taken up with Eucalyptus oils. They are divided into five groups:—

First group. Cineol (Eucalyptol) containing oils—*E. globulus* (quantitative determination of Cineol in Eucalyptus oils). *E. odorata*, *E. cneorifolia*, *E. oleosa*, *E. dumosa*, *E. amygdalina*, *E. rostrata*, *E. populifolia*, *E. corymbosa*, *E. resinifera*, *E. Baileyana*, *E. microcorys*, *E. Risdoni*, *E. leucorylon*, *E. hemiphloia*, *E. crebra*, *E. macrorrhyncha*, *E. capitellata*, *E. eugenoides*, *E. obliqua*, *E. punctata*, *E. loxophleba* (*fæcunda*), *E. dextropinea*, *E. lavopinea*, *E. Smithii*.

Second group. Citronellal-containing oils—*E. maculata*, *E. citriodora*, *E. decubata*, *E. Planchoniana*.

Third group. Citral-containing oils—*E. Staigeriana*.

Fourth group. Oils with a peppermint-like odour—*E. hæmastoma*, *E. piperita*.

Fifth group. Oils less known and of indefinite odour—*E. diversicolor*, *E. fissilis*, *E. goniocalyx*, *E. gracilis*, *E. Lehmanni*, *E. longifolia*, *E. occidentalis*, *E. pauciflora* (*coriacea*), *E. Stuartiana*, *E. tereticornis*, *E. tessellaris*, *E. Dawsoni*, *E. camphora*.

Smith, H. G. “On the Amyl-ester of Eudesmic Acid occurring in Eucalyptus Oils.” *Proc. Roy. Soc. N.S.W.*, xxxiv, 72. Describes a new organic acid and indicates the origin of the amyl alcohol found in these oils.

“On the constituent of Peppermint Odour occurring in many Eucalyptus Oils. Part I.” *Proc. Roy. Soc. N.S.W.*, xxxiv, 136. Describes the isolation and preliminary chemical investigation of this constituent, which has since been named Piperitone.

“On a Eucalyptus Oil containing 60 per cent. of Geranyl-acetate.” *Proc. Roy. Soc. N.S.W.*, xxxiv, 142. Describes the occurrence of this ester in quantity in the oil of *Eucalyptus Macarthuri* Deane and Maiden. This is a tree of great promise as an oil-yielding species.

“On a new Aromatic Aldehyde occurring in Eucalyptus Oils.” *Proc. Roy. Soc. N.S.W.*, xxxiv, 286. Describes a new Aldehyde, here named Aromadendral. This substance occurs in many of these oils, and was previously supposed to be Cumin-aldehyde. This aldehyde often shows considerable lævo-rotation.

1901.—Smith, H. G., and Baker, R. T. “On the relation between leaf venation and the presence of certain chemical constituents in the Oils of the Eucalypts.” *Proc. Roy. Soc. N.S.W.*, xxxv, 116. A relationship is here shown to exist between certain botanical characters and chemical constituents of these trees, indicating contemporaneous alteration as the species evolved.

Smith, H. G. "Note on the Sesquiterpene of Eucalyptus Oils." *Proc. Roy. Soc. N.S.W.*, xxxv, 124. A determination of this frequently occurring constituent in these oils, which is here named Aromadendrene.

1902.—"Notes on two chemical constituents from the Eucalypts." *Proc. Roy. Soc. N.S.W.*, xxxvi, 61. Describes more fully the chemical characters of the oil of *Eucalyptus Macarthuri*, and completes the chemical work in connection with Myrticolorin.

Smith, H. G., and Baker, R. T. "A Research on the Eucalypts, especially in regard to their Essential Oils." Royal 4to (12 x 10), xi-300 pp., 46 plates. This research embraces the results of six years botanical and chemical study of these trees in their living state, based on economic considerations. The data obtained from 110 species from Eastern Australia are here published, the comprehensive results being based on botanically correct material. The chemistry of the Essential Oils from all these species is somewhat fully treated, and new oil constituents are described.

Maiden, J. H. "Leaves of *E. linearis* Dehn., of Tasmania, seem to have an odour of oil of geranium when crushed." *Rep. Aust. Ass. Adv. Science*, 1902.

McClatchie, A. J. "Eucalypts cultivated in the United States." See "Eucalypts as a source of oil in U.S.A.," p. 38. *Bureau of Forestry Bulletin, U.S. Dept. of Agric.* No. 35, (1902).

1904.—Hall, Cuthbert. "On Eucalyptus Oils, especially in relation to their bactericidal power." (Parramatta, N.S.W., 1904.) "Eucalyptus oil in the treatment of typhoid fever." (*Aust. Med. Gaz.*, 20th September, 1904.) Abstracted in *Chem. and Drugg. Aust.*, xix, 249, 1st October, 1904.

He shows that the value of Eucalyptus oil depends on ozonisation products from the terpenes, of which the chief is phellandrene, and that Eucalyptol is of minor importance.

If, says he, Eucalyptus oil be valued medicinally chiefly for its power as an antiseptic, then we must regard ozone as its most valuable constituent, and next to this the pinenes and other terpenes, as they are not only antiseptic in themselves, but are the agents in the production of the ozone. Piperitone also seems likely to prove a valuable constituent, and is well worth further trial. Eucalyptol we must regard as the weakest antiseptic of all, and to be chiefly valuable as a carrier of ozone. It also helps to dilute and cover the taste of the rather nauseous terpenes, and makes the oil more palatable and more pleasant for inhalation. . . . Another matter that presents itself is that the amount of ozone developed must depend on the amount of terpene present, and it is, therefore, necessary to ensure that a proper proportion of this is present in an oil.

Earlier he establishes the ozonising property of the terpenes, phellandrene and aromadendrene, and that eucalyptol and piperitone only develop ozone in the very slightest degree, although he shows that piperitone has well-marked bactericidal properties.

The drug which is likely to be most effectual in the treatment of typhoid fever must possess the power of reducing the temperature, of acting as an antiseptic, and of producing a tonic effect on the heart and system generally. These indications are fulfilled in a marked degree by Eucalyptus oil. Eucalyptol, when pure, has little bactericidal power. Piperitone and terpenes have a much more powerful action, while, if the oil is to have a particularly powerful bactericidal effect, it must have a sufficiency of ozone, derived

from oxidation of the terpenes. If one is not sure that the brand of oil he is using contains much ozone, this may be made up for by prescribing a little peroxide of hydrogen along with the oil. The oil which he employed most was that of *E. Smithii*, which consists mainly of pinene, and this was ozonised by exposing it to the action of light and air for a month before use.

It will be observed that Dr. Hall takes up a different standpoint from Schimmel & Co. (following certain Pharmacopœias), who insist on the fundamental of Cineol (Eucalyptol) for therapeutic purposes.

1905.—*Bennett, C. T.* (*Chem. and Drugg.*, lxvi, 33 (1905)) draws attention to cases of adulteration of Eucalyptus oil with Castor oil.

Smith, H. G. "The Refractive Indices, with other data, of the oils of 118 species of Eucalyptus." *Proc. Roy. Soc. N.S.W.*, xxxix, 39. The physical constants of Eucalyptus Oils in this direction are here recorded, and some interesting results obtained. The material worked upon was of undoubted origin and had been distilled at the Museum.

Smith, H. G., and Baker, R. T. "Some West Australian Eucalypts and their Essential Oils." *Pharm. Journ.* (4), xxi, 356, 382. The chemistry of the oils of eight species is here recorded, also a research on the Aldehyde Aromadendral from the oil of *E. salubris*.

1906.—"*Eucalyptus Staigeriana*, the 'Lemon-scented Ironbark,' and its Essential Oil." *Pharm. Journ.* (4), xxii, 571, March, 1906. An investigation to determine the constitution of the oil of this Queensland species. The occurrence of lævo-limonene in large quantities is here recorded. The aldehyde was Citral, and Geraniol and Geranyl-acetate were also present.

Schimmel & Co. Important papers on Eucalyptol (Cineol) determination will be found in Schimmel's Semi-annual Reports, October, 1907, p. 45, and April, 1908 p. 50.

1909.—Eucalyptus leaves extract (left after the distillation of the oil of *E. globulus*) has been used at Port Esperance, Tasmania, to prevent incrustation in boilers. (*Schimmel's Semi-annual Report*, October, 1909, p. 67.)

1910.—*Brownscombe, W. J.* "Essential Oils of the B.P. The Eucalyptus Oil Monograph." *Chem. and Drugg.*, lxxvi, 669, 30th April, 1910.

The principal constituents of Eucalyptus oils are Eucalyptol (generally associated with Pinene) and Phellandrene (generally associated with Piperitone). Eucalyptus oils may be roughly divided into three characteristic classes, according as they consist principally of one or other or both of these constituents, thus:—

Class 1. Oils consisting principally of Eucalyptol and containing no Phellandrene.

Class 2. Oils consisting principally of Phellandrene and containing no Eucalyptol.

Class 3. Oils consisting of both Eucalyptol and Phellandrene.

He points out that the oil introduced by Bosisto and the first to bring Eucalyptus oil under public notice, belonged to Class 3, and that some years afterwards distillates of *E. globulus* (Class 1) from Algeria came on the English market, and both 1 and 3 were used in medical practice and were recognised as official.

Later on quantities of oils belonging to Class 2 came on the market, and “probably to meet the competition of these new Australian oils, dealers and distillers of the Algerian oils turned the attention of medical authorities to the greater abundance of the crystallisable body (Eucalyptol), to be found in the *E. globulus* class of oils compared with the Australian oils then in use, many of which contained none at all, and evidently succeeded in impressing them with the view that this body contained the valuable medicinal principle of the oil, with the result that in the next revision of the Pharmacopœia (1898) oils of the Eucalyptol-Phellandrene class, as well as oils of the purely Phellandrene class, were excluded in favour of the purely Eucalyptol oils.”

He then draws attention to the results of Dr. Hall's researches, which have already been referred to.

Mr. Brownscombe suggests to the General Medical Council that, provided phellandrene-piperitone oils contain a reasonable proportion of Eucalyptol, they should be admitted for medical use and official recognition in the next edition of the Pharmacopœia.

Brownscombe, W. S. “Eucalyptus Oil; its composition and analysis.” Paper read before the Society of Chemical Industry of Victoria. *Chem. and Drugg. of Aust.*, 1st August, 1910, p. 240. This is a valuable paper, with the following headings:—The oils on the market, adulteration very rare, the Victorian standard, specific gravity and its variations, refractive index, fractional distillation, estimating Eucalyptol, aldehydes and terpenes, Phellandrene, the theoretical standard for Eucalyptus oil. The original should be referred to.

Martindale, Dr. W. H. “Essential oils as Antiseptics.” *Perfumery and Essential Oil Record*, November, 1910. Abstract in *Chem. and Drugg.*, lxxvii, 3rd December, 1910, p. 50. The oils were used in aqueous or saponaceous solutions, and the experiments were made with *Bacillus coli communis*.

“The Lancet” bacteriological method was employed to determine the carbolic acid coefficient of each oil or aromatic substance, the details being fully set forth in the paper. The results show that some essential oils are much more antiseptic than has hitherto been credited by bacteriologists, the following being the coefficients in the Eucalyptus oils quoted:—

<i>E. amygdalina</i>	...	...	...	...	...	4.35
Eucalyptol	...	...	...	...	...	3.76
<i>E. globulus</i>	...	...	...	...	...	3.55

In a supplementary note, Dr. Martindale, in commenting on these coefficients, recalls the discussion between Umney and Brownscombe (*Chem. and Drugg.*, vol. 76, 1910, pp. 271 and 669) as to which type of oil should have preference in the forthcoming New British Pharmacopœia, and says:—

“As the action of Eucalyptus oils is generally considered due to antiseptic power, it would seem desirable not to exclude oils rich in phellandrene. Personally I would stipulate that the oil must not be of such a character as to produce a choking sensation on inhalation. The spasmodic effect is stated to be produced by aromadendral and other aldehydes; other authorities say the phellandrene is the choking body. Of this much we are certain, that of the three samples under discussion the *amygdalina* produces by far the most choking, and the *globulus* has by far the pleasantest smell.”

Dr. Martindale assigns bactericidal coefficients as follows:—

<i>E. amygdalina</i>	...	...	...	...	...	4.35
Eucalyptol	...	...	...	...	...	3.76
<i>E. globulus</i>	...	...	...	...	...	3.55

results which support Hall's view that the antiseptic power of Eucalyptol is less than that of the other main constituents of Eucalyptus oil, and is exceeded by that of phellandrene and piperitone. He adds

that "as the action of Eucalyptus oils is generally considered due to antiseptic powers, it would seem desirable not to exclude oils rich in phellandrene." Other workers have lately emphasised the absence of scientific support for the adoption of a cineol basis for Eucalyptus oil, and it seems eminently desirable that those responsible for the strictly therapeutical matters in connection with the current revision of the B. P. should give close attention to the questions whether the more recent knowledge justifies a continuance of the present official requirement excluding oils containing "much phellandrene"; and whether the history of oil of Eucalyptus and the investigations since the present B. P. was published, do not warrant a pharmacopœial status to distillates of the phellandrene-cineol class. (*British and Colonial Druggist*, 21st November, 1911.)

(No author given.) "Use of Eucalyptus oils in Metallurgy." *Chem. and Drugg.*, lxxvii, 724, 811 (1910). Schimmel, April, 1911, p. 72; October, 1911, p. 49.

Eucalyptus oil possesses but slight anthelmintic properties. See Schimmel, April, 1911, p. 121.

Milke (Milne) recommends the external use of Eucalyptus oil as a prophylactic against scarlatina, and also as a remedy. See Schimmel, April, 1911, p. 73. J. Elgart confirms the efficacy of this method of treatment in scarlatina and measles. See Schimmel, April, 1914, p. 61.

Case of poisoning by Eucalyptus oil. Schimmel, October, 1911, p. 49.

1911.—*Smith, H. G.* "Some remarkable Essential Oils from the Australian Myrtaceæ." *Rep. Aust. Ass. Adv. Science*, xiii, 73, Sydney, 1911. In this paper the commercial possibilities of the perfumery and other oils of this group are dealt with, and also the advantages to be derived from their cultivation.

"The Chemistry of the Eucalypts and the Australian Pines." *Journ. Soc. Chem. Ind.*, Victoria, May, 1911. This paper is divided into two parts:—(a) Its technical aspect, read before the Society of Chemical Industry in Melbourne; (b) its scientific aspect, read before the Melbourne University Chemical Society.

"The present state of the Eucalyptus Oil Industry." *Technical Gazette of N.S.W.*, August, 1911. A report on the Industry prepared for presentation to the Minister of Education and Labour.

Smith, H. G., and Baker, R. T. "On some New England Eucalypts and their Economics." *Proc. Roy. Soc. N.S.W.*, xlv, 267 (1911). Deals with the economics of several New South Wales species not hitherto investigated, and extends the knowledge of the products of some other species having a more extensive range.

1912.—"A Research on the Eucalypts of Tasmania and their Essential Oils." *Proc. Roy. Soc. Tasmania*, 1912, p. 139, with four plates. This research deals with the whole of the present known species of Eucalyptus growing in the island, and indicates their economics. The botanical and chemical agreement with species which have characteristic morphological features is illustrated, and the comparative constancy in specific characters between identical species, whether growing in Australia or Tasmania, is again demonstrated.

1914.—*Maiden, J. H.* "Notes on some Tasmanian Eucalypts." *Ib.*, 1914, p. 20. Discusses the Eucalyptus oil question; includes a criticism of part of the nomenclature adopted in the preceding paper.

1913.—Cineol determinations, Schimmel, April, 1913, p. 62. This paper contains the results of their own researches, and a useful bibliography. Schimmel refers to the researches of C. T. Bennett and F. D. Dodge in regard to Cineol, and also to the suggestions of W. J. Brownscombe in regard to a uniform method of testing various oils for pharmacopœial purposes.

Smith, H. G. "Note on the Paraffins of Eucalyptus Oils." *Proc. Roy. Soc. N.S.W.*, xlvii, 95. The Stearoptene in the oils of some Eucalyptus species is shown to belong to the paraffin series. (See also *Proc. Roy. Soc. Tasmania*, 1912.) It was first isolated from the oil of *E. acervula* (*E. ovata*) of Tasmania, and later from the oil of *E. Smithii*, and from those of other species. The results indicate a mixture of two or more members of the series, as the melting point is not the same with all.

The Phellandrene question. Schimmel, October, 1913, p. 55. This is a valuable contribution to an important discussion.

1914.—*Smith, H. G.* "On the butyl ester of butyric acid occurring in some Eucalyptus oils." *Proc. Roy. Soc. N.S.W.*, xlviii, 464. This ester occurs in some quantity in the oils of some Eucalyptus species. The acid is normal butyric, and most probably the alcohol is the normal form also.

Robinson, R., and Smith, H. G. "A note on the Phenols occurring in some Eucalyptus Oils." *Proc. Roy. Soc. N.S.W.*, xlviii, 518. In this paper the announcement is made of two phenols in Eucalyptus oils. One of these appear to be new, and the name Tasmanol is proposed for it. It contains one methoxyl group.

1915.—*Earl, J. C.* "The Essential Oil of *Eucalyptus platypus*." *Proc. Roy. Soc. Vict.*, xxviii (New Series), 154 (1915). The leaves were cultivated in the Botanic Gardens, Melbourne. The yield of oil on distillation of the fresh leaves was 1 per cent. The following is the approximate composition:—

Pinene	...	...	...	...	20-25 per cent.
Phellandrene	...	...	...	...	10-15 "
Cineol	...	...	...	...	55-60 "
Aromadendrene	...	...	...	...	10-15 "
Alcohols, free, and combined as esters, up to	...	...	...	...	5 "

Smith, H. G. "The Essential Oil of *Eucalyptus Smithii*, from various forms of growth." *Proc. Roy. Soc. N.S.W.*, xlix, 158. The object of this investigation was to determine the range of variation in the amounts of the chief constituents in the oil of this species, when distilled from either seedling or "sucker" growth, or from trees

of various ages. Much evidence was also collected in reference to the rapid growth of this species, and photographs are given to illustrate this.

Smith, H. G., and Baker, R. T. "*Eucalyptus australiana* sp. nov. (Narrow-leaved Peppermint) and its Essential Oil." *Proc. Roy. Soc. N.S.W.*, xlix, 514. This paper gives the results obtained with the oil of this species, distilled from material growing in the Nerrigundah and Yowrie districts of New South Wales. The method of fractional separation of the oil during periods of time is now commercially adopted with this species. The product of the first hour is an excellent pharmaceutical Eucalyptus oil.

1916.—"A Research on the Eucalypts of South Australia and their Essential Oils." *Trans. Roy. Soc. South Australia*, xl, 464, with four plates.

1917.—Maiden, J. H. "Notes on some South Australian Eucalypts," *ib.* xli, 333. A criticism of some of the nomenclature adopted in the preceding paper.

1919.—Greig Smith, R., D.Sc. (Macleay Bacteriologist to the Linnean Society of New South Wales.) "The germicidal activity of the Eucalyptus Oils." Part I. *Proc. Linn. Soc. N.S.W.*, xliv, 72.

"When a serum-suspension of *Micrococcus aureus* was absorbed in cotton and placed in dilutions of the Eucalyptus oils in olive oil for two hours at 20 degrees, it was found that the bactericidal power was proportional to the acidity of the oils.

The germicidal effect was not caused by the acidity, but was assisted by it.

The effect upon *B. coli communis* was of much the same nature, although the action of the acid was not so clearly shown.

The iodide reaction was no criterion as to the germicidal value of the oils.

The vapours of the oils had a decided bactericidal action."

Part 2. "The action of the oils in aqueous solutions." *Proc. Linn. Soc. N.S.W.*, xliv, 311 (1919).

A summary of the results is given at p. 346, but they cannot be usefully abstracted at this place. He not only tested the oils, but also some of their constituents (p. 333). The oils dealt with are *E. cinerea*, *E. Smithii*, *E. cneorifolia*, *E. fruticetorum* (*polybractea*), *E. radiata* (*australiana*).

Wiadrowski, H. J. "Erecting a Eucalyptus Oil Distillery." *Journ. Dept. Agric. South Australia*, 22, 1033-4. July, 1919.

1920—An informative article on the firms actually distilling Eucalyptus oil in Australia, and their products, will be found in *Chem. and Drugg. Aust.*, February, 1920, p. 61.

Perez, G. V. "Eucalyptus and Diabetes" *Medical Press and Circular*, New Series, cxiv, No. 5211, January, 1920, p. 52.

The following is a useful study of the present state of our medical knowledge in regard to Eucalyptus leaves and Diabetes, by the late Dr. G. V. Perez, of Teneriffe, Canary Islands, who had been a close student of Eucalyptus for many years, and who died almost on the day of publication of his paper:—

A great sensation has been caused in these islands this year with the reported improvement and cure of a great many cases of diabetes, which is a frequent disease in this country, by means of a decoction of eucalyptus leaves (not infusion).

The exact history of what has taken place is as follows:—

The *Revue Horticole* of Algiers, having published in 1917, p. 151, that a Captain Laurent had adopted successfully the treatment of a number of diabetic cases with an infusion of the leaves of *Euc. diversicolor* (= *E. colossea*), the same was tried by a subscriber to that Review, in Teneriffe, but at the very first the leaves of a tree of *Euc. robusta* were used (in decoction) with apparently very good results; all species of eucalyptus, probably through the essential oil they contain, appear to have the property to decrease the quantity of glucose in the urine of diabetic patients. Soon after the first commencement of the treatment the leaves that have been used have been those of *Euc. diversicolor* (= *E. colossea*), although there is no evidence that these leaves have any advantage over those of the common *Euc. globulus* (blue gum); in fact, I think that the latter, being much richer in essential oil, ought to be the better, if there is any value in this treatment, and unless the long decoction of the leaves extracts from these some other constituents.

The writer of these lines, on hearing the preceding sensational news, communicated at once with Dr. Trabut, who, besides being the editor of the Algiers *Revue Horticole*, is a well-known botanist, and a professor of that Medical School. He answered on the 5th of July that he knew nothing positive about it, besides what the *Revue Horticole* had published, but that he was much interested in what I told him.

At the same time I wrote to Mr. J. H. Maiden, the well-known botanist of Sydney, and the greatest authority on eucalypts, who answered me as follows:—

“In reply to the postscript of your letter of 18th of July last, in the matter of eucalyptus leaves for diabetes, you will find an article in the Bulletin of the Department of Agriculture, Jamaica, entitled ‘Eucalyptus in the Treatment of Diabetes,’ vol. 2, Part 2, p. 47, 1904; this is based on extracts from the *British Medical Journal* of 24th of May, 1902, and the Medical Annual of 1903. The reports would appear to have been based on experience with *E. globulus* in New Zealand (in which country no eucalypts are native).

“Some years ago an opinion as to its value for diabetes was widely held in New South Wales, and it fell to my lot frequently to supply leaves to Sydney sufferers, but I never heard of a permanent cure attributed to this remedy, and I understand it is not now prescribed by regular practitioners.

“The late Sir James Graham, who specialised in diabetes, and the late Sir Philip Sydney Jones, physicians of high standing, who both sent patients to me for material, told me that they could not say that valuable results accrued, although they gave it a good trial.”

The above quotation by Mr. Maiden refers no doubt to Mr. A. G. Faulds, of Glasgow, who said he knew of this treatment through Mr. James Dick, of New Zealand, and who published in the *British Medical Journal* for 1902, vol. 1, No. 2160, p. 1295, that he had treated forty-six cases of diabetes by an infusion of the leaves of eucalyptus, and that all recovered; this latter quotation figures in Martindale's Pharmacopœia and others. It would be very interesting to know if since 1902 any more cases of the treatment of diabetes by eucalyptus leaves have been recorded, and with what results, as the above information is very contradictory.

In Teneriffe, where diabetes, or, at least, glucosuria, is very frequent, the fact remains that many cases have experienced great relief with this drug, and that there are reports of cures. I heard in May from a good source that there were over 400 cases taking the decoction of eucalyptus leaves, and I also know for a fact that analysis of the urine of such patients, frequently made, has shown a very marked diminution in the quantity of glucose excreted.

I have it also from quite a trustworthy witness that in several cases where sexual impotence was a marked symptom of diabetes, the sexual powers in the male have been restored, and this symptom appears to me to be a very remarkable one. Lasègue, the well-known Paris physician of the middle of the last century,

who is quoted in Charcot's treatise of medicine, used to give to this symptom a great importance in diabetes, and to say that it had often helped him to diagnose unsuspected cases. The most probable explanation of this occurrence is that the quantity of glucose being diminished by eucalyptus treatment, sexual power is restored; another possible explanation is that as eucalyptus oil is known to have a marked action on the nervous system, it may affect this function directly, and, in fact, act as an aphrodisiac. Mr. J. H. Maiden, in his book, "The Useful Native Plants of Australia," 1889, pp. 256 and 257, quoting the *Therapeutic Gazette*, compares the essential oil of eucalyptus in its action to that of *Conium maculatum*, and that overdoses produce similar results; also that a strong cup of coffee is an antidote.

As diabetes and glucosuria are not at all well understood, surely there is room in London hospitals to make a proper investigation of well selected cases of diabetes, and subject them to treatment with eucalyptus leaves, and, if possible, to do so with those of different species. According to the work above-named of Mr. Maiden's, the essential oil of the different species appears to vary very much indeed, in both quantity and quality, being sometimes quite different from one another.

At any rate, the leaves of the common kind, *E. globulus* (blue gum), which is very rich in oil, and those of *E. diversicolor*-*E. colossea* or "Karri," ought be tried, as the latter is the species that has attracted such notice in Teneriffe during the past year.

The fact that it has been used in this island as a decoction and not as an infusion, as hitherto, ought to be borne in mind, as possibly other active bodies in eucalyptus leaves may be extracted by the prolonged boiling to which they are submitted.

On the evidence to be culled from the preceding pages, it appears to be largely impossible to determine the oil best suited for medicinal uses.

On the one hand, we have by far the greater number of witnesses working on oils rich in eucalyptol, and these state that they find benefit from prescribing it in certain diseases. But they do not produce evidence of having made comparative tests with oils containing phellandrene. Neither did they experiment with the pure eucalyptol. Their evidence, therefore, while proving a certain value for oil containing from 50-60 per cent. of eucalyptol, does not prove that the curative property was due to the eucalyptol or to the balance of the other 40-50 per cent. of constituents.

On the other hand, we have the opposing evidence, which maintains that the original reputation of eucalyptus oil was built on an oil containing phellandrene and eucalyptol, and that the rubifacient qualities of eucalyptus reside almost exclusively in the terpenes, phellandrene, pinene, and sesquiterpene, and that public experience of sixty years supports the claim of superior medicinal virtue for phellandrene eucalyptol oils as compared with oils rich in eucalyptol and devoid of phellandrene. It is maintained that pure phellandrene must be considered as only too strong for internal use when not associated with a certain percentage of eucalyptol, and not as in any sense injurious.

Then we have the independent witnesses who give evidence from the bacteriological point of view, which strongly supports the contention that the antiseptic virtue of eucalyptus oil is mostly associated with the terpenes, being due mainly to ozone developed by their oxidation.

In conclusion, we have judgments in the case given by J. C. Umney, of London, E. M. Holmes, of Kew Gardens, Baker and Smith, of Sydney, who have reviewed the evidence as far as they knew it. They have judged "that the constituents upon which the therapeutic action of eucalyptus oil depends cannot be stated."

Addendum.—The following are the regulations in force in the various States in regard to Eucalyptus oil, for which I am very grateful to Mr. W. S. Brownscombe:—

NEW SOUTH WALES.

Regulations under the Pure Food Act, 1903.

Regulation 83, Eucalyptus Oil.

(1.) Eucalyptus Oil prepared for internal use by man shall be the colourless or pale-yellow oil distilled from the leaves of various species of Eucalyptus, subsequently rectified, and possessing a characteristic aromatic odour and pungent cooling taste. Its specific gravity at a temperature of 60 degrees Fahr. shall be from 0.910 to 0.930. It shall contain not less than fifty parts per centum of eucalyptol (cineol) as determined by the phosphoric acid method described in the British Pharmacopœia, 1914, pages 260 and 261; mixed with one-third of its volume of phosphoric acid of specific gravity 1.75, it shall quickly become semi-solid. It shall be soluble in three volumes of seventy per centum alcohol; and its refractive index at sixty degrees Fahr. shall be below 1.4800.

LABELLING.

(2.) There shall be written in the label attached to every package which contains eucalyptus oil, a statement in bold-faced sans-serif capital letters, of not less than six-point face measurement, of the composition of the oil in the following form:—

This Eucalyptus Oil contains Phellandrene and (the words “phellandrene and” are to be omitted if phellandrene be not present) not less than (here insert the number of parts per centum) parts per cent. of Eucalyptol.

Provided that this declaration shall not be required when the oil either—

- (a) conforms to the British Pharmacopœia standard, and is labelled accordingly; or
- (b) has been distilled from one species of eucalyptus only, the name of which is written on the label in bold-faced sans-serif capital letters, of not less than six-point face measurement.

(3.) In the label attached to every package containing eucalyptus oil intended for external use only, shall be written in bold-faced sans-serif capital letters, of not less than eight-point face measurement, and immediately following the words “Eucalyptus oil,” the words “For external use only.”

HEALTH ACTS.—VICTORIA, 1916.

Regulations and Standards for Foods and Drugs.

Regulation 75. Eucalyptus Oil.

(1.) Eucalyptus oil is the essential oil distilled from the leaves of one or more species of Eucalyptus. When prepared for internal use or inhalation, it shall not contain more than a trace of aldehydes having a boiling point below 120° C.

Labelling.

(As this is practically a copy of New South Wales sections Nos. 2 and 3, it has been omitted.)

SOUTH AUSTRALIA.

Regulations under the Food and Drugs Act, 1908.

Eucalyptus Oil.

(Similar to Victorian Regulations, almost word for word.)

QUEENSLAND.

British Pharmacopœia standard in force.

WESTERN AUSTRALIA

British Pharmacopœia standard in force.

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Livistona australis Mart.

The Cabbage Palm.

(Family PALMÆ.)

Botanical description.—Genus *Livistona* R.Br., in *Prodromus*, p. 267 (1810).

Flowers hermaphrodite, in a loose panicle, with sheathing bracts on the main rhachis and peduncle.

Outer perianth thin, three-lobed or three-toothed, inner longer, of three valvate segments.

Stamens six, distinct, but contiguous; filaments broad and thick, very shortly filiform at the top; anthers small, ovate.

Ovary laterally three-lobed, the carpels readily separating, with one erect ovule in each.

Style shortly columnar, with a three-toothed stigma.

Fruit ovoid or globular, reduced by abortion to a single carpel, the pericarp not thick, hard when dry.

Seed erect, the hilum somewhat lateral. *Albumen* with a deep, broad excavation on the inner side, filled with a brown spongy tissue. *Embryo* dorsal.

Low or tall, erect palms.

Leaves fan-shaped, plicate, the lobes or segments acuminate and entire or two-cleft, and frequently a small bristle or filament between the lobes.

Panicles usually large and decompound from among the leaves.

Flowers very small, solitary or clustered along the slender rhachis of the ultimate branches. (B.Fl. vii, 145.)

We then have the interesting account by Robert Brown in the *Prodromus*, of which the following translation is offered. It will be seen that the generic description of *Corypha* was drawn up by Brown from *C. australis*, which is none other than our Cabbage Palm (*Livistona australis*).

Corypha L. Gaertner.—

Flowers hermaphrodite. Perianth double, both divided into three parts. Stamens six, filaments distinct, dilated at the base. Ovaries three, cohering within. Styles connate. Stigma undivided. The one berry ripening, globular, monospermous. Albumen hollow. Embryo basilar.

Obs.—The description is drawn from *Corypha australis*, in which the excavation of albumen is on the inner side, half-filled with a corky substance, so that, therefore, perhaps it is more allied to *Livistona* than to *Corypha umbraculifera*.

1. *C. australis*—fronds flabellate-palmate, with no threads, petioles spinulose, outer perianth trifid (three-cleft), acute.

Livistona.—

Flowers hermaphrodite. Perianth double, both divided into three parts. Stamens six, filaments distinct, dilated below. Ovaries three, cohering within. Styles connate. Stigma undivided. Berry (one maturing) monospermous. Albumen, with a ventral cavity. Embryo dorsal. Fronds pinnate-palmate, segments bifid at the apex

Botanical description.—Species *australis*, Martius, *Historia Naturalis Palmarum*, iii, 241 (1839).

Stems attaining 40 to 80 feet.

Leaves in a dense crown, orbicular in circumscription when fully out, 3 to 4 feet diameter, divided to the middle or lower down in narrow plicate acuminate lobes, either entire or two-cleft at the apex.

Panicle large, very much branched, quite glabrous, the primary branches thick, often angular and usually much curved and flexuose, the ultimate branches or spikes 1 to 3 inches long.

Spalva at the base of the panicle sheathing with a lanceolate point, 6 to 10 inches long.

Flowers not so closely sessile as in *L. humilis*, and not so small. *Inner perianth* about one and a half lines long, the outer fully half as long with very acute lobes.

Fruit globular, six to nine lines diameter, the pericarp hard and crustaceous when dry. *Seed* globular. (B.Fl. vii, 146.)

Besides these two references we also have:—

A. Wendland and Drude, in their *Palm. Austral.* in *Linnaea*, xxxix, p. 232, t. iii, f. 5 (1875), give the reference “*L. australis* Martius, l.c., p. 241, cum. tab. *Corypha australis* R. Brown, l.c., p. 123.”

B. Hooker in *Bot. Mag.*, t. 6274 (1877).

C.

The specimen figured in the Botanical Magazine was raised at Kew from seeds collected by Cunningham probably at Illawarra. Wendland and Drude can surely not have had access to Martius' work, for they refer to a plate of *L. australis* which I cannot find there, besides the mistake they have fallen into as to *L. inermis*. (Bentham, in B.Fl. vii, 147.)

D.

The Australian species of Livistona.—There has been some confusion in gardens with regard to the proper application of the names *Livistona australis* and *L. inermis*, and perhaps also *L. humilis*, three species described by R. Brown in “*Prodromus Floræ Novæ Hollandiæ*,” p. 267, the first under *Corypha*. Allan Cunningham is credited with having introduced all three of these palms into English gardens as early as 1824, but it is exceedingly doubtful whether there are, or ever were, more than two Australian species of *Livistona* in cultivation. It is also probable that his *L. inermis* and *L. humilis* are states of the same species, the latter differing only in having more or less prickly petioles. *L. Leichhardtii* of Mueller is also, as Sir F. Mueller himself suggests, the same species From an examination of Brown's specimens and comparisons with his descriptions, however, it is quite clear what palm he intended by *Corypha australis*, and it may be added that he himself suggested that it might, perhaps, be better placed in the genus *Livistona*, to which Martius subsequently referred it. Brown described *L. australis* as having flabellate-palmate—that is fan-shaped—leaves, and a globose fruit; and *L. inermis* and *L. humilis* as having pinnately-palmate leaves. These distinctions are so evident in the cultivated specimens—it is somewhat surprising that confusion should have arisen. The leaves of the latter are remarkable, in being intermediate between the fan and feather forms of structure; and the fruit associated with this type of leaf is oblong or ovoid. *Livistona australis* appears to have been the only one of the three that long survived their introduction by Cunningham—or, at least, the only one that grew to a large size at Kew.

It is one of the few of the large palms enumerated in the "Guide to Kew Gardens," as long ago as 1851. In 1877 it was figured in the Botanical Magazine, Plate 6,274, where we are informed that it flowered annually at Kew in the spring months for many years. At that date it had outgrown the limits of the palm-house and was felled. This was, undoubtedly, the *Corypha australis* of Brown, the common palm of sub-tropical and temperate regions of eastern Australia, found as far south as the Snowy Range in Victoria. Nevertheless some botanists had conceived that it was the true *Livistona inermis*, and this alteration found its way into gardens, but the late Mr. Bentham rectified the error in his "Flora Australiensis." Yet even he did not seize upon the distinctive characters of the foliage. Both *L. inermis* and *L. humilis*, with pinnately-palmate leaves, were collected by Brown in the islands of the Gulf of Carpentaria. But the most curious fact is to come: About three years ago an exploring party, including Professor Baldwin Spencer and Mr. C. French, F.L.S., visited Croajingolong, in the extreme east of Victoria, and in about 37 degrees south latitude, where they discovered a palm in some plenty, growing to a height of more than 100 feet. This palm was taken by them to be *Livistona australis*; but from the photographs reproduced in the Victorian "Naturalist," vi, p. 8, the leaves are pinnate rather than palmate, and have even more of the pinnate character than *L. inermis*. This is shown both in young and adult trees, therefore it seems uncertain what this palm is that attains such a stature in so rude a climate. It is stated, however, that directly the heads of the palms grow out into the open above the general vegetation of the valley, the sun's heat seems to scorch the leaves up, and they have a brown, withered appearance. (W. Botting Hemsley, in *Sydney Mail* of 19th March, 1892.)

[The drawing is not as clear, from the botanical point of view, as it might have been, but it is undoubtedly *L. australis*. J.H.M.]

Botanical Name.

Livistona.—"I have called it in memory of that noble man Patrick Murray, Baron de Livistone, a friend of Balfour, who arranged a botanical garden in his own estate with over a thousand plants, and enriched that of Edinborough, which was then founded; he travelled through the whole of France for botanical reasons, when, attacked by fever, he died. For more facts concerning the most meritorious man of his time see Sibald's Memoir of Balfour, p. 69, *et seq.*" (Robert Brown, *Prodromus*, p. 124). *Australis*, Latin, southern.

Vernacular Name.—It is the "Cabbage Tree" or "Cabbage Palm" of eastern Australia, one or other of the names being almost universally in use.

Aboriginal Name.—"Dtharowal" of the aborigines of the Illawarra, New South Wales (Sir William Macarthur); "Binkar," of South Queensland; "Kondo," or "Konda," of the Rockhampton aborigines. Dr. Roth, in his "North Queensland Ethnography," No. 3, gives the following aboriginal names for the tree and its parts:—Fibre-twine, Leaf-troughs, (Middle) Palmer River, "Alkarint"; hinterland and coast of Princess Charlotte Bay, "alki-an"; hinterland and coast of Princess Charlotte Bay, "ararai-ya"; Cooktown, "Karai," (but where it is no longer found); Cape Bedford, "do-bi."

Synonyms.—*Corypha australis* R.Br., *Prod.*, 267; *L. inermis*, Wendl. & Drude, l.c., 229 (Bentham).

Leaves.—The following measurements were made by Mr. A. A. Hamilton from a specimen in the Botanic Gardens, Sydney:—

Length of petiole or leaf stalk—3 feet; length from top of leaflet, 3 feet 6 inches. Diameter of leaf, 5 feet. Width of leaflet at base, 1 inch.

The petioles are armed with powerful recurved spines, like sharks' teeth, which render them very formidable.

The Immature Leaves as Food.—"The first (*Livistona australis* Mart.) which grew plentifully to the southward has leaves plaited like a fan; the cabbage of these is small, but exquisitely sweet, and the nuts, which it bears in great abundance, make a very good food for hogs." (*Journal of the Right Hon. Sir Joseph Banks, 1770, &c., p. 299.*)

The aborigines are very fond of the growing centre or heart of this tree, which they eat in a raw or cooked state. But they informed Mr. Backhouse (*Narrative, 1835, p. 436*) that the value of this esculent was not known to them before the advent of whites.

Considering how fond the blacks are of eating the "hearts" of so many plants, and that they ate almost everything that came in their way, it seems difficult to believe that the blacks in no part of Australia ate this food before pointed out to them by the white man.

"Several of my companions suffered by eating too much of the Cabbage Palm." (Leichhardt, *Overland Expedition to Port Essington, 1847.*) At p. 41 he says, "The tops of the Corypha Palm eat well, either baked in hot ashes or raw, and, though very indigestible, did not prove injurious to health when eaten in small quantities." At an earlier date (quoted in "Lang's Cooksland," p. 376), he says of the blacks, "They seem to have tasted everything from the highest top of the Bunya-tree, and the Seaforthia and Cabbage-palm," &c.

The Immature Leaves as Plait.—The leaves are used for baskets. The unexpanded fronds, prepared by being immersed in boiling water, or boiled, then dried and bleached; the fibre thus obtained is much valued for the manufacture of hats, which somewhat resemble the celebrated Panama hats.

The fibre on the stem is useless to bedding manufacturers and of no use as a paper material, as "there is very little fibre left when the silica is got rid of," according to a Sydney firm I consulted.

The District Forester at Windsor reported that for the last twenty years the Hawkesbury Agricultural Society has given an annual prize for the best cabbage-tree hat, and the prize has been carried off each year by Mrs. Overton, of the Kurrajong.

The method of making Cabbage-tree hats is recited by W. S. Campbell in *Journ. Roy. Austral. Hist. Soc. v, 260.*

At Princess Charlotte Bay, the young as-yet unopened leaf shoot is cut off as low down and as cleanly as possible, and then smartly tapped upon a piece of log: the shoot thus becomes unfolded, and can then be conveniently split along its natural folds. The outer cortex is next stripped off from each septum of leaf by means of a finely-pointed ironwood pointer or pin, or else with a sharp kangaroo-bone drill. These cortical strippings are, by a process to be subsequently described, rolled in the dry, after exposure to the sun, neither spiritum nor water being used. For fish-nets and dilly-bags, Princess Charlotte Bay and Northern Queensland generally. (Dr. Roth, in *N.Q. Ethnography Bull., No. 1.*)

Timber.—It is used for making spear-heads by the blacks in Northern Queensland (E. Palmer). Wood or outer part of the stem moderately hard and of a light colour. It is occasionally used for walking-sticks, slabs for buildings, or the trunks are hollowed out for pig troughs.

A. Thozet says the growing stem was eaten by the Queensland blacks, and he differentiates this from the "white part of the undeveloped leaves," which he also says is eatable.

Exudations.—The gum, exuding from this tree, is sucked like a lolly by the Morehead River, Queensland, blacks. (A. Thozet.)

Size.—Height from 20 to 120 feet, diameter 12 to 18 or 24 inches.

Habitat.—Following are the localities given in the "Flora Australiensis":—

"*Queensland.*—Woods (W. Hill); Rockhampton (Moore's Creek Range) (Thozet).

New South Wales.—Illawarra (Ralston).

Victoria.—Snowy Range (F. Mueller). I refer this here on the authority of F. Mueller, *Fragm.* V. 49. "There is only a single small leaf preserved in his herbarium which looks somewhat different." (The locality is thousands of feet below the Snowy Range, in deep, humid valleys.)

Victoria.—The following two references are to Bentham's or rather Mueller's "Snowy Range" locality:—

1. J. Stirling, "Notes on the Physiography of the western portions of the County of Croajingalong," *Proc. Roy. Soc. Vict.* i (New Ser.), 89 (1889).

The occurrence of the Cabbage Palm (*Livistona australis*) on Cabbage-tree Creek, near Orbost, where it grows to a height of over 100 feet, is also a remarkable feature in the vegetation of the area. The isolation of this species from its tropical home in a humid valley in the temperate zone, requires further elucidation at the hands of botanists, or of those interested in the geographical distribution of plants. I am inclined to consider it as a survival of a once tropic vegetation which covered South-Eastern Australia in earlier Pliocene times, and which was destroyed by the subsequent glacial action, of which there are not wanting evidences in South-Eastern Australia since Miocene times.

2. Baldwin Spencer and C. French, in *Vict. Nat.* vi, 8, 9, with two illustrations (May-June, 1889).

At p. 7 Cabbage-tree Creek (referred to by Stirling) is mentioned, and at p. 9 the Palms are referred to. Figures 2 and 3 are sketches of the Palms, but some of the leaves are sketchily drawn, being represented as pinnate rather than palmate, and so the warning of Mr. Botting Hemsley in the *Sydney Mail* of 19th March, 1892, (see p. 355), is necessary.

Spencer and French say:—"The curious point about these particular ones (Palms) is that they are only found in this one spot, within a short distance of the sea-coast, in Victoria, and considerably to the south of the region to which they are otherwise confined." The question of the distribution of the Palm is then gone into, both geologically and in reference to conveyance by animals and man.

New South Wales.—It occurs in well-sheltered gullies from south to north of this State, and the following are some localities from near the Victorian to the Queensland border:—

Southern slopes of the Dromedary Mountain, between Tilba and Cobargo, county of St. Vincent, the furthest south they occur in any quantity (District Forester, Moruya).

A great number grow on the Cambewarra Mountain and around Berry, Budgong, and the Kangaroo Valley.

In the Windsor Forest district there are many growing on the eastern slopes of the Blue Mountains in the vicinity of the Kurrajong (District Forester).

From the Hawkesbury River to the Hunter River, and from the sea-coast west for a distance of about from 10 to 20 miles. Confined to the gorges and scrubby slopes, these Palms grow luxuriantly in the district described. Round about Ourimbah centre these Palms are—or were—particularly abundant (District Forester, Wyong).

Inland on flats abutting on most of the estuaries and inlets, also on most of the salt-water lakes along the coast, up to a depth of 8 or 10 miles. Fairly abundant on the Port Stephens water at the Tea Gardens (District Forester, Taree).

In limited quantities in the gorges about Telegraph Point in the Wilson River district, near what is known as Red Hill (Forest Guard W. G. Cameron).

Parishes of Waihou, Orara, and Moonee, county of Fitzroy (District Forester, Urunga).

Particularly abundant in many parts of the Tweed River district, especially Stott's Island (District Forester, Casino).

Queensland.—Mr. F. M. Bailey, "Queensland Flora," p. 1684, simply says, "Many of the coastal scrubs south and here and there in the tropics."

There are several other Australian species of *Livistona*, viz. :—

1. *L. humilis* R.Br., *Prod.*, 268.

Following is Bentham's description of *L. humilis* :—

Stems 4 to 6 feet high (*Martius*), 10 feet (*Schultz*), 15 feet or tall (*Gallier*). Leaves orbicular-cordate in circumference when fully out, with a radius of about $1\frac{1}{2}$ feet, deeply divided into narrow plicate segments tapering to a fine point, the thread-like bristles between the lobes varying from nearly 1 inch to very minute or altogether wanting; petiole much flattened, the acute edges more or less bordered by small prickles in our specimens, but said to be often intermixed with larger ones even as much as $\frac{1}{2}$ inch long. General panicle very large and loose, the partial ones between the sheathing bracts pyramidal and 8 inches to 1 foot long, twice or three times branched, the ultimate branches or slender spikes $\frac{1}{2}$ to 1 inch long in flower, often twice that in fruit. Flowers numerous, in little sessile clusters along the spikes. Inner perianth segments scarcely 1 line long, the outer perianth about half as long with short, broad, rather obtuse lobes. Berry ovoid-oblong, obtuse, 7 to 8 lines long, more or less contracted at the base. Seed oblong, somewhat flattened.

Landsborough, in his "Expedition," says, "Boiled a pot of the young wood of the Cabbage Palm, which tastes like asparagus."

This may refer to *L. humilis*; on the other hand, it, and similar statements by Leichhardt and some others, may refer to their experiences with *L. australis*, collected on their way to the Northern Territory, and not in the Territory itself.

2. *L. inermis* R. Br.

I have already referred (p. 354) to the confusion with *L. australis* to which Bentham draws attention, but the following confusion of *L. inermis* with another Palm (*Linospadix monostachyus*) seems more difficult to understand.

In the Catalogue of New South Wales timbers for the Paris Exhibition of 1855, we have, under number 189, "*Livistona inermis*, Dwarf Palm, diameter in inches, 1-2; height, 6-10 feet. Pretty species of Palm, common in the Cedar brushes, from Brisbane Water northerly; much in request for walking canes."

In the Catalogue of the London Exhibition of 1862 the identical exhibit is labelled (under the number 213) "*Areca* sp., Walking Stick Palm, used for walking-sticks. In Cedar brushes from Brisbane (Water) northerly."

Bentham's note on the Palm is :—

L. inermis, R.Br., *Prodr.* 268.—A moderate sized or tall palm (14 to 30 feet), with the ovoid-oblong fruits of *L. humilis*, but said to differ in the petioles entirely without prickles, and the lobes of the outer perianth more acute. *Mart. Hist. Nat. Palm*, iii, 230, t. 145, 146.

N. Australia.—Islands of the Gulf of Carpentaria, *R. Brown*. I have seen no specimen of this Palm and Martius appears only to have known it from Bauer's drawings which he copied, the general habit being also represented in Flinders' Voyage in the View of Sir E. Bellew's Island, vol. ii, p. 172. It may prove to be a variety only of *L. humilis*.

3. *L. Leichhardtii* F.v.M.

In his "Select Extra-tropical Plants" Mueller took the opportunity of naming the North Australian Fan Palm, *Livistona Leichhardtii*.

He says :—

Under this name might be combined *L. inermis* and *L. humilis* (R. Brown), neither name applying well to this finally tall palm with thorny leaf-stalks. The author of this work, as well as Dr. Leichhardt, saw it far inland in dry, open, not mountainous, regions also; nevertheless, it may need a moister climate than the following species. (1885, p. 202.)

Mr. Nicholas Holtze informs me that the leaves are eaten by horses in the Northern Territory.

4. *L. Muelleri* Bail.

This is the *L. humilis* R.Br. var. of Bailey in *Queensl. Agric. Journ.* ii, 130, and is described in his "Queensland Flora," p. 1683 (1902). It is a small Palm (trunk 7 or 8 feet), only recorded from Cairns so far, and known as "Bel-em-buna," by the aborigines.

5. *L. Benthani* Bail.

Described in his "Queensland Flora," p. 1683. It is a tree of about 50 feet, and native of Cape York Peninsula. It is known as "Dre-amberi" by the Batavia River blacks. It is included under *L. humilis* var. by Bailey in *Queensl. Agric. Journ.*, ii, 130.

It is evidently the same plant as the following, referred to as *L. humilis* by Dr. Roth.

B

Dr. Roth, in "North Queensland Ethnography," Bull. No. 3, speaking of this species, says:—

Heart hammered and roasted at Red Island. On the Pennefather River, the "heart" is baked in ashes, then uncovered and holes made in it with a stick. Water is next dribbled into each hole, and the vegetable left to cool. It is finally either beaten up and eaten, or else put into water—which it sweetens—and is drunk. Red Island, "inmurn"; Pennefather and Batavia Rivers, "dre-amberi."

Bailey (p. 1684), says:—

The above two palms (*Muelleri* and *Benthami*) may probably have been taken by botanists for one or other of those doubtful species of Robert Brown, viz. *L. humilis* and *L. inermis*. I gave them provisionally in the work quoted as varieties of the former, but as doubts still exist regarding the identity of that species, I have thought it better, in the present case, to give them specific rank bearing the names of the authors of the "Flora Australiensis."

[That Mueller was an "author" of the "Flora Australiensis" was always warmly repudiated by Bentham.—J.H.M.]

6. *L. Mariæ* F.v.M., *Fragm.*, xi, 54, 1878.

Mueller quotes Giles' "Geographical Travels in Central Australia," p. 222 (1875), for the original description, and further describes it (in Latin).

He states that it is abundant on the Fortescue River, North-west Australia (F. Gregory and J. Forrest), and in "Glen of Palms," Macdonnell Range, Central Australia (E. Giles).

Bailey ("Queensland Flora," p. 1684) doubtfully refers a portion of a leaf from the Campaspe River, Queensland, to this species.

But see Dr. Udo Dammer in *Gard. Chron.*, 21st October, 1905, p. 297, for an account of the confusion which has gathered around *L. Mariæ* F.v.M. and *L. Alfredi* F.v.M., and allied species.

"Mueller (under *L. humilis*) refers to this species a Palm found by Giles in the so-called Glen of Palms, Macdonnell Range, in the interior, but the only leaf I have seen looks rather like that of *L. australis*. It cannot, however, be determined without flower or fruit." (B.Fl., vii, 146.) This is *L. Mariæ* F.v.M.

Livistona Mariæ F. v. Mueller. Central and West Australia, barely within the tropics. This noble Fan Palm attains 40 feet in height, and is likely to prove very hardy.

Then we come to a "Note on the West Australian Fan Palm," by Baron von Mueller:—

It is known since the discovery of the Hammersley Ranges, fully thirty years ago, that a *Livistona* Palm occurs on the Mill-stream there, far isolated from any other species of that genus; but former incomplete specimens led to the surmise that this palm might be identical with *Livistona Mariæ*, a species restricted to the Palm-glen and several valleys of the Macdonnell Ranges in Central Australia. The last-mentioned palm we know now through Mr. J. Edgar, of the Rockhampton Botanic Garden, to be, while in a young state of cultivation, much more robust and upright in foliage than *L. australis*, besides the leaves at the early age of the plant being of a "rich bronzy colour." This particular characteristic seems neither to apply to the West Australian species, as ascertained by the Hon. Captain Phillips and Mr. H. Keep from

360'

E.A. King del. et lith.

THE CABBAGE PALM.

(*Livistona australis* R.Br.)

3602

Government Printer, photo.

FLOWER FROM CABBAGE PALM (*Livistona australis*) IN BOTANIC GARDENS, SYDNEY.

His Honor Judge Docker, photo.

CABBAGE PALMS (*Livistona australis*) NEAR BATEMAN'S BAY, SOUTH COAST,
NEW SOUTH WALES

King, photo.

CABBAGE PALM (*Livistana australis*) IN BOTANIC GARDENS, SYDNEY.

Government Printer, photo.

CABBAGE PALM (*Livistana australis*) IN BOTANIC GARDENS, SYDNEY.

Sergeant J. Beresford, stationed near the Hammersley Ranges. Moreover, I have always found transmitted fruitlets considerably larger than those of the genuine *L. Marie*, and further some minor differences exist also in the flowers of the two species, as recently ascertained. The West Australian Fan Palm has, therefore, now been named *L. Alfredi*, in honour of H.R.H. the Duke of Edinburgh, at whose nuptial festival the Central Australian Palm became dedicated to the Princess Marie of Russia. What applies to many other palms holds good also for *L. Alfredi*, namely, that the leaves are more strongly spinous in the young than in the aged plant. Mr. Beresford records this palm now also from the Fortescue River and its tributaries, from the sources of the Robe River, and from Cave's Creek. (*Vict. Nat.* ix, 112, November, 1892.)

EXPLANATION OF PLATE 256.

- A. Bud.
- B. and c. Male flowers.
- D. Female flower.
- E. Female flower, petals and calyx removed, showing—
 - (a) pistil divided into three carpels;
 - (b) abortive stamens.
- F. Portion of panicle and spathe (cultivated Botanic Gardens, Sydney).
- G. Fruits.
- H. Portion of petiole.

PHOTOGRAPHIC ILLUSTRATIONS.

1. *Livistona australis*. Botanic Gardens, Sydney. (King, photo.)
2. *Livistona australis*. Botanic Gardens, Sydney. (Government Printer, photo.)
3. Flower of *Livistona australis*. Botanic Gardens, Sydney. (Government Printer, photo.)
4. Cabbage Palms (*Livistona australis*), near Bateman's Bay, South Coast, N.S.W. (His Honor Judge Docker, photo.)

No. 265.

Eucalyptus robusta Sm.

The Swamp Mahogany.

(Family MYRTACEÆ.)

Botanical description.—Genus *Eucalyptus*. See Part ii, p. 23.**Botanical description.**—Species *robusta* Smith, in “A specimen of the Botany of New Holland” (1793).

Smith's original description of this species consists simply of the following words:—“Lid conical, contracted in the middle. Umbels lateral and terminal; general and partial flower-stalks compressed.” But the figure he published is so good that no mistake can arise as to the species referred to.

It is a fine, umbrageous tree, attaining a height of 80 to 100 feet and more, and a trunk diameter of 3 or 4 feet.

Following is Bentham's description:—

Leaves ovate-lanceolate, nearly straight, or the upper ones narrower and falcate, 4 to 6 inches long, or sometimes more, with numerous fine but prominent parallel veins almost transverse, the intra-marginal one very near or close to the edge.

Peduncles axillary or lateral, stout, angular, or flattened, often 1 inch long, each with about four to twelve rather large flowers, on thick angular pedicels.

Calyx tube narrow-turbinate or slightly urceolate, 3 to 4 lines long, tapering into the pedicel.

Operculum thick, obtusely acuminate, usually rather longer than the calyx tube.

Stamens 4 to 6 lines long, somewhat raised above the calyx border by the annular margin of the disk.

Anthers avoid-oblong, with distinct parallel cells.

Ovary flat-topped or slightly conical in the centre.

Fruit ovoid-oblong, truncate, smooth, contracted above the middle, about $\frac{1}{2}$ inch long, or rather more, the rim thin and slightly prominent, the capsule much sunk. (B.Fl. iii, 228.)

Botanical Name.—*Eucalyptus*, already explained (see Part II, p. 34); *robusta*, Latin, strong, firm, robust, &c. The botanist who first described this tree said, “The size and strength of the tree, like that of the European *Quercus Robur* (the Oak), seem particularly to justify the name *robusta*.”

Vernacular Names.—It is called “Swamp Mahogany” because of the situation in which it grows, and because the wood was supposed to resemble the true Mahogany of Central America in appearance. Our ordinary “Mahogany” (*Eucalyptus resinifera*), usually qualified by the adjectives “red” or “forest” more strongly

resembles the American timber. The term "Mahogany" was applied to Port Jackson timbers within the very first year of Australian settlement. With an excellent figure of *E. robusta* in Sir James Smith's "A specimen of the Botany of New Holland," published in London in 1793, we have the name "New Holland Mahogany," or "Brown Gum-tree" applied to this tree. The latter name was, doubtless, given because "its resin (kino) is an inferior sort of red gum, of a brown hue." This name "Brown Gum" is occasionally still quoted (as repetition) in English books in connection with this species, and it is simply referred to at this place in order to point out that the term is never employed in Australia, and was simply Smith's appellation.

Aboriginal Names.—"Burram Murra," of the aborigines of the Illawarra (Sir William Macarthur). "Gunnung," Richmond River, New South Wales. "Gnorpin," and "Kimbarra," various Queensland tribes; "Dadangba" was also an aboriginal Queensland name, according to Leichhardt.

Leaves.—There appears to be no record of the leaves of this tree having been tested for Eucalyptus oil. They are so coriaceous that they promise but little in this direction. Smith, in 1793, remarked, "This is not so highly aromatic as some other species."

Flowers.—They are very rich in an inferior nectar.

Bark.—It has a thick, softish, furrowed and somewhat flaky bark.

Timber.—"Burram Murra" (aborigines at Illawarra), or "Swamp Mahogany" (Sir William Macarthur, London Exhibition of 1862). "A useful timber for inside work, but not equal to the better sorts of Eucalypti in strength or durability," is *E. robusta*, according to specimens in Herb. Kew and Herb. Cant. ex Herb. Lindley.

It affords a reddish timber, difficult to split, and rather brittle (for a hardwood); resembles Blue Gum (*Eucalyptus saligna*) in colour. Much valued for wheelwrights' work, for ship-building, and for general building purposes; used for shingles; fairly durable for posts, especially in damp situations, such as the tree itself frequents, yet only a timber of the second class, being much inferior in quality to red Mahogany (*Eucalyptus resinifera*). It is worthy of very careful tests as regards its suitability for wood paving.

This timber is much valued for shingles, wheelwrights' work, and building purposes generally. As a timber for fuel, and where no great strength is required, this species is excellent, especially when we consider its adaptability to stagnant, swampy, or marshy places. It is reddish, difficult to split, and rather brittle; it is much used for round and square posts, joists, and sleepers, and is remarkable for its freedom from destructive insects, ascribable to the presence of kino-red. The specific gravity of air-dried wood is 1.098; absolutely dry, .889. Dr. Woolls speaks of the usefulness of this wood for mallets, rough furniture, and inside work, but states that it is not considered durable. A slab in the Technological Museum, which has been seasoned over twenty-five years (tested by me in 1887, having been exhibited at the London International Exhibition of 1862), has a weight which corresponds to 58 lb. 9 oz. per cubic foot.

Professor Warren gives the weight of some Swamp Mahogany at 75.98 lb. per cubic foot; the same specimen weighed three years later gave 61.6 lb. per cubic foot. Baron von Mueller and Mr. Rummel give the specific gravity of "air-dried wood" at 69.15 lb., and "absolutely dry" at 56.45 lb. per cubic foot. A specimen of Swamp Mahogany weighed by me after having been cut nearly thirty years gave a weight of 58.6 lb. per cubic foot. I do not attach too much importance to these figures, as to be comparable, the timbers should have been obtained from trees grown under similar circumstances, of about the same age, and taken from the same part of the tree. It would be a useful work—to be undertaken by a Government department or some wealthy individual—this determination of the specific gravities of our timbers. It would occupy the unremitting attention of one observer for several years to do it properly. Meantime, we must be content with specific gravity determinations, of the relation of which to each other we know little or nothing.

It is so durable that the late Father Scortechini (*Proc. Linnean Soc. N.S.W.* vii, 248 (1883) goes so far as to say that its timber is reported immune from borers.

It is being planted in Chili, and is appreciated as a valuable timber. See a pamphlet by Federico Albert, Chief of the Division of Forests and Water Supply, "La Caoba de las Vegas o *Eucalyptus robusta*" (Santiago, Chile, 1907).

Exudation.—The Swamp Mahogany yields but a very small quantity of a reddish-brown gum or so-called kino, which contains true gum in its composition, and which, therefore, belongs to my one-time "Gummy Group," a group numerically much inferior to either the Ruby or Turbid group.

Size.—It is a medium-sized tree, which may attain a height of 80 feet and more, with a stem diameter of 3 or 4 feet.

Habitat.—It is a coast-district species, confined to New South Wales and Queensland, and extending from Twofold Bay in the south of New South Wales to South Queensland in the north. It does not extend far inland; in the county of Cumberland or Sydney district it has not been noted further than Richmond and the Lower Hawkesbury.

For details as to localities see my "Critical Revision of the Genus *Eucalyptus*," Part XXIII, p. 47.

EXPLANATION OF PLATE 257.

- A. Juvenile leaf, from Bondi, Sydney.
- B. Flowering twig.
- C. Fruits.

B and C from Manly, Sydney.

PHOTOGRAPHIC ILLUSTRATIONS.

1. *Eucalyptus robusta*. Concord Park, Sydney.
2. Same tree, showing bark. (R. H. Cambage, photo.)
3. Swamp Mahogany (*E. robusta*), Wyong, N.S.W. Girth 12 feet, barrel 35 feet. (F. A. Kirton, photo.)

THE SWAMP MAHOGANY.
(*Eucalyptus robusta* Sm.)

3642

F. A. Kirtan, photo.

SWAMP MAHOGANY (*Eucalyptus robusta*), WYONG, NEW SOUTH WALES.

R. H. Cambage, photo.

TREE (*Eucalyptus robusta*) IN CONCORD PARK, SYDNEY.

R. H. Cambage, photo.

TREE (*Eucalyptus robusta*) SHOWING BARK, CONCORD PARK
SYDNEY.

No. 266.

Nothofagus Moorei (F.v.M.) Maiden.

Negro-head Beech.

(Family FAGACEÆ.)

Botanical description.—Genus *Nothofagus* Blume, in *Mus. Bot. Ludg. Bat.* i, 307 (1850).

Male and female flowers single or in three-flowering dichasia in the axils of the foliage leaves; pistils short, in heads; scales of the fruiting-calyx, in fours or two parts, and of varied form. Leaves summer or winter green, consisting of two rows, folded along the side-nerves or not.

Botanical description.—Species *Moorei* F.v.M. (*of Fagus*), *Fragm.*, v, 109.

Tall tree, nearly glabrous. Leaves ovate or ovate-lanceolate, crenate. Male flower-heads in the lower axils on short recurved peduncles, the involucre irregularly eight to twelve-lobed and mostly splitting. Stamens about twenty. Female flower-heads in the upper axils on erect short peduncles, ovoid, glandular, containing each three flowers. Ovulory of the two outer flowers three-angular and three-winged, of the inner flower flattened and two-winged. Fruiting involucre about 5 lines long. (Moore and Betche, *Handb. Fl. N.S.W.*, p. 85, 1893.)

I have quite satisfied myself that the separation of *Nothofagus* from *Fagus* is justifiable.

Cheeseman, who knows the New Zealand Beeches well, writes:—

Fagus proper, including the Beeches of the northern hemisphere, and which have comparatively large leaves, many-flowered male-heads or catkins, and large-fruited involucre; the other, *Nothofagus*, comprising the species from the southern hemisphere, in all of which the leaves are small, the male-heads one-two flowered, and the fruiting involucre very small indeed.

Botanical Name.—It was found by Mr. Carron and Mr. W. A. B. Greaves in 1865 on the Upper Clarence, and Mr. Charles Moore, desiring to commemorate Mr. Carron in regard to it, called it *Fagus Carroni*. Baron von Mueller, however, described it under the name of *F. Moorei*. I cannot find that *F. Carroni* Moore was ever formally described, but Mr. Moore freely distributed it under that name, and printed it in his and Mr. Betche's "Handbook of the Flora of New South Wales," p. 85.

Vernacular Names.—"True or Negro-head Beech" of New South Wales, the latter name being given owing to the rich dark colour of the foliage. Sometimes called "Mountain Beech." I have heard it called Red Beech.

We cannot expect the name of Beech or Colonial Beech to be exclusively appropriated to it, for thousands of people in New South Wales and Queensland regularly employ those terms when speaking of the wood of *Gmelina Leichhardtii*. Beech will, therefore, remain a name for *Gmelina* till the last stick of it is cut out, so we had better make the best of things, and by way of distinction, call our tree "True or Negro-head Beech."

It has been called "Red-wood," but it seems a pity to give this name to so many timbers.

Aboriginal Name.—I know of none, although it is probable they had a name for so conspicuous a tree.

Synonym.—*Fagus Moorei* F.v.M. in *Fragmenta* v, 109, 186.

Timber.—

It is the hardest timber of the brush, and it is also very heavy. These two characteristics are against its extensive use in the sparsely-settled localities in which it grows. It often grows in practically inaccessible localities. There is no doubt that it is a most durable timber. I cut into logs which had evidently lain by the side of creeks for very many years, and they were damp and moss-grown, but they were perfectly sound. I would look upon it as a valuable timber for culverts and such situations, where it is liable to wet, and I trust that the proper authorities will give it a fair trial. It is red when freshly cut, and dries to a pinkish colour Large trees throw out burrs, from which depend aerial roots. The timbers of these burrs often yield a beautiful figure. I would point out that the "Myrtle of Tasmania" (*Fagus Cunninghamii*) is a highly esteemed timber. The bark of our tree is rough and porous, and because of the moisture-laden situations in which it grows, the bark is often loaded with ferns, orchids, mosses, and lichens. No tree in the brush surpasses it in the quantity of epiphytal vegetation it supports. Many of the trees are bent and gnarled. The very dark-green foliage is striking, and the shape and habit of the leaves is handsome. Altogether, it is one of the most interesting of our forest trees.

(J.H.M., in *Agric. Gaz. N.S.W.*, p. 627, 1894, speaking of the Dorrigo.)

I am calling your special attention to this tree, because I think it will prove of exceptional value. Some years ago I took a piece of its timber to a Mr. Winter, now on the Manning, who was engaged at piano building, and he assured me that he found it far superior to any others he had tried for fretwork. I think it will also prove excellent for carving.

(The late Augustus Rudder, in a letter to me dated 1895.)

Size.—On the Dorrigo I found very many trees were 5 feet and more in diameter, but they are usually unsound when they are more than 3 feet in diameter. Mr. J. Kaleski, who lived for some time on the Dorrigo, told me that it grows about 100 to 140 feet, girth about 9 to 10 feet.

Habitat.—Following is the record in the "Flora Australiensis":—

"*New South Wales.*—On high mountain slopes forming dense forests at the head of the Bellinger River and Bealsdown (Beilsdown) Creek, a few at the head of Macleay River (C. Moore) (in Herb. F. Muell.). Received also from Mr. Moore himself under the name of *F. Carronii* Moore."

So far as we know, it is confined to northern New South Wales. It prefers the banks of streams or deep gullies at probably not less than 2,000 feet above sea-level, say from the head of the Paterson to the head of the Clarence. It is surprising how imperfect our information is as the precise range of species.

E. A. King del. et lith.

NEGRO-HEAD BEECH.
(Nothofagus Moorei (F.v.M.) MAIDEN.)

The following localities are represented in the National Herbarium, Sydney:—

“Mr. Slater, of the Works Department, informs me that he saw it at head of the Paterson, on the same line of range at the head of the Barrington and Manning. I saw it myself coming across from the Hunter watershed at Gloucester” (Mr. W. Heron, of the Dorrigo, who knows the district well).

Upper Gloucester River; Upper waters of Manning; Comboyne; parish of Vernon, Port Macquarie district.

“The Negro-head Beech has recently (1890) been discovered by Mr. MacDonald, one of our Forest Rangers, on Mount Bandi Bandi or Kippara, near Kempsey, which is a new habitat for it” (late Forest Inspector Duff).

Ascending the Dorrigo Mountain from the Bellinger, the first *Fagus* trees to be seen are on the banks of Rocky Creek. They are here of a height of 100 feet, and a diameter of 2 or 3 feet and more. When we are thoroughly in the Dorrigo, commencing at Beilsdown Creek, the *Fagus* is in the greatest luxuriance. It is found following the course of all the creeks, often it skirts the edge of the brush, but it is also found a considerable distance in the forest. It would be difficult to estimate the number of *Fagus* trees in the Dorrigo, but it must be enormous. From the Dorrigo it extends westerly and south-westerly as far as Bald Hills Station, at the back of Guy Fawkes, where it is present in large quantity in the gullies. This, I believe, is its most western locality, passing south to the county boundary of counties Dudley and Clark, and the western slopes of Mount Kippara, in the Macleay district. I am informed that it is also found in the rough country in the north-west of the county of Gloucester. This must remain its most southern locality, as far as our knowledge goes at present. Its most northern locality would be on the Tooloom Run, on the main Clarence River, where Mr. Greaves has recently found it. It would appear that *Fagus Moorei* rarely descends much below 3,000 feet. It is worthy of note that cedar and *Fagus* do not grow together.

(J.H.M., in *Agric. Gaz. N.S.W.*, vol. v, p. 627 (1894).

“The former is of gregarious habit. I have seen it in considerable quantity in several places in the upland brushes bordering New England, even before it had been reported upon by any others, excepting that at Dorrigo” (Augustus Rudder).

“Found anywhere in Dorrigo in creeks and watercourses. No commercial value at present. Always grows in clayey ground, generally poor, on banks of creeks, though also found on flat ridges of good red soil above creeks. Will not thrive without plenty of moisture” (Robert Kaleski, a former resident of the Dorrigo).

Head of Clarence Waters. 3-5 feet, 130-150 feet.

EXPLANATION OF PLATE 258.

- A. Flowering twig. Dorrigo, N.S.W. (male flowers only).
- B. Flowering twig. Cultivated in Botanic Gardens, Sydney.
- C. Cupule with nut enclosed.
- D. Cupule empty.
- E. Female flowers (one three-angular and three-winged; one flattened and two-winged).
- F. Male flower.
- G. Involucre.
- H. Anther.
- I. Bracts.

C

C-I from the Dorrigo.

No. 267.

Daphnandra micrantha Benth.

Light Yellow-Wood.

(Family MONIMIACEÆ.)

Botanical description.—Genus *Daphnandra* Benth in B.Fl., v, 285 (1870).

Flowers hermaphrodite. Perianth-tube short, segments about fifteen, in about three rows. Stamens four or five, opposite the inner segments; filaments flat, with a wing-like appendage on each side; anthers short, extrorse, with two distinct cells opening from the base upwards in convex valves, the connective truncate; staminodia (or abortive carpels?) five to twelve, between the stamens and carpels. Carpels several, in two or three rows with one pendulous ovule in each, and tapering into the style. Fruit unknown. Tree. Leaves serrate. Flowers small, in axillary thyrsoid panicles. (*Loc. cit.*)

Botanical description.—Species *micrantha* Benth in B.Fl., v, 285 (1870).

Following is the original description:—

A handsome tree of moderate size, quite glabrous, or the young inflorescence minutely hoary. Leaves petiolate, oblong-lanceolate or elliptical, acuminate, more or less serrate, contracted at the base, 3 to 4 inches long, green on both sides, the primary veins oblique and anastomosing. Panicles shorter than the leaves, the flowers not numerous. Bracts scarcely 1 line long, very deciduous. Perianth-tube short and broad, outer segments broad, about 1 line diameter, inner ones narrower and more petal-like. Stamens not exceeding the perianth. Carpels of the ovary glabrous, or slightly hairy, sessile in the hairy receptacle.

Only three other species of *Daphnandra* are recognised by Dr. Janet Perkins in her monograph on the Monimiaceæ. A translation of one other species is herewith.

Daphnandra tenuipes Perkins in Engler's "Pflanzenreich," Heft iv, Monimiaceæ, p. 75 (1901).

A small tree, with nearly terete branches, the young ones brownish hairy, the adult ones glabrous. Leaves opposite, very shortly petiolate, ovate or ovate-oblong, about 4 to 5 cm. long, chartaceous, shortly and broadly acuminate at the apex, rounded or rounded-cuneate at the base, serrate in the upper third, with small teeth, glabrous above, somewhat brownish hairy beneath, especially on the venation. Inflorescence axillary, paniculate, with slender branches 9 cm. long, loosely and sparsely flowered. Flowers bisexual, nearly 5 mm. long, with a nearly flat receptacle. Sepals four to five, broadly ovate, obtuse. Petals eight to nine, oblong, about twice as long as the sepals. Fertile stamens four to five, with flat filaments, with a wing-like gland on each side. Anthers two-celled, the valves opening upwards; staminodia several between the stamens. Carpels several, terminating in a pilose style. Fruit not yet known.

The species was discovered by E. Betcher in the Macpherson Range, near Murwillumbah, in March, 1893, but mistaken for a broad-leaved form of *D. micrantha* Benth., from which it is readily distinguished by the broader leaves and the slender inflorescence.

There is no doubt it extends into Queensland.

The two species differ in fact in a number of, what might be termed by some, small particulars. In the aggregate there is no doubt the species are distinct.

The key to the two species is:—

Leaves elliptical or oblong lanceolate, cuneate at the	
base, glabrous	<i>D. micrantha</i>
Leaves oval, ovate or ovate-oblong, at the base	
rotundate-cuneate or rotundate, underneath	
somewhat hairy	<i>D. tenuipes.</i>

Bailey (*Queensland Flora*, p. 1296), recognises two additional species, native of tropical Queensland scrubs, viz.:—

1. *D. repandula* F.v.M. (*Fragm.*, x, 105).
2. *D. aromatica* Bail., the “Cheed-ingnan” of the Barron River natives. It is figured at fig. 415 of Bailey’s “Comprehensive Catalogue of Queensland Plants.”

D. repandula is suppressed by Perkins and Gilg (“Pflanzenreich,” Heft iv, 79, 1901) and brought back to *Atherosperma repandum* F.v.M., as originally described by him in *Fragm.*, x, 105. However, in the same work, Heft 49, 44 (1911), Perkins restores *D. repandula* F.v.M. and adds *D. Dielsii* Perk., n. sp. (p. 46), from the Barron River, North Queensland.

Botanical Name.—*Daphnandra*, from two Greek words, signifying that the anthers resemble those of a Daphne; *micrantha*, from two Greek words signifying small-flowered.

Vernacular Names.—Because of the colour of the timber, it is often called “Yellow-wood” or “Light Yellow-wood,” and of a certain sheen, “Satin-wood.” Because of the aroma of the tree it is known as “Sassafras.” It is sometimes known as “Socket-wood” for the reason explained under “Branchlets.”

Aboriginal Name.—“Tdun-dambie” of the aborigines of the Clarence River, New South Wales, according to the late Mr. Charles Moore.

Synonym.—*Antherosperma micranthum* Tul., Monogr. Monim. in *Archiv. Mus. Par.*, viii, 421; t. 34; *Alph. DC. Prod.*, xvi, ii, 676.

Branchlets.—Note the swelling (flattened) of the base of the rhachis as it joins the stem. To me this has been a ready diagnostic character in the bush, but I am not prepared to say to what extent this holds true.

Mr. Sid. W. Jackson, some years ago, when on the Dorrigo, wrote to me, drawing attention to the "peculiar socket-jointed limbs," and sent a number of specimens to illustrate them. The ends of the branchlets, where they join the stems completely articulate, forming rounded knobs up to 2 inches in diameter. As a result, one has to be careful in climbing a tree of this kind.

Bark.—The bark of this tree is bitter, and is in repute as a tonic amongst sawyers. Dr. T. L. Bancroft has quite recently drawn attention to the properties of this bark.

Dr. Bancroft reports:—

The genus *Daphnandra*, of the order Monimiaceæ, is very interesting, as possessing several alkaloids of a stable and crystalline nature. In their physiological action they resemble somewhat the *Digitalis* group. I have for some years now occasionally used a tincture of the bark of *Daphnandra micrantha* in the treatment of heart cases, apparently with good results; my patients expressed themselves as feeling much better, and the sphygmograph showed some improvement in the condition of the pulse. *Daphnandra* kills frogs by its action upon the heart, and kills warm-blooded animals by its paralysing effect upon the spinal cord. Although I did not anticipate that any good would result from the use of any substance having a paralysing action upon the cord in the treatment of tetanus, yet I tried *Daphnandra* in a severe case of tetanus in a man. He derived no benefit therefrom, and the last two days of his life he was kept, at his own desire, under the influence of chloroform. Should a remedy ever be discovered for tetanus, I believe it will be a substance having an injurious effect upon the microbes that cause the disease, like the effect of salicine in rheumatic fever, and quinine in ague. (*Trans. Intercol. Med. Congress*, 1890.)

At an earlier date he reported on the bark of *Daphnandra repandula* F.v.M.

The bark of this tree has a transient bitter taste, and when first removed from the tree it has a yellow colour on the inner surface, which changes to a metallic black on exposure to the air, but this disappears again as it dries. Infusions of the bark are of a yellow colour, and remain free from microscopic organisms when kept. The extract of the bark is very poisonous, one grain being a fatal dose for a frog, and ten for warm-blooded animals. The alkaloids contained in the bark are colourless when pure and crystalline. The active one is easily separated from the others, being soluble in water. Its poisonous action is chiefly due to its action on the heart. To some extent it is antagonistic to strychnia. The poison powerfully affects fish, molluscs and infusoria. When applied topically to voluntary or involuntary muscles, it paralyses them rapidly. It also retards the development of septic organisms, and will deodorise putrid meat. It will kill some water plants. (*Proc. Roy. Soc. N.S.W.*, 1888, p. 69.)

The subject is continued, and the physiological action more thoroughly treated, in a paper by the same author in *Proc. Roy. Soc. Queensland*, 1887.

Timber.—The wood is excellent, according to Dr. T. L. Bancroft. It is doubtful as to what species is really referred to by Mr. Hill below. At the same time, it is only right to mention that Monimiaceæous timbers are, as a rule, of little value for industrial purposes.

"The wood of this tree-climber is soft and weak, and of little value except for packing cases." (Hill.) It is quite yellow when fresh, takes a fine polish, but it becomes dirty-looking with age, and is rarely pretty. It is fragrant, and might perhaps be suitable for cabinet work, such as the making of cabinet drawers, shelves, &c. A slab in the Technological Museum, which had been seasoned over twenty-five years in 1887 (having been exhibited at the London International Exhibition of 1862), has a weight which corresponds to 43 lb. 8 oz. per cubic foot.

I have a note that the timber has a "putrid smell when drying." (Port Macquarie.)

The late Mr. Charles Moore, many years ago, reporting on it from brush forests on the Clarence, near Grafton, says:—"A remarkable and very handsome tree. Timber quite yellow when fresh." From the same district Forester T. H. Wilshire sent me some timber which, when fresh, was of a deep-yellow colour (tumeric coloured).

The Cairns Sassafras (*Daphnandra aromatica*), is described in a Queensland catalogue as producing occasional trees in tropical scrubs. A medium-sized tree, with rather smooth bark and stiff dark-green leaf, both of which have a strong fragrance. Wood of a light colour, not unlike pine. Employed for many of the purposes for which pine is used.

Size.—Especially in Queensland it often attains a height of 100 feet, and a diameter of 2 feet and more.

Habitat.—It is recorded in the "Flora Australiensis" from "Queensland, Moreton Bay (Fraser, W. Hill).

New South Wales.—Clarence, Richmond and Lansdowne Rivers (C. Moore)."

—The species belongs to the coastal brushes. The following localities of specimens in the National Herbarium, Sydney, bring the recorded localities as far south as the Upper Hunter River. We require further investigation as to its range.

"In scrub at foot of Mount Woolooma, at Belltrees, Upper Hunter River." (Sid. W. Jackson.)

Wingham (A. Rudder). "A loose-growing tree of 20-30 feet, sparsely branched, flowers pale yellow, and the inflorescence very brittle." Wingham, Manning River (J. L. Boorman).

"Small trees of 8-15 feet growing in masses, in shade." South Brother, John's River (J. L. Boorman).

Urunga, Bellinger River (A. H. Lawrence). "Sassafras" or "Yellow-Wood." Yellow-wood is hard to eradicate, as it springs up again from fragments of root which may be left in the soil. Banks of Bellinger River, Dorrigo, and Glenfernle Forest Reserves. Abundant. (J.H.M., 1893.) Dorrigo Scrubs (Sid W. Jackson). Satin-wood, Dorrigo (Forest Guard W. Lowe.)

Tall tree of 80 feet, Richmond River, 1865 (Charles Moore). Satin-wood, plentiful, fine straight trees from 40 to 50 feet to branches on Wilson's Creek high up to Lismore, about 1865 (Charles Moore.) Newrybar, Richmond River (W. Baeuerlen). Casino, Richmond River (D. McAuliffe).

Acacia Creek, Macpherson Range, Queensland border (W. Dunn).

Queensland.—Ennoggera, Brisbane (Dr. T. L. Baneroff).

Tambourine Mountain (Dr. J. Shirley).

EXPLANATION OF PLATE 259.

Daphnandra micrantha Benth.

- A. Flowering twig.
- B. Bud, (e) bract.
- C. Plan of flower showing (a) perianth segment, (b) anther, (c) staminodium, (d) gynoecium.
- D. Part of flower showing (c) staminodia, (d) gynoecium.
- E. Extrorse anthers with appendage or gland valve open and closed.
- F. Fruiting twig.
- G. Achene.

Daphnandra tenuipes Perk.

- H. Flower.
- I. Longitudinal section of flower.
- K. Anther with valve open (front view).
- L. Back view of anther.
- M. Ovarium (longitudinal section).
(t-m taken from Pflanzenreich, Heft. 4, p. 74, 1901.)
- N. Leaf from Wingham, N.S.W.
- O. Leaf from Tweed River, N.S.W.

PHOTOGRAPHIC ILLUSTRATION.

Daphnandra micrantha, Dorrigo Scrubs, N.S.W. (Sid. W. Jackson, photo.)

LIGHT YELLOW WOOD.

(*Daphnandra micrantha* BENTH.) (A-G)

(*D. tenuipes* PERK.) (H-O)

Sgt. W. Jackson photo.

Daphnandra micrantha, DORRIGO SCRUBS NEW SOUTH WALES.

APPENDIX.

THE CULTIVATION OF EUCALYPTS IN COUNTRIES OUTSIDE AUSTRALIA.

THE acclimatisation of Eucalypts in various parts of the world has already a very copious literature, and the *Gardeners' Chronicle* is a fountain of information in this direction ; take vol. xxv, third series (January-June, 1899) for example. I can only submit a few works and a few references, and must leave those who desire ampler ones to follow up the matter for themselves.

Eucalypts have been largely planted, chiefly because it was thought they were a specific in malarial fevers, and hence the plantings in the Campagna, near Rome, which gave rise to so much controversy. Then came lesser plantings to alleviate diseases of the respiratory organs.

Monsieur Ramel appears to have first suggested the idea of planting Eucalyptus trees in Europe, with a view of thus ridding territory from malarial fevers. The same object led to its cultivation at the Cape. It is but right to quote testimony on the other side of the question. Speaking of *E. crebra*, the Rev. J. E. Tenison-Woods states (*Proc. Linn. Soc. N.S.W.*, 1882, 336) :—

On the Peak Downs, about Clermont and Copperfield, it is especially plentiful, and all around the Hodgkinson diggings. I mention this fact just to show that, whatever febrifuge qualities the Eucalyptus may possess, the mere presence of some species will not be enough to dissipate malaria. In the places I have mentioned the fever and ague were common enough, yet the prevailing winds used to blow through hundreds of miles of these gum trees ere they reached the infected localities.

Experience has shown that any good that has accrued from planting them arises from the absorption of moisture during their rapid growth, together with the mild exhalation of oil of some species.

En parenthèse, it may be remarked that while we in Australia have in the past been prone to recommend Eucalyptus planting to dwellers in other countries for sanitary purposes, we do not follow our own precepts. It is a fact that comparatively very few Eucalypts are artificially planted in Australia, and yet most of its towns are like other towns in having low-lying, undrained portions, and typhoid fever carries off an undue proportion of their population. It is also a fact that the orthodox method of improving (?) land is to fell the trees (generally Eucalypts) which grow upon it. In preparing suburban land for purposes of sale it is usually the object to eradicate every trace of vegetable growth, and the idea of leaving one Eucalypt to each allotment for the purpose of desiccating the ground seems never to be thought of.

Baron von Mueller attributed the salubrity of Eucalyptus regions to the following causes :—(1) Their ready and copious absorption of moisture from the soil. (2) Their corresponding power of exhalation, much greater than that of many other kinds of trees. (3) Their evolution of a peculiar, highly antiseptic, volatile oil. (4) The disinfecting action of the fallen leaves on decaying organic matter in the soil. Eucalyptus leaves create no noxious effluvia by their own decomposition.

The same author, in his "Eucalyptographia," under *E. globulus*, gives a valuable bibliography on (*inter alia*) the cultivation of plants of the genus outside Australia. There is a useful one in McClatchie, and the imperfect bibliography which follows increases these lists.

Certain Eucalypts, being specially rapid-growing trees, have a certain value in assisting in the desiccation of areas in which they flourish. As malaria is the earliest and principal disease that planters of Eucalypts set about to systematically combat, the following brief notes on it may be useful.

Malaria is a febrile disease, formerly supposed to be due to poisonous exhalations from the soil, but now known to be due to the presence in the red blood corpuscles of animal parasites of the genus *Plasmodium*. Different species of *Plasmodium* (which are Protozoans) produce different types of the disease.

Anopheles is a genus of mosquitoes which are secondary hosts of the malaria parasites, and whose bite is the usual, if not the only, means of infecting human beings with malaria. As mosquitoes pass their early stages in stagnant water, it is obvious how the drainage of swamps, such as the Roman Campagna, the covering of stagnant water with a film of kerosene, and the protection of human beings from the winged insects by means of mosquito-nets, have enabled sanitarians to render malaria-infected districts practically innocuous. An analogous case is the elimination of yellow fever in the Isthmus of Panama.

NEW ZEALAND.

No species of Eucalyptus is indigenous in the neighbouring Dominion. At the same time quite a number have become acclimatised, and no writer has done more to ascertain what these species are, and to give particulars of them, than the Rev. J. H. Simmonds, of Auckland. He has chosen the local official *Journal of Agriculture* for his papers, which are admirably illustrated, and his paper, "Eucalyptus for Fencing Timber; Some Suitable Species, and How to Grow Them" (Journal for April, 1916), may be taken as a type.

FRANCE AND ALGIERS.

The history of the introduction of Eucalyptus into France and Algiers, from the pen of Dr. Trabut, will be found under "Hybridisation," in a forthcoming Part of my "Critical Revision of the Genus Eucalyptus." Here follow some references from the pens of other writers. Those of M. Planchon will usefully supplement M. Trabut's record. The literature of the introduction of Eucalyptus into Algiers and France, and its development, cannot with advantage be dissected and kept apart at this place.

In *Revue Horticole*, 1861, p. 205, in an article entitled "Plantations Hygieniques," M. Naudin attributes to Sir William Macarthur, of Camden Park, Menangle, New South Wales, the discovery of the anti-malarial character of Eucalyptus plantations. I do not know the direction Sir William's action took (I know he wrote in 1861 to Decaisne),

but it was probably in connection with his presence as New South Wales Commissioner at the Paris Exhibition of 1855, when he was given the Legion of Honour. See note from my pen in regard to him in *Journ. Roy. Soc. N.S.W.*, xlii, 111 (1908).

He was one of the best horticulturists of his time, and there is no doubt that he would introduce some seeds of the national genus, although, being a reserved man, he would not say much about it.

Now we come to

PLANCHON, J. E.—“*L'Eucalyptus globulus au point de vue botanique économique et médical.*” *Revue de Deux Mondes*, 1875 (translated into English by the U.S. Dept. of Agric., 1875, and published by the Department with an introduction.) This pamphlet is excessively rare, and the Department had the kindness to forward me a photographic copy or photostat of it. It is referred to below as “Planchon.”

RAMEL.—“*Sur les Eucalyptus oleosa et globulus.*” *Bull. de la Soc. d'Acclim. de Paris*, 1861.

“*L'Eucalyptus globulus de Tasmania.*”—*Rev. Maritime et Coloniale*, 1861.

“*L'Eucalyptus globulus.*”—*Bull. de la Soc. d'Acclim. de Paris*, 1862.

. . . . the deeds of two men whose memory should be bound to the name of Eucalyptus, wherever this tree thrives as a source of public wealth and salubrity, Ferdinand Mueller and Ramel. In the history of the future naturalisation of the Eucalyptus, Mueller is the savant who justly calculated the future of the tree, traced it in its itineracy, and predicted its destiny. Ramel is the enthusiastic amateur who has thrown body and mind into the mission of propagating it. Both have faith, but one is a prophet, the other an apostle, and, in the noble confraternity of services, public gratitude will not separate the names that are bound together by friendship

Ramel, who possesses an ardent and unreserved nature, a zeal that grows out of a profound faith in the future of an idea, owes it partly to chance that he became a patron of the Eucalyptus. In 1854, while a trader in Australia, he one day visited the botanical garden [Melbourne ?] from curiosity, where, in a by-path, his attention was attracted to the Blue Gum, which struck him by its elegance and beauty. Almost a stranger to botany, he says he knew neither the form nor name of the tree; but, from the moment he saw it, it became his fixed idea, and formed the tie which binds him so intimately with Mueller, and his constant relations with the Museum of Paris, the Society of Acclimatisation, the gardens, savants, and amateurs He sees his beloved tree covering the mountains of Algeria, making the marshes salubrious, chasing away fevers, and replacing the stupefying fumigations of hashish by salutary and odorous cigars. The dream of yesterday has almost become the reality of to-day; for no tree has in so short a space of time introduced into the forest vegetation of Algeria so picturesque an element, or is as useful and as promising for the future. (Planchon.)

TROTTIER, N.—

Soon after, N. Trottier, another colonist, proved his faith in the new tree by his works. An ardent planter, he regarded this tree as possessing a forest substance capable one day of enriching the colony [Algiers], and he took, for the motto of one of his writings, the following ambitious words: “The wood of the Eucalyptus will be the great product of Algeria.” Carrying his confidence still further, he saw the desert retreating before this colonized tree, and speculating upon the incontestable fact that the forest created humidity, and changed the hygrometrical regime of a country, and remembering besides the subterraneous sheets of water beneath the arid surface of this region, he boldly named another pamphlet—“The Wooded Desert and Colonies.” There may be something Utopian in this illusion, and indifferent minds may conclude that the writer’s language is so assured and positive as to create suspicion; but enthusiasm has its price where its object is to urge opinion towards a useful end, and, if the pioneers of a new path are doomed to disappointment, their mistakes will serve to open the way to the prudent and

timid. However, if the desert is not to be conquered, the cause of the Eucalyptus has gained greatly in other respects. In Algeria, it is most favourably naturalised. It triumphantly borders the railways, of which it has seen the birth and marked the date. The garden inclosure can no longer retain it; it is planted by hundreds of thousands, in groves, in avenues, in groups, in isolated stalks, in every section of three provinces, and the foreigner who does not know the exotic origin of the Eucalyptus would suppose it to be an indigenous tree. (Planchon.)

CORDIER, M.—

In 1862, M. M. A. Cordier, a distinguished colonist (Algerian) obtained directly from M. Ranel one hundred seeds of the coveted tree. He sowed them, and obtained sixty-two plants, which in May, 1863, were only about 5 inches in height. (Planchon.)

See also Cordier, M. "Des Eucalyptus." *Bull. de la Soc. d'Agric. d'Agen.*, 1874. "L'Eucalyptus en Algerie," 1876. See also Bourlier.

HARDY,—

The *Eucalyptus globulus* was introduced into Algeria in 1854, as has been already said. In 1863, while walking with Mr. Hardy in that part of the botanical garden which rises from the Sahel (the western portion of the Sahara), the writer (Planchon) picked up from the ground one of the buds of a tree, which he at once recognised and declared to be a bud of the *Eucalyptus globulus*. Mr. Hardy denied his positive assertion, a fact of no great importance, but proving that it is well for one to be posted in the true names of plants. This tree probably came from Paris, and, perhaps, from the same seed-plot as the cultivated stalks in the museum at that time. Mr. Hardy naturally destined his young subjects for general distribution in the colony; but the calculated slowness of the emancipation of this plant discouraged the impatient desires of the amateurs who were waiting for its culture. (Planchon.)

See Hardy, p. 377, and under Pepper, p. 379.

HUBER.—

The introduction of the Eucalyptus in Eastern Provence (France), goes back to about the year 1858. In 1860, the garden of the Huber brothers, at Hyères, possessed a well characterised plant, which was almost a tree, with a pyramidal summit. (Planchon.)

THURET, G.—

At the same time (1860), M. Gustave Thuret, of Antibes, had one specimen plant in his lawn which had survived two winters. In June, 1860, I sent M. Thuret seed; that produced subjects which, planted in the early spring of 1861, and passing through a year of excessive dryness, were from 6 to 9 feet in height in 1862. When I saw them in November, 1863, I could not believe my eyes; they were veritable trees, with trunks, ample foliage, and flowers. Now the entire region from Cannes to Monaco displays to travellers the pale foliage and venerable trunks of the olive, and the vast forests of Italian pines, the aspiring branches of the Eucalyptus, with their scythe-shaped leaves trembling beneath the slightest breeze, and supporting the repeated and violent winds of the east, which are similar to the mæstral, and the tyrant of these parts. (Planchon.)

BOURLIER, M. C. (see Trabut, L. C.).—

In the spring of that year (1863), I sent M. Charles Bourlier twelve stalks of the Eucalyptus from Montpellier, which were distributed among careful amateurs, principally to M. Cordier, and attained such rapid development that the desire to possess this beautiful tree increased. From that moment, the Eucalyptus, at first by hundreds and then by thousands, took possession of Moorish ground; M. Cordier keeping the advantage in this steeplechase for the Eucalyptus by planting many acres in masses. (Planchon.)

PHILLIPE.—"Sur l'*Eucalyptus globulus*." *Bull. de la Soc. d'Acclim. de Paris*, 1862.

ANDRE, M.—"L'*Eucalyptus globulus*." *Revue Horticole*, 1863.

CARLOTTI, REGULUS., Dr.—“De la culture de l'Eucalyptus en Corse.” *Bull. de la Société d'Acclimation de Paris*, 1866. “Notes on *Eucalyptus globulus*.” *Mém. lu à la Soc. de méd. d'Alger*. (Corse, 1869.) “L'Eucalyptus globulus.” Ajaccio (Corsica), 1870. “Assainissement des régions chaudes insalubres par l'Eucalyptus.” Ajaccio, 1875. “L'Eucalyptus en Corse.” *Bull. de la Soc. d'Acclim. de Paris*, 1877. The author was a medical man, and dealt with its reputed therapeutic properties.

MONCHALAIT.—“Eucalyptus.” *Bull. de la Soc. d'Acclim. de Paris*, 1867.

TROTTIER, N.—“Boisements dans le desert et colonisation au moyen de l'Eucalyptus.” Alger., 1869. “De l'accroissement et de la valeur progressive de l'Eucalyptus.” Alger., 1871. “Arbres de l'Australie.” Alger., 1872. “Role de l'Eucalyptus en Algérie.” Alger., 1876. “Note sur l'Eucalyptus,” 1878. See also p. 375.

GIMBERT.—L'Eucalyptus globulus; son importance en agriculture, en hygiène, en médecine.” Paris, 1870. “*Eucalyptus globulus* as a disease-destroying tree.” *Gard. Chron.*, 22nd November, 1873, p. 1567. This article refers to the article by M. Gimbert, a physician of Cannes (*Compt. Rend.*, 6th October, p. 764), in which he narrates the success of his experiments in improving the miasmatic climate of some parts of Algeria, by plantations of *E. globulus*. The result is attributed to the absorption of water and the emission of vapour from its leaves. There is an abstract of this article in *Pharm. Journ.*, (3), iv, 494.

MARÈS.—“Note sur l'Eucalyptus.” Alger., 1870.

RAVERET-WATTEL.—L'Eucalyptus. Rapport sur son introduction, sa culture, ses propriétés, usages, &c. Paris. *Bull. de la Soc. d'Acclim.*, 1871-2. (Two editions). Deals with the species of Eucalyptus in cultivation in Europe and Algeria, together with notes on the uses of other species in addition. Cultural notes, timbers, essential oils, &c. “The genus Eucalyptus; its acclimatisation and uses.” *Pharm. Journ.*, (3), iii, 22, 43. A full *résumé* of the foregoing. “L'Eucalyptus et son avenir.” *Bull. de la Soc. d'Acclim. de Paris*, 1873.

LAMBERT, ERNEST.—Eucalyptus: culture, exploitation et produit. *Bull. de la Soc. d'Acclim. de Paris*, 1872. (See 1874, below.)

PASQUIER.—De l'Eucalyptus. Chateau Gontier, 1873.

MERICE.—Progres et development de la culture de l'Eucalyptus. *Bull. de la Soc. d'Acclim. de Paris*, 1874.

LAMBERT, ERNEST.—“Eucalyptus; culture, exploitation et produit, son role en Algérie.” Nouvelle edition, 1874, 8vo., pp. 56. See under “Pepper,” below.

HARDY.—“Les Eucalyptus du littoral de la Méditerranée.” *Journ. de la Soc. Centrale d'Hortic. de France*, 1875. See also p. 376.

BERTHERAUD (a physician).—“L'Eucalyptus au point de vue de l'hygiène en Algérie.” Alger, 1876.

PIETRA-SANTA.—“Influence de l'Eucalyptus en Algérie et en Corse.” *La Nature*, 1877.

“The Sanitary Influence of the Eucalyptus.” *Pharm. Journ.*, (3), vii, 986. Note, from the *Meteorological Magazine*, of hygienic results of the planting of *E. globulus* in Algeria.

MARTIN, FÉLIX M.—(Ingénieur des ponts et chaussées). “L'Eucalyptus et ses applications industrielles.” 1877.

GRISARD, M.—*Bulletin de la Soc. d'Acclim. de Paris*, 1877. List of publications on Eucalypts.

CERTEUX, M.—“Le Guide du planteur d'Eucalyptus.” Alger, 1877.

MUELLER, F. v., in his “Eucalyptographia,” under *E. globulus* and *E. amygdalina*, gives useful bibliographical references and notes on reports on the cultivation of Eucalyptus trees in other countries, and holds to the view that the planting of the tree in the Campagna, near Rome, directly subdued malaria.

NAUDIN, C. H.—“Mémoire sur les Eucalyptus introduites dans la Région Méditerranéenne.” *Annales Sc. Nat.*, (6), xvi, 337, 1883. *Abstr. Pharm. Journ.*, (3), xiv, 602. Notes on the Eucalyptus introduced into the Mediterranean region; botanical considerations; value of the trees for forestry purposes; description of those species which have attained the adult state in France and Algeria. The value of this fine and lengthy memoir is enhanced by the comprehensive bibliography it contains (chiefly of French publications), in regard to Eucalypts.

On p. 374 it is stated that the first idea of utilising the Australian Myrtaceæ, and particularly Eucalypts, for dealing with marshy and malarial localities, came from Sir William Macarthur (of Camden Park, near Sydney), who in 1861 gave his views on the subject in a letter addressed to M. Decaisne, which was published in *Revue Horticole* of the same year, p. 205.

M. Naudin recommended:—Species for rapid growth—*E. globulus*, *E. Muelleri*, *E. gomphocephala*. Timber of great solidity, density and durability—*E. marginata*, *E. rostrata*, *E. polyanthemos*. For ornamental purposes—*E. robusta*, *E. cornuta*, *E. botryoides*, *E. leucoxylon* (probably *E. sideroxylon* is meant). Hardy species outside the regions of the Olive—*E. coccifera*, *E. viminalis*, *E. Gunnii*, *E. urnigera*, *E. cordata*.

SAHUT.—“Les Eucalyptus.”—Montpellier, 1888.

NAUDIN, C.—“Description et emploi des Eucalyptus introduits en Europe.” (Second mémoire). Par Charles Naudin (de l'Institut). Antibes, J. Marchand, 1891, 8vo, pp. 72.

COOMBS.—“L'Eucalyptus et ses dérivés.” Paris, 1895.

PEPPER, EDWARD.—“The Eucalyptus in Algeria and Tunisia, from Hygienic and Climatological points of view,” by Edward Pepper, M.D. (Paris). *Proc. American Phil. Soc.*, vol. xxxv, 39-56 (read 6th March, 1896).

This is a useful paper. It is divided into six chapters:—

1. Division of Algeria and Tunisia into three zones, as regards climate, water, trees, health, and population.
2. Chronological facts relating to the growing of Eucalypti in Algeria and Tunisia.
3. General and special advantages of these trees. Limitations of their uses, and objections to them.
4. Species and varieties most serviceable in Tunisia and Algeria.
5. When, where, and how to grow them.
6. Commercial value of Eucalypti.

Under (2) the statement is made “The first seeds of Eucalypti consigned to the earth in northern Africa were sown in the Jardin d’Essai of Algiers, in 1862, by Mr. Hardy, Director of the Botanical Gardens thus named, and in the same year by the Comte de Bellerocche, who procured them from the director and sowed them in his property in the Commune of El Biar, 4 miles from town, now known as El-Afia, and belonging to the author.”

The author here adds a note in my copy:—“In the same year (1862), Mr. E. Ramel obtained seeds from Australia and sowed them in his property at Hussein-Dey. This gentleman must also be recognised as being the first to plant Eucalypti on a forestial scale in these Colonies.”

Malaria made cruel ravages in Algeria between 1867 and 1876, and Eucalypti were grown “in the principal settlements infested by the disease, believing that they had at last discovered a panacea against the evil.”

In 1868 Mr. Ernest Lambert, Inspector of the Forests of Algeria, sowed a grove on the Bouzareah Mountain, above Algiers, where now is the forest, or rather wood, of Baihnen. Then Dr. Marés, at Boufarik, planted a grove on his farm, reporting to the Société d’Agriculture seven years later, that the health of his neighbourhood was satisfactory. Malaria in its worst forms had constantly prevailed there until then, and *until the land had been successfully drained.* (Author’s italics.)

During the two succeeding years, the Société Algérienne planted 100,000 Eucalypti near Ain-Mokra, a village on the shore of Lake Fetzara.

The mining company of the Mokta soon followed with many still larger plantations in the same region, where the public health improved towards 1875, the mines being thenceforth worked during the summer, an impossibility till then, owing to the excessive mortality among the workmen, due principally to pernicious forms of malaria.

The latter plantations remain amongst the most extensive in Algeria, and offer a striking instance of the frequently great aid given by Eucalypti against malaria. Thick curtains of the trees were grown between the lake and the village, while, at the same time, a draining canal was cut in the shallow bed of the lake, sufficiently deep and wide (so thought the engineers) to carry off the stagnant waters and dry up the swamp. This result, however, was not attained, but yearly thenceforth the waters of the lake were emptied early enough in the spring, and before the summer heats, for the spongy shores to be covered with an herbaceous vegetation, offering here and there comparatively fair pasturage. The coincidence of this partial draining with the planting of Eucalypti does not permit the conclusion that the improved sanitary condition of Ain-Mokra is wholly due to these trees.

At Maison Carrée, Cardinal Lavigerie and the White Fathers, as well as MM. Saulière, Cordier, Trétiér and others, sowed and planted, the first large, the last small, groves of Eucalypti, with a marked improvement on the health of the community, which, however, still remains far from good.

These enterprises were rapidly followed by many others, and now most Algerian villages, especially if in malarial districts, have more or less extensive groves or avenues of Eucalypti, and many farms are also well provided with these trees.

MOUL, H.—“L'Eucalyptus.” *Bull. Soc. Acclim.*, xlviii, 306–19 (1901), Paris.

SPAIN.

“Experiments followed in Spain, where the Eucalyptus was introduced in 1860 by the Society of Acclimatisation, and flourished in the provinces of Cadiz, Seville, Cordova, Valencia, and Barcelona.” (Planchon.)

According to a report made by Herbert W. Bowen, American Consul at Barcelona in 1894, Eucalypts were introduced into Spain in 1865, when *E. globulus* became known as the “fever tree,” because it is believed to purify boggy and aqueous regions that engender fevers. (McClatchie.)

“*E. globulus* is the favourite species in Spain, where it thrives in humid soil, but not in humid air; *E. resinifera* is found to resist the wind remarkably well, and to accommodate itself to every soil; *E. urnigera* is suited to the mountainous districts and to low temperatures; *E. Gunnii* and *E. coriacea* are indifferent to cold; *E. marginata* is rather sensitive; *E. amygdalina* grows best in sandy soil; *E. fissilis* (*E. regnans*) prospers in poor soil; *E. odorata* thrives in dry soil.” (Novísima Guia del Hortelano, Jardinero y Arbolista, quoted in *Gardeners' Chronicle*, 11th March, 1899, p. 146.)

PORTUGAL AND GREECE.

In Portugal and Greece Eucalypts are grown successfully, but have not yet been planted on so extensive a scale as in other parts of southern Europe (McClatchie).

See also a pamphlet, Sousa-Pimentel “*Eucalyptus globulus*; descrição culture aproveitamento d'esta arvore.” Lisbonne, 1884.

Senor J. Henriques, Professor of Botany in the University of Coimbra, has interested himself in the acclimatisation of the genus in Portugal in recent years.

ITALY.

Although these references to the cultivation of Eucalyptus in Italy are chiefly in regard to Italian authors, other writers, particularly French, deal with Italian experience. The most sensational Italian Eucalyptus planting was on the malarial Campagna, near Rome, and it was only of comparatively recent years that, the origin of malaria being understood, scientific methods of combating it (the planting of rapidly-growing trees like Eucalyptus being only an aid) could be adopted.

SACCHARO, G.—“Utilità dell' Eucalyptus.” Catania, 1868, 8vo.

GLOVER, R. D.—“Anti-malarial properties of the Eucalyptus.” *Pharm. Journ.* (3), vi, 625.

Account of the planting of *E. globulus* in the Campagna, near Rome, by the Trappist monks. See also *Pharm. Journ.*, (3), vii, 160.

TORELLI.—(*Eucalyptus Torrelliana* was named after him.) “L'Eucalyptus e Roma.” “La Malaria in Italia.”

MEAUME, M. E.—“L'Eucalyptus à la colonie des Trois-Fontaines, près de Rome.” (Published at Paris?)

BUTONI.—“L'Eucalypto.” (Bologna, 1875.)

GILDAS.—“L'Eucalyptus dans la Campagne romaine.” *Bull. de la Soc. d'Acclim. de Paris*, 1875.

FEDELI, Dr.—“Sulle proprietà bonificante, et terapeutiche del l'Eucalyptus globulus.” (Forti, 1876.) The *Eucalyptus globulus*; its hygienic and medical properties. *Pharm. Journ.* (3), vi, 912. Abstract of a paper read before the Academy of Medicine, Rome.

POLLI.—“Sull-Eucalipto.” (Milano, 1876.)

MAROLDA-PETILLI, F.—“Gli eucalitta; notizie raccolte.” (Roma, 1880.) “The Genus *Eucalyptus*; its acclimatisation and uses.” *Pharm. Journ.* (3), iii, 22, 43. A full résumé of the foregoing.

AITKEN, L.—“Planting of Eucalypts in the Campagna, near Rome.” *B. Med. Journ.*, 27th Sept., 1884. *Pharm. Journ.* (3), xv, 293. The writer, an English physician at Rome, pronounces the planting, of which so much has been said, to have been a costly failure.

Gardeners' Chronicle, 6th April, 1889, p. 437.—*Eucalyptus Staigeriana* F.v.M. Drawing of a flowering twig growing at Mr. Thomas Hanbury's garden at La Mortola.

VALLÉE, A.—“L'Eucalyptus . . . près Rome.” (Rome, 1879.)

BROWN, J. C.—“African Fever and Culture of the Blue Gum tree.” (Small 8vo., pp. 50, Aberdeen, W. and W. Lindsay, 1890.) Contains M. Vallée's report on the cultivation of *Eucalyptus* at Tre Fontane, near Rome.

CELLI, ANGELO (Rome).—“Malaria according to the new researches.” (1890.) Condemns the planting of *Eucalyptus* in the Campagna.

At p. 142 he says: “The *Eucalyptus* planted round our railway stations are now proved to be useless against malaria, if even they do not do more harm than good by harbouring the mosquitoes near the houses. Here, outside the gates of the city, at Tre Fontane, an intensely malarious spot, there is a fine wood of them, and in Australia there are enormous forests of these trees, and all are malarious.”

And again he says, at page 234: “That the planting of woods is not a protection against malaria has been demonstrated by the example already recorded of the Tre Fontane, where, in spite of the *Eucalyptus* wood which has grown vigorously, this disease still remains.”

(Quoted in “Report of Bot. and Afforestation Department of Hongkong.” 1901.)

Eucalyptus at Rome. The best all-round species is stated to be *E. resinifera*; “it is much to be preferred to *E. globulus*, or to any other.” It grows slowly, although *E. globulus* makes a great show and promises wonders. (*Gardeners' Chronicle*, 7th January, 1899, p. 1.)

Interview with the Trappist Monks at Tre Fontane.—

"We have planted to our certain knowledge 200,000 Eucalyptus trees near to and about the Monastery." Some are 75 or 80 feet high. Measured girth, between 4 and 5 feet.

The monks are very pleased with the experiment and speak most highly of the change the trees have made in the area. They sell Eucalyptus oil, to which they attribute great virtues, but the interviewer thinks "they are on much more solid ground when they descant on the efficacy of their trees for draining purposes." (*Gard. Chron.*, 7th January, 1899, p. 1.)

SCHIMMEL & Co.—

Eucalypts in the Roman Campagna possess in a high degree the power of drying up marshy districts, and, therefore, indirectly provide active means for the reclamation of the land and for combating malaria. From this property of the tree it has been assumed that in a corresponding degree the leaves would show a comparatively high exhalation. Recent experiments by Griffon (*Compt. rend.*, 138, 157, 1904) have proved the error of this assumption; according to these, the exhalation of the Eucalyptus leaves, as compared with those of European trees, especially the Willow, Birch, and Ash, is twice to three times less powerful. For this reason, the draining action of the Eucalyptus tree, which has given rise to the name "Fever-tree," must be doubtless attributed chiefly to the property of producing in a very short time an abundant foliage. (Schimmel & Company's Report, April-May, 1904, p. 54.)

Eucalyptus oil is manufactured at Castelvechio, Italy (*E. globulus*). (Schimmel & Company's Report, April, 1907, p. 52.)

CYPRUS.

Eucalyptus in Cyprus. (Kew Report, 1878, 34.)

GREAT BRITAIN AND IRELAND.

1. Notes on individual species. The notes are from the *Gardeners' Chronicle*, (dates given), unless otherwise stated. No doubt some of the names require revision, particularly in view of the fact that some of the species are liable to change under cultivation.

E. coccifera Hook f.—*E. coccifera* at Powderham Castle, Devon, figured as a large tree (*Gard. Chron.*, 7th Feb., 1891, p. 176). This article gives a summary of the knowledge of Eucalypts in regard to their growth in Britain. See also p. 801, 30th June, 1888, for a figure, lacking however details of the operculum. At p. 798 this species, and also *E. cordata* and *E. urnigera* are usefully contrasted for British readers. Twigs of juvenile foliage of *E. urnigera* and *E. coccifera* are given from specimens sent by M. Naudin.

E. cordata Labill.—Flourishes at Castlewellan, county Down, Ireland. In the year 1878 the Earl of Annesley planted out about two dozen kinds of Eucalyptus, which did very well till the first severe frost set in, and killed all but *E. coccifera* and *E. urnigera*. Some of them are now more than 50 feet in height, and flower and seed regularly. The following have stood the severe winters of the past ten years: *E. cordata*, *E. gomphocephala*, *E. piperita*, *E. resinifera*, *E. rostrata*, *E. saligna*. (28th January, 1899, p. 61.)

E. ficifolia F.v.M.—In England. (7th August, 1920, p. 67.)

E. globulus L'Herit.—See issue of 24th December, 1887 (Suppl.), for a fine plate of a flowering spray grown in Britain. At p. 777 is a figure of a tree at Heyères, South of France.

E. globulus is 18 feet in height from seeds sown in January, 1897, grown off in heat, and planted out the same season. They have been unprotected ever since the frost, which registered 13 degrees, which had no effect on them whatever. Maidenhead, England. (7th January, 1899, p. 13.) The editor adds that if these Eucalypts are protected from the coldest winds, they are really hardy in the warmer maritime counties. At p. 19 it is stated that they live for a few years till a really severe frost comes along, and then they are all destroyed. Specific instances are given.

A tree in county Cork, Ireland, rather more than 13 years old and 61 feet high, was killed by 18 degrees of frost. There is a tree of *E. globulus* in the south-west part of the county of Cork, planted out from a small pot in 1880. At end of 1893, when it was killed by frost, it was 61 feet high. (14th January, 1899, p. 28.)

E. globulus at Torquay is a tree twenty years old, 50 feet high, "spreading circumference of the trunk at the base is $3\frac{1}{2}$ feet." There is a tree at Lutterworth, Leicestershire, planted out in May, 1895, now over 35 feet high; the stems have been bound for about 10 feet with hay bands each winter. (28th January, 1899, p. 61; 4th February, 1899, p. 76.)

E. Gunnii Hook f.—See 24th December, 1887, p. 781, where there is a figure of juvenile foliage and also a leaf and flowering twig (the latter not very satisfactory) of "*E. Gunnii*," thought at the time to be the "hardest species" in Britain.

A remarkable avenue at Brightlingsea Hall, near Colchester (25th March, 1899 p. 189), was planted from seed received from the Argentine. See also 1st April, 1899, p. 202.

E. urnigera Hook f.—The Whittinghame (Prestonkirk, Scotland) tree is figured at pp. 460, 461, 14th April, 1888; a flowering and fruiting twig, and also the tree, which is of considerable height. It is referred to as *E. Gunnii* by Rev. Dr. Landsborough, in *Trans. Bot. Soc. Edin.*, 1887, p. 21. See also p. 595 (G.C.). It is over 60 feet in height, 1888, having been planted in 1845 and cut down by frost in 1860. But see also p. 628. It yields fertile seeds. It has been variously referred to *E. viminalis* and *E. Gunnii*.

E. viminalis Labill.—In issue of 24th November, 1888, p. 597, we have a twig, in bud and flower, from the Isle of Arran, where it was looked upon as *E. amygdalina*, probably by Landsborough.

2. Notes on collections, or more than one species.

LANDSBOROUGH, D.—"Report on Australian and New Zealand Plants grown on the East Coast of Arran (Scotland)." (*Trans. Roy. Bot. Soc. Edin.*, xvi, 194.) Miscellaneous plants.

Also "Australian and New Zealand Trees in Arran."—*Trans. Bot. Soc. Edin.*, xvii, 21. Arran (off western coast of Scotland) has a comparatively equable climate. Notes on the cultivation of the following Eucalypts are given:—*E. alpina*, *E. globulus*, *E. Gunnii* (see *E. urnigera*, J.H.M.), *E. coccifera*, *E. ficifolia*, *E. amygdalina* (see *viminialis*, J.H.M.), *E. viminalis*, *E. polyanthema*, *E. cordata* var. *urnigera*, *E. pauciflora*.

CHRISTISON, D.—In *Trans. and Proc. Bot. Soc. Edin.*, Sess. lvii, p. 504 (1892), D. Christison quotes Rev. D. Landsborough as having grown the following species in the Isle of Arran, with the results stated:—*E. alpina*, *E. globulus*, *E. coriacea* (*pauciflora*), *E. viminalis*, *E. urnigera*. Particulars are also given of the Whittinghame Eucalypt, a species raised from seed about 1845.

"Eucalypts in Scotland."—(*Trans. Bot. Soc. Edin.*, xx (iii), 1896.)

Gardeners' Chronicle.—At Loch Hourn, Inverness-shire, opposite the Isle of Skye, *E. vernicosa*, the hardiest, but a mere shrub. "*E. coccifera*, *E. Gunnii*, and *E. urnigera* are nearly as hardy. *E. alpina*, *E. augustifolia* (sic.), *E. cordata* and *E. viminalis* come next, but *E. amygdalina*, *E. coriacea*, *E. regnans*, *E. rudis*, and *E. resinifera* seem not much more hardy than *E. globulus*, which is killed at Loch Hourn by 15 degrees or 20 degrees of frost." (*Gardeners' Chronicle*, 11th Feb., 1899, p. 84.)

The severe winter of 1894–5 practically exterminated Eucalyptus from the Island of Jersey. Many of the trees had attained to a very large size, and seemed to be thoroughly acclimatised in the island, where the average temperature is considerably higher, and the extremes of heat and cold considerably less than in England. (11th March, 1899, p. 145.)

The following are the species recorded as cultivated in the open-air in British gardens:—*E. coccifera*, *cordata*, *globulus*, *Gunnii*, *leucoxydon*, *urnigera*, *viminialis*, *vernica*, *calophylla*, *alpina*, *amygdalina*, *resinifera*, *coriacea*, *polyanthema*, *Staigeriana*, *submultiplinervis-pauciflora*, *stellulata*. For the hybrids, see *Revue Horticole*, 1903, p. 325. See also *Gardeners' Chronicle*, 7th May, 1881; 2nd February, 1884; 26th November, 1886; 30th June, 1888. (*Gardeners' Chronicle*, 1st July, 1905, p. 13.)

The following particulars concerning Eucalypts in Ireland, were given to me by Sir Frederick Moore, Director of the Botanic Gardens, Glasnevin, Dublin, under date 4th March, 1918:—

In accordance with my promise I have had notes made in different districts of the special Eucalyptus which are hardy in Ireland. I got Mr. Walpole's in county Wicklow, a favoured locality, Sir John Ross, of Bladensburg, Rostrevor House, county Down, a particularly favoured locality, and the gardens here at Glasnevin, a typically cold and exposed locality, but not so bad as parts of the midlands where no Eucalyptus is really hardy. As a guide I may inform you that here we had last year the severest winter since 1879; the frost lasted until April. We had repeated snow, and we had over 20 degrees Fahr. of frost. The frost also lasted for a fortnight at a spell, so the plants were highly tried. Perhaps it may also be of further assistance to you if I state that I do not consider *Eucalyptus globulus* as a hardy species in Ireland. It will live in favoured localities; in others for five years, about its limit. Those that I consider to be absolutely hardy are those that have lived out at Glasnevin, all of which have also lived out in any districts of Ireland where this genus will grow. The list gives the species which may absolutely be relied on. I consider others are all doubtful. Where I could ascertain them, I give you the dimensions of the specimens. My plants are

all comparatively small. Our experience here in this country is that until the plants are fully established, that is to say, four or five years planted, they are much more liable to injury by frost. Wind is the great enemy. In many cases they grow so rapidly that a gale either splits them or blows them down, hence they have to be frequently cut back in their young state until fully established and well rooted. The names I take to be fairly accurate, but there is confusion between *Stuartiana* and *Stuartia*.

There are scattered through the country several isolated fine specimens of *globulus*, *Gunnii* and, possibly, *urnigera*. The plant which is at Rostrevor under the name *Muelleri* is a very fine plant.

Hardy.—County Wicklow :—*E. amygdalina*, *coccifera*, *pulverulenta*, *Stuartiana*, *urnigera*, *viminialis*. Rostrevor House, county Down :—*E. amygdalina* (35 feet), *cinerea*, *coccifera* (70 feet), *cordata* 30 (feet), *globulus* (50 feet), *Gunnii*, *Macarthuri*, *Muelleri* (50 feet), *obliqua*, *pauciflora*, *pulverulenta* (30 feet), *stellulata*, *Stuartiana* (20 feet), *urnigera* (20 feet), *viminialis*, *vernica*. Glasnevin :—*E. amygdalina*, *coccifera*, *Gunnii*, *Macarthuri*, *obliqua*, *pulverulenta*, *regnans*, *urnigera*, *viminialis*, *vernica*.

Not hardy.—County Down :—*E. alpina*, *gigantea* [*delegatensis*], *hæmastoma*, *leucorylon*, *resinifera*, *rostrata*. Glasnevin :—*E. rubida*, *paniculata*, *Smithii*, *citriodora*, *Stuartiana*, *punctata*, *globulus*, *Maideni*.

Hardest species. —*E. amygdalina*, *cinerea*, *coccifera*, *cordata*, *Gunnii*, *Macarthuri*, *obliqua*, *pulverulenta*, *regnans*, *urnigera*, *vernica*, *viminialis*.

Following is an extract from "The effect of the frosts of the winter of 1916-17 on vegetation," by E. A. Bowles, M.A., F.L.S., V.M.H., in *Journ. Roy. Hort. Soc.*, xliii, February, 1919 :—

An asterisk following the name of the locality shows that the plant was grown against, or close to, a wall. When a numeral follows the name of the locality, it shows the number of years the plant has been in its present position. The extent of damage, or escape from injury, is shown by the use of the initial letters of the following words in italics :—*K* = Killed; *G* = cut down to the Ground level; *B* = Badly injured; *S* = Slightly injured; *U* = Uninjured.

Eucalyptus, all species. *K*, Crawley; *S*, Abbotsbury.

E. acervula. *S*, Rostrevor.

E. alpina. *K*, Rostrevor.

E. amygdalina. *K*, Headfort, Leonardslee, Wakehurst; *U*, Rostrevor.

E. Beauchampiana. *K*, Leonardslee 4.

E. cinerea. *K*, Enfield (also *B*); *U*, Rostrevor.

E. citriodora. *G*, Glasnevin.

E. coccifera. *K*, Hargham 6 (slight shelter); *G*, Dorking 12, Hargham 7 (sheltered); *B*, Stow; *S*, Glasnevin, Wakehurst; *U*, Enfield 8, Rostrevor.

E. cordata. *K*, Headfort, Leonardslee 4; *B*, Enfield 10; *U*, Rostrevor.

E. coriacea. *K*, Headfort; *B*, Wakehurst.

E. delegatensis (*gigantea*). *K*, Rostrevor.

E. ficifolia. *K*, Abbotsbury.

E. globulus. *K*, Downham, Leonardslee 4, Osterley, Sherborne 11, Slough 3, Wakehurst; *G*, Ashford (1 foot diameter), Enfield 1; *U*, Bosahan (80 feet high), Rostrevor.

E. Gunnii. *K*, Aldenham (also *B*), Aldersey (also *S*) 5, Hayling Island 6; *G*, Colesborne 10; *B*, Carnarvon 50, Glasnevin, Hargham (cut to stem, shot in May), Exeter 16; *S*, Lanarth 14, Wakehurst, Whitby 18; *U*, Enfield.

E. hæmastoma. *U*, Rostrevor.

E. leucorylon. *B*, Rostrevor.

E. Macarthuri. *K*, Wakehurst; *U*, Rostrevor.

E. Maideni. *K*, Kew 5; *U*, Rostrevor.

E. Muelleri. *K*, Headfort; *U*, Rostrevor, Wakehurst.

E. obliqua. *S*, Rostrevor (one *K*); *U*, Enfield 3, Uckfield.

E. paniculata. *K*, Glasnevin.

E. pauciflora. *U*, Rostrevor.

- E. pulverulenta.* K, Enfield 6, Lanarth 10 (also B); S, Islesworth 8.
E. resinifera. G, Glasnevin; B, Rostrevor.
E. rubida. K, Glasnevin, Wakehurst.
E. Smithii. K, Glasnevin.
E. stellulata. U, Rostrevor.
E. Stuartiana. K, Hargham 6, Kew 5; G, Glasnevin; B, Enfield 10.
E. urnigera. K, Hargham 5, Hayling Island 6 (and B), Headfort (two plants U); G, Tortworth 7; S, Glasnevin, Enfield, Lanarth 10, Leonardslee 5 (injured in 1908), Lyndhurst 6, Wakehurst; U, Rostrevor.
E. vernicosa. U, Enfield, Rostrevor, Uckfield, Wakehurst.
E. viminalis. K, Headfort, Leonardslee 5; G, Glasnevin (also B).
E. whittinghamensis. K, Aldenham (also B); G, Colesborne 10; S, Enfield 12, Glasnevin, Kew 20; U, Wakehurst 12.

"Tenderness of Eucalypti" (in Cumberland).—*E. coccifera*, *E. urnigera*, *E. Muelleri* (from Tasmania). (*Gard. Chron.*, 14th August, 1920, p. 85.)

INDIA.

The Forest Reports issued by the central and local Governments in India will furnish many details in regard to the success, or the reverse, of Eucalyptus in that Empire. See also Kew Report for 1879, p. 16, on Eucalyptus in India.

Mr. J. E. O'Connor wrote a report (fep., 8 pp., Dept. of Revenue, Agriculture and Commerce—Forests, India, 1874, printed 22nd August, 1876) entitled "Note on the cultivation of the *Eucalyptus globulus* and other Australian Gums in India."

This is a useful historical résumé, chiefly dealing with *E. globulus*, though a few other species are touched upon. After speaking of the extensiveness of the test, he goes on to say, "The experiment has not been particularly successful, and, in fact, it may be said that the trees have lived only in two places—the Nilgiris and Raniket."

Then we have a note to the same Department for the year 1876, but actually printed before Mr. O'Connor's report. It is entitled "On the cultivation of the different species of Eucalyptus in Northern India," by D. Brandis, Inspector-General of Forests.

He says his remarks should be read in connection with those of Mr. O'Connor. He recommends that no time or money should be wasted on experiments with *E. globulus* on the plains of India. The desirability of experimenting with other species is discussed, but Mr. Gamble's notes (below) seem to render a further abstract of Dr. Brandis' paper not now necessary.

"Cultivation of the Eucalyptus in Northern India," is an 8vo pamphlet of twenty-three pages, published by the Government Central Press, Calcutta, on 23rd January, 1882. It consists of a mass of official correspondence (chiefly military), and includes the reports of Mr. O'Connor and Dr. Brandis already referred to. The correspondence has now only historical value.

J. S. Gamble, in his "Manual of Indian Timbers" (1902 ed.), p. 352, says:—

It is probable that the earliest attempts to grow the Eucalypts in India were those made on the Nilgiri Hills in 1843 by Captain Cotton, who planted *E. globulus* at Ootacamund on the estates known as Gayton Park and Woodeot. He was followed in 1856 by General Morgan, and the first Government

plantation was made in 1862. (D. E. Hutchins, in this "Report on measurements of Australian trees on the Nilghiris, Madras, 1883.) There are now very large areas, partly belonging to the Government, partly to private persons, on the Nilghiris and the other hill ranges of south India and on the mountains of Ceylon, planted with Eucalypts and flourishing well, capable of easy reproduction, and supplying a cheap fuel and some building timber. In other parts of India, Eucalypts have not been so successful as on the Nilghiris, the chief localities where they have thriven being Abbottabad in the hills of the Punjab, and Ranikhet and Almora in Kumaon (on this see papers in "Indian Forester," vol. ii, by J. E. O'Connor and Sir D. Brandis). In some places in the plains of northern India, such as Lahore, Changa-Manga, Dehra Dun, Saharanpur, Lucknow, fairly grown specimens may be seen; and the Canal Department have made plantations, especially near Hardwar.

The species are very difficult of identification, but the following are a few of the chief species I have observed on the Nilghiris and identified with tolerable certainty:—

1. *E. amygdalina* Labill.
2. *E. obliqua* L'Her.
3. *E. siderophloia* Benth.
4. *E. crebra* F.v.M.
5. *E. pulcrudenta* Sims (*E. cinerea* F.v.M.—J.H.M.).
6. *E. globulus* Labill.
7. *E. longifolia* Link and Otto.
8. *E. robusta* Sm.
9. *E. viminalis* Labill.
10. *E. calophylla* R.Br.
11. *E. corymbosa* Sm.

In the plains of South India, *E. tereticornis* Sm. and *E. rostrata* Schlecht are occasionally seen in cultivation.

In the north of India, according to Brandis ("Indian Forester," ii, 139), *E. amygdalina* Labill, *E. viminalis* Labill, *E. resinifera* Sm., and *E. rostrata* Schlecht. are the chief species found.

At Dehra Dun only two species really thrive, viz., *E. tereticornis* Sm. and *E. citriodora* Hook.

A good deal has been written, urging the more extended cultivation of Eucalypts in India, but until some species is found which, with a minimum of trouble, can be grown and will thrive, on poor, barren soils where indigenous trees are wanting, there seems no object in spending money on their further growth.

Following are some notes on species in alphabetical order:—

E. amygdalina Labill.—Cultivated in the Nilgiris, and very common and conspicuous. Locally this has passed under the name of *E. piperita*. (Gamble, p. 354.)

E. calophylla R.Br.—Cultivated on the Nilgiris about Ootacamund and in Coonoor Peak Plantation. One of the finest species, and very ornamental. (Gamble, p. 354.)

E. cornuta Labill.—Major McRae reports that "most of the plants of *E. cornuta*, *E. rostrata* and *E. latifolia* are doing so well that I feel certain they could be grown for road-side trees and may pay the cost of cultivation on a large scale for timber." See Kew Report for 1881, p. 12.

E. globulus Labill.—By far the fastest growing species cultivated in the Khasia Hills, and next to it comes *E. rostrata* (Gustav Mann). See Kew Reports for 1876, p. 7, and 1879, p. 16.

Dr. E. Bonavia stated that *E. globulus* grew well at Lucknow until torrential rains came one monsoon and the trees got too wet at the roots and perished. He sounds a warning in regard to the employment of this tree for draining marshy land.

The only species he succeeded with was *E. maculata* var. *citriodora*. (See *Gard. Chron.*, 1885, p. 762; *Pharm. Journ.* (3), xv, 1069; and *Gard. Chron.*, 18th March, 1899, p. 163.)

The only place in India where he saw *E. globulus* thrive is on the Nilgherry Hills at Ootacamund.

The chief Nilghiri plantations, which may now be called forests, as most of them are in their second term of rotation, are those of Norwood, Aramby, Bathri, Rallia, and Coonoor Peak (there are many others, and many private forests), and these were described fully in Mr. D. E. Hutchins' work already referred to. Mr. Hutchins found that the average rate of growth in quantity of material was 12 tons per acre per annum. The present Working Plans are all, or nearly all, for coppice under standard, and the rotation for coppice has been settled at ten years. The reproduction has been very good; and to anyone not accustomed to the tree and its power of growth, the first view of such a forest as that of Bathri or Coonoor Peak seems little short of marvellous. (Gamble, p. 353.)

E. globulus oil is manufactured in Madras at Ootacamund, Lovedale, and Coonoor. (Hooper in *Chem. and Drugg.*, lxx, 208, 1907.)

E. leucoxydon F.v.M.—This species has succeeded admirably at Abbotabad, Punjab, India (Gamble). Indian foresters should enquire if there has been the common confusion with the Ironbark (*E. sideroxydon* A. Cunn.) in this case.

E. maculata Hook. var. *citriodora* F.v.M.—It has taken very kindly to Bengal, and being sweeter than *Aloysia citriodora*, Sweet-scented Verbena, besides growing to a good size, ought to make it a very popular plant, and one that no house should be without. See Kew Report for 1882, p. 20.

E. marginata Sm.—Cultivated on the Nilgiris, but does not do well. (Gamble, p. 353.)

E. melanophloia F.v.M.—For its growth in India see Kew Report, 1878, p. 36.

E. obliqua L'Her.—Cultivated in the Nilgiris, especially in Aramby, Rallia, and Coonoor Peak plantations. (Gamble, p. 354.)

E. rostrata Schlecht.—Major McRae reports concerning Sind, "Most of the plants of *E. cornuta*, *E. rostrata*, and *E. laifolia* are doing so well that I feel certain they could be grown for road-side trees and may pay the cost of cultivation on a large scale for timber." See also Kew Reports (for Assam), for 1879, p. 16; (for India) 1879, p. 23; 1879, p. 16; 1881, p. 12.

E. tereticornis Sm.—Cultivated in various places on the Indian plains. (Gamble, p. 354.)

STRAITS SETTLEMENTS.

For *E. siderophloia* Benth. and *E. Baileyana* F.v.M. in the Straits Settlements, see Kew Reports, 1879, p. 16.

JAVA.

The following is a translated copy of a letter from the Government Secretary, Batavia, to the Consul of the Netherlands, Sydney, *re* a proposal to plant *Eucalyptus* trees at Tanjong Priok, Batavia, to avert epidemics of fever on board vessels there. It appeared in the Sydney newspapers of 23rd November, 1887. It is a valuable report, although it dates from a period prior to many important discoveries as to the role of certain mosquitoes.

Batavia, 20 October, 1887.

The Governor-General, gratefully acknowledging the interest shown by you, nevertheless decides not to accept your well-meant offer to send a supply of young plants of *Eucalyptus globulus* to be planted at Tanjong Priok with the object of improving the sanitary condition there. All attempts to introduce this species of trees into this country have shown that they will only grow at an altitude of 3,000 feet and above.

The Government has meanwhile planted liberally *Eucalyptus alba* and sunflowers in the neighbourhood of the harbour, and is still continuing to do so steadily.

Seeing that the *Eucalyptus alba*, however, grows and thrives only in the higher parts of Tanjong Priok, and less successfully in the lower in the immediate neighbourhood of the docks, attention is being given to other quick-growing trees for planting there, and in particular to a species of *Eucalyptus* from the island of Flores, from which good results are anticipated.

Meanwhile as regards the sanitary condition of the harbour, this has been much improved since the time when it was first made use of, as can be shown by the favourable state of health on board the flagship, which has now its fixed moorings in the outer harbour, and also on board the European and Netherlands India steamers, which continue to use the harbour; and, further, by the fact that the same sailing ships frequently come into this harbour.

The shore marshes undoubtedly have an unfavourable effect, but this is experienced along the greater part of the north coast of Java, and, as has been said, precautions have already long been taken against it.

Although, however, in some degree the cases of fever which occur may be attributed to the marshes, to a great extent the fault lies with the ships' crews themselves, who generally, by careless clothing and living, by sleeping on deck, by the excessive use of fruit, and by resorting to the shore with its attendant extravagances, frequently bring the sickness upon themselves.

Again, it frequently happens that the captains of vessels overwork their crews in discharging cargoes, not taking into consideration the effects of the climate, and paying little attention to sick men, giving them no medicine.

Another source of sickness, and one easily prevented, is taking in freshly-excavated wet ballast. Ships which had previously no sickness on board have had many sick after their departure, caused by the exhalations from the ballast, the cases disappearing after the ballast was got rid of in order to load cargo. This source of sickness can be avoided by taking ballast not recently excavated, but which has for some time been exposed to the air, or by getting ballast from Batavia, as some do. Captains have it in their power also, if not entirely, to remove, yet in a great degree to limit, chances of sickness by seeing to a speedy discharge of their vessels. By present arrangements of the docks a vessel can discharge 250 to 300 tons a day, so that a prolonged stay can be avoided.

From the foregoing it will appear to you that the evil reputation which some have given to Tanjong Priok is not deserved, and the Governor-General considers it of the utmost importance that you give as much publicity as possible to the foregoing, and that you will use every exertion to replace this unfavourable opinion by a better one.

By bringing the above to your notice, with thanks for the interest shown by you, I have the honour to comply with instructions received.

The first Government Secretary.

(Signed) SWEERTS.

To the Consul of the Netherlands for New South Wales, Sydney.

EGYPT.

1. GASTINEL BEY.—“Memoire sur l'Eucalyptus globulus d'Australie.”

2. MAILLARD DE MARAFY.—“L'Eucalyptus: nouvel emploi industriel.” (L'Egypte Agricole, 1870.)

Papers written during the excavation of the Suez Canal.

ZANZIBAR.

For a note on the cultivation of *E. maculata* var. *citriodora* in Zanzibar, see Kew Report for 1879, p. 16.

RHODESIA.

Notes on some species which have been tested at the Rhodes Estate, Matoppos, will be found in the *Rhodesia Agric. Journ.*, vol. xv, p. 143 (April, 1918).

As regards Southern Rhodesia, there are notes on *E. saligna*, *E. tereticornis* and *E. maculata* var. *citriodora*; also references to literature concerning the acclimatisation of Eucalypts, in “Forestry in Southern Rhodesia,” being a statement prepared for the British Empire Forestry Conference, London, July, 1920.

TRANSVAAL.

(See also Cape Reports.)

There are important plantations belonging to the mining companies in the neighbourhood of Johannesburg and Pretoria, all planted within twelve years, “the trees ran from 15 to 40 feet high, the older portions supplying good pit wood, girthing from 12 to 18 inches, and from 20 to 25 feet long; these were merely thinnings.”

The predominant species planted were *E. globulus*; *E. viminalis*, *E. resinifera*, *E. robusta*, and *E. diversicolor* have also been tried. However, the two species which appear to do best are *E. globulus* and *E. viminalis*, each attaining great size in a few years. For hardiness I think *E. viminalis* is preferable . . . One thing I specially observed, however, was that *E. viminalis* seemed to be much hardier than *E. globulus*.

In the winter of 1894 there were frequently 15 to 20 degrees of frost. The plantations were all situated on elevations varying from 4,500 to 6,000 feet above sea-level. (Chas. S. France, in *Gard. Chron.*, 8th April, 1899, p. 210.)

SCHIMMEL & Co. (Report of October, 1909, p. 67) report on a sample of *E. globulus* oil from the Transvaal.

There are occasional articles in the South African journals on the cultivation of Eucalypts, but it is somewhat disappointing that our most valuable species make but little progress in South Africa. This may be contributed to by various causes, *e.g.*—

1. The revision of nomenclature and the general overhauling the genus has received during the last quarter of a century.
2. The fact that planting is mostly in the vicinity of the mines on the Rand, which are at such an elevation that but few species flourish.
3. Little systematic attempt has been made to co-ordinate the climatic zones of South Africa and Australia, with the view to a proper system of acclimatisation of species.

MAURITIUS.

For a note on *E. calophylla* R.Br., see Kew Report for 1878, p. 36.

E. maculata var. *citriodora* oil from Mauritius. See *Bull. Imp. Inst.*, xi, 48 (1913).

WEST TROPICAL AFRICA.

In Kew Report for 1881, p. 12, it is stated (as expected) that *E. globulus* does not succeed, but that "*E. Baileyana* thrives wonderfully well, also *E. acmenioides* and *E. resinifera*." Years ago *E. globulus*, the pet species, was sent to all parts of the world, often with little consideration as to whether it had the remotest prospect of succeeding. For *E. globulus* in West Africa, see also Kew Reports for 1873, p. 5, and 1881, p. 12.

MOLONEY, A.—"Sketch of the Forestry of West Africa." (Sampson Low, 1887.) At p. 224 is an account of experimental Eucalyptus plantations.

A. ZIMMERMAN discusses the question of planting Eucalypts for the purpose of draining the soil, in German tropical colonies. While urging experiments, he suggests that *E. rostrata*, *E. robusta*, *E. resinifera*, and *E. cornuta* may be suitable, and eliminates *E. globulus*. See *Der Pflanze*, ix, 107 (1913).

At Amani (German colony of South West Africa ?) of all the Eucalypts planted there *E. citriodora*, *maculata*, *resinifera*, and *amygdalina* have made the best growth. *E. corymbosa*, *robusta*, *goniocalyx*, *microcorys*, *paniculata*, *rostrata*, *melliodora*, *salubris*, *pitularis*, also made good wood. (*Der Pflanze*, x, 54 (1914).)

ARGENTINE.

ABERG, E.—"Irrigacion y Eucalyptus," 8vo, p. 103, Buenos Aires, 1874. This was a pioneer work, and the following touching letter to me, dated 16th June, 1902, from this old pioneer, is full of instruction:—

I had once, as it turned out later, the very foolish idea to form in this country, so little civilised it then was, a small botanic garden with special regard to the genus Eucalyptus. In my endeavours to introduce and promote the cultivation of these magnificent fast-growing trees on its vast plains without a tree to shade or shelter for thousands and thousands of square miles, I had of course to make a selection of those which seemed most liable to adapt themselves to existing conditions of climate and soil. My aim was accordingly to collect all the species I could get hold of and by cultivation ascertain their resistance to cold, drought, saline soil, of which there is much in the south, &c.

But besides this there was another motive of nearly equal importance, that is to say, to try by a scientific determination to do away with the existing great confusion of species, the seeds of many of these having come with nothing but their vernacular names and other errors. To mention but one instance. I had got one labelled *populifolia*, which later on I was able to determine to be *polyanthemos*, one of the most suited to this country, as I found it to be the only one self-sowing. All that was many years ago in the sixties and early seventies of last century.

I was at that time in frequent correspondence with the Baron F. von Mueller, and he had the kindness to send me seeds of some of the rarer kinds; from Vilmorin in Paris I obtained all he was able to procure, and still others I got from some Italian nurserymen here, in all a splendid collection of about ninety species. Now, after the lapse of more than thirty years, only fancy what they might have been! Quite the thing, I suppose, from which to collect herbarium specimens for you; another source for me to deplore my misfortune.

Well, circumstances over which unhappily I had no control obliged me to leave for Sweden, my native country. I need not tell you with what regret I left behind my tender plantations. At my return after six years absence I found everything destroyed. I could at first not even conceive how they had been able to cause such a complete ruin, but soon it became apparent that they had allowed large herds of cattle to trample down and browse on the tender plants. Scarcely a few stumps were left, and in profound disgust I had to abandon the whole concern, as I was already then too old to begin over again. Such was the state of this country at the time, and my case is just the common lot, it seems, of all promoters of a new scheme, which in general has the only, but great, fault of being too early. At present things are much altered for the better by the progress of civilisation, in which this people have of late made great strides, and twenty years have done wonders. There are now magnificent municipal gardens, and a very energetic and clever director thereof, Mr. Thays, whom I will see, as he may perhaps be able to comply with your wishes.

I am myself very old indeed, nearly eighty, and besides broken down by several domestic bereavements which have befallen me in my old age in a sequence without interruption.

In spite of the regret for the loss and destruction of my scientific plantations, I have still had the satisfaction, before I die, to be apprised of the most important fact, that in the big plain which stretches from the Atlantic until the Cordilleras, there scarcely is now a single estancia without a forest plantation of *Eucalyptus* amounting in many cases to several thousands.

To know that I myself have played a part in this progress of vast improvements is certainly something and very pleasing, although the plantations, being for the most part of a single species, viz., the *globulus*, have not been done with the selection and variety I wished and intended to promote.

BRUNEL.—“Sobre el *Eucalyptus globulus*.” *Revista medico quirurgico*. Buenos Ayres, 1876.

CONSUL BAKER (*U.S. Consular Reports*, Nov. and Dec., 1882, p. 403) gives a glowing account of the success which has attended the planting of *Eucalypts* in the neighbourhood of Buenos Ayres, and singles out *E. globulus* for particular recommendation. See, however, Mr. Aberg's remarks.

BRAZIL.

NAVARRO DE ANDRADE.—“Manual do Plantador de *Eucalyptos*.” S. Paulo (Brazil), 1911. A well got-up 8vo volume of 343 pp., well illustrated.

The cultivation has made remarkable strides in the State of San Paulo, and perusal of the book and conversation with the author during his visit to Sydney in 1913 show me how advanced is the study of species and silviculture in Southern Brazil.

WEST INDIES IN GENERAL.

“The culture and uses of the species of *Eucalyptus*.” See *West Indian Bulletin* (the journal of the Imperial Department of Agriculture for the West Indies), iv, 145 (1904).

It mainly consists of an abstract of Mr. McClatchie's work. At p. 166-175 is information in regard to “*Eucalypts* in the West Indies.”

E. globulus will only grow at considerable elevations, but a number of species are enumerated as flourishing in the lowlands of Jamaica, British Guiana, Trinidad, Dominica, and Antigua, not only as shade or shelter trees, but also as a source of fuel. *E. microtheca*, *E. robusta*, *E. citriodora*, *E. rostrata* and others were tried.

"Eucalyptus in the West Indies" (*ib.*, x, 125, 1910). Additional experience has been gained, and notes are published on results obtained at St. Lucia, Dominica, Montserrat, Antigua, St. Kitts, Grenada, St. Vincent, Virgin Islands, and Barbados.

Neither paper readily bears abstraction, and both should be referred to.

JAMAICA.

The Gums (Eucalyptus) get very much blown, and seldom look well except in clumps, where, for the first four or five years, they are sheltered on the outside by other trees. (See Kew Report for 1879, p. 16.)

E. globulus Labill.—"The first batch of *E. globulus* seeds were imported in 1869; the seedlings were planted out at the Cinchona plantations seven years ago. Some of these now measure upwards of 60 feet in height, with the trunks 3 feet in girth, five feet above the ground. Thus in ten or twelve years large timber trees are producible. No more valuable tree could be planted on our barren hills that are readily accessible to the plains." (Kew Report for 1877, p. 30.)

E. maculata Hook., var. *citriodora*—"One of the best trees for the plains here is *E. citriodora*. You can safely recommend this for warm climates. Its foliage, as its name denotes, is beautifully fragrant, the tree itself is fast growing and hardy." (Kew Report for 1882, p. 21.)

UNITED STATES.

This is only a very brief list of the Eucalyptus literature published in the United States, but it may be suggestive.

COOPER, ELLWOOD—"Forest Culture and Eucalyptus trees." Sm. 8vo, p. 237, San Francisco, 1876.

This is based on a lecture he delivered at Los Angeles in 1875 (pages 9-40), but it mainly consists of some writings of Mueller's. The details contained in the lecture are but slight, but the writer is one of the pioneers of Eucalyptus planting in California on a large scale, having set a practical example at his ranch near Santa Barbara. For an account of Mr. Cooper's results, see McClatchie.

LYON, W. S.—"Some notes on the genus Eucalyptus." *Th'rd Biennial Rep., California State Board of Forestry*, 1890. Chiefly deals with the planting of them in California. Special allusion is made to *E. cladocalyx* (*corynocalyx*) (Sugar Gum), *E. diversicolor* (Karri), *E. marginata* (Jarrah), *E. Gunnii* (White Swamp Gum).

U.S. CONSULAR REPORT, 1894—"Limit of Cold Endurance of Eucalypts." See abstract in *Gard. Chron.*, 11th March, 1899.

STEARNS, R. E. C.—"The *Eucalyptus globulus* in California." *Western Lancet*, i, 696; *Pharm. Journ.* (3), iii, 603. An account chiefly dealing with its medicinal properties.

"Eucalyptus Oil in Southern California." *Bull. of Pharmacy*, June, 1892.

KINNEY, ABBOT.—"Eucalyptus," Los Angeles, 1895, 8vo, p. 298. With a number of plates (twenty-nine in my copy), chiefly of fresh flowering twigs. The author takes each species grown in California seriatim, and has chapters on Eucalyptus for bee feed, barks, sanitary (instances of improved health attributed to Eucalyptus planting—malaria is chiefly referred to), Eucalyptus medicinally, &c., &c.

"Eucalyptus," in Bulletin No. 11, Div. of Forestry, U.S. Dept. of Agric.

McCLATCHIE, A. J.—"Eucalypts Cultivated in the United States." U.S. Dept. of Agric. Bur. of Forestry, Bull. No. 35 (1902).

This is the most important work on the genus hitherto published in the United States. He says it is reported that they were introduced into California in 1856 by Mr. Walker, of San Francisco, fourteen species being planted. In 1861, Mr. Stephen Nolan, a pioneer nurseryman of Oakland, Cal., greatly extended the cultivation. Then comes the work of Hon. Ellwood Cooper, who greatly developed the cultivation, from the early seventies. I have before me "Forest Culture of Eucalyptus trees" by him. See p. 393. He mentions other American pioneers. At p. 42 he discusses Eucalypts "as improvers of climate," giving the usual pros and cons.

The most valuable and most extensive part of the work is that which deals with the species grown in America, and it is the most authoritative work on the subject, its value being greatly enhanced by its abundant and admirable illustrations.

The Forest Service of the U.S. Department of Agriculture has issued Circular No. 59 (19th January, 1907), being a "Forest Planting Leaflet" on Eucalypts. *E. globulus* is taken as the leading species, but *E. rostrata* and *E. corynocalyx* (*cladocalyx*) are also referred to, and useful notes for the propagation of the species in the United States are given.

INGHAM, NORMAN D.—"Eucalyptus in California," being Bulletin No. 196 of the Agric. Expt. Station, Berkeley, Cal., 1908, p. 114. Useful, much on the lines of McClatchie, but introducing new points.

KREMERS, E.—"Californian Eucalyptus Oil." He mentions, *inter alia*, the names of the principal producers of this oil, from which it appears that it is principally distilled in the districts of Alameda, Los Angeles, and Garden Grove. He is still engaged on the chemical properties of Californian Eucalyptus oil, and will report further. (*Pharm. Review*, xxvi, 177, 1908.)

WESTERGAARD, C., Jnr.—"Eucalypts Cultivated in the United States." *Forestry Quarterly*, vol. vii, No. 3, p. 280. He takes cognisance of forty-two species, and gives notes on trees grown in Californian localities. Most of the species appear to have been imperfectly tested.

MARGOLIN LOUIS.—“Yield from Eucalyptus Plantations in California.” California State Board of Forestry, Bull. No. 1, Sacramento, 1910, 8vo, p. 38. It chiefly deals with the yield of *E. globulus* from a number of stations. The other species are relatively unimportant.

ZON, RAPHAEL, and BRISCOE, JOHN M.—“Eucalypts in Florida.” U.S. Dept. of Agric., Forest Service, Bull. No. 87, 1911.

Most of the United States literature on Eucalyptus refers to California, and this publication has a special value, if only for the reason that it refers to Florida. It is, however, valuable on its own merits. The date of the introduction of Eucalypts into Florida is quoted as 1878, when Rev. A. H. White planted six or eight species at Georgiana, on Merritt's Island. They soon appeared in seedsmen's catalogues, and the largest trees of the early sowings are *E. goniocalyx*, *E. resinifera*, and *E. robusta*, though *E. rostrata* and *E. amygdalina* succeeded well. The record of introduction of various species is useful, and Florida experience is not on all fours with that of California.

A list, and particulars of sixteen species growing in Florida is given. The species most promising, tested so far, are *E. resinifera*, *rostrata*, *viminalis*, *robusta*, and *tereticornis*. At the same time it is stated that the planting of Eucalypts in Florida is still in the experimental stage.

Brachychiton discolor F.v.M.

A Lace-bark Tree.

(Family STERCULIACEÆ.)

Botanical description.—Genus *Brachychiton*, see Part LXII, p. 39.

Botanical description.—Species *discolor* F.v.M., in Mueller's *Fragmenta Australiensis*, i, i (1858).

A tall tree, the young shoots tomentose. *Leaves* very broadly cordate, nearly orbicular, shortly acuminate, angular, or very shortly and irregularly five or seven-lobed, glabrous above, white underneath, with a very close tomentum, mostly 4 to 6 inches diameter. *Flowers* (if correctly matched) like those of *B. ramiflora*, and similarly clustered. *Calyx* $1\frac{1}{2}$ to 2 inches long, broadly campanulate, tomentose inside and out, divided to the middle into broad lobes with induplicate margins. *Follicles* very shortly stipulate, 4 to 6 inches long, acuminate, densely rusty-tomentose outside (as *Sterculia* in B. Fl., i, 228).

Botanical Name.—*Brachychiton*, see Part LXII, p. 39. The specific name *lurida* is in allusion to the dull, lurid appearance of the flowers.

Vernacular Name.—It is often called "Sycamore." The name "Sycamore" is given to our tree because of a fancied resemblance of its wood to that of the Sycamore (*Acer Pseudo-platanus*) of Europe. The other local name, Hat-tree, is used because the fibre from the inner bark is used in making hats, but this will be alluded to presently. The word "Kurrajong" is from an aboriginal source (often spelt Coryjong in old books), and signifies "fibre." All the *Sterculias* and *Brachychitons* are useful fibre plants, and the name Kurrajong is applied generally to many of them. It as fairly belongs to the Hat-tree as to any of them, but although I have made diligent inquiry I cannot trace any districts in which our tree is called "Kurrajong." Perhaps my readers can give the information on the subject, as it is often difficult to trace local names, but also to state in what districts they stand current. The matter will become increasingly difficult, as some of our native trees, formerly well-known to settlers in particular districts, become scarce, and the existence and names of them have been forgotten.

Aboriginal Name.—"Stunga" of the aborigines of the Richmond and Clarence Rivers, New South Wales, according to the late Mr. Charles Moore. Because the aborigines used the wood for shields, it is one of those known as Heilaman-tree.

Aboriginal plant names are becoming increasingly difficult to procure, chiefly because the aborigines are becoming scarce, as well as the plants. When the aborigines were numerous, knowledge of our native plants was in a very different state from what it is to-day, and so it is that many of the aboriginal names for trees, &c., given in the older works of Australian travel and exploration, cannot be associated with the plants to which they refer, and, therefore, are merely interesting to the philologist as combinations of syllables. The late Sir William Macarthur did much to record the native names of plants found in what I may term the "home counties," and he took steps to assign the botanical names wherever he could. Aborigines are difficult to deal with, because the answers they give in reply to questions on the subject are often liable to be misunderstood, for they are not plant names at all. It requires much tact and knowledge of the blacks to bring out the plant knowledge they possess, and since they are coming more frequently into contact with the whites, they find that there is less and less necessity for such knowledge of the uses of plants as was indispensable to them in their wild state. This is, of course, a digression, but it is a reasonable one, and I venture to express the hope that residents in the country will interest themselves in this question of local names.

Synonym.—*B. discolor* F.v.M., *Fragm.*, i, i (1858).

Leaves.—Attention is invited to a short paper "Notes on *Sterculia* (*Brachychiton*) *lurida* and *discolor*" by the present writer and the late Mr. E. Betcher in *Proc. Linn. Soc., N.S.W.*, xxiii, p. 159 (1898). Reference was made to a recent revision of the genus *Brachychiton* by Professor A. Terracino ("Le specie de genere *Brachychiton*," *Bolletino del R. Orto Botanico di Palermo*, Anno 1, Fasc. ii, 1897), and from our paper the following extracts are taken:—

"The only difference indicated in the *Flora Australiensis* is in the leaves, which are 'angular and very shortly and irregularly five or seven lobed and white underneath, with a very close tomentum' in *S. discolor*, and 'deeply five or seven lobed and pubescent underneath but not white' in *S. lurida*. The flowers and fruits appear to be exactly the same in both species. The difference in the leaves in the two extreme forms is so great that nothing short of the fact that we have seen both forms of leaves growing on the same tree could induce us to adopt Professor Terracino's view of uniting the two species.

The tall trees of *S. lurida* in the Sydney Botanic Gardens are about forty years old, and were probably planted shortly after Mr. Moore's discovery of the species in 1858, from seeds or young seedling plants brought by him from the original locality (Clarence River). All these old trees have now either completely changed into *S. discolor*

or bear leaves of both forms, while young trees, raised from seeds of these trees, preserve completely the character of *S. lurida*. From the above we can only draw the conclusion that *S. lurida* is only the young (perhaps for this reason we must retain the name *discolor* for the double plant) state of *S. discolor*, and cannot even rank as a distinct variety, much less as a species."

This tree is very abundant here, and is edible. During the drought period it saved the lives of many working bullocks. The wood, to my idea, is very musical; if you tap it with your knuckles it sounds quite hollow-like and sings nicely. I am of opinion that the wood could be put to some economic use. (W. Dunn, Acacia Creek, Macpherson Range, *via* Killarney, Queensland.)

Just a warning in regard to feeding stock on a plant like this (a close relation of the Kurrajong). All *Brachychitons* contain fibre in the twigs and trunk, and the thicker the twig the more and tougher the fibre. Obviously the proper thing to do, if you cannot avoid giving twigs, is to give stock twigs of as small diameter as possible, remembering that only the leaves carry nutriment.

In the cooler parts of its habitat it is often deciduous, or nearly so, and is to be added to the scanty list of our deciduous trees.

Flowers.—There are few flowers more charming amongst our native trees. They are large, fleshy, campanulate, and deciduous, and produced so abundantly that they form a very carpet during the spring. Internally they are pink with a crimson throat; externally they are a little darker, say a brownish-pink.

Bark.—We can lay it down as a general rule that trees of the genus to which it belongs yield porous, inferior wood, but the inner bark is useful fibre. It is very rarely the case that the same tree produces valuable timber and valuable fibre. This tree has bark up to 1 inch and 2 inches thick, consisting of sometimes as many as a hundred layers or sheets of fibre or lace-bark. It is a beautiful substance, and when suitably prepared, beautiful light hats are sometimes made from it locally. It makes pretty plait when cut into strips, and very useful ropes, which have the advantage of remaining pliable when wet. They also take tar readily. It is not a delicate, fine fibre, so it could not be used for textile fabrics, except those of the most open, coarse description.

The pith helmets often imported into Australia come from the pith of a leguminous, swamp-loving plant, *Æschynomene aspera*, from India and elsewhere, but this light substance is not lace-like.

Timber.—The aborigines used it for shields or heilamans because of its extreme lightness. It is white, light in weight, soft, and not durable. But it is easily split, and locally it is occasionally used for shingles, but only in default of better wood. It might be made into staves for casks—not for liquids, but only for packing purposes. I think I have said all I can in favour of the wood as a timber.

Size.—It grows to a maximum height of about 100 feet, and with a diameter of up to 3 feet or 4 feet.

Habitat.—It has been chiefly recorded from eastern New South Wales and Queensland. It is a brush, or gully tree, and the most southerly locality noted, so far, is Dungog, New South Wales.

It is a tree so often found in gardens that one must distinguish localities where it is indigenous.

Following are the localities represented in the National Herbarium, New South Wales :—

NEW SOUTH WALES.

Near Dungog (J. K. MacKay). Copeland (E. Betcher).

Nymboidia (Miss G. Dudley Jones).

Grafton (J. W. Black). Susan Island, Clarence River (J. L. Boorman).

Tunstall, near Lismore, Richmond River (H. J. Farmer).

An interesting locality is Blue Nobby's Station, between Coolatai and Yetman, north-west of Warialda. The specimens were collected by Charles Gifford Pryce and Alan Langley Pryce, who lost their lives in France and Gallipoli respectively. This is the most westerly locality recorded for the species.

Macpherson Range, both the New South Wales side (William Dunn) and the Queensland side (Dr. John Shirley).

QUEENSLAND.

Besides the Macpherson Range locality referred to, Bailey, in his "Queensland Flora," has "Pine River and other southern localities." Its range in Queensland is probably very much more extensive.

NORTHERN TERRITORY.

In the *Flora Australiensis* it is recorded as having been collected by A. C. Gregory on Buckland's Tableland.

Propagation.—*Brachychitons* are useful as shade trees, and nurserymen will supply several, of which a Flame-tree (*B. acerifolia*) is the most in demand. The present species does not seem to be much planted, so far as my experience goes; but the foliage is handsome, and I do not know of any reason why it should not be planted in the warmer, moister portions of New South Wales.

The Bottle-tree.—The Bottle-tree (*Sterculia rupestris*) is a Queensland species closely allied to the Lace-bark tree, and, because of the lemonade-bottle shape of its trunk, it is widely known as the Bottle tree. Wherever it is seen it excites interest because of its grotesque appearance, and there are some healthy specimens of it in the Botanic Gardens, Sydney.

It is not generally known that, like all the Kurrajongs (for it is also a Kurrajong), it has large succulent roots which the aborigines used to dig up for food. It is also not generally known that in times of drought Queensland sheep-owners actually use the porous wood for food, and the stem contains a gummy substance resembling tragacanth.

Many years ago Mr. Edward M. Bowman, of Taroom, Queensland, wrote a letter in regard to this remarkable tree, extracts of which are given hereunder :—

“ You will also find,” he adds, “ that bottle-tree boiled in a little water makes the most beautiful starch procurable. In fact, a young lady told me she never did up a dress so well as with starch produced in this way.”

Mr. Bowman accompanies his letter with instructions for feeding cattle, horses or sheep with bottle-tree in billets, in troughs and boxes, and also in the log. As to the first, he advises that the trees be cut into billets of any length desired, the bark stripped, then cut into slabs from 3 to $3\frac{1}{2}$ inches in thickness. It will be found that these slabs can be run through the chaffcutter with ease. When placed in the feed boxes it should be sprinkled with salt and mixed with bran or chaff, if such be procurable. “ Should the beast not at first take to it, place some in its mouth with your hand until it makes some attempt to eat. When once some gets down the animal’s throat there will be no further trouble.” Feed sparingly for the first few days. On no account should the bottle-tree be damped if it becomes dry, as it would “ sour.” The cut-up bottle-tree is particularly recommended by Mr. Bowman for milking cows. For feeding in the log, the tree when felled should be stripped of its bark along the top to where the branches commence, and then troughed, and a certain portion of it “ loosened ” with an axe. Cattle or horses, as the case might be, should first be tried on the leaves of the newly-cut tree, and from them worked on to the log. For sheep a strip of bark about 1 foot wide should be cut off each side of the log, and a ledge of fodder on each side cut about the height to enable feeding to take place comfortably. “ I cannot say that working horses can work too hard on bottle-tree,” says Mr. Bowman in conclusion, “ but it will at all events keep them alive.”

This tree sometimes attains considerable size, and Mr. W. Selkirk, of the Department of Public Works, Sydney, gives me the measurements of a tree near the residence of Mr. R. D. Champion, Lauriston, Jandowal, about 43 miles from Dalby, Queensland. It is in scrub country :—

20 feet circumference at ground; 28 feet circumference at 4 feet from ground; probably 34 to 36 feet circumference at 16 feet from ground; trunk from ground to where branches fork, 21 feet, and from fork to top of foliage, about 35 feet.

EXPLANATION OF PLATE 260.

- A. Flowering twig.
- B. Bud.
- C. Perianth of flower.
- D. Female flower opened out showing :—
 - (a) lobe of of perianth with stellate hairs,
 - (b) scale of perianth,
 - (c) gynophore,
 - (d) stamens,
 - (e) peltate stigma,
 - (f) 5 carpels of ovary.
- E. Female flower staminal column (magnified).
- F. Male " " " "
- G. Female flower (plan) showing :—
 - (a) stigma,
 - (b) carpels,
 - (c) stamens.
- H. Flower-buds with bracts.
- I. Variation of leaves from the one tree.
- K. Seed pods.
- L. Seed coat.
- M. Embryo.

PHOTOGRAPHIC ILLUSTRATIONS.

1. *Brachychiton discolor*, Botanic Gardens, Sydney, March, 1908.
2. *Brachychiton rupestris*, the Queensland Bottle-tree, Botanic Gardens, Sydney, April, 1921.

(Both Government Printer, Sydney.)

A LACE-BARK TREE.
(*Brachychiton discolor* F.v.M.)

4022

Government Printer, photo.

Brochychiton discolor. BOTANIC GARDENS, SYDNEY.

Government Printer, photo.

THE QUEENSLAND BOTTLE-TREE (*Brachychiton rupestris*). IN BOTANIC GARDENS, SYDNEY.

No 269.

Eucalyptus Maideni F.v.M.

Maiden's Gum.

(Family MYRTACEÆ.)

Botanical description.—Genus *Eucalyptus*, see Part II, p. 33.

Botanical description.—Species *Maideni* F.v.M., in *Proc. Linn. Soc. N.S.W.*, xiv, 1020 (1890), with two plates.

Botanical Name.—*Eucalyptus*, already explained, Part II, p. 33; *Maideni* in honour of the author of the present work, when he was Curator of the Technological Museum, Sydney. Although I had been in correspondence with Baron von Mueller in regard to this Blue Gum, which had been confused with *E. globulus*, I did not discover it, and it was owing to the pertinacity of the late Mr. William Baeuerlen, Botanical Collector for the above Museum, that Mueller described it.

Vernacular Names.—As a rule it is known as “Blue Gum,” because of its glaucous appearance, but, in describing it, Mueller mentioned that it also bore the names of White and Spotted Gum in addition, but they are less used.

Aboriginal Name.—I know of none.

Timber.—

It has very little kino, and from that fact one would judge that it is a good timber. Somehow or other it is not much used, which is, no doubt, to a certain extent, owing to its situation, mostly difficult of access, and also to the fact that in situations where it occurs other valuable and time-proved timbers occur, such as *E. tereticornis*, &c. The timber is, however, used for fencing, both for rails and posts, also for rough building purposes, and to a certain extent for wheelwrights' work. As posts, it is said, it lasts fairly well, and it makes excellent rails. The timber is very heavy, hard, and of a rather pleasing yellow colour, not somewhat brownish, as that of *E. goniocalyx*. (Mueller.)

The first report on it by the late Mr. Hutchinson, carpenter of the Technological Museum, made in 1890, reads:—

Timber very hard, heavy, and tough, and interlocked grain. I think the transverse strength of this timber will be great. Difficult to plane and dress up. Pale coloured and has some gum-veins.

Following are two other reports:—

There is no doubt as to the value of the timber for any strong, heavy work, where strength, durability, and elasticity are required. It is easily worked. It is close, but free grained, of a yellowish colour, tough across the grain, free from knots, and not with many gum-veins. It is used in the uplands for wheelwrights, bridges, and mining purposes with *E. globulus*. Of the latter, there are miles of open

tail-races round Tumberumba boarded with it to a depth of 3 feet, with $1\frac{1}{2}$ inch boards, exposed to all weathers, which have been in for years and look little the worse for wear, although every flood passes over them, as well as the friction from moving sand and water combined. (Forester Taylor, Wagga, 21st September, 1892.)

Its timber is quite distinct from the *E. globulus* in colour and texture, and is mostly to be found full of gum veins and shells sadly in small sizes. It is dark yellow in colour, remarkably tough and interlocked, and very durable. In large sizes, such as squared piles and girders, it bears an excellent record, particularly in the Braidwood district. For building purposes it is only suitable in large sizes, such as beams, &c.; in scantling sizes it warps and opens. When green it is easily worked, but when seasoned it is almost of the consistency of bone and stands exposure well. In round piles there are few timbers to equal it in durability. (J. V. de Coque.)

Size.—Up to 200 feet high, with diameter of 4 feet (average 2–4 feet).

Range.—It is at present only known from south-easterly New South Wales and eastern Victoria. Additional localities are required to more definitely establish its range.

New South Wales.—It is found in the southern part of the county of Camden, the most northerly locality recorded being Box Point to Tallong, and additional search will prove it to be somewhat farther north than that.

Going south it occurs in the counties of St. Vincent, Dampier, and Auckland, and so into Gippsland. It has not been recorded west of the counties named. In the counties of Wellesley and Wallace I fully expect to hear of this species, or *E. globulus*, or both of them, being found.

The localities given by Mueller in the original description are:—"In rich soil only on steep mountain slopes from the southern boundary (of New South Wales) as far north as the Braidwood and Nelligen districts" (W. Baeuerlen).

Victoria.—In this State it is confined to Gippsland, and we require further collecting to absolutely determine its range.

For details as to specific localities in both States, see my "Critical Revision of the Genus *Eucalyptus*," Part XVIII, pp. 257, 258.

Propagation.—I have been honorary purchaser of seeds of Australian native trees to the various South African Governments, and, since the Union, to the Union of South Africa, for the last twenty-five years. The present species seems to satisfy the requirements of our South African friends in an especial degree, for, during recent years far more seed of it has been supplied than of any other two species.

Forester Taylor, of Wagga, wrote in 1892: "It is a very fast grower, and will adapt itself to almost any climate so long as the situation is moist, and not too much exposed to the wind. It is not suitable for granite ridges, in hot, dry situations."

EXPLANATION OF PLATE 261.

- A. Juvenile leaf, from Spring Hill, Wingello.
- B. Juvenile leaf, from Colombo, Candelo.
- C. Flowering twig, from Colombo.
- D. Buds (Bega district).
- E. Fruits (Araluen Mountain). All from New South Wales.

MAIDEN'S GUM.
(*Eucalyptus Maideni* F.v.M.)

E.A. King. 1916

No. 270.

Tristania laurina R.Br.

Water Gum.

(Family MYRTACEÆ.)

Botanical description.—Genus *Tristania*, see Part V, p. 107.

Botanical description.—Species *T. laurina* R.Br. in Ait., *Hort. Kew*, ed. 2, iv, 417 (1812).

A somewhat scrubby shrub in exposed localities, becoming in moist situations a tree, often of great height, the young shoots more or less glaucous or silky-pubescent, especially the under side of the leaves, the older foliage glabrous. *Leaves* alternate, elliptical or obovate, lanceolate, acuminate, penniveined, 2 to 4 inches long, narrowed into a petiole. *Flowers* yellow, in short axillary cymes, on a very short common peduncle, the pedicels rarely longer than the calyx. *Calyx-tube* broadly campanulate, $1\frac{1}{2}$ to $2\frac{1}{2}$ lines diameter, lobes small, triangular, distant at the time of flowering, although imbricate in the young bud. *Petals* $1\frac{1}{2}$ to 2 lines long, usually undulate. *Staminal* bundles inflexed, scarcely exceeding the petals, the claws very short, each with fifteen to twenty filaments. *Ovary* half-adnate, the summit very convex, hirsute, not depressed round the style, with several (about ten) reflexed ovules in each cell. *Capsule* obovoid or almost globular, 3 to 5 lines diameter, adnate at the base only, filling the calyx-tube and protruding considerably beyond it. *Seeds* oblong, flat, laterally attached near the top, the upper part thin and winglike, embryo in the lower thickened portion; cotyledons deeply cordate and folded over each other; radicle superior, rather long. (B. Fl. iii, 261.)

Botanical Name.—*Tristania*, see Part V, p. 108; *laurina*, Latin, meaning reminiscent of a Laurel leaf, which is, however, nor very appropriate, our tree having leaves narrower than those of the true Laurel as a rule.

Vernacular Names.—The commonest name is “Water Gum,” because it often grows in damp situations, usually in beds of more or less intermittent streams. I have heard other names applied to it, but none better than the above, I think. Because it sometimes grows at a fair elevation, *e.g.*, on the Upper Manning and Ellenborough Rivers, it is locally known as “Mountain Water Gum.”

Aboriginal Names.—“Wallaya” of the aborigines of Brisbane Water, New South Wales, according to the late Sir William Macarthur.

The late Dr. A. W. Howitt told me that in Gippsland (*e.g.*, about Metung), it is called “Kanooka,” but it is not an aboriginal name, although it looks like it. The aboriginal name is “Koomil.”

Synonym.—*Melaleuca laurina*, Sm. in *Trans. Linn. Soc.*, iii, 275 (1797).

Flowers.—They are yellow, and have an unpleasant scent.

Timber.—Timber dark in colour, hard, tough, and close-grained, used for tool handles, cogs of wheels, &c. It is generally sound to the centre. It is very difficult to season, but when dry it is of singular closeness and toughness. (Sir W. Macarthur). It is apparently well adapted for all machinery purposes. (*Jurors' Reports, London International Exhibition, 1862.*)

Many years ago I heard that it was highly prized by carpenters, who have had mallets of it in almost daily use, lasting from eighteen months to two years (Moruya district). Mr. Forester Brown told me that Mr. Wynter, of Taree, used to value it for screws of handscrews, sheaves of blocks, and clean turnery. Mr. G. L. Hill, of Bungay, Wingham, tells me that it is highly valued for axe-handles on the Bulga.

Mr. G. W. Green, of Bobin, wrote to the press from Wingham in July, 1914, as follows :—

Having for three years been experimenting with a timber (called by the local bushmen "Mountain Water Gum") in various ways, particularly in its steaming properties, and also bending properties, and having used all timbers on the market that will steam and bend well for over forty years, I emphatically state that the timber that grows on the Bulga called "Mountain Water Gum," on account of its wonderful qualities of lightness, strength, and ease with which it springs straight, if bent, without steaming, or keeps any shape desired if steamed and bent, is a better timber than the American hickory, ash, or elm. (I have called it aeroplane wood, being a member of the New South Wales Aerial League ever since it started, and therefore knowing a little about aeroplanes.) I assert it is as light as ash, as tough as elm, and as strong as hickory (all of these being largely imported into the Commonwealth for bending purposes), or any other timber that I have used for boat-building, carriage-building, &c. It makes the best possible handles of all kinds, especially axe-handles.

It varies from very pale pink to a rich reddish colour, and a shaving displays remarkable toughness.

Size.—As a rule it is a small or medium-sized tree, but growing in streams is against its development. Many years ago I recorded trees of it 2 feet 6 inches in diameter on the banks of the Bellinger, and there were some fine trees on the Dorrigo (Beilsdown and other creeks).

Mr. G. L. Hill, of Bungay, Wingham, Manning River, says :—

On account of the floods you never see a tree of any size on a straight trunk, but on the Bulga it grows through the scrub and I have seen trees with a fair trunk, and I measured one with a girth of 16 feet three feet from the ground. I do not think there is enough of it to become of much value, and what there is there will soon be destroyed.

Habitat.—It extends from Gippsland, Victoria, to south Queensland. It is found in or on the banks of watercourses.

The National Herbarium, Sydney, has specimens from the following localities :—

VICTORIA.

Nowa Nowa (H. B. Williamson); Wingan River, East Gippsland (C. Walter); Orbost, Snowy River (E. E. Pescott, J. Rowe).

NEW SOUTH WALES.

Monga or Sugar Loaf, near Braidwood (J. L. Boorman); found all over the district, from the summit of the mountain to its base, being 3 feet high on the summit and 20-30 feet at the base, Clyde Mountain, near Nelligen (J. L. Boorman); top of the Pigeon House, near Milton, the only specimen seen (R. H. Cambage); Barbers' Creek (H. J. Rumsey); Cambewarra Mountain (Miss J. Close); Cataract Dam (J.H.M.); North Clifton (J.H.M.).

G. S. Hill, photo.

WATER GUM (*Tristania laurina*), NEAR ELLENBOROUGH FALLS,
via WINGHAM. NEW SOUTH WALES.

WATER GUM.
(*Tristania laurina* R.BR.)

Bent's Basin, Nepean River (E. Cheel and J. L. Boorman); Valley Heights, Blue Mountains (A. A. Hamilton); Mount Irvine (Jesse Gregson).

Cowan Creek, Hawkesbury River (W. F. Blakely); Wiseman's Ferry (A. L. Blackshaw); "Hickory" trees 1-3 feet in diameter, very tall and straight, Matcham's Brush, Erina (A. Murphy); Walkivory Creek, Gloucester (J.H.M.); The Bulga (E. F. Rudder; G. F. Hill); 15-25 feet, with a trunk diameter of 1 foot, bark smooth, timber hard and heavy and used for pick-handles, and for other work requiring toughness, Wingham, Manning River (J. L. Boorman); Wauchope (W. D. Goodacre); "I have seen them as small trees of 12-25 feet, large trees near permanent water, dwarf bushes in exposed situations," Port Macquarie (J. L. Boorman); Urunga (Forester A. H. Lawrence); overhanging, spreading tree, grey bark, on river bank, Bellinger (E. H. F. Swain); on the banks of the Bellinger, 2 feet 6 inches in diameter; some fine trees also in moist situations in the Dorrigo Forest Reserve (Beilsdown and other creeks), also, in the same reserve, a very small-leaved form that might casually be mistaken for *T. neriifolia* (J.H.M.); tall trees of 30-60 feet, scaly bark, tips of branches pale yellow; found in all the watercourses of the North Coast district, Coramba, Orara River (J. L. Boorman); trees of 20-30 feet, much branched; bed of Clarence River at Tabulam (J. L. Boorman); Copmanhurst, Clarence River (Rev. H. M. H. Rupp); "Mountain Water Gum," "Mountain Hickory," Wyong (Forester F. C. McPherson); Casino, Richmond River (Forester L. C. Irby).

QUEENSLAND.

Little Nerang Creek (C. T. White). Mr. Bailey, in his "Queensland Flora," simply says "Southern localities."

EXPLANATION OF PLATE 262.

- A. Flowering twig.
- B. Flower showing :—
 - (a) calyx,
 - (b) ovary.
- C. Flower in section showing :—
 - (a) calyx,
 - (b) petal,
 - (c) a staminal bundle of from 15 to 20 stamens.
- D. Fruits (natural size).
- E. Obovoid capsule protruding from calyx (enlarged).
- F. Obovoid capsule after dehiscence.
- G. Oblong, flat, winged seeds.
- H. Anther, back and front view.

PHOTOGRAPHIC ILLUSTRATION.

Water Gum, 16 feet in circumference at three feet from the ground, near Ellenborough Falls, *via* Wingham. (G. S. Hill, photo.)

No. 271.

Eugenia Moorei F.v.M.

A Rose-Apple.

(Family MYRTACEÆ.)

Botanical Description.—Genus *Eugenia* Mich ex. Linn., Syst., ed. 1 (1735).

Calyx-tube from globular to narrow-turbinate, not at all or more or less produced above the ovary; lobes four, very rarely five, from large and imbricate to very short and scarcely prominent above the truncate margin.

Petals four, very rarely five, either free and spreading, or more or less connivent, or connate or falling off in a single calyptra.

Stamens numerous, in several series, free or obscurely collected in four bundles; anthers versatile, usually small, the cells parallel or very rarely divaricate, opening longitudinally.

Ovary two-celled or very rarely (in species not Australian) three-celled, with several ovules in each cell, or only two in an American section.

Fruit a berry or sometimes almost a drupe, or nearly dry with a fibrous rind.

Seeds either solitary or globose, or few and variously shaped by compression; testa membranous or cartilaginous; embryo thick and fleshy with a very short radicle, the cotyledons either united in an apparently homogenous mass or more or less separable.

Trees or shrubs.

Leaves opposite, penniveined.

Flowers (in the Australian species) either solitary in the axils, or in lateral or terminal trichotomous cymes or panicles. (B. Fl. iii, 280, 1866.)

Eugenias are either trees or shrubs, and are found chiefly in the West Indies and tropical America, India, and eastern Australia. Many species are to be found in the hot-houses and conservatories of Europe, including some of the Australian species, of which *E. Smithii*, the Lillypilly (as it is called by the aborigines [?]), was the first to be sent, it having been cultivated since the year 1790.

Botanical Description.—Species *E. Moorei* F.v.M., *Fragmenta*, vol. v, p. 33 (1865).

Following is a translation of the original:—

A tall tree 80 feet or more in height, glabrous in all its parts. *Leaves* thinly coriaceous, broad-lanceolate to oval-oblong, shortly acuminate or obtuse, attaining about 9 inches in length, narrowed into a short petiole, dark and shining above, paler underneath, the secondary veins oblique, numerous and rather close together, connected by an intramarginal vein, the reticulation between them faintly prominent on both sides. *Flowers* red, in broad trichotomous panicles on the old wood below the leaves. *Calyx* turbinate-campanulate, short and broad. *Petals* broad and obtuse, usually falling off together calyptra-like. *Stamens* 4 to 6 lines long, red as well as the calyx and the petals. Style about as long as the stamens. *Fruit* compressed globular, white and very succulent, about as large as a middle-sized apple.

Synonym.—*E. Jambolana* Benth. non Lam. (*B.Fl.*, iii, 283).

Bentham was not satisfied as to the specific identity of the two species, but Mueller's remarks (*loc. cit.*), of which I offer a translation, make the matter quite clear :—

I cannot unite *E. Moorei* with the true *E. Jambolana*. These are the points of difference : panicles issuing from old branches and not from the younger ones, calyces larger, always narrowed into a rather long pedicel, and with larger lobes by no means truncate, filaments longer, crimson, anthers red. Fruits of both species are yet to be compared.

Botanical Name.—*Eugenia*.—The name *Eugenia* perpetuates that of Prince Eugene of Savoy, the celebrated military commander who co-operated with the famous Duke of Marlborough in the fierce Continental wars in which the British troops were so incessantly involved during the early years of the last century. It will be remembered that these two great captains led the British army and their allies to victory at the battle of Blenheim, and the pugnacious Eriton loves to recall this "glorious" event, of which however, Southey sings :—

With fire and sword, the country round
Was wasted far and wide.

Prince Eugene was also fond of the peaceful occupation of gardening, and when the records of his fighting exploits have all faded away in the dim past, he will be remembered as long as the world lasts by the beautiful and useful trees belonging to the genus named by Micheli (and subsequently adopted by Linnaeus) in his honour.

Moorei, in honour of the late Mr. Charles Moore, from 1848 to 1896, Director of the Botanic Gardens, Sydney.

Vernacular Name.—I have called this "A Rose-apple" from its affinity to *E. Jambolana*, but I do not say that the name is a good one, for I cannot say that the scent of rose in eating the fruit is marked; I believe I have smelt it when eating sparingly of that of the Sydney Botanic Gardens tree. Certainly its perfume is very much less than that of *E. Jambolana*.

Aboriginal Name.—It has the name "Durobby" among the natives, according to Carron (original description).

Leaves.—They are large and rather thick.

Flowers.—They are large and pink, and are borne on the old wood.

Fruits.—*Eugenia* fruits are useful chiefly on account of the aromatic unripe fruits of some or of the luscious ripe of others. The best known is *Eugenia pimenta*, of the West Indies, which yields "allspice," so called because the flavour appears to be that of a combination of spices. *E. acris* is the Bay-berry tree of the United States, its unripe fruits being used in the preparation of the bay rum of the United States *Pharmacopœia*, employed in the preparation of hair-wash and for other purposes. The rose-apples, useful for dessert, and much appreciated in the East, where rose perfumes are far more in vogue than with us, are the produce of at least two species of

Eugenia, viz., *E. Malaccensis* and *E. Jambos*, the latter being the smaller. *E. Jambos*, when cultivated in Sydney in warm situations, ripens its fruit. It is 2 or 3 inches long, with flesh emitting a dainty rose-like odour, hence the name. In fact, most of the *Eugenias* yield edible fruit when fully ripe (to which rule the Lilly pilly is no exception), and there can be no doubt that some of them can be highly improved in this respect by cultivation. All *Eugenia* trees are more or less ornamental when in full fruit, and some of our Australian species, of which the common bush cherry (*E. myrtifolia*) is a good example, are lovely garden objects at that season. Nearly all the *Eugenias*, Australian or not, are notable, and in giving an account of the genus one would have something to say about each.

Coming to the *Eugenia* now figured, except the mere fact that the fruits were eaten by the aborigines, and also by the white man (they are fleshy and acidulous, and have no special flavour), I do not know much about them. Their shape is that of the earth, which we are told is an oblate-spheroid, the greatest diameter being 2-2½ inches. The colour is white, suffused with green. The fruit was unknown at the time the species was described.

Following are some notes from Indian sources concerning a Rose-apple, *E. Jambolana* Lam., with which our species was so long confused :—

“The fruit is much eaten by the natives of India; in appearance it resembles a damson, has a harsh but sweetish flavour, somewhat astringent and acid. It is much eaten by birds, and is a favourite food of the large bat or flying fox.” (Brandis.)

A vinegar prepared from the juice of the ripe fruit is an agreeable stomachic and carminative; it is also used as a diuretic in India. The bark is a useful astringent. The expressed juice of the leaves enters into Indian medicine in various ways. The seeds are said to be a powerful remedy in diabetes, but their true value has not yet been assigned.

De Candolle (“Origin of Cultivated Plants,” p. 240) says that the seeds of the Rose-apple are poisonous.

Timber.—I can only give an account of the timber of the closely-allied Indian *E. Jambolana* :—

Timber flesh or red coloured, firm, and close-grained; not much used, except for building purposes. It stands well in drying. It is used for building, agricultural implements, and carts, also for well-work, as it resists the action of water. Five sleepers of this wood were taken from an Indian railway in 1875. They had been in the ground five years, and were reported to be fairly sound and not touched by white ants. Weight about 49 lb. per cubic foot. (Gamble.)

Size.—It attains the dignity of a large tree, not far from 80 or 90 feet high, but those I have seen are much smaller.

Habitat.—I only know this from New South Wales, but, in view of the localities about to be quoted, it is impossible for it not to occur in Queensland.

“C. H. Fawcett lately brought this beautiful tree from the banks of the Richmond River.” (Original description.)

Government Printer, photo.

TREE OF *Eugenia Moorei* IN BOTANIC GARDENS, SYDNEY.

Government Printer, photo.

CLUSTER OF FRUITS ON TREE OF *Eugenia Moorei* IN BOTANIC GARDENS. SYDNEY.

A ROSE-APPLE.
(*Eugenia Moorei* F.v.M.)

Mullumbimby, Brunswick River (W. Baeuerlen); Murwillumbah, Tweed River, (J. L. Boorman and J.H.M.); Tweed River (R. A. Campbell).

The *Flora Australiensis* also records it from the Tweed River (C. Moore).

As regards Queensland, Benthams quotes "Albany Island, W. Hill," and adds, "Very common in East Indian Archipelago, where the fruit is much eaten." (In the last sentence he is referring to *E. Jambolana*, the Rose-apple.

But see the following remarks by Mueller, in the original description of *E. Moorei*, in which he refers to this reputed Albany Island specimen, and also to a supposed Rockingham Bay locality :—

The same species, with the flowers not yet opened and without fruits, received from Dallachy, seems to be present at Rockingham Bay (Queensland). A plant occurring at Albany Island, not yet seen by me, seems perhaps to resemble the true *E. Jambolana*. (See Beddome's *Flora Sylvatica*, cxcvii.)

Bailey (*Queensland Flora*) only quotes Albany Island, but inasmuch as he follows Benthams in confusing it with *E. Jambolana*, and we know *E. Jambolana* is occasionally cultivated in Queensland, the matter should be cleared up.

EXPLANATION OF PLATE 263.

- A. Flowering twig.
- B. Bud.
- C. Trichotomous inflorescence.
- D. Flower viewed from above, calyptra absent.
- E. Stamens front and back view.
- F. Calyptra of united petals.
- G. Petals of calyptra.
- H. Fruit.
- I. Vertical section of fruit.
- K. Seed.
- L. Leaf.

PHOTOGRAPHIC ILLUSTRATIONS.

1. Tree in Botanic Gardens, Sydney.
2. Cluster of fruits on previous year's wood from same tree.

(Both Government Printer, photo.)

APPENDICES.

A. OPTIMUM OF TIMBER.

THIS word is, of course, the neuter form of the Latin *optimus*, best. It has gradually developed a biological application, and it is only of recent years that the use of the term has crept into standard dictionaries. Thus in Webster's International of 1910 we have it defined as "The most favourable conditions as to temperature, light, moisture, food, &c., for the growth and reproduction of an organism. Often used adjectively, as *optimum* conditions, *optimum* temperature, &c."

The use of the term is an expression of the terminology of variation which is well worthy of consideration. Foresters and ecologists use it, and its use undoubtedly tends to clarity of view. In Australia it has a more direct economic bearing with timber than with anything else.

In 1918 I appealed to the Chief of Forest Investigations of the United States in regard to the use of the term in the Forest Service, and Professor J. W. Stokes replied as follows:—

The term "Optimum" is frequently used in describing the growth and quality of a certain species in the most favourable part of its range. The word is also used to describe the most favourable light conditions or the density of stand most favourable to the growth of timber of first quality.

The term "Optimum Light Intensity" is used on page 11, Forest Service Bulletin 92, by R. Zon and Henry S. Graves. C. A. Schenck, in "The Art of the Second Growth," Brandon Printing Company, Albany, N.Y., 1912, uses the expression frequently and in the most general way, pages 25-26: "The region occupies a big belt stretched across the continent, so that the western and eastern flora join hands in it. A typical tree of this region, the white spruce, often forms large pure forests. Other species of the zone are . . . cedar and tamarack, the latter here obtaining its *optimum*."

On page 27 the term is used as follows in describing the Pacific forest of moderately warm zone: "*Pinus ponderosa*.—Height and timber quality dependent on proximity to Pacific Ocean. *Optimum* in Sierra Nevada, where trees 300 feet high are frequently found."

On page 28 in the same connection is found: "*Abies grandis*.—The only fir on Vancouver Island. *Optimum* at coast in Oregon, where it grows up to 300 feet high."

D. T. Mason, in Department of Agriculture Bulletin, 154, "The Life History of Lodgepole Pine in the Rocky Mountains" speaks of "Optimum density."

"The use of the word "optimum" in forestry literature is very generally accepted and understood, but I have been unable to find it specifically defined."

We say a species attains a certain size, but we may or may not know its *optimum*. In our very partially botanically explored country we have to exercise a reservation as to whether we yet know the conditions or the situation in which the *optimum* of a species has been evolved. A plant may evolve in two directions—in the direction of exuberance, and in the direction of nanism—under hard conditions. It develops variously as it seeks to adapt itself to its environment.

We must carefully discriminate between material of the type, and material illustrating the optimum of the species; the two may exhibit a good deal of difference.

The physical properties of timber vary greatly according to *environment*, timbers rapidly growing under "soft" conditions, *i.e.*, those which favour great bulk, may be very different to those in which the conditions are harder. Coloured plates bringing these differences out admirably as regards Oak and Spruce are to be found in Fisher (Schlich's) "Manual of Forestry," v, Plates 1 and 2 (1896). Fisher does not actually employ the term "optimum," and the first important work on timbers in which I find it is "Traité d'Exploitation Commerciale des Bois" (by Alphonse Mathey, Paris, 1906), p. 43, certain passages of which are offered in translation :—

2. Influence of the place of origin and position (station).

Law.—Things being equal in regard to the soil, there is one region and *one alone* (italics as in original) which realises the *optima* conditions giving to the wood of each forestry species its *maximum* of specific weight, hardness, elasticity, cohesion, &c., that is to say, its *maximum* of utility. *This region is the natural habitat of the species taken into consideration.* When this natural habitat forms a belt or zone of country it is in the middle of this zone that the wood is best; it is in the centre if the area forms a circumference. At this time when exotism is the rage in the forestry world it is good to enlighten the public as to the value of the products which are delivered to it—products which commerce, rightly distrustful, buys cheap, but sells again as dear as possible to ignorant customers. It is the consumer who pays finally the expenses of the venture.

Let us now see, from the point of view of the value of the wood, how certain species behave in their natural and artificial habitat. And, for that, let us consult the diagram of Dr. Gayer below :—

Artificial position—III^F colder than the natural position.

Natural position— II^F colder than the *optimum*.

I *optimum*.

II^C warmer than the *optimum*.

Artificial position—III^C warmer than the natural position.

If the law enunciated above is true for each species, the weight of the wood ought to decrease from I to II, then from II to III. At the same time the breadth of the rings ought to become larger or smaller. Or, let us put it this way :—

Decreases in weight—

- 1 { (a) From I (optimum) to II^F (colder than optimum).
 (b) From I (optimum) to II^C (warmer than optimum).
- 2 { (a) From II^F (colder than optimum) to III^F (colder than natural).
 (b) From II^C (warmer than optimum) to III^C (warmer than natural).

Facts.—(1) In Germany the area of the oak extends over II^F, except in the plains of the Rhine, where the climate is near to the *optimum*. By cultivation this species has been introduced as far as III^F. In a general way the breadth of the rings increases with the heat, and the increases diminish regularly from III^C to III^F. Let us see how the specific weight varies. In the Spessart (a large forest in Germany, between Wurzburg and Aschaffenburg—*Rees Encyclop.*) (II^F) the wood of the adult oak, dried in the open air, has a specific weight of 50. In the plains of the Rhine the specific weight attains 74.

(2) The Larch was introduced more than a century ago into II^C in Germany and into III^C in Denmark. In these two artificial positions the growth is extraordinarily rapid, but the wood is lighter. Its specific weight there is only 45, while it attains 80 in its natural position.

(3) The Spruce Fir [*Epicéa* (*Abies* or *Picea excelsa*)] in its natural position (I and II^C) has a specific weight of 45; introduced into III^C, its weight becomes lower, drops to 38 and 41. In the Alpine forests (of boundary) (II^F), the specific weight varies between 40 and 42; that is to say, it is always inferior to the figure found for the natural position. In France the Spruce Fir cultivated in III^C is still lighter and softer, its wood cracking like glass; it is only suitable for the making of *papier-mâché*.

The white American Oaks have in the South—that is to say, in their *optima* station—a specific weight of 89, and the Black Oaks of 75. In the North, the White Oaks have only a specific weight of 77 and the Black of 70.

These observations have a very great interest from the point of view of industrial utilisation of wood, resistance to pressure, and fracture being a function of the specific weight.

All the other properties of the timbers are, moreover, more or less affected by transplanting the species outside its habitat. Who does not know that in Australia the Eucalypt furnishes railway sleepers lasting from thirty to forty years without preparation, and that this same wood only lasts from ten to twelve years in Algeria under similar conditions? Who does not know that the *Pinus sylvestris* (Scots Pine) of the Yonne, France, is useless to such an extent that, cut up in rafters and laths, one could not fix slates on it? Who does not know that our fir-tree, when it is from too low altitudes, furnishes a fibrous wood without elasticity and strength, and to such an extent that the Jurassic commerce, which sells its inferior woods in Algeria, is discredited in our colony? Finally, who does not know, taking another train of ideas, that the Maritime Pine of the Landes is no longer in the Sologne (centre of France district of Orleans.—J.H.M.) and Corsica; that the Australian Acacias, the precious producers of gum and tannin in the country of their origin, have only given inferior products in Algeria?

It is necessary then to guard oneself from foolish enthusiasms and impress one's mind with the idea that introduced species will never seriously compete with our own. The Weymouth Pine, which has the reputation of being the best American wood, is justly known to be the worst in Europe. What can we then expect from *Pinus resinosa*, *P. Banksiana*, *P. rigida*, *P. ponderosa*, whose wood is less valued than that of the Weymouth Pine in their country of origin? Does one imagine himself to be able to improve eventually in the course of time, and by good cultivation, the timbers of the bad introduced species?

Finally, the best thing for us to do is to continue to cultivate the oak, the ash, and the elm in the plains, the beech in the stony slopes, the fir and the spruce fir in the mountains, following as far as possible the indications of nature. In this way only we will obtain the best and the most useful products of the soil. So that if, nevertheless, for certain reasons, one is forced to employ certain species outside their natural habitats, it will always be necessary to be careful in the *utilisation* of their wood.

The following notes from my pen in the *Journ. Roy. Soc., Tasmania*, 1914, p. 23, have some pertinence in this connection :—

Let us consider the question of timber for a moment. No two sticks of timber in a timber yard or in the forests are precisely alike. The timber is subject to all the limitations of variation of the species from which it sprang. And if these nuances of variation are difficult to record in the species itself, they are difficult to interpret in the quantitative records of the timber tester. All that we can say is that these records vary between such limits as have been (perhaps arbitrarily) assigned to the species by the systematic botanist. To say that the quantitative results are variable between certain limits is another way of saying that the species is variable, that certain forms have been admitted under the banner of the species by the botanist. If the botanist changes his views as to the direction and amount of variation in a species the timber-tester must modify his figures accordingly, or persuade the botanist to alter his views. There is nothing final about timber tests, and the only way to render them comparable is to render available with them the fullest particulars as to habitat, size of tree, year and season of felling, and subsequent treatment, relative position in the trunk of the tree of the test piece, particulars in regard to the meteorological conditions of the locality of the tree for as long a period as possible. Of each piece of timber a number of thin sections should be submitted to microscopic examination in addition, in order that clues may be obtained for the interpretation of the quantitative tests aforesaid.

Quantitative tests are only valuable to the extent to which they are supplemented by specific particulars which will render the materials comparable. In old-settled countries a considerable amount of information has been accumulated which enables an expert to say the directions along which variation has proceeded. Scots Pine, for example, is not a definite entity like refined gold, but a living, plastic, variable something, and the results of the timber-tester must be variable, because he does not deal with a constant. Although we have aggregations of individuals which we label a species, it is pertinent to remind engineers that no two blades of grass in the field, no two leaves of a tree, no two trees, are absolutely identical.

The following is taken from my "Some of the Commercial Trees of New South Wales" (*Forestry Handbook*, Part II, Sydney, 1917):—

I wrote the following note in "Australia To-day" of 1st November, 1911, p. 93: "The stringy-bark (*Eucalyptus obliqua*) of Tasmania is used for wood-paving, and while Western Australians will not agree with the judgment of a Tasmanian expert that 'it is preferable to jarrah,' the statement is evidence of the local esteem in which it is held, and gives me an opportunity of reiterating the fact, of which abundant proof has come before me, that certain timbers are their best in particular States. . . . *E. obliqua* seems to attain its best development in Tasmania."

The Rev. (now Bishop) J. W. Dwyer, then of Temora, New South Wales, wrote to me "*Re Eucalyptus Stuartiana*. I often heard from farmers at Bowna, near Albury, where it grows well on flats, that for fencing-posts it is pretty lasting if put into the same kind of ground in which it grows, but not elsewhere, which may account for the rosy report given by one of your correspondents. . . ."

I have suggested that every species of tree has an "optimum" district—that is to say, a district in which that tree grows better than anywhere else; in other words, produces the most valuable product. We should endeavour to learn the optimum district for each species, in order that we may search for other districts offering similar conditions and find standing timber, or cultivate the species under those conditions.

We know that certain plants vary exceedingly in regard to their product when grown in different districts, *e.g.*, champagne grapes and lavender, and we have much to learn in regard to variation in the timber of the same species of tree when grown in different districts.

For instance, *Eucalyptus obliqua*, to which I referred at the beginning of this article, yields a product which is deservedly esteemed in parts of Tasmania, but I have known the same timber condemned as being of very little value in a certain district of New South Wales.

I have known high words and sharp controversy to arise between officials of two Australian States in the discussion of the merits of a certain timber. Perhaps both were right, but they were certainly arguing about the same tree growing in a district which promoted its best development and one which certainly did not. We must, therefore, get away from the idea that a species as we know it is always very good or very bad. Both Jones and Brown may be right. The rose that we have imported from England at great cost because experts speak so highly of it may, in our garden, turn out a very disappointing thing.

I have touched lightly and very imperfectly on a subject which is obviously of very considerable importance to the Australian forester, many of whose data he will have to find out himself, for he certainly will not obtain them from books.

The question of the optimum has a very practical bearing, and the forester will have to weigh the evidence available to him and consider which forests and which districts produce the optimum timber of a given species. Obviously the scientific forester will concentrate his best energies on the development of the forests within that optimum district, leaving, as far as can be justified, the regions of inferior timber for appropriate treatment.

I anticipate that timber from an optimum district will be regularly specified in contracts, where the best quality is required.

Here we have the key to the situation when we have two men, jealous of the reputation of their district or State, arguing as to the merits of a particular timber, when one man may have in view the timber from the optimum district, and the other timber from a locality which produces an inferior article.

The question of the supply of Eucalyptus seeds for non-Australian countries comes into view in this connection. When they are ascertained, seeds will only be ordered from optimum districts. However, in spite of the best that can be sent, it is not likely that other countries will produce Eucalyptus timber equal to the Australian optimum for each species, and thus, in spite of all the non-Australian planting, Australia will have the monopoly of the best Eucalyptus timber. This statement of course cuts both ways. For example, we may plant in Australia the soft woods of the Baltic and the Pacific Slope, but the optima for those timbers lie in the countries mentioned, and it is suggested that in Australia we shall never be able to produce such soft woods ranking above the second class.

The timid person who thinks that if we send seed of the highest quality out of his country he will be faced with superior forests of his own timbers in other lands, need suffer no apprehension. Endeavour should be made (as I have done for many years) to supply the best seed available, and correspondents in other countries should take reciprocal action. Planters have natural handicaps to begin with, as already indicated, and the least a supplier of seeds can do is to see that he is not further handicapped by inferior seed.

B. EXPERIMENTS ON THE STRENGTH OF AUSTRALIAN TIMBER.

Timber is by far the most important commercial product of most trees, certainly of Eucalypts, and methods of ascertaining its physical properties have engaged the attention of many so-called "practical men," and of many physicists, engineers, and botanists. As was to be expected, the amount of work in this direction is much less in regard to Australian timbers (and these chiefly comprise Eucalypts) than in regard to European and American timbers.

In leaving this matter in the hands of specialists I would point out how little engineering test-work has been done in regard to species concerning whose biological history we have data. No experimenter should be encouraged to waste his own and other people's time by publishing results which cannot be interpreted in regard to known species or recognised standards of timber.

In my "Useful Native Plants of Australia" I wrote over thirty years ago:—"Experiments on Australian timbers (chiefly hardwoods) have occupied different workers for many years, but they vary so much in their results, and have been performed under such diverse circumstances, that it is impossible to condense them into one general statement."

In the matter of engineering tests, my readers must turn to the originals, as anything short of the amplest abstracts would be unsatisfactory. The size of the piece tested, whence obtained, from what part of the tree, degree of seasoning, are only a few of the details that the engineer and user of timber seeks from the experimenter.

In this connection I would invite attention to a paper entitled, "The want of a uniform system in experimenting upon timber," by F. A. Campbell, C.E., *Proc. Roy. Soc., Victoria*, 9th December, 1886. Mr. Campbell summarises as follows the circumstances which affect the results in timber tests:—

1. Age of tree.
2. Nature of locality where grown.
3. Part of tree from which timber is taken.
4. Length of time seasoned.
5. Deflection as affecting the bending moment of a beam.
6. Size of piece tested.

A modern author who insists on the necessity of so selecting his pieces of timber that the tests of them will be comparable, is Mr. G. A. Julius, whose remarks will be found in the works quoted at p. 424.

I know of nothing which appeals so directly to one as illustrative of variation, as the difficulty that presents itself to engineers in the selection and preparation of timbers for the purpose of their tests. Distinguished engineers do all in their power to eliminate anomalies and render their results comparable, and yet (through no fault of their own) they often fail as regards the latter.

Since the above was written I have seen an admirable short paper, "Standardising timber tests," by L. H. Boas in "The Australian Forestry Journal," March, 1920, p. 75).

The following records of engineering tests are referred to under the various States. I have been at some pains to record some of the earlier tests, but they are the compilation of a botanist, and an engineer will complete the references:—

TASMANIA.

1851.—"On the strength, durability, and value of the timber of the Blue Gum* of Tasmania, and of some other Eucalypts† for ship-building." With tables, by James Mitchell. (Papers and Procs., *Roy. Soc., Van Diemen's Land*, vol. ii, Part I, 1852. 12th Nov., 1851.)

The apparatus used for testing the transverse strength consists of two strong pieces of frame-work, 7 feet asunder, attached to the sides of a small building. The deflection was measured upon a scale attached to the wood by a silk thread stretched over the frame-work by plummets, in the same manner as described by Professor Barlow. The weights (56 lb. and under) were placed upon a scale hung upon the middle of the wood by means of a $\frac{1}{2}$ -inch iron-eye, $2\frac{1}{2}$ inches square.

The weights were then placed upon the scale until the deflection amounted to half an inch, when they were removed, and the wood was permitted to resume its original straight form; the weights were then replaced, and removed at each succeeding eighth of an inch of deflection, until the wood was observed to lose, however slightly, the power to recover its rectilineal form; a failure in this respect, amounting to the diameter of the thread, was sufficient to determine its character for elasticity, after which the weights were continued until the fracture took place.

* *E. globulus*. † *E. viminalis* and *E. obliqua*.

The apparatus used for ascertaining the direct cohesion was as follows : Lengths of about 16 inches were cut from the pieces broken transversely, and turned in an ordinary lathe to about $1\frac{1}{2}$ inches diameter; about 1 inch in the middle was further turned down to three-eighths of an inch diameter, which was then carefully squared to a quarter of an inch with a fine file; and this in each case formed the portion to be tested. Through a hole accurately bored across the thick part of these pieces, near each end, short bolts were passed; to these bolts were attached short pieces of good rope, having eyes spliced in each end to receive them. A second piece of rope, passed through the first in the form of a link, sustained the scale at the lower end; and a similar one at the upper end hooked the beam which held the whole.

1902.—A. O. Green. "The Timber Industry" (published separately as 'Tasmanian Timbers; their qualities and uses'), *Proc. Roy. Soc., Tas.*, 1902 (p. 35).

This paper contains a number of results of tests of strengths of Tasmanian timbers, including some Eucalypts. The principal species dealt with are Blue Gum (*E. globulus*), Stringybark (*E. obliqua*), Swamp Gum (*E. regnans*).

VICTORIA.

1879.—"Experiments on the Tensile Strength of a few of the Colonial Timbers," by Fred. A. Campbell, C.E., *Trans. Roy. Soc., Victoria*, 1879.

As the power I could bring to bear on the specimens did not exceed 1 ton I found it necessary to work upon specimens with a sectional area of one-sixteenth of an inch. . . . The apparatus used was of the roughest description, but it answered its purpose. The specimens were held at each end by wrought-iron clips (figures are given with the paper), and then hung and pulled by means of a lever. Using known weights, and sliding them along the lever, which was graduated, I readily obtained the breaking weight of the specimen. The weights were always applied in such a way as to cause a gradually increasing stress upon the specimen, perhaps fifteen to twenty minutes being taken to work up to the breaking weight.

1880.—"Results of experiments on the transverse strength of the wood of *E. globulus*," by Baron von Mueller and J. G. Luehmann.

"Results of experiments on the transverse strength of the wood of various Eucalypts," by the same.

Both these tables are published in a *Catalogue of Timbers of Victoria in the Technological Museum of Melbourne*, by Baron Mueller. They were originally published in the Sixth Decade of the learned Baron's *Eucalyptographia* under *E. globulus*.

The experiments were performed on pieces of 2 inches square, and 2 feet long between the supports, the weight suspended in the middle, both ends free. The *E. globulus* timber was seasoned for nine months; similar information is not given in regard to the other timbers.

1884.—"Official Report of the Carriage Timber Board, Victorian Railways, Melbourne, 1884." This Board was appointed on a motion in the Victorian Parliament, with a view of ascertaining, by various experiments, the best kind of timber grown in the Australian colonies adapted for the construction of railway vehicles.

The timbers received were seasoned for a year, and tests of them were conducted at the railway workshops at Newport, near Melbourne, from January to April, 1884. The mode of testing the various specimens was as follows :—

Two standards, 6 feet apart, were erected to form bearings for the specimens, which were 7 feet long, and $1\frac{1}{4}$ of an inch square. Weight was applied at the centre, where a measure was adjusted to show, in inches and parts, the exact deflection at and before breakage. Three specimens of each contribution were tested, and the mean result recorded.

1885.—Experiments on the elasticity and strength of Red Gum Timber (*E. rostrata*), made at Sandhurst, Victoria, March, 1885, by the Engineer-in-Chief, Railway Department, are quoted at p. 135 of the N.S.W. "Railway Bridges Enquiry Commission," 1886, referred to below, p. 421.

1887.—Experiments on the transverse strength of Colonial and other Timber, by J. Lunt, Engineer for Existing Lines, Victoria, 15th September, 1887. In fourth Progress Report of Victorian Royal Commission on Vegetable Products, p. 488. The timber was *E. rostrata*. See James Mann, below.

1892.—"Tests of Victorian Timbers," by E. R. Meekison (Annual Report of Secretary for Mines, Victoria, 1892).

The pieces tested were nine months seasoned, and were all planed to 1 inch square. All the tests were made with the weight in the centre and the ends free; the distances given were those between the supports.

From the tests the following co-efficients of rupture were obtained :—Ironbark 19, Blue Gum 18, Stringybark 17, Red Gum 7·5.

L. Length of beam or span	...	} in inches.
B. Breadth of beam		
D. Depth of beam		
K. Co-efficient of rupture	...	

$$\frac{4 K B D^2}{L} \text{ breaking weight in cwt.}$$

(The botanical names of the timbers were doubtless *E. sideroxylon*, *E. leucoxylon*, *E. macrorrhyncha*, *E. rostrata* respectively.

1900.—"Australian timber; its strength, durability, and identification," by James Mann (Melbourne, 1900).

The specimens were tested in the Engineering Department of the University of Melbourne, and the work, though small, is an admirable one. It not only takes cognizance of the effect of various stresses, but goes into the question of the various agencies which impair the durability of timber.

He quotes details of the tests made by Mr. Lunt at Sandhurst (Bendigo) in 1865 on behalf of the Railway Department. The timber was Red Gum (*E. rostrata*). Details of other experiments by Victorian engineers are also quoted.

NEW SOUTH WALES.

1855.—“Tests of New South Wales timbers at the Paris Exhibition, by Captain Fowke, R.E.” (The author has been unable to obtain access to a record of these tests.) Some of the results are reproduced in Mr. Balfour’s Report (*infra*).

The experiments were all made on samples 2 inches square and 1 foot between supports, any which did not agree with those standard dimensions being reduced thereto by calculation.

1858.—“Report of Results obtained from Experiments on the Elasticity and Strength of Timber in New South Wales, procured through the Chief Commissioner of Railways, and tested at the Sydney Branch of the Royal Mint, in the month of March, 1858.” Read before the Philosophical Society of New South Wales (now the Royal Society), 12th May, 1858, and printed in the *Sydney Magazine of Science and Art* for May, 1858 (p. 258).

The document was also printed by order of the Legislative Assembly on 3rd August, 1858, under the title “Timber of New South Wales (its elasticity and strength).”

The specimens used were fresh cut, taken from trees in the neighbourhood of Belford, which lies 18 miles from Maitland and 10 miles from Singleton, on the Great Northern Road.

The experiments were conducted as follows:—“The distance between the supports was 4 feet; the beam rested on iron trestle-heads, firmly fixed and prevented from collapsing by stays, the ends left free; the weights were applied in the centre, and increased by half-hundred weights at a time, at the intervals of half an hour, till the elasticity was evidently destroyed, when the interval between each addition was prolonged to an hour. At the end of each interval the beam was relieved of its weight. This was effected by means of a screw-jack, which raised the scale on which the weights rested, thus the beam was always relieved from pressure, and subjected to it, without jerks.”

1860.—“Report of further experiments conducted at the Sydney Branch of the Royal Mint, to determine the strength and elasticity of colonial timber, by E. W. Ward, Esq., Deputy-Master, presented to Parliament 6th February, 1861.” *New South Wales Votes and Proceedings* for 1861, vol. ii. (In the following pages this report is referred to when the words “Sydney Mint” are used.)

The experiments were conducted as follows:—“The timber, which usually consisted of a beam 2 inches x 2 inches in scantling, and 5 feet in length, was placed horizontally on supports 4 feet apart, and consisting of iron trestle-heads firmly fixed and secured from collapsing by stays. The ends of the beam were left free. The weights were applied to the centre by means of a scale suspended from an iron staple adjusted half way between the supports. Commencing with a weight of 6 cwt., an addition of $\frac{1}{2}$ cwt. was made at the end of every half-hour until 9 cwt. had been applied, when the interval between each successive application was extended to one hour. At the end of each interval the beam was relieved of its weight by means of a screw-jack, which raised the scale in which the weights rested, and after the addition of $\frac{1}{2}$ cwt. the weight was brought to bear by gently lowering the scale by the means by which it had been raised. As soon as it was noticed that the beam on being relieved did not return to its horizontal position, the weight in the scale, and the deflection of the beam at that weight (the deflection at any particular weight was indicated on a dial fixed above the beam, and having a point connected by a simple arrangement with the iron staple to which the scale was attached) were recorded as those at which the elasticity had become impaired, and used as the necessary factors for determining the value

of E. After this, successive additions were made of $\frac{1}{2}$ cwt. at the intervals and in the manner already mentioned until the beam broke; the breaking weight, or that less by $\frac{1}{2}$ cwt., if the beam broke within one minute of the weight being applied, being taken to determine the value of the constant S."

"The screw-jack employed was found convenient for many purpose. Being fitted on the top with a horizontal table, it served to raise and lower the scale containing the weights, and thus to apply to the beam the desired pressure without jerk; it admitted of such an adjustment of the table as to prevent (on the fracture of the beam) the fall of the scale through unnecessary space, and the damage to the scale often so occasioned; and it allowed the scale to be attached to a fresh beam without removing the whole of the weights."

1865.—"Results of a series of experiments on the strength of New Zealand and other colonial woods, by J. M. Balfour, C.E., Provincial Marine Engineer of Otago, &c." Forming Appendix C of the *Report of the New Zealand Exhibition* of 1864. (See "Captain Fowke's results" above.)

1886.—"The strength and elasticity of Ironbark timber as applied to Works of Construction." by W. H. Warren (*Proc. Roy. Soc. N.S.W.*, xx, 261, 1886).

Some previous experiments are also quoted. In this paper Professor Warren (besides the experiments performed by himself) alludes to two experiments on the transverse strength of beams of Ironbark not referred to above.

1886.—Railway Bridges Enquiry Commission. Report of the Royal Commission appointed to inquire into the stability of . . . and also of the timber approaches to the bridge over the Murrumbidgee River at Wagga Wagga. (Sydney, Government Printer, 1886).

Special Reports:—Wagga Wagga Viaducts, p. 94; Clyde Experiments on Timber, p. 97; Strength and elasticity of colonial timber (Ironbark and Red Gum), p. 99.

See also 1885, Victoria, above, p. 419.

1887.—Warren, W. H. "The strength and elasticity of New South Wales timbers of commercial value" (1887). Prepared for the Adelaide Jubilee Exhibition (1887) and the Melbourne Centennial Exhibition (1888).

The paper is illustrated by numerous plates showing the apparatus employed, and also showing graphically the stresses to which the timbers were subjected. An autographic stress-strain apparatus (designed by Professor Warren and Mr. J. A. McDonald) was used.

1889.—Warren, W. H. "The transverse strength of Australian timbers." Read before the Engineering Association of New South Wales. *Building and Engineering Journal*, Sydney, 22nd July, 1889, p. 452.

While it mainly deals with New South Wales timbers, it also takes cognizance of some Victorian, South Australian, and Western Australian ones.

1889.—J. H. Maiden. "Notes on some New South Wales Timbers." A paper read by invitation before the Engineering Association of New South Wales, and published in the *Building and Engineering Journal* of 25th May, 1889.

This paper gives references to engineering tests on each timber referred to.

1889.—Maiden, J. H. "The Ironbarks of New South Wales." Read by invitation before the Sydney Architectural Association, and printed in the *Australasian Builder and Contractor's News*, 9th September, 1893.

Part I.—Ironbarks in general; (a) Introductory; (b) Principal uses; (c) Talk of Ironbarks; (d) How to tell Ironbark; (e) Ironbark substitutes; (f) Ironbark and white ants; (g) Properties of Ironbark; (h) Where Ironbark grows.

Part II.—The various kinds of Ironbark. The paper concludes with "A Tentative Bibliography of the Ironbarks," containing references to twenty works, those containing engineering tests being specially indicated.

1906.—Nangle, J. "Transverse tests of Jarrah made at Sydney Technical College." *Proc. Roy. Soc. N.S.W.*, xl, ci (1906).

The Jarrah is *E. marginata*, a Western Australian timber.

1913.—Nangle, J. "On some transverse tests of Australian and foreign timbers." *Proc. Roy. Soc. N.S.W.*, xlvii, 165 (1913).

The results of a number of Eucalypts are given in the tables at pages 168, 169.

1918.—In the Report of the Forestry Commission of New South Wales for the year ended 30th June, 1918, will be found notes on compression tests on 2-inch cubes, on the timbers of *E. nitens*, *E. Muelleriana*, *E. obliqua*, *E. dives*, and *E. viminalis*. Also transverse tests on the timbers of *E. nitens*, *E. Muelleriana* and *E. obliqua*.

1920.—A comparative test of Ironbark (*E. paniculata*) and Jarrah (*E. marginata*) conducted at the Engineering School, Sydney University, is quoted in New South Wales Forestry Commission Report, 30th June, 1920, p. 24.

The same experimenter and the same report (p. 25) gives "Tests of Timbers for Aeroplane Construction, Ironbark (*E. paniculata*), Jarrah (*E. marginata*), and Mountain Ash (*E. gigantea*) being employed.

In the report on these tests it is stated :—"That one of the questions influencing the relative values of timbers for aeroplane construction is the ratio of the strength to weight per cubic foot."

QUEENSLAND.

1879.—Byerley, F., C.E., in the *Australian Engineering and Building News*, November, 1879.

He experimented (see *Eucalyptographia* under *E. tessellaris*) on seasoned specimens of 1 inch square, weights being applied to the middle of the rods between supports 1 foot apart, the ends being free.

1905.—MacMahon, P. "The Merchantable Timbers of Queensland" (Brisbane, 1905). Page 21, "Durability of Queensland sleepers"; p. 24, Strength of Queensland timbers." Table 21 consists of transverse tests. The work contains many records (some illustrated by excellent photographs) of various physical tests, mostly undertaken by the Railway Department.

1916.—"Notes on and Tests of Queensland timbers used in Railway works" (Queensland Railways, Chief Engineer's Branch). Government Printer, Brisbane, 1916, p. 140, including plates.

This is a very important publication, and contains the results of original tests on Eucalyptus and other timbers. The Eucalypts are enumerated at pages 7 and 8. See also the corrections in the "Addenda" list. To some extent Queensland has a set of vernacular names of timbers of her own.

1917.—Jolly, N. W. "Notes on the principal timbers of Queensland," Forestry Bulletin, No. 2 (Brisbane, 1917).

Notes are given in regard to twenty-one species. Particulars are given in regard to the Railway Department's tables (1916) of the strength and durability of some of them.

SOUTH AUSTRALIA.

1908.—Chapman, Professor R. W. "The strength of some South Australian timbers." (*Trans. Roy. Soc. S.A.*, xxxii, 328, 1908).

WESTERN AUSTRALIA.

1875.—"Timber and Timber Trees, native and foreign," by Thomas Laslett, Timber Inspector to the Admiralty, London. Macmillan & Co. (1st edition, 1875).

The tests for the transverse strengths in my experiments were conducted in every case with pieces 2 inches x 2 inches x 84 inches = 336 cubic inches. Each piece was placed upon supports exactly 6 feet apart, and then water was placed gently and gradually into a scale suspended from the middle until the piece broke, note being taken of the deflection with 390 lb. weight, and also at the crisis of breaking.

After this a piece 2 feet 6 inches in length was taken, whenever it was found practicable, from one of the two pieces broken by the transverse strain, and tested for the tensile strain by means of a powerful hydraulic machine, the direct cohesion of the fibres being thus obtained with great exactness. Further, for the purpose of determining the proportions of size to length best adapted for supporting heavy weights, a great many cube blocks were prepared, of various sizes, as also a number of other pieces of different form and dimensions, which were then, by the aid of the same machine, subjected to gradually increasing vertical pressure in the direction of their fibres, until a force sufficient to crush them was obtained.

A second edition of this work, edited and enlarged by the late Professor Marshall Ward, was published in 1893. Chapter XXIII is devoted to the "Timber-trees of Australia," and includes accounts, more or less full, of the timbers of Tuart (*E. gomphocephala*), Jarrah (*E. marginata*), Karri (*E. diversicolor*), Ironbark (*E. siderophloia*) (as *E. resinifera*), Blue Gum (*E. globulus*), Stringybark (*E. obliqua*).

Most of the trees referred to being Western Australian, a note of it is given at this place.

1907.—Julius, G. A. "The economic use of Australian hardwoods." A paper read before the Western Australian Institute of Architects, Perth, 20th July, 1907. 8vo., p. 69. Profusely illustrated, and embodies the results of many physical tests by the author.

1908.—Julius, G. A. (a) "Western Australian Timber Tests, 1906: The physical characteristics of the hardwoods of Western Australia." Fcp., 74 plates, 2nd edition, 1908.

(b) A Supplement, with twenty-one plates, containing the 1907 tests, was also published. 2nd edition, 1908.

(c) Then we have, by the same author, "Notes *re* timbers of Western Australia, suitable for Railways, Engineering Works and constructional purposes generally," with a number of excellent photo. illustrations and a map. The brief descriptions of the "principal trees and timbers" given at p. 6, refer to Jarrah, Karri, Tuart, Blackbutt, Wandoo, York Gum, Red Gum. (In addition, Yate, Salmon Gum and Morrell, together with five non-Eucalypts, were dealt with in the original work.)

Under (a), p. 6, we have "To satisfactorily determine the 'strength' both 'ultimate' and 'within the elastic limit' of the various timbers of the State, the following tests were conducted:—

- "1. Tests in cross-bending, the timber being used as a beam, supported at the ends and loaded centrally.
- "2. Tensile tests.
- "3. End compression tests, the load being applied 'endwise' upon specimens of various dimensions, the ratios of 'length to breadth.'
- "4. 'Cross' compression tests, the load being applied across the fibre of the material.
- "5. Shearing tests along the fibre of the material.
- "6. 'Hardness' tests determined by the resistance to penetration, under both, 'steadily applied' and 'suddenly imposed' loads.
- "7. 'Spalling' tests, which were arranged to record the resistance opposed to splitting and crushing under repeated blows 'on end.'

"In addition to the above, tests were made to ascertain the 'holding power' of the various timbers upon railway 'dog spikes,' both with green and dry timbers, with spikes newly driven and with those that had been in place in 'sleepers' for a varying number of years."

"Chemical tests were also conducted to determine the nature of the sap present in the various timbers and its effect upon metals, &c."

Mr. Julius (1906 (a), p. 24) states that his tests show the extraordinary strength of *E. cornuta*, or Yate. "As a 'sawn' timber it is probably the strongest in the world, being far ahead of the rest of the Australian hardwoods in every variety of tests, and

in one tensile test with this timber a breaking load of $17\frac{1}{2}$ tons per square inch was recorded, a value only $3\frac{1}{2}$ tons below that usually specified for wrought iron of ordinary quality.

“The results given are fair averages only, the timber being obtained as logs, which were wholly cut up and tested.”

Mr. Julius' supplementary tests, 1907 (1908).

Since the publication of (a), “and particularly of those portions referring to the strength of the timbers of the eastern States of the Commonwealth, various other data have been received, and notably a ‘Report issued by the Government of New South Wales in 1905,’ embodying the results of tests carried out since the publication of Professor Warren’s test results in 1892.

In this report the strength of certain of the timbers indigenous to New South Wales and Queensland are set down at figures considerably below those previously quoted, and it is to be presumed therefore, that these latter results are more nearly representative.

Taking, however, the whole of the data published concerning these hardwoods, the comparatively small number of specimens tested, and the manner in which they were apparently selected and prepared (*vide* Prof. Warren’s report), it precludes the acceptance of the resultant data as in any way conclusive.

The Western Australian Government has therefore conducted a further series of tests upon the most important of the valuable hardwoods of Eastern Australia in a manner exactly similar to and with the same appliances as were used in the tests of the Western Australian timbers. . . . ”

Julius’ results in turn come in for criticism at the hands of D. E. Hutchins (“Discussion on Australian Forestry,” p. 224, 1916).

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Eugenia Smithii Poir.

The Lilly Pilly.

(Family MYRTACEÆ.)

Botanical description.—Genus *Eugenia*, see Part LXIX, p. 408.

Botanical description.—Species *Smithii*, Poir. Encycl. Meth. Suppl., iii, 126 (1813).

A tree, sometimes small and slender, but attaining in some places a considerable height, quite glabrous.

Leaves petiolate, from ovate to ovate-oblong or ovate-lanceolate, obtuse or more or less acuminate, narrowed at the base, mostly 2 to 3 inches long, smooth and finely penniveined.

Flowers small and numerous, in a terminal trichotomous panicle, sometimes corymbose and shorter than the leaves, sometimes longer and more pyramidal.

Bracts minute and deciduous.

Calyx-tube turbinate, about 1 line long, the free part very much broader; lobes either all very short, broad and scarcely prominent, or one or two rather larger almost petal-like and deciduous.

Real petals four, united in a small flat, very deciduous, calyptra.

Stamens scarcely 1 line long; anthers small, with distinct globular divaricate cells.

Ovules rather numerous.

Fruit white or purple, globular, $\frac{1}{4}$ to $\frac{1}{2}$ inch in diameter, crowned by the circular prominent calyx-rim; endocarp thick and hard. Cotyledons closely combined. (B.Fl., iii, 280, 1866.)

Botanical Name.—*Eugenia*, already explained in Part LXIX. *Smithii*, in honour of Sir James of that ilk, purchaser of the Linnæan herbarium, and an assiduous worker at Australian plants during the end of the eighteenth and the early part of the nineteenth century.

Vernacular Name.—"Lilly Pilly" is the name in universal use, and I suspect it to be of aboriginal origin, but I cannot trace it as such. Sir William Macarthur, in the Catalogue of New South Wales exhibits for the Paris Exhibition of 1855, spelled it "Lily Pily."

Aboriginal Names.—Called "Tdgerail" by the aborigines of Illawarra (New South Wales), according to the late Sir William Macarthur, and "Coochin-Coochin" by some Queensland aborigines.

Synonyms.—*Eugenia elliptica* Sm., in *Trans. Linn. Soc.*, iii, 281 not of Lam; *Bot. Mag.*, t. 1872; *Myrtus Smithii* Spreng., *Syst.* ii, 487; *Acmena floribunda*, var. B. DC. *Prod.*, iii, 262; *Bot. Mag.*, t. 5,480 (wrong as to the petals); *Syzygium brachynemum* F. Muell., *Fragm.* iv, 59 and *Pl., Vict. Suppl.*, t. 18 (the petals not quite correct); probably also *Acmena Kingii*, G. Don., *Gard. Dict.*, ii, 851.

It is therefore a species which has had a not entirely smooth botanical career.

Flowers.—The anthers with divaricate cells are, so far as hitherto observed, exceptional in the genus, as originally pointed out by Mueller.

Fruit.—The fruits are eaten by the aborigines and small boys. They are formed in profusion, are acidulous and wholesome. They are white with a purplish tint, and up to 1 inch in diameter. When they are ripe, one frequently notices that a large proportion of them have been pecked by birds, and no doubt they also provide sustenance to flying-foxes and other native animals. It is probable that every Australian *Eugenia* yields, or has yielded, food to the hungry blackfellow, but the following species undoubtedly have done so:—*E. cormiflora*, whose fruit is called “Murro” by some Queensland blacks; *E. eucalyptoides*, the “Endeavour River Pear,” of Queensland, which has a pear-shaped fruit of about 1½ inches in length, and of a pinkish colour. It is a beautiful object, and of an agreeable flavour. *E. myrtifolia* is the well-known “Native Myrtle” or “Brush Cherry” often to be seen in gardens, where it forms a beautiful object when in fruit, which fruit can be eaten by a hungry white man. The Queensland *E. Tierneyana* also produces fruit in large quantities, and it is sometimes made into jam. For some others, see Bailey’s “Queensland Flora.”

Timber.—The *Eugenias* and some other myrtaceous timbers (“Myrtles,” as they are generically called by many people) are only to be sparingly used for building purposes, as they are liable to dry-rot and white-ant. The lilly pilly does not yield the best timber of the genus, but it is a representative one, and it is very apt to split in seasoning. It is, however, a tough, hard wood, and is used for such purposes as axe-handles and tool-handles in general. *Eugenia* timbers have not, however, received careful investigation, and closer attention to them may show that they are more valuable than they have hitherto been considered.

Bark.—In the *Sydney Mail* of 10th January, 1891, I wrote as follows:—

Just a few words in conclusion as to the value of Lilly Pilly as a tan. In these colonies it is usually supposed that no trees produce tan-barks except Wattles, and that no Wattle-barks are worthy of attention except two or three of the best. I do not wish to underrate the importance of Wattles, and of course they are likely always to produce the great bulk of our tan material from wild or cultivated trees. In Tasmania, where Wattle-bark has for many years proved so valuable an article of export, the necessity has already arisen for falling back on the barks of other of our native trees, and Myrtle bark (*Fagus*) has met with much acceptance. And in different parts of the colonies different tan-barks are used locally, the choice of which has not always been made with discrimination, for it requires much practice to gauge the value of tan-bark. Some few years ago I drew public attention to the value of Lilly Pilly bark for tanning, and the matter is well worthy of note. The trees attain a large size; they are often abundant, while the bark is of fair thickness. Most of the barks examined by me contained under 20 per cent. of

tannic acid, but one from the Shoalhaven River yielded the respectable result of 28.6 per cent. of tannic acid. This result having been once reached can be attained again, and there are doubtless thousands of tons of Lilly Pilly bark in New South Wales containing nearly 30 per cent. of tannic acid, but not in any way utilised. Experiments such as these throw a little sidelight on the marvellous unused and unappreciated wealth produced by the indigenous plants of New South Wales. Sooner or later this wealth will be utilised.

In the same journal for 13th August, 1892, the previous article was followed up as follows :—

I expressed a desire for Lilly Pilly bark to be put to a practical test, as the laboratory determinations of tannic acid had proved so satisfactory. Mr. Thomas Shepherd, tanner and leather factor, of Cambewarra, a few miles from Moss Vale, has had the public spirit to very carefully submit Lilly Pilly bark and good Black Wattle bark to comparative tests with hides as far as possible alike. An account of his labour is given in his own words, and it has been his endeavour to state the case for and against Lilly Pilly bark as fairly as possible. It will be observed that the chief objection to it lies in the colour of the leather, but the leather is superior to Wattle leather both in texture and strength. Surely this is most encouraging. As far as I know, Lilly Pilly bark has not been utilised on a commercial scale hitherto. If it be still unutilised, neglect of it will mean the waste of thousands of tons of a useful, cheap and readily available tan bark. It is true that Wattle bark is comparatively low at present, but it has crept up and up in price during the last few years, and (until the Wattle plantations are in full bearing) the demand even exceeds the local supply, and leaves no margin for export. The use of Lilly Pilly bark should render some of our choice Wattle bark available for export. Besides the Lilly Pilly, I hope to bring under the notice of the readers of the *Mail* the very important fact that we have other valuable tan-barks as well. In fact, the coast forests of New South Wales are teeming with wealth, not only in timber, but in bark; and it is a favourable sign that people engaged in local industries are seriously turning their attention to this vegetable wealth. The exploitation of it will yield steady and satisfactory results, neither as brilliant nor as disappointing as many mining ventures.

Through reading your papers, writes Mr. Shepherd, on tan substances of New South Wales, in which you give an assay of Lilly Pilly bark, and expressed a desire that it should be put to practical tests, I have carried out your wish, and herewith give you my results. Some time back I procured 100 bundles of Lilly Pilly bark. I had it finely ground, and one-half was put in the tan-pit with clean water to spend it, and for six days heated it with steam. Then the remainder of the bark was placed in No. 2 pit, and the liquor from No. 1 pumped on to it, slightly heating it for three days, and allowed to remain for two days to get thoroughly cold. The liquor was then pumped off for tanning. Sixty sides for kip leather which had just been coloured, were placed in it, handled each day for four weeks, and thoroughly tanned. The leather I found very easy to work; in fact, the softest cutting I ever had anything to do with, and, what was most singular, it had all the appearances of being hard, very dark in colour, and with cloudy grain, with scarcely any difference to cut on any portion of the sides, the softest or coarsest fibre parts showing just as smooth or close surface as the hardest. The tan, or rather stain, I should call it, from its action upon the hands, has this objection. It stains them just as if they were immersed in lime and then in tan liquor, and the stain can only be removed with pumice-stone. Several times during the day I had to wash my hands in a strong solution of sulphuric acid to remove a hard, gummy feeling from them in order that I might retain a firm hold upon the knife used in shaving the hides.

I am of opinion that Lilly Pilly is a very fine tan for light-dressed leather, being soft, and well filled, and should wear well. With this I send you leather shavings from three different parts of two sides respectively treated with Lilly Pilly and Wattle tannage. Each side has been treated similarly to the other, and the sides chosen as nearly alike as my judgment would lead me. Each of the three parts of the sides is taken from cheek, rib, and butt respectively, and each shows both flesh and grain. The half side or side cheek just under the jawbone yields always coarse fibre, and is difficult to cut; the rib is close and easy to cut; the butt hard, brittle, and hard to cut in Wattle tan. But with Lilly Pilly tan there is not perceptible difference in cheek, rib, and butt. In fact, there is no variation, even in the bellies, which show close and good surface and are easily cut. I intend to put the two sides (tanned with Lilly Pilly and Wattle respectively) to a further comparative test, viz., wearing, the result of which I will inform you.

There is, however, one objection to Lilly Pilly as a tan, in that it has a very bad colour, dirty-brown approaching to black, and cloudy, and would only do for dressed shoe-leather. From the second liquor I pumped off I tried some sole leather; it turned out a very unsaleable colour, and had an appearance like fine sand upon each surface, both flesh and grain.

In Lilly Pilly leather there is a gloss and closeness in texture almost the same in each piece. It has a very much smoother feel than the Wattle, which has a dry, harsh look and feel, which is most noticeable if the whole is damped. Again, any portion of the Lilly Pilly leather stands a stronger strain than the Wattle leather.

If Wattle fails, or becomes dear, Lilly Pilly is the best substitute we have that I know of, and next spring I will get in a quantity and put it in use.

Size.—It is a moderate-sized, glossy-leaved tree, bearing an abundance of small, white flowers, and it is particularly ornamental when covered with a profusion of fruit, each of which is about an inch long and of a white colour, tinted with pink and purple.

Habitat—Following are the localities given in the *Flora Australiensis*:—

New South Wales.—Port Jackson to the Blue Mountains, R. Brown and others; northward to Hastings, Clarence, and Macleay Rivers, Beckler, Wilcox; New England, C. Stuart; southward to Illawarra, A. Cunningham; Twofold Bay, F. Mueller.

It, however, extends to Victoria on the south, and to Queensland and the Northern Territory on the north. It likes shelter from the sea-breezes; at the same time, in a stunted form, it is found in many localities almost within reach of the sea-spray.

It is, however, a denizen of the brush, and if it can obtain its requirements of deep soil, even if light and sandy, plenty of moisture, and sufficient shelter, it flourishes in mountain gullies more than up to a hundred miles away from the sea.

Following are some specimens represented in the National Herbarium, Sydney:—

Victoria.—Sealer's Cove (J. L. King).

New South Wales.—Eden; this is near the Victorian border (J. L. Boorman); tree of 30 feet, Bermagui (W. Dunn). Boyne State Forest, 10 miles north of Bateman's Bay (Forest Guard L. Walker).

Sussex Inlet Heads (J.H.M.). Stanwell Park (A. A. Hamilton).

All the above are coastal localities.

Wingello (J. L. Boorman) is on the southern tableland near Goulburn.

Then it is very abundant in the Sydney district, Prospect Creek, Fairfield (E. Betche), the Blue Mountains generally, and Newnes, Wolgan Valley (Henry Deane), are western localities.

North of the Hawkesbury River we have—

Wiseman's Ferry (J. L. Boorman), "White Myrtle," Gosford (W. A. W. de Beuzeville), Pink Lilly Pilly, Yarramalong (W. A. W. de Beuzeville), Maitland (E. W. Rudder, 1855), Booral (A. Rudder), Bullahdelah (A. Rudder), Wauchope (W. D. Goodacre), Port Macquarie (Forester G. R. Brown), Upper Hastings River (J.H.M.),

1897), Tooloom (J.H.M.), Tabulam (J. L. Boorman), Coramba and Orara River (J. L. Boorman), Coff's Harbour to Grafton (J.H.M. and J. L. Boorman), Byron Bay (J.H.M. and J. L. Boorman), Tenterfield to Sandy Flat (J.H.M.), Sandiland Range (J. L. Boorman), Drake (J. Richards), Acacia Creek, Macpherson Range (Forester W. Dunn), Ballina (W. Baeuerlen), Brunswick River (J.H.M. and J. L. Boorman), Murwillumbah (W. Forsyth), Tweed Heads (J.H.M. and J. L. Boorman).

Queensland.—Myrtle Creek towards Brisbane, 4th December, 1843 (Dr. L. Leichhardt).

Ithaca Creek and Goodna (C. T. White).

Toowoomba (Hubert A. Longman and J.H.M.).

It occurs both south to north in the coastal districts, as far as the Northern Territory.

Variety *minor*.

In the *Agricultural Gazette, N.S.W.*, ix, 581 (1898), in an article "Mount Seaview and the Way Thither," I constituted the above variety.

There is a small-leaved form of the Lilly Pilly (*Eugenia Smithii*). It is very abundant on the banks of the Hastings River, where it is up to 30 feet in height and 1 foot in diameter.

It is a small-leaved tree with leaves (say) $1\frac{1}{4}$ by $\frac{1}{2}$ inch. Leaves much the same shape as those of *E. Smithii*, but much smaller. This characteristic is constant over a large area, and I therefore propose the name *minor* for this variety. It was in flower when I collected it, and I thought it might be *E. parvifolia* C. Moore, but the spreading calyx shows that that cannot be the case. Leaves, flowers, and fruits are alike smaller than those of the normal species.

Following are some ascertained localities of this variety which, like the normal species, requires more careful collecting to ascertain its range :—

Beginning south, the following are localities represented in the National Herbarium :—

Stewart's Brook, tributary of the Upper Hunter River (J.H.M.); Upper Hastings River (type locality), (J.H.M.). Dorriggo (J.H.M.).

"A very distinct plant from the normal species, being of a more tapering growth, and grows to a long slender tree of 10-20 feet or more high, much after the style of *Myrtus fragrantissima*." Dorriggo (J. L. Boorman).

Tunstall, Richmond River (H. Tanner).

20-60 feet, Acacia Creek, Macpherson Range (Wm. Dunn).

Mount Warning, near Murwillumbah (W. Forsyth).

The above are New South Wales localities; doubtless it is common enough in Queensland.

EXPLANATION OF PLATE 264.

- a. Flowering twig.
- b. Vertical section of flower—
 - (a) Calyx.
 - (b) Petal.
 - (c) Stamens.
 - (d) Pistil.
 - (e) Ovary.
- c. Plan of bud showing calyx lobes.
- d. Anthers.
- e. Fruiting twig.
- f. Fruit.

PHOTOGRAPHIC ILLUSTRATIONS.

Eugenia Smithii, Milton, New South Wales. (R. H. Cambage. photo.)

Eugenia Smithii in fruit. (R. H. Cambage, photo.)

LILLY PILLY.
(*Eugenia Smithii* POIR.)

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R. H. Cambage, photo.

THE LILLY PILLY (*Eugenia Smithii*), MILTON, NEW SOUTH WALES.

R. H. Cambage, photo.

THE LILLY PILLY (*Eugenia Smithii*) IN FRUIT, MILTON.

No. 273.

Eucalyptus Bakeri Maiden.

Baker's Gum.

(Family MYRTACEÆ.)

Botanical description.—Genus *Eucalyptus*, see Part ii, p. 23.

Botanical description.—Species *Bakeri* Maiden, in *Journ. Roy. Soc. N.S.W.*, xlvii, 87 (1913).

A large shrub or small, pendulous, Willow-like tree, attaining a height of 30-50 feet, forming a single stem or stooling from the ground.

Juvenile leaves dull green on both sides, linear-lanceolate, hardly acuminate, about 6 or 7 cm. long, the venation not distinct, the intramarginal vein close to the edge, the lateral veins penniveined, plentifully besprinkled with oil-dots and the branchlets angular and glandular.

Mature leaves linear-lanceolate, petiolate, acuminate or with a hooked tip, bright-green, dull-shiny, richly covered with oil-dots, venation indistinct, the intramarginal vein distinct from the edge, the lateral veins penniveined. Average dimensions 9 by 1 cm.

(If the species were gregarious, it would probably be found to be a valuable oil-yielding species.)

Flowers.—Umbels mostly axillary and flowers numerous, often 10-13 in an umbel, which sometimes takes on a stellulate appearance. Operculum elongated, very much larger than the calyx-tube, which is of slightly increased diameter, and which tapers, somewhat abruptly, into the short pedicel. The common peduncle about 1 cm.

Anthers small, renantheroid, but the two cells more united than in the Renantheræ; spherical gland at top and back.

Fruits.—Small, about 5 mm. in diameter, truncate-spheroid, the tips of the valves awl-shaped, and protruding 2 mm. from the orifice.

Botanical Name.—*Eucalyptus*, already explained (see Part II, p. 34); *Bakeri*, in honour of Richard Thomas Baker, who has done valuable work in connection with this genus, and who has co-operated with Mr. Henry George Smith in "Research on the Eucalypts," and in many other smaller works on the genus. The two species, which commemorate the names of these partners, will be found described in the present Part.

Vernacular Name.—"Baker's Gum" is the name I propose, since it has none other than an inappropriate appellation in the bush.

Leaves.—The leaves are certainly rich in oil, and I would like to see a distillation made of them.

Bark.—Dark, box-like, or hard and scaly up to its branches, falling away in long flakes, rough at the butt, branches clean, bluish-green or pale-yellow to white right up to the tips.

Timber.—Hard and heavy, of a deep red when freshly cut, becoming browner with age, the grain of the timber fibrous, very tough, reputed to be an excellent timber for wheelwrights' work.

Size.—It is a large shrub or small, pendulous, willow-like tree, attaining a height of 30–50 feet, forming a single stem or stooling from the ground.

Habitat.—It extends from northern New South Wales to Central Queensland, so far as we know at present.

Following are specimens in the National Herbarium, Sydney. I am satisfied that careful research will bring many new localities to light.

New South Wales.—"Willowy Eucalypt," Warialda, N.S.W. (W. A. W. de Beuzeville, No. 3); Ticketty Well, Wallangra (E. H. F. Swain, July, 1911. The type. J. L. Boorman, December, 1912); "Tree-like Mallee," 28 feet high and 5 inches in diameter, wood brown, bark grey up to 6 feet, then yellowish. Ticketty Well, locality of type (Forest Guard A. Julius, Nos. 17 and 19). The leaves of these specimens are broader than those of the type (*Journ. Roy. Soc. N.S.W.*, liii, 68, 1919).

Queensland.—"Small bush, grows up to 10 feet high, grows very thickly on the poorest soil, where there is no Ironbark cover." Warwick (Forester W. E. Moore, through C. T. White). Near Jericho (J. L. Boorman). It is a Mallee, and it would appear that Mallee is rare in the northern State. It grows in masses on red stony ridges around the black soil of the flats, up to 10 feet high as seen. Gidgee (*Acacia Cambagei* R. T. Baker), and *Gastrolobium grandiflorum* F.v.M. grow in the immediate neighbourhood. (*Proc. Roy. Soc. N.S.W.*, xlvii, 235, 1913, as *E. oleosa*). Eidsvold (T. L. Bancroft).

EXPLANATION OF PLATE 265.

- A. Juvenile leaves.
- B. Buds.
- C. Fruiting twig.
- D. Leaf from fruiting twig.

BAKER'S GUM.

SMITH'S GUM.

(*Eucalyptus Bakeri* MAIDEN.) (A-D) (*Eucalyptus Smithii* R. T. BAKER.) (E-H)

No. 274.

Eucalyptus Smithii R. T. Baker.

Smith's Gum.

(Family MYRTACEÆ.)

Botanical description.—Genus *Eucalyptus*, see Part II, p. 23.

Botanical description.—Species *Smithii* R. T. Baker in *Proc. Linn. Soc. N.S.W.*, xxiv, 292 (1899).

A tall tree, sometimes attaining a height of 150 feet and a diameter of from 2 to 4 feet. Bark on old trees deeply furrowed and dark grey to blackish, standing between a Stringybark and an Ironbark, but smooth above 10 or 12 feet from the ground to the branches.

Young leaves sessile, lanceolate or rounded at the base, resembling *E. viminalis*, 5 to 6 inches long, not glaucous.

Mature leaves narrow, lanceolate, acuminate, of an equal colour on both sides, not shining, venation not very distinct; lateral veins fine, numerous; intramarginal vein close to the edge; petiole about an inch long.

Oil glands very numerous.

Peduncles axillary, flattened, about as long as the petiole, with numerous flowers, from three to fifteen.

Calyx turbinate, narrowing into a short petiole, the whole 3 to 4 lines long.

Operculum hemispherical, shortly acuminate.

Stamens all fertile.

Anthers kidney-shaped.

Ovary flat-topped.

Fruits inclined to hemispherical, occasionally pyriform, 2 to 3 lines in diameter, rim domed, sometimes expanding into a flange; valves exerted, obtuse.

Botanical Name.—*Eucalyptus*, already explained (see Part II, p. 34); *Smithii*, in honour of Henry George Smith, who has made admirable chemical researches chiefly in regard to the oils of Eucalypts, and which are recorded in "Researches on the Eucalypts," in co-operation with Mr. R. T. Baker, and in many scientific papers, most of them read before the Royal Society of this State.

Vernacular Names.—It is called “White-top” because it has smooth limbs, but so are several other species. It is also sometimes called “Blackbutt,” but there are other trees that go by such a name. “Gully Ash” is not distinctive, and simply means that it is a denizen of gullies. I have recommended the name “Smith’s Gum” for the tree. It has been called “Jimmy Green,” but this is suspiciously like “Jerrigree” of aboriginal origin.

Aboriginal Name.—“Jerrigree” was given me as a name in use in the Bungendore district many years ago, but I could not get further particulars concerning it.

Bark.—Already noted under “Botanical description.” It has a peculiarly strong, pleasant odour. In making a cross-section it has a very peculiar appearance, having a number of streaks or rays of a pithy substance, yellow in colour, radiating from the sapwood outwards to the circumference of the bark. (W. Baeuerlen.)

Timber.—The wood is very hard, close-grained, and of a pale brown colour, and can be placed amongst the pale hardwoods of the State. There are no data as to its durability or seasoning qualities, but it probably ranks with “Blackbutt,” *E. pilularis* Sm.

Mr. Andrew Murphy, speaking of the vicinity of Robertson, says: “Timber hard and durable, and splits well; sought after for the mills.”

Size.—A medium-sized or exceptionally large tree. Some sizes are given under “Range.”

Range.—When originally described its range was restricted to a few localities in the south-eastern part of New South Wales. Some additional localities were given in my “Critical Revision of the Genus *Eucalyptus*,” Part XII, p. 77. The following localities show that it has been discovered in Victoria, as predicted, and are in addition to those already recorded:—

Victoria.—Wando Vale. Locally called “Blackbutt.” Bark very rugged and persistent up to small branches. Said to be good durable timber (A. W. Howitt).

“A tall, straight, medium-sized tree. Bark on lower part of bole very rough and scaly, almost like *E. Sieberiana*, tapering off to quite smooth clean bark at 20–30 feet up the stem, thence, as well as branches, clean and smooth. Old bark peeling off upper parts in thin, ribbony flakes like *E. viminalis* or some *E. radiata*. Branches slender and branchlets very slender, giving the tree a graceful, almost willowy appearance. Wood very full of small gum-veins, rather soft and inferior.” Genoa, north-east Gippsland (Harry Hopkins, No. B).

New South Wales.—“Locally known as Jimmy Green. A tough, strong timber, used for waggon construction. Grows to fair height, common up to 80 and 100 feet, but of small girth—up to about 6 feet. Is not plentiful.” Parish of Palerang, county of Murray (Forester G. Boyd).

" Generally leaning, few met with upright. Bark of a port-wine colour in patches, at times almost the whole of the trunk of this one colour. Not of much value commercially." On tops of ridges, Nerriga (J. L. Boorman). Evidently these were wind-swept trees.

" Four miles from Robertson, going south, a great deal of it. Trees of immense size " (Andrew Murphy).

" Trees with rather low spreading tops, with rough bark on the butt. They rather resemble the Black Sally (*E. stellulata*) of New England in the limbs. Between Moss Vale and Paddy's River (Forest Guard William Dunn, No. 23).

" Like Ironbark at base to half-way up trunk, then smooth up to the branches." Wattle Ridge, near Hill Top, Mittagong (E. Cheel).

" Called locally ' White Top.' Very tall tree, with dark persistent bark at the base, and ribbony towards the branches, the inner bark of a whitish colour. Very strongly reminiscent of *E. viminalis*." Hill Top (J. L. Boorman).

Ben Bullen, near Wallerawang. (J.H.M. and J. L. Boorman.)

As it has been commonly confused with other species in the past, its range will probably be extended in the near future.

EXPLANATION OF PLATE 265.

E. Sucker leaves.

F. Sucker leaf from Nye's Hill, Wingello.

G. Flowering twig.

H. Fruits.

No. 275.

Codonocarpus cotinifolius F.v.M.

Horse-radish Tree.

(Family PHYTOLACCACEÆ.)

Botanical description.—Genus *Codonocarpus* A. Cunn. in *Hook. Bot. Misc.*, i, 244 (1830).

Flowers diœcious or monœcious. Perianth very open under the fruit, very shortly and obtusely or obscurely sinuate-toothed. Stamens in the males ten to twenty, radiating in a single series round a central disc, the anthers oblong, nearly sessile. Ovary in the females of twenty to fifty carpels connate in a ring round a central column dilated into a flat disc at the top. Styles or stigmas short or linear, free or slightly connected in a ring round the terminal disc. Fruiting carpels closely connected till near their maturity, separating when ripe from each other and from the central column and opening only along their inner edge. Seeds of adjoining carpels alternately placed near the top and below the top of the carpel, each with a small membranous aril or strophiole. Tall shrubs or trees. Leaves linear or broad. Flowers in leafless racemes, axillary or terminal or the females on the leafless bases of the year's shoot. Bracteoles usually very small under the perianth.

The genus is limited to Australia (B.Fl., v, 147, 1870.)

- Leaves narrow-linear. Styles rather long. Carpels
 thirty to forty *C. pyramidalis*.
 Leaves lanceolate, tapering into a long point.
 Carpels forty to fifty *C. australis*.
 Leaves obovate to broadly lanceolate, obtuse or
 shortly pointed. Styles short, conical. Car-
 pels about twenty to thirty *C. cotinifolius*.

Botanical description.—Species *cotinifolius* F.v.M., *Pl. Vict.*, i, 200 (1862).

Usually a tall shrub or small tree, but attaining sometimes 40 feet, of a pale or glaucous green.

Leaves from broadly obovate or ovate to elliptical, oblong or almost lanceolate, obtuse or shortly pointed, contracted into a rather long petiole, 1 to 2 inches long.

Flowers diœcious or monœcious, but usually the two sexes in separate racemes in the upper axils, sometimes forming a terminal panicle, the males on very short, the females on rather long pedicels.

Perianth about 2 lines diameter in the females, rather smaller in the males.

Stamens, fifteen to twenty.

Ovary about twice as long as the calyx, broadly turbinate, depressed in the centre, consisting of twenty to thirty or rather more carpels, the ovules in alternate carpels inserted near the top or about the middle of the cavity, so as to give the appearance of biseriate cells or carpels.

Styles or stigmas shortly conical and soon wearing off or falling off in a ring.

Fruit oboconical or obovoid, much less expanded at the top and much less depressed in the centre than in *C. australis* (B.Fl., v, 149, 1870).

Following is the original description of this plant :—

A new and genuine species of *Gyrostemon*, *Gyrostemon pungens* (Lindl. MSS.), foliis rhomboideis acutis glaucis in petiolum angustatis. The capsules are arranged in a single verticillus, and consequently this species will belong to *Gyrostemon*, as distinguished from *Codonocarpus* by Mr. Endlicher. (Mitchell's "Three Expeditions," ii, 121.)

Botanical Name.—*Codonocarpus* from the Greek *Kodon* (*codon*), a little bell, and *carpos*, a fruit, owing to the shape of the same; *cotinifolius*, resembling in foliage that of the genus *Cotinus*.

Vernacular Names.—It has a peculiar and somewhat pungent odour, and this pungency extends to the taste, chiefly of the young foliage, but also of the bark. This attracted the attention of the discoverer (Sir Thomas Mitchell) who likened it to Horse-radish. Country people term it "Mustard Tree or Bush," or "Horse-radish Tree," and also compare the odour to turnips. Carrying on the same train of thought, less informed people call it "Quinine Tree" and "Medicine Tree." Because of the appearance of the tree, and perhaps of the lightness of the wood, it is often known as "Native Poplar."

Aboriginal Name.—The only aboriginal name I know is that of "Cucurdie," given by the late K. H. Bennett, a well-known observer in the Ivanhoe, *via* Hay, district, New South Wales.

Synonyms.—*Gyrostemon cotinifolius* Desf., in *Mem. Mus.*, viii, 116, t. 110; Moq., in DC. *Prod.*, xiii, ii, 39; *G. pungens* Lindl., in Mitch., *Three Exped.*, ii, 121; *G. acaciæformis* F.v.M. in *Linnæa* xxv, 439.

Leaves.—Mr. Oswald McMaster wrote to me in 1896—

Shrub 15 feet high, has yellow curly and very brittle roots, and I fear may one day be a very great nuisance to agriculturists, as the roots spread very rapidly in broken ground, and each part grows very freely of its own accord. It has a dark green leaf, of which horses and cattle eat a little in very bad seasons, but do not care for it. It is also subject to ravages of insect pests, which eat every leaf off in some seasons.

Six years later another correspondent, Mr. E. Good, wrote from Bourke—

A small tree or shrub, that grows luxuriantly on red ground about 15 miles south-west from here. It is called the "Mustard Tree," owing to its tasting like mustard; it grows like a Fir-tree, tapering to the top; the wood is very soft and sappy, and when fully matured attains a height of about 15 feet, and at its base 6 to 8 inches in circumference; is an evergreen and seeds to a great extent; appears to thrive best on open ground away from other trees or shrubs, for where an odd tree of it is growing with trees of a different class, it (the Mustard Tree) is stunted in growth. Further, its seeds produce plants quickly

in abundance; in fact, it stands drought here better than the Salt-bush. If it is an edible tree or shrub, stockowners will no doubt encourage its growth. It grows apparently straight down in the ground, as if it has a tap-root, and roots do not spread out near the surface. A short way from the top of the tree in the middle all round, seeds grow in abundance, but below the middle seeds do not grow.

Mr. Peacock, then of the Coolabah Experiment Farm, wrote not long afterwards—

Grows to the height of from 15 to 25 feet, the trunk, limbs and leaves having a bluish-green colour having a rather pleasant, pungent, bitter taste. The leaves are eaten by stock when nothing better is available.

It was not, however, found immediately about the Farm, for while on a visit, Mr. Peacock told me that the only Mustard bush of the district known to him was at Willeroon, some miles away.

Bark.—A number of years ago I wrote—

This bark contains a peculiar, bitter, and perhaps possesses medicinal properties. The taste is, however, quite distinct from quinine. Its leaves resemble horse-radish or turnips in taste. The bark is smooth, and when quite fresh, of a pinkish colour. In describing an allied species (*C. australis*), Hooker (*Bot. Miscell.*, i, 245) says, "While dissecting the flowers and fruit, they were found to diffuse a most powerful smell, resembling that of ether."

I do not know whether the plant has been subjected to chemical analysis.

Timber.—"The wood soft and sappy" and odorous, as already stated. It is yellowish in colour, and has been compared to Kurrajong, also an exceptionally light-weight timber. I do not know any use to which it has been put. "Wood as soft and as light as deal." (K. H. Bennett.)

Size.—A small tree, usually between 15 and 25 feet in height.

Habitat.—It is a native of the drier parts of Australia. The following localities are quoted by Bentham in the *Flora Australiensis* :—

New South Wales, Lachlan, Darling and Murray deserts, Mitchell, Victorian and other Expeditions, Mount Murchison, Bonney.

Sir Thomas Mitchell was north of the Murray, and ("Three Expeditions," ii, 121) he found on a sand hill or flat *Eucalyptus dumosa* country a solitary tree. "The leaves, bark and wood tasted strongly of horse-radish. We now obtained specimens of its flower and seed, both of which seemed very singular."

Following are some localities represented in the National Herbarium, Sydney :—

New South Wales.—"Poplar"; Native name, "Cueurdie." "A tall slender growing tree, attaining a height of 30 feet. In appearance it somewhat resembles the European Poplar, hence the name. The bark and leaves possess a remarkably pungent taste, resembling water-cress, but very much stronger. Stock will not touch it. When young, it has a very graceful appearance. The wood is soft and light as deal." (K. H. Bennett, *Ivanhoe, via Hay.*)

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Kerry and Jones' photo.

"MUSTARD TREE" (*Codonocarpus coltinfollum*). WEELAMURRA STATION, 60 MILES WEST OF BOURKE,
NEW SOUTH WALES.

MUSTARD TREE.
(*Codonocarpus cotinifolius* F.v.M.)

" Growing in Cooper's Creek in places. As a rule it grows about 12 feet high, and then dies off. The wood is similar to Kurrajong." Barrioolah, Cooper's Creek. (J. P. Conrick, through A. Morris.)

" 20 feet high or upwards. One tree only, on summit of Broken Hill. (R. H. Cambage, No. 4341.)

" Wood brittle, and of a pale yellow colour. Emits a strong, turnip-like odour." Waverley Downs, near Wanaaring (J. L. Boorman).

Experiment Station, Coolabah (J. N. Peacock).

South Australia.—Sandy highland, bordering the River Murray, between Overland Corner and Renmark (Walter Gill).

Western Australia.—Comet Vale, via Kalgoorlie (J. T. Jutson, Nos. 162 and 232). Coolgardie Goldfields (E. Pritzel, No. 854).

Port Hedland (Dr. J. B. Cleland).

Fitzroy River (Keartland, in the Calvert Expedition of 1894).

Mr. W. V. Fitzgerald says it is locally known as " Native Poplar," " Quinine," and " Medicine Tree," and quotes it from various localities in North-west Australia (Kimberley, &c.).

EXPLANATION OF PLATE 266.

- A. Broad leaves.
- B. Flowering twig (male flowers).
- C. Front view of male flower.
- D. Back view of male flower.
- E. Anther.
- F. Female flower.
- G. Fruiting twig.
- H. Section of fruit.
- I. Carpel.
- K. Seed.

PHOTOGRAPHIC ILLUSTRATION.

" Mustard Tree," Weelamurra Station, 60 miles west of Bourke, New South Wales (Kerry and Jones, photo).

No. 276.

Tarrietia actinophylla Bailey.

A Stavewood or Ironwood.

(Family STERCULIACEÆ.)

Botanical description.—Genus *Tarrietia*, see Part LXVII, p. 323.

Botanical description.—Species *actinophylla* Bailey, *Queensland Flora*, i, 141 (1899).

Following is the original description :—

A large tree, the young growth and inflorescence more or less covered with scurfy tomentum, otherwise glabrous.

Petioles 3 to 9 inches long, often curved upward at the end, and bearing from three to nine radiating oblong-lanceolate leaflets 3 to 9 inches long, including the often rather elongated petiolule.

Flowers in loose, broad panicles, 6 to 15 inches long.

Calyx densely tomentose; deeply lobed, campanulate, expanding to about 3 lines.

Carpels 1 to 2 inches long, including the wing, which is from $\frac{1}{2}$ inch to 1 inch broad.

Botanical Name.—*Tarrietia*, already explained (see Part LXVII, p. 344; *actinophylla*, from two Greek words signifying a ray and a leaf, in allusion to the leaves spreading out like rays of light.

Vernacular Names.—"Stavewood," for obvious reasons; "Ironwood" because of its hardness; "Black Jack," from the dark appearance of the trunk.

Aboriginal Name.—"Byong" and "Boyung" are forms of the same aboriginal name, which has been made a vernacular, *e.g.*, as "Red Boyung."

Synonym.—*Tarrietia Carroni* C. Moore in General Report, Sydney International exhibition, 1879, where it is named "Stavewood" and "Red Boyung," and its height and diameter are quoted at 100–150 feet, and 2–4 feet respectively.

Leaves.—Reference to the spreading appearance of the leaflets has been already made. In the present species the leaflets are usually seven to nine, in *T. argyrodendron* usually three.

Fruit.—The fruits are larger than those of *T. argyrodendron*, and the wings less bright in colour.

Timber.—A tall tree. Wood very tough, of a stringy, straight grain, resembling English Ash; will bend better than that wood, which points it out as a suitable wood for chair-making, carriage work, axe-handles, &c. (F. M. Bailey).

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Government Printer, photo.

A TREE (*Tarrietia acilnaphylla*) IN THE BOTANIC GARDENS, SYDNEY, NEW SOUTH WALES.

A STAVEWOOD OR IRONWOOD.
(*Tarrietia actinophylla* BAILEY.)

In 1894 I published the following note :—

“Dorrigo and Glenfernle Forest Reserves.—Locally known as ‘Ironwood.’ The name ‘Stavewood’ does not appear to be in use on the Dorrigo. In abundance, magnificent trees, both as regards height and stem diameter. The trees are very often buttressed. No use is made of the timber locally.” A few years ago I obtained from Forest Guard Lowe, also from the Dorrigo, the following note :—

“Byong or Ironwood. A hard, rather heavy, pale-coloured, fissile timber, with an oak-like grain.”

Size.—It is a very large brush tree, stated to attain a height of over 100 feet, but like most brush trees, it is difficult to give the precise height.

Habitat.—

Queensland.—Southern parts and particularly mountain scrubs, according to F. M. Bailey. We have it in the National Herbarium, Sydney, from Gladfield (W. E. Moore), and also from the Queensland side of the Macpherson Range.

New South Wales.—It is a tall timber tree, growing on low-lying, loamy ground, near watercourses, and we have it from the following New South Wales localities, going south from the Queensland border :—

Acacia Creek, Macpherson Range (Forest Guard William Dunn).

Richmond River (W. Carron, 1865). Between Clarence and Richmond Rivers (Agardh Hagman).

“Byong” or “Ironwood,” Dorrigo (Forest Guard Ralph Lowe and District Forester T. H. Wilshire; J.H.M.).

“Ironwood,” Port Macquarie (J. Staer). Wauchope (unnamed collector).

Taree district (late District Forester Hardman).

Mount Mograni, near Gloucester (J.H.M., R. Mitchell). Craven State Forest, near Gloucester (W. A. W. de Beuzeville).

In other words, it is found in brush forests from southern Queensland as far south as the Gloucester district (below the Manning), New South Wales. Definite localities north and south of those stated should be searched for, in order that its precise range may be defined.

EXPLANATION OF PLATE 267.

- A. Flowering twig.
- B. Bud.
- C. Flower opened out showing—
 - (a) Calyx.
 - (b) Staminal column.
 - (c) Anthers.
- D. Fruits.

PHOTOGRAPHIC ILLUSTRATION.

A tree in the Botanic Gardens, Sydney (Government Printer).

APPENDIX.

ENEMIES OF TREES.

Fauna, Sheep, Cattle, Horses, Native Animals, Insects, and Birds.

THE following notes are additional to those on the same subject, which will be found in Part LVIII, p. 228 :—

For two articles embodying American experience, see—

1. "Grazing in the Forest Reserves," by Filibert Roth (Year-book, U.S. Department of Agriculture, 1901, 333).

A valuable paper, dealing with both sheep and cattle grazing, and well illustrated, including some illustrations showing the harm done by sheep, enumerates the Regulations then in force governing grazing in the reserves, and makes suggestions for additional ones.

2. "Forest Grazing," by Gifford Pinchot (Year-book, U.S. Department of Agriculture, 1898, 187).

A page included in a large paper "Notes on some Forest Problems." The writer mainly discusses the problem of summer grazing on the high lands of Oregon, and we must face our problem of summer grazing on Mount Kosciusko and other elevated areas in the interests of our forests. While he points out that such grazing can be regulated in some cases, he gives reasons why "many forest regions should be entirely protected against sheep."

Amongst the little Australian literature on the subject, see "On the Decadence of Australian Forests," by Albert Norton, *Proc. Roy. Soc. Q.*, iii, 15 (1886). He deals with the destruction of trees over large areas, illustrating his remarks chiefly by New England (Europambela Run, near Walcha, New South Wales). He discusses the alteration of the soil surface owing to over-stocking and trampling, and so reducing the available moisture and quality of the soil (bringing the pipe-clay more to the surface). The trees were chiefly Peppermint (*E. nova-anglica*).

Now we proceed to consideration of various species of *Eucalyptus* eaten by stock. I wrote the following letter to the Secretary of the Forestry Commission :—

I shall be glad, for the purposes of the "Forest Flora," if forest officers could indicate the *Eucalypts* whose leaves are most eaten by stock and by native animals.

You are aware that I have already given such information in regard to insects (see Parts LXV and LXVI), and I think that some very interesting facts would be brought out if we could see what *Eucalypts* are eaten by animals in different parts of the country. It has, of course, a very practical bearing, partly in regard to grazing in forests and partly in regard to the conservation of useful trees from the attacks of opossum, &c.

The reports from the forest officers are arranged under the headings of Stock and Native Animals, and subdivided into (a) higher tablelands, (b) coastal districts, (c) western districts (c) are regions of comparatively low rainfall).

The paucity of the reports is eloquent testimony to the fact that the matter has not formed the subject of special investigation, and it is commended to the attention of foresters and others, for, until it is worked out, we cannot say of what importance it really is to Australian forestry. It is immediately important to the western districts, and flowering or fruiting twigs should be supplied with reports.

Eucalyptus foliage is more palatable to stock after wilting. Probably some fermentation is set up; perhaps some of the oil evaporates. It may be a combination of both these happenings, but we have no research on this aspect of animal dietetics, so far as I am aware.

It is shown that the White Box (*E. hemiphloia* var. *albens*) is of special importance for stock feed, and its reasonable conservation is in the interests of foresters and pastoralists alike.

Following is a list of the trees referred to :—

<i>Angophora intermedia</i>	...	...	See Burrow, p. 449.
<i>Eucalyptus acmenioides</i>	...	...	See Lyne, p. 455.
<i>albens</i>	{...	...	See Burrow, p. 449.
<i>Andrewsi</i>	...	...	See Boyd, p. 454.
<i>Bancrofti</i>	...	...	See Boyd, p. 454.
<i>bicolor</i>	...	...	See Wentworth, p. 448.
<i>Caleyii</i>	...	...	See Burrow, p. 449.
<i>cladocalyx</i>	...	...	See Samuel, p. 450; Wentworth, p. 448.
<i>coriacea</i>	...	...	See Boyd, p. 454.
<i>corymbosa</i>	...	...	See Briggs, p. 455.
<i>crebra</i>	...	...	See Samuel, p. 450.
<i>dealbata</i>	...	...	See Boyd, p. 454; Burrow, p. 449.
<i>Deanei</i>	...	...	See Boyd, p. 454.
<i>eugenioides</i>	...	...	See Boyd, p. 454.
<i>gigantea</i>	...	...	See de Beuzeville, p. 447.
<i>goniocalyx</i>	...	...	See Clulee, p. 455; de Beuzeville, p. 447.

- grandis* ... See Boyd, p. 454.
- hemiphloia* ... See Boyd, p. 454; McPherson, p. 448;
Rummery, p. 448; Wentworth, p. 448.
- hemiphloia* var. *albans* ... See Boyd, 454; Burrow, p. 449;
de Beuzeville, p. 447;
Gardner, p. 450; Garling, p. 449;
Samuel, p. 450; Wall, p. 450;
Wentworth, p. 456.
- longifolia* ... See Clulee, p. 455.
- macrorrhyncha* ... See de Beuzeville, p. 447.
- maculata* ... See Briggs, pp. 448 and 455; McPherson,
p. 448.
- melanophloia* ... See Boyd, p. 447; Burrow, p. 449; Wall,
p. 450;
Withers, p. 451.
- melliodora* ... See Burrow, p. 449; de Beuzeville, p. 447;
Garling, p. 449; McPherson, p. 448.
- microcorys* ... See Briggs, p. 455; Lyne, p. 455.
- microtheca* ... See Burrow, p. 449; Gardner, p. 450;
Withers, p. 451.
- obliqua* ... See Boyd, p. 454; Burrow, p. 456.
- pilularis* ... See Boyd, p. 454; McPherson, p. 448.
- piperita* ... See McLeod, p. 455.
- polyanthemos* ... See de Beuzeville, p. 447.
- populifolia*... See Wall, p. 450.
- propinqua* ... See Boyd, p. 454; Lyne, p. 455.
- punctata* ... See Clulee, p. 455; McPherson, p. 455.
- resinifera* ... See Lyne, p. 455.
- rostrata* ... See Burrow, p. 449; Garling, p. 449;
Samuel, p. 450; Wentworth, p. 448;
Withers, p. 451.
- saligna* ... See Boyd, p. 454; McPherson, p. 455.
- siderophloia* ... See Samuel, p. 450.
- Stuartiana*... See Boyd, p. 454.
- tereticornis* ... See Boyd, p. 454; Briggs, p. 455;
Burrow, p. 449; Clulee, p. 455;
Rummery, p. 456.
- Geijera parviflora*... See Samuel, p. 449.

(a) HIGHER TABLELANDS.

District Office, Tumut.

In this locality the Eucalyptus leaves most favoured by stock are the following, in order of preference :—

1. *E. polyanthemos* (Round-leaf Gum or Red Box).
2. *E. melliodora* (Yellow Box).
3. *E. macrorrhyncha* (Stringybark).
4. *E. hemiphloia* var. *albens* (White Box).

None of the highland trees, such as Alpine Ash, Mountain Gum, &c., are eaten by stock, except the very young seedlings.

W. A. W. DE BEUZEVILLE, Assistant Forester.

E. gigantea (Alpine Ash); *E. goniocalyx* (Mountain Gum).

District Office, Glen Innes.

The following list shows the various Eucalypts most favoured in the various sub-districts :—

Glen Innes.—Sheep are fond of the foliage of Ironbark and White Box, but these leaves are eaten by large stock only in time of drought when grass and herbage is not available.

Inverell.—Silver-leaf Ironbark (*E. melanophloia*), Silver-leaf Mountain Gum, Stringybarks, White Box, and Apple is the foliage most favoured by stock in this subdivision.

Legume and Tenterfield.—Grey, Red, and Flooded Gum.

Armidale.—The species most favoured by stock are Apple and Grey Box.

F. S. BOYD, District Forester.

(For species probably referred to, see p. 454.)

(b) COASTAL DISTRICTS.

District Office, Moruya.

During thirty years' experience on the coastal district of New South Wales (south of the Hunter River) the eating of Eucalyptus foliage by stock has not been observed or heard of by me.

C. J. CLULEE, District Forester.

District Office, Windsor.

From investigations and personal observations, stock generally are not partial to the leaves of the Eucalypts growing in this district, which rarely suffers to any extent from drought.

J. J. McLEOD, Assistant Forester.

District Office, Wyong.

The leaves of Eucalyptus trees in this district most favoured by stock are Spotted Gum, Blue Gum, Blackbutt, and Grey Gum in young stages of growth, and only in drought time when grass and other more favoured kinds of forest growth are unobtainable. Cattle readily eat the leaves of White and Yellow Box (*Eucalyptus hemiphloia* and *melliodora* respectively).

FRED. G. MCPHERSON, District Forester.

E. maculata (Spotted Gum); *E. saligna* (Blue Gum); *E. pilularis* (Blackbutt);
E. punctata (Grey Gum).

District Office, Taree.

Cattle and horses do not as a rule eat leaves of the Eucalypts, except in time of drought or shortly after rain, and then only to a very limited extent; they do not appear to be particular as to species so long as the shoots are young and tender.

H. J. LYNE, District Forester.

District Office, Urunga.

My experience is that stock do not to any extent eat Eucalyptus leaves, but will casually nip off the very early shoots of Spotted Gum. As regards forest growth, stock will frequently damage young coppice growth and seedlings, when in a playful or fighting mood, by pawing and rooting up the ground with their horns, and knocking the young growth about with their heads.

W. F. BRIGGS, District Forester.

E. maculata (Spotted Gum).

District Office, Casino.

I have to state that from personal observation and inquiries of stockowners the only Eucalyptus that stock appear to favour is the Red Gum, which grows on generally low-lying country and is regarded here as *E. tereticornis*. Grey Box (*E. hemiphloia*) has also been mentioned, but there appears to be a good deal of doubt in this respect.

G. E. RUMMERY, District Forester.

(c) WESTERN DISTRICTS.

District Office, Deniliquin.

Cattle will eat the leaves of the matured Sugar Gum (*E. cladocalyx*—a South Australian tree) during the period of drought.

Sheep will eat the leading shoots of Red Gum (*E. rostrata*), Grey Box (*E. hemiphloia*), and Black Box (*E. bicolor*) seedlings almost at any time, and during a drought will eat the whole of the leaves on a seedling plant.

N. C. WENTWORTH, Assistant Forester.

District Office, Wagga Wagga.

Reports received from officers do not convey much information in the above respect. The Forest Guard at Narrandera and the Assistant Forester at Corowa both agree that sheep, cattle, and horses will eat seedlings and the tender growth of practically all Eucalypts.

J. S. BARRY, District Forester.

District Office, Forbes.

I have to report that trees most favoured by stock are *E. hemiphloia* var. *albens* (Grey or White Box), *E. melliodora* (Yellow Box), and *E. rostrata* (Red Gum).

The Grey Box takes first place in relation to stock feed, and is readily eaten when the trees are matured, but when young or in sapling stage it is difficult to induce sheep to touch them until the tree has lain on the ground for some days. Further, if the tree is burned down, the leaves are more readily eaten than when felled by the axe, but the reason for this I have never been able to discover. The leaves of the Yellow Box are also fairly readily eaten, but trees must be matured, otherwise stock will not touch them unless very hungry. Red Gum is used for feed, but is not so readily eaten as the Box, and is not used at all if Box is obtainable.

H. W. GARLING, District Forester.

District Office, Narrabri.

The tree most favoured for fodder for stock is, of course, the Apple Tree (*Angophora intermedia*), which, though not a Eucalyptus, belongs also to the Myrtaceæ family. Of the Eucalypts themselves, Silver-leaved Ironbark (*E. melanophloia*) is perhaps the most favoured in such localities where it is obtainable. Next comes White Box (*E. albens*, or *E. hemiphloia* var. *albens*). *E. microtheca* is the main Eucalypt fodder tree in the Western districts, where it takes the place of White Box, and is of equal value for the purpose of feeding starving stock.

When hard pushed, stock will try most of the Eucalypts, but they do not favour the Red Gums (*E. rostrata*, *tereticornis*, *dealbata*, &c.). Mountain Ironbark (*E. Caleyi*) is fairly good, but its range is limited. Yellow Box (*E. melliodora*) is the least favoured, even starving stock will refuse it. The Stringybarks are also generally left alone if other fodder is obtainable.

In this district there are generally so many shrubs and trees of other than the Eucalyptus species that, except for White Box and Silver-leaf Ironbark, their fodder value is negligible.

GORDON BURROW, District Forester.

District Office, Dubbo.

From my experience, I find that stock (sheep and cattle) frequently refuse the same species of Eucalyptus, whereas two or three weeks later they will eat it greedily. I have seen two trees of exactly the same species lopped together side by side and cattle refuse one and eat the other—this also applies to the Wilga (*Geijera parviflora*).

I have found that by varying the Eucalyptus from Gum to Box, or *vice versa*, and feeding alternately on these, say two or three days on each, that stock in times of drought do best. Any of the Box species will be eaten by cattle or sheep. Red Gum (*E. rostrata*) is also favoured, also Sugar Gum. There have been numerous inquiries for Sugar Gum from the Acclimatisation Area since the late drought. The Ironbarks are not so favoured by stock, although when starving they will nibble at same. I consider that all holders should preserve a quantity of Box of any species on their holdings, if such is available, for drought purposes.

A. R. SAMUEL, District Forester.

Sugar Gum is *E. cladocalyx* from South Australia.

Ironbarks are *E. crebra* and *E. siderophloia* principally.

Forest Office, Dunedoo.

I have to report that the most favoured Eucalypt for stock in this district is what is known as the Coolabah, also the White Box. In drought time in this district stock are eating all classes of Eucalyptus leaves, but without some change of grasses or other foodstuff every second or third day, the stock will do no good, as they cannot digest the leaves alone.

C. H. GARDNER, Forest Guard.

E. microtheca (Coolabah); *E. hemiphloia* var. *albens* (White Box).

327 Peg, Mundooran.

My own experience has been mostly with cattle, extending over twenty-five years. I have found the broad-leaved Ironbark or Silver-leaved Ironbark in the Narrabri and Moree districts will be readily eaten by cattle. I have at different times fed my bullocks on Silver-leaved Ironbark for weeks at a time with nothing else to eat and worked them, and they held their own on it, but they were always in good condition when I started to feed them on scrub. They like it best when fallen a couple of days. Some trees they will eat more readily than others. I have often noticed them clean one tree up and not leave a leaf, while others they would hardly touch. I have examined the trees and chewed the leaves myself, but could find no difference. When clover and other herbage was plentiful, I have seen bullocks eat green Coolabah leaves, and always made it a rule afterwards to lop a few bushes which, when they eat them, they never blew up so much. Bibble Box or White Box as it is sometimes called, I have fed to sheep to fill them up when fed on corn or wheat. They eat it readily. I have seen sheep kept on it alone for over three weeks, and they seemed to do all right.

ROBT. WALL,

Overseer, Sleeper-cutters' Training Camp.

E. populifolia is Bibble Box. To call it White Box, the name usually applied to *E. hemiphloia* var. *albens*, is unusual. Perhaps the latter tree is really meant.

E. melanophloia (Silver-leaved Ironbark).

Gilgandra.

During the last severe drought the leaves of Silver-leaved Ironbark (*E. melanophloia*) were extensively used in the Wee Waa district as feed for cattle. In a lesser degree those also of River Gum (*E. rostrata*) and Coolabah (*E. microtheca*) were also utilised as fodder for sheep and cattle. In the majority of cases all the leaves within reach of the stock (or nearly all) were eaten, but in the case of Coolabah it was noticed that the stock would not eat the leaves of some trees, whilst those of others were eagerly devoured.

GEO. A. WITHERS, Forest Guard.

I will now give a few notes on Eucalypts (arranged in alphabetical order), which are more or less eaten by cattle and sheep.

E. aggregata Deane and Maiden (Black Gum). Young trees are often eaten down by cattle.

E. bicolor A. Cunn. (Black or Flooded Box), was used for feeding sheep through the 1902 drought, Deniliquin district (Forester Wilshire).

E. coriacea A. Cunn. (a White Gum), is known sometimes as Cattle Gum because cattle feed on the leaves when grass is scarce (see Part V, pp. 133, 134, and 140, of "A Critical Revision of the Genus Eucalyptus"). An analysis of the leaves, by Mr. F. B. Guthrie, will be found at Part II, p. 115, of the present work.

E. cladocalyx F.v.M. (*E. cerynocalyx* F.v.M.), the Sugar Gum of South Australia, has been known as an occasional stock feed for very many years. Owing to the sweetness of the leaves it owes its vernacular name.

E. Gunnii Hook. f. (the Cider-tree of Tasmania). A tree whose leaves are somewhat succulent and sweetish, and eaten by stock.

E. hemiphloia var. *albens* F.v.M. (a "White Box"). Mr. George Pring, Cooyong, Crowther, with twenty-five years' experience in the district at the time, told me that sheep will "eat up every leaf" of the "Blue White Box" (this is *E. hemiphloia* var. *albens*), which grows on hilly, gravelly country, while the "Green White Box" (this is *E. hemiphloia* var. *microcarpa*), which is found on flat country, they do not care for.

E. ovata Labill. "I have seen well-fed cows in a good grass paddock (in the Colac district of Victoria) rush up to and greedily devour the leaves and twigs of a large branch of *E. ovata* Labill. that had suddenly crashed to the ground." (A. D. Hardy, *Vict. Nat.*, XXXV, 28.)

E. Stuartiana F.v.M. ("Apple"). The leaves are sometimes eaten by cattle. Following is an analysis of them by Mr. F. B. Guthrie in *Agricultural Gazette, N.S.W.*, for October, 1899 :—

Water.	Ash.	Fibre.	Other Extract (Oil, &c.).	Albumenoids.	Carbo- hydrates.	Nutrient Value.	Albumenoid Ratio.	Tannin, Oak Bark.
34.55	3.27	9.65	3.17	6.37	42.99	56½	1 : 8	6.3

Some Native Fodder-plants not always Edible.

Now we come to a phase of the subject of dietetics to which I have drawn attention for a number of years, but so far I have not been able to get pastoralists sufficiently interested to forward specimens from time to time in order that the plants eaten and rejected by stock may be identified. A good many people have such confidence in the botanist as to believe that he can determine any incomplete twig. Sometimes a tree has to be watched for months before it can be determined, that is to say, accurately or botanically determined.

It is very easy to say whether certain plants are edible or not, but in regard to some of our trees and shrubs it is simply impossible to reconcile the statements concerning them. From the same district one receives the same species of plant in two different parcels, with the label that stock eat the one and reject the other. The plants are not even in a different stage of growth; they simply appear to be identical in every respect. If they were sent at different times by different people, one might solemnly record them as edible or the reverse, and the information, without qualification, would be misleading.

The fact of the matter is, there are two factors, the plant and the animal. The plant may vary and be edible in one district or at a particular season of the year, or particular sheep, cattle, or horses may be fond of this particular plant, while others may reject it. In other words, all plants of the same species may not be edible, and all animals of the same kind may not show partiality to the same plants. Animals have their idiosyncrasies, just as men have, liking one kind of food and disliking another. If we could but persuade some Australian animals that certain plants are so nutritious and palatable if they would only take our advice, what a different place Australia would be!

Much depends on the district in which an animal is bred; much depends on habits of feeding he has recently formed; in other words, as regards foods an animal may be bred from infancy in the midst of certain food and use of it may be quite natural to him, or through necessity he may have become educated to it. In either case he will eat similar food in another district or reject dissimilar. If the flock or herd be of mixed origin (in the above sense), when they come to a new locality some of the animals will eat a certain plant, while others will reject it.

Twenty-three years ago I received edible and non-edible Red Gum leaves (*Eucalyptus rostrata*) from Moulamein, absolutely identical, so far as I could see, with the labels from the same gentleman that sheep were fond of one and rejected the other. Here I may say that I do not for one moment believe that trees eaten and rejected by stock are morphologically identical. In other words, they require investigation by the botanist.

Then from Marra Creek, *via* Nyngan, I received several specimens of twigs of "Box, Drooping Box, or Coolabah" (*Eucalyptus bicolor* A. Cunn.), with the following notes :—(1) Sheep will not eat; (2) sheep very fond of this; (5) sheep will eat; (6) sheep fond of this; (8) sheep will not eat. The twigs are all from the same species, though doubtless from different trees, and were collected by Mr. A. W. Grigg, an esteemed correspondent.

From Warena Run, Castlereagh River district, I received specimens of "Bimble Box" (*Eucalyptus populifolia* Hook. f.) from the same gentleman. They appear to be absolutely identical, yet (1) is labelled "Stock will eat"; (2) "Stock will eat, but do not care much for it"; (3) "Stock will not eat."

Discussing the matter with Mr. R. H. Cambage, that gentleman gave me the following example with regard to one of the She-oaks (*Casuarina*) of the interior :—

An old resident mentioned that a man had brought a team of bullocks a distance of over 100 miles, and, when camping, inquired from my informant what trees were good for feed. On being told that the Belah (*Casuarina lepidophloia*) was one of the best in this locality he thereupon cut down a number of branches, only to find his bullocks reject them. He therefore went further afield, and some time afterwards returned to say his bullocks had had a great blow-out on Bull Oak (*Casuarina Luehmanni*). When telling me of this, my informant appeared amused at the recollection, for it seemed to him that these travelling bullocks must have had a queer palate to prefer Bull Oak to Belah, but the driver explained that they were used to the former in their native district.

I would cordially invite correspondence on the very interesting subject I have brought before my readers.

In Part XLIV, p. 180, of this work, I give particulars as to the fodder value of the leaves of the Napunyah or Yapunyah (*E. ochrophloia* F.v.M.), which was certainly during droughty times on "the other side of Bourke" the means of saving the lives of sheep. An analysis of these leaves will there be found.

Stock Chewing and otherwise Injuring Bark.

Under *Eucalyptus piperita* at page 38, Part XXXIII, I have shown two remarkable photographs, and have given some details in regard to the very destructive work of cows barking fibrous-barked trees.

A number of Stringybark trees (*E. eugenoides* Sieb.) in a paddock near the railway carriage washing sheds (between Strathfield and Homebush railway stations, near Sydney, going west) were healthy until some cows were turned into the paddock about 1910. I noticed the bark gradually eaten away in broad rings and the trees destroyed. It is important to bear this in mind. I do not know to what extent the larger herbivora bark trees.

Mr. Walter Gill, Conservator of Forests, Adelaide, gave me in 1919 a photograph taken near Penola township, 22 miles north of Mount Gambier, showing where the bark had been stripped off for say, 3 feet of a small *Eucalyptus viminalis* sapling. "This was done by wild deer, which do great damage by barking young trees—gums as well as pines—by their antlers. I have had them shot and killed by great dogs, as they are an inveterate nuisance—breaking netting fences and letting rabbits in." He also writes: "I may also say that both at Wirrabara and Bundaleer Forests in the north, both of which you visited with me many years ago, as well as at Mount Burr Forest in the south-east, the common opossum has ruined hundreds of Maritime Pines (*Pinus maritima*) and Aleppo Pines (*Pinus halepensis*) by eating off the tender green bark of the leaders for 2 or 3 feet, causing great exudation of turpentine accompanied by the ultimate death of the trees affected. I had, therefore, to take vigorous measures for their destruction."

The destruction of both native and introduced trees by native and introduced animals is only imperfectly known at the present time, and further detailed information is sought.

Native Animals.

District Office, Tumut.

The Mountain Opossum eats the Ash leaves (*E. gigantea*).

W. A. W. de Beuzeville, Assistant Forester.

(Opossums often kill *E. coriacea* A. Cunn., a Mountain White Gum, because of their fondness for the young leaves.)

District Office, Glen Innes.

Inverell.—Opossums favour principally Blue Gum, Brown, and Red Gum and White Box, but as opossums are mainly grass feeders, little damage is done to trees.

Legume and Tenterfield.—The opossums in this sub-district seem to have preference for Apple.

Armidale.—The trees most favoured by native animals are the Stringybarks, Messmate, Peppermint, Blackbutt, Blue and White Gum.

F. S. BOYD, District Forester.

The species referred to are probably—

E. saligna (Blue Gum).

E. Bancrofti and *E. tereticornis* (Red Gum).

E. hemiphloia var. *albens* (White Box).

E. dealbata (Silver-leaf Mountain Gum).

E. eugenioides and others (Stringybarks).

E. Stuartiana (Apple).

E. grandis (Flooded Gum).

E. obliqua (Messmate).

E. pilularis (Blackbutt).

E. Deanei (Brown Gum).

E. propinqua (Grey Gum).

E. hemiphloia (Grey Box).

E. Andrewsii (Peppermint).

E. coriacea (White Gum).

District Office, Moruya.

Opossums will, I think, eat the young foliage of almost any Eucalypt, but the native bear, now practically extinct in the coastal strip, had a decided preference for the Grey Gum, and where that species does not occur, for the Mountain Gum (*E. goniocalyx*), Woollybutt, and Red Gum (*E. tereticornis*).

C. J. CLULEE, District Forester.

The Grey Gum and Woollybutt are *E. punctata* and *E. longifolia* respectively.

District Office, Windsor.

As a destructive agency, the native animals as a cause may be reckoned as negligible, especially as they are becoming fast extinct.

The opossum favours the young foliage of the Messmate varieties, but the harm done is not of a serious nature.

J. J. McLEOD, Assistant Forester.

The Messmate is probably *E. piperita*.

District Office, Wyong.

Those mostly eaten by native animals are:—By opossums and squirrels: Blue Gum and Grey Gum; by native bears: Grey Gum. Other native animals are not partial to the leaves of the Eucalyptus.

F. G. McPHERSON, District Forester.

Blue Gum is *E. saligna*, and Grey Gum *E. punctata* and *E. propinqua*.

District Office, Tarée.

The opossum (very scarce in this district) feeds principally on grass, although it is generally understood they eat leaves of Eucalypts and prefer Grey Gum, Tallow-wood, and White and Red Mahogany.

Native bears (almost extinct) and squirrels eat leaves of Eucalypts, but I am unable to state what kinds.

As to bandicoots, kangaroo rats, paddymelons, &c., these live mostly on grass, fern, and other roots. I do not know if they eat leaves of Eucalypts.

H. J. LYNE, District Forester.

Grey Gum (*E. propinqua*), Tallow-wood (*E. microcorys*), White Mahogany (*E. acmenioides*), Red Mahogany (*E. resinifera*).

District Office, Urunga.

Of native animals, the ground marsupials do not particularly favour any Eucalyptus leaves if grass is available. Opossums and bears will eat Spotted and Red Gum leaves, also Tallow-wood, in fact, all kinds of Eucalyptus leaves.

Flying foxes are very destructive, and especially favour Bloodwood and Spotted Gum when flowering.

W. F. BRIGGS, District Forester.

Spotted Gum (*E. maculata*), Red Gum (*E. tereticornis*), Tallow-wood (*E. microcorys*), Bloodwood (*E. corymbosa*).

District Office, Casino.

So far as native animals are concerned, the general opinion is that opossums favour Red Gum more than any other Eucalypt.

G. E. RUMMERY, District Forester.

Red Gum (*E. tereticornis*).

District Office, Deniliquin.

The opossum eats all the foregoing (eaten by stock, p. 448), Grey Box preferably. The opossum is too few in numbers in this district to be classed as doing any great harm to the Eucalypts.

N. C. WENTWORTH, Assistant Forester.

Grey Box (*E. hemiphloia* var. *albens*).

District Office, Wagga Wagga.

I also regard native animals as a natural, but not important, enemy of the young tree.

With regard to the eating of leaves, no officer consulted by me considers that any damage done by the eating of leaves of grown trees by native animals is very material, an opinion in which I concur.

J. S. BARRY, Inspector and District Forester.

District Office, Forbes.

The opossum finds his home and feed chiefly in the Red Gum, and to some extent in the Yellow Box, but to-day it is seldom seen, and so far as this district is concerned he has practically disappeared, except in the mountains.

H. W. GARLING, District Forester.

Red Gum (*E. rostrata*); Yellow Box (*E. melliodora*).

District Office, Narrabri.

Regarding native animals, the opossum seems to favour White Box or Ironbark also. Trappers, some years ago, used to say that the best skins came from White Box country. In the Nundle district the wombat is very destructive, damaging hundreds of trees by stripping the bark, but this is for his nest, not for food. The Woollybutt (*E. obliqua*) suffers chiefly, also various Stringybarks.

GORDON BURROW, District Forester.

For botanical names, see p. 449.

District Office, Dubbo.

Native animals—marsupials—prefer Eucalypts of the same species as stock—the White Box (*E. hemiphloia* var. *albens*) being their favourite. Marsupials will eat almost any species of grasses and Eucalypts. The climbing marsupial survives droughts much better than other species, such as kangaroos, wallabies, &c.

Emus depend more on berries, grasses, although they will eat the leaves of Eucalypts of any species when starving.

My report above refers only to inland Eucalypts.

A. R. SAMUEL, District Forester.

Most of the foresters who refer to the opossum speak of him as a grass-eater and not an important eater of *Eucalyptus* leaves.

Two papers bearing more or less on the subject may be referred to—

1. Rev. Dr. Woolls, *Vict. Nat.*, viii, 78, 1891.
2. Rev. Peter MacPherson, *Proc. Roy. Soc. N.S.W.*, xix, 83, 1885.

A very reliable observer in the Hay, New South Wales, district, the late K. H. Bennett, has a paper "Remarks on the decay of certain species of *Eucalypti*" (*Proc. Linn. Soc. N.S.W.*, x, 453, 1885). He agrees with Rev. Peter MacPherson as to the very destructive effects of opossums, and quotes his experience in Gippsland when, almost without exception, these animals destroyed large numbers of *E. rostrata* and *E. melliodora*.

Mr. W. F. Blakely informs me that in the Hornsby, Sydney, district, he has observed that the trunks of the Grey Gum (*E. punctata* DC.), are largely marked by the claws of the opossums which frequent this tree for the leaves. The surrounding trees, consisting chiefly of *Angophora lanceolata*, *E. hæmastoma* Sm. and its var. *micrantha* Benth., *E. pilularis* Sm. (the Blackbutt), and *E. piperita* Sm. (the Peppermint), either do not appear to be touched by these animals, or very slightly so.

Confirmation of Mr. Blakely's observations is given by the fact that Mr. A. S. Le Souef, Director of the Sydney Zoo, applied to me in June, 1918, for young trees of the Grey Gum to grow food for the opossums.

So abundant is the native bear (sometimes locally called monkey), in some trees, e.g., *Eucalyptus numerosa*, on the South Coast of New South Wales, that I have known them to be called "Monkey Gum" on that account.

Insects and Birds.

"Bird-helpers in Forests" forms the subject of a short article by Ralph C. Blacket, Forest Guard, *Aust. Forestry Journal*, October, 1918, p. 35. He makes a plea for the protection of the birds because of the work they do in ridding the forests of "thousands of insect pests, ranging from big wood-boring beetles down to microscopic individuals under the cuticle of leaves. . . ."

The Black Cockatoo tears open the hard fruit of various species of *Eucalyptus*, e.g., *E. pilularis*, the Blackbutt, to obtain the seeds for food. The bird may do good in disseminating the species by this operation. At the same time, black cockatoos tear open saplings to get at grubs. They have surprisingly powerful beaks and tear off large chips. But the most remarkable instance of the kind brought under my notice is the following:—

A small forest of Stringybark (*E. obliqua* L'Herit.) ringbarked near Interlaken, Tasmania, is now a feeding ground for flocks of black cockatoos, which tear off the bark in shreds in search of grubs. The trees having been killed, became a prey to these grubs, and the shredded bark lies at the foot of the trees in great heaps. Photo. reproduced in *Aust. For. Journ.*, August, 1919, p. 241, from "The Gum Tree" herewith.

R. C. Gunn, a well-known naturalist, wrote a paper "On the Probable Cause of the Destruction of the Forests of Eucalypti in the lower levels of Tasmania" (*Tas. Journ.*, ii, 460, 1846). He states that the death of the forests of Gum trees at Quamby's, Formosa, Epping Forest, and many other localities in the settled districts had been attributed by Mr. James Backhouse, Lieut. Breton, and others, to various causes, such as long-continued drought, severe frost, depasturing the land by sheep and cattle, and electricity (lightning), but he was of opinion that they were all destroyed by an insect (species at present unknown), but most likely allied to *Scolytus destructor*. The insect seems to penetrate the bark of the Eucalypti, and then cut innumerable channels in all directions in the inner bark and soft wood so as to prevent the circulation of the sap, their operations being precisely similar, except as to the form and direction of the channels, to those of *S. destructor* described by Mr. W. S. Macleay.

Mr. Gunn further observed that the death of the forests in the alpine regions of the colony was caused by a severe frost in the winter of 1836.

PHOTOGRAPHIC ILLUSTRATION.

Photo. from "The Gum Tree" (Melbourne photo.)—*E. obliqua* barked by cockatoos for grubs. (See p. 457.)

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Melbourne photo.

STRINGYBARK (*Eucalyptus obliqua*); BARK TORN
BY COCKATOOS.

BINDING LIST JAN 1 1929

Bot. Flora M.
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Author Maiden, F. H.
Title The forest flora of New South Wales. Vol. 7.

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