

ACACIA SEEDLINGS, PART I.

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With Plates VIII to XII.

[Read before the Royal Society of N. S. Wales, July 7, 1915.]

SYNOPSIS:

SEQUENCE IN THE DEVELOPMENT OF LEAVES.

SEEDS.

HYPOCOTYL.

COTYLEDONS.

PRIMARY LEAVES.

BIPINNATE LEAVES.

PHYLLODES.

DEVELOPMENT OF UNINERVES AND PLURINERVES.

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. IN order to study the development of the genus *Acacia* in Australia, numbers of seedlings of many species are being raised by me, and from an investigation of their characters it is thought that some information will be obtained which will assist in making the past history of this important genus better understood.

Australia is the home of that curious form of *Wattle*, which, as an adaptation to environment, has dispensed with its ancestral type of pinnate leaves, and developed a flattened or cylindrical leaf-stalk or phyllode to carry on the functions of leaves, and the seedlings show the phases of this transition occurring at the present day. A few species of phyllodineous *Acacias* are also found in New Caledonia,

the Indian Archipelago, and the Pacific Islands, and these closely resemble some of the species of tropical Australia.¹

Sequence in the Development of Leaves.

As already pointed out, the usual sequence in the development of the leaves is that the cotyledons are succeeded by one simply-pinnate leaf, and this is followed by a varying number of alternate abruptly bipinnate leaves, the common petioles being mere stalks on the lower leaves, but gradually becoming more dilated on the upper ones, until at last they develop without any bipinnate leaves on their tips, and carry on the functions of ordinary leaves.²

From an examination of about 400 seedlings of about 60 species, the above sequence is found to be maintained in the great majority of cases, in fact only four species have been noticed so far, which show a constant divergence. The point of difference lies in the number of simply-pinnate leaves. Seedlings of the majority of species so far examined have only one pinnate leaf, immediately following the cotyledons, but in four species, about 70 examples have been found to produce an opposite pair of pinnate leaves. One seedling of *A. aneura* had an opposite pair of pinnate leaves, though this species appears to commonly have only one. In every case this pair has been succeeded by a bipinnate leaf, and except for the pinnate leaves appearing singly or in pairs, the sequence is the same in each case. In no instance has an example been found with the cotyledons immediately succeeded by a bipinnate leaf, although Lubbock records *Acacia Burkittii* as such a case.

¹ B. Fl., Vol. II, p. 301.

² "A Contribution to our Knowledge of Seedlings," by Sir John Lubbock, Vol. I, p. 339, (1892).

"Dimorphic Foliage of *Acacia rubida* and Frutification during Bipinnate Stage," by R. H. Cambage, this Journal, XLVIII, p. 136, (1914).

Amongst those species which have only one pinnate leaf are the following:—

<i>Acacia triptera</i> , Benth.	<i>Acacia vestita</i> , Ker.
„ <i>lanigera</i> , A. Cunn.	„ <i>pravissima</i> , F.v.M.
„ <i>juniperina</i> , Willd.	„ <i>elongata</i> , Sieb.
(with few exceptions)	„ <i>Dawsoni</i> , R.T. Baker
„ <i>armata</i> , R.Br.	„ <i>pendula</i> , A.Cunn.
„ <i>hispidula</i> , Willd.	„ <i>stenophylla</i> , A. Cunn.
„ <i>undulifolia</i> , A.Cunn.	(with an exception)
„ <i>verniciflua</i> , A.Cunn.	„ <i>melanoxylon</i> , R. Br.
„ <i>leprosa</i> , Sieb.	„ <i>implexa</i> , Benth.
„ <i>stricta</i> , Willd.	„ <i>binervata</i> , DC.
„ <i>falcata</i> , Willd.	„ <i>alpina</i> , F.v.M.
„ <i>penninervis</i> , Sieb.	„ <i>longifolia</i> , Willd.
„ <i>neriifolia</i> , A.Cunn.	„ <i>floribunda</i> , Willd.
„ <i>accola</i> , Maiden and	„ <i>phlebophylla</i> , F.v.M.
Betche	„ <i>linearis</i> , Sims.
„ <i>pycnantha</i> , Benth.	„ <i>Maideni</i> , F.v.M.
„ <i>obtusata</i> , Sieb.	„ <i>pityoides</i> , F.v.M.
„ <i>rubida</i> , A. Cunn.	„ <i>aneura</i> , F.v.M. (with
„ <i>amœna</i> , Wendl.	an exception)
„ <i>suaveolens</i> , Willd.	„ <i>torulosa</i> , Benth.
„ <i>linifolia</i> , Willd.	„ <i>glaucescens</i> , Willd.
„ <i>fimbriata</i> , A. Cunn.	„ <i>Cunninghamii</i> , Hook.
„ <i>prominens</i> , A. Cunn.	„ <i>aulacocarpa</i> , A. Cunn.
„ <i>buxifolia</i> , A. Cunn.	(with some exceptions)
„ <i>podalyricæfolia</i> , A.C.	„ <i>holosericea</i> , A. Cunn.

BIPINNATÆ:—*A. elata*, A. Cunn., *A. pruinosa*, A. Cunn., *A. spectabilis*, A. Cunn., *A. discolor*, Willd., *A. decurrens*, Willd., *A. Baileyana*, F.v.M., *A. dealbata*, Link., *A. leptoclada*, A. Cunn., *A. pubescens*, R.Br., *A. Bidwilli*, Benth., (only one examined).

Lubbock records five species with only one pinnate leaf, viz.:—*A. verticillata*, Sieb., *A. dodoneæfolia*, Willd., *A.*

lophantha, Willd., (regarded as an *Albizzia* by Bentham), *A. acanthocarpa*, Willd., and *A. dealbata*.

The four species so far noticed which constantly have an opposite pair of simply-pinnate leaves are:—UNINERVES—Racemosæ: *A. leiophylla*, Benth., *A. salicina*, Lindl., var. *varians*, and var. *Wayæ*, Maiden, *A. myrtifolia*, Willd.

BIPINNATÆ—Gummiferæ: *A. Farnesiana*, Willd.

This feature was first noticed on seedlings of *A. Farnesiana* and next on those of *A. myrtifolia*. As the former is the only *Acacia* known to occur in Africa, Asia and America as well as Australia, and the latter is one of the most widely spread in Australia, it was considered that possibly these are among the older forms and that the more recent species have lost one pinnate leaf. Prompted by the assumption that the widely spread species are the oldest, which of course is by no means a certainty, and that those with a pair of simply-pinnate leaves are in some way connected with such a group, an effort was made to procure seeds of *A. salicina*, another widely spread species recorded from all the States of the mainland of Australia. Seeds of the type were not obtainable, but some of the variety *Wayæ*, grown at the Sydney Botanic Gardens, were obtained from Mr. J. H. Maiden, and later those of the variety *varians* were forwarded by Mr. H. C. Cullen from near Barcaldine in Queensland. Both of these varieties produced seedlings with the opposite pair of pinnate leaves, and subsequently the feature has been noticed on seedlings of *A. leiophylla*, a West Australian species, with a more restricted range. Probably other examples may be found later.

If those species with only one pinnate leaf have been developed from an older type with two pinnate leaves, then it seems reasonable to expect that the newer form will

sometimes revert to the original or ancestral type. Possibly the above quoted example of *A. aneura* is such an instance.

The point is certainly an interesting one, and as the present work of examining seedlings proceeds, information may be obtained which will admit of a more definite conclusion being arrived at in regard to the relative ages of those species with one, and those with a pair of simply-pinnate leaves. It has already been noticed in the case of *A. leiophylla* that although the pair of pinnate leaves appear at the same time, they are of unequal size, as though in some way one has an ascendancy over the other, but in the course of a week or two they become almost equal. In the other three species mentioned the pinnate leaves of each pair are equal in size from the time they first appear.

Seeds.

Acacia seeds vary in shape, size and colour. In shape they may be compressed-globular, orbicular, ovate, obovate, ovoid, ovate-oblong, obovate-oblong, oval-oblong, oblong, and flat. In size they range at least from 3 mm. long by nearly 2 mm. broad, as in the case of *A. holosericea*, and up to a diameter of 1.1 cm. in the case of the flat seed of *A. Bidwilli*.

The method adopted in raising seedlings has been to place the seeds in a cup which is then filled with boiling water and left for about two hours. The seeds are then placed in pots and covered with about half an inch of light soil.

The oldest seeds used so far were eight years old, being those of *A. leprosa*, but it is well known that Acacia seeds will germinate after fifty years, and Professor Ewart of Melbourne records having in two instances, germinated Acacia seeds sixty-seven and sixty-eight years old.¹ In

¹ "On the Longevity of Seeds," by Prof. Alfred J. Ewart, D.Sc., Ph.D., F.L.S., Proc. Roy. Soc. Victoria, XXI, (N.S.) pt. 1, 1908.

my own garden, seedlings of *Acacia falcata* appear every year, and these are from seeds which have been in the soil for twenty-six years and upwards.

Hypocotyl.

The hypocotyl varies in colour, thickness and length. So far as observed, it is usually glabrous in this genus, but in some species the upper portion may in time become sprinkled with a few hairs, and it tapers from base to apex, generally evenly, but in some cases becoming suddenly constricted just above the soil. Its colour ranges from very pale or almost colourless, to pale green and pale pink, brown or red. Its thickness at the base is from about 1 mm. to 2 mm., and at the apex from about .5 mm. to 1.5 mm. According to present observations its length ranges from about 1 cm. to 5.5 cm., but the total length or extent above the soil, does not appear to be constant for any species, and is largely regulated by the presence or absence of shelter, those growing in the open often being shorter than others which are sheltered, and which attain the greater length in their upward search for the light. The first portion of the plant to appear above the soil is the curved upper part of the hypocotyl and the base of the cotyledons.

Cotyledons.

The majority of *Acacia* cotyledons are oblong with the apex rounded, and with the outer side at first more or less convex, and the inner surface flat. Some are ovate while others are orbicular. All, so far examined, have entire margins but may be sagittate or auricled at the base, and are glabrous. The majority are sessile though a few are distinctly petiolate. As the curved upper portion of the hypocotyl straightens out it gradually pulls the cotyledons from the soil and out of the testa, the apex being the last to appear. If the seeds are not sufficiently covered with soil, they sometimes appear before the cotyledons have

emerged, and if the latter are unable to free themselves, the seedling may perhaps perish.

The majority of *Acacia* cotyledons first assume a vertical position, but within about a week, or less in some cases, become horizontal, and may remain on the plants from two to eight weeks or even longer. Those which remain vertical usually fall off in about eight or ten days during the summer months, but may remain longer in the winter, notably those of *A. neriifolia*, *leiophylla*, *salicina*, and *myrtifolia*. A feature of thin cotyledons is that within a day or two they become revolute, and later, often cylindrical, after which they soon fall. In some species such as, amongst others, *A. juniperina*, *armata*, *suaveolens*, *aneura* and *Dawsoni*, the cotyledons may remain on the plant until after the advent of the phyllodes.

The cotyledons of *A. stenophylla*, *Bidwilli*, and *Farnesiana* are fairly fleshy while those of *A. pendula* and *aneura* are slightly less so. The significance of the geographical distribution of the fleshy cotyledons will be discussed in a later paper after more evidence becomes available, but this form appears to be one which is able to exist in areas where the climate is subarid, or where the rainfall is confined mainly to one season of the year.

Primary Leaves.

In about 400 seedlings raised, the first leaf to appear has always been simply-pinnate. In a few cases, already referred to, there have appeared an opposite pair of such leaves. These leaves are petiolate, with stalks averaging from 3 to 5 mm. long, and which emerge from the stem at right angles to the cotyledons and very slightly above them, the first internode often measuring scarcely .5 mm., consequently the first leaf and the cotyledons often appear to be at the same level. In the cases of *A. hispidula*, *leiophylla* and *stenophylla*, the stalks are sometimes over 1 cm. long.

In many species the primary leaf is quite glabrous, but in others the stalk, or in fewer cases the rachis, may be pilose, and the margins of the leaflets ciliate. Leaflets commonly number from two to five pairs, but the number is not constant for any species and sometimes only one pair may appear on a species which usually has two. *A. accola* may have up to eight, and *A. Bidwilli* nine pairs.

The leaflets are generally very shortly petiolate, the petiolule varying from about .2 mm. to 1 mm. long, and they are usually opposite, but some are alternate. The terminal pair are generally opposite, and the rachis excurrent. A common shape of the leaflets is oblong-acuminate, sometimes mucronate and oblique, though they may be even cuneate.

There is considerable similarity in the venation of the leaflets of most species. First there is the midrib extending somewhat obliquely along the length of the leaflet and nearer to the upper than the lower margin. Next between the lower margin and the midrib there is, in many species, a second longitudinal vein, radiating from the base of the leaflet, and extending, in part, almost parallel to the midrib until it reaches near the lower margin about or above the centre. There is also a system of reticulating veins, but owing to the thickness of the epidermis this is often indistinct. (Fig. 1.)

The disposition of the two longitudinal veins, in many species, is suggestive of the possibility that the present form is a modification of a leaflet which was formerly triplinerved. This suggestion is supported by the triplinerved venation of the cotyledons of such species as *A. suaveolens* and *A. aneura*, but requires to be further investigated.

Out of about 400 seedlings taken from about 60 species, only two cases so far have been noticed where the third

leaf is simply-pinnate, viz., those of *A. juniperina*, (Plate VIII, No. 1), though a few others have appeared so, owing to one of the pinnæ not having developed or having fallen

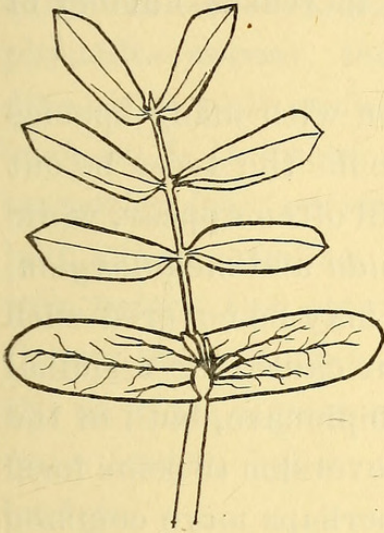


Fig. 1. *Acacia suaveolens*.
Cotyledons and primary leaf. $\times 2$.

off. In all these cases the first leaf has been simply-pinnate, so that the generally-accepted view that the ancestors of the present Acacias had simply-pinnate leaves seems correct. This being so, it is perhaps not remarkable that the simply-pinnate leaf should sometimes reappear among the seedling foliage, and with extended search, many more examples among various species will probably be found.

Bipinnate Leaves.

Next after the pinnate leaf, or in some cases the opposite pair of pinnate leaves, come the bipinnate leaves, arranged alternately; the common petioles usually becoming longer for each succeeding leaf. The leaflets much resemble those of the pinnate leaf. In some instances one of the pinnæ may be broken off, or may not properly develop, and unless care be exercised in the observations, the leaf may perhaps be regarded as simply-pinnate. Often, however, some slight portion of the absent pinna or the excurrent point of the common petiole remains as evidence of the previous state of the leaf. In certain species, however, including *A. aulacocarpa*, the second and third leaves may commonly develop with only one pinna, but with the excurrent point of the petiole quite distinct, and no definite evidence of even the rudiments of the second pinna. These appear to be examples of a transition stage which will be referred to when more data are available, and should rather be

regarded as abnormal bipinnate than pinnate leaves. In a few species the pinnæ increase on some of the succeeding leaves to several pairs, and on many species each succeeding bipinnate leaf often produces an increased number of leaflets.

A well known feature in connection with many species of phyllodineous Acacias is that should the trees be cut back or wounded, bipinnate leaves will often appear, while in a few species, particularly *A. rubida* and *melanoxylon*, the older portions of a sound branch may be covered with phyllodes, while without any apparent cause, the terminal leaves of the same branch may be bipinnate, both of the above characters thereby showing a reversion to some form of ancestral foliage. The feature is perhaps more common on suckers than on plants which have grown from seedlings; though so far as observed, an Acacia sucker does not appear to ever produce a simply-pinnate leaf, but the point requires further investigation. Mr. A. A. Hamilton has recorded an instance of a tree fifteen feet high of *A. melanoxylon* producing bipinnate leaves on the tips of the phyllodes.¹ At the last monthly meeting of this Society Mr. E. Cheel exhibited a flowering specimen of *A. suaveolens* showing bipinnate foliage above the fruiting or pod-bearing twigs.

Phyllodes.

It is well known that the phyllodes are the cylindrical, dilated or vertically flattened petioles of the bipinnate leaves, and this curious development has apparently taken place in response to environment. For some reason, probably climatic, the plants evolved this form of structure as being more suitable under the existing circumstances for carrying on the functions of leaves than were the original leaves. A study of the seedlings shows that the transition from leaves to phyllodes takes place at different periods of

¹ Proc. Linn. Soc. N.S. Wales, xxxix, 1914, p. 254.

growth in different species, and also even in the same species. As already pointed out in a previous paper in this Journal (1914, p. 136), *Acacia rubida* may reach a height of ten feet, and bear flowers and fruit before any phyllodes appear, though it is the only species of phyllodineous *Acacia* so far recorded as doing so, while others, such as *A. Dawsoni* and *aneura*, may show considerable transition from petiole to phyllode on the second bipinnate leaf, the succeeding leaf being wholly phyllodineous, and this before the plants are more than two inches high. Others again, such as *A. salicina* var. *varians* may show the phyllode almost complete on more than a dozen bipinnate leaves, before the phyllode appears without any leaflets.

Development of Uninerves and Plurinerves.

In studying the transition from linear to dilated petioles and phyllodes, it becomes apparent that in many species of both uninerves and plurinerves one of the first indications of the change is manifested by a thickening of the nerve, partially or wholly, along or near the lower margin of the petiole, with the upper margin sometimes channelled. Next comes a vertical flattening or flange-like extension of the upper margin, with perhaps no dilation for some time on the lower margin, as though the effect of sunlight may be in some way responsible for this curious upward development. During this development the strong lower marginal nerve may be seen to retain the place of the original petiole, and is continuous from the plant stem to the base of the pinnæ. If the phyllode ultimately becomes a uninerve, then succeeding petioles show an increased amount of flange below as well as above the nerve, until at last the phyllodes appear with the nerve in about the centre of the blade, which shows obscurely a system of reticulating veins. (Fig. 3.)

The development of the plurinerved phyllode is somewhat more complex. The first indication of its advent is also a strong straight nerve along or near the lower margin of the petiole. On a succeeding petiole a convex flange-like extension is developed on the upper margin, and in this lamina a fine vein may appear approximately parallel to the lower nerve and often confluent with it at both ends.¹ A subsequent petiole may show the lamina becoming much broader on the upper side of the strong nerve, with an increased interval between the two nerves, while a lateral extension of the lamina has commenced on the lower side. If the phyllode is finally two-nerved, as in *A. verniciflua* and *binervata*, the lower nerve is usually the more prominent, and the remainder of the blade may be pinnately veined with fine lateral veins on either side of both nerves. (Fig. 2.)

When the phyllode is triplinerved, or quintuplinerved, the early development is the same as in the two-nerved types, but succeeding petioles show a lateral extension below the more prominent nerve which now appears to become the central vein, and the lower margin becomes nerve-like, or an intramarginal vein may develop on the lower side.

With a continued expansion of the blade in subsequent petioles or early phyllodes, the nerve-like margins of one phyllode sometimes seem to be represented by intramarginal veins on subsequent ones. Where the phyllodes are multinerved, the interspaces are usually finely striate with parallel veins.

Until more species are examined no conclusive opinion can be expressed as to the relative ages of the uninerves

¹ "The Development and Distribution of the Natural Order Leguminosæ," by E. C. Andrews, B.A., F.G.S., this Journal, Vol. XLVIII, p. 396, (1914).

and plurinerves, but the evidence to hand points to the uninerves as being the earlier form.

Twin Stems.

A curious feature noticed in connection with seedlings of *A. juniperina* raised from seed obtained near Professor David's residence at Woodford, is that in two separate cases one seed produced a divided hypocotyl, each portion becoming a separate stem having its pair of cotyledons, its one pinnate leaf, bipinnate leaves and phyllodes. (See Plate VIII, Nos. 3 and 4). In the case of Number 3 the bifurcation occurs just below the cotyledons, one of which is slightly higher than the other, but in Number 4, although the division first appeared at about the same position, it gradually worked down as the plant grew, until it reached the base of the hypocotyl. This appears to be the first record of twinning in the genus *Acacia*.

Mr. E. C. Andrews has recently found an example of twinning in a seedling near Botany Bay, apparently *A. juniperina*, and extended investigation will probably show that the feature occurs in many species.

Transport of Seeds by Water.

In connection with plant distribution over isolated areas, and the possibility of certain species being indigenous to a particular country or not, the question of transport of seeds by water has been much discussed by various writers. Where a species is found in two or more continents or on widely separated islands, theories are propounded to account for its distribution over these areas. Two of the commonest theories in regard to such dispersal are that the distribution is due either to a former land connection having existed between the two countries in question, or that seeds may have been transported by water. In certain cases the question of dispersal by wind and birds has to be carefully considered. The only Australian species of

Acacia which occurs also in America, Asia, Africa, and intervening islands, is *A. Farnesiana*, and as it seemed doubtful that its existence antedated the final separation of the great tropical lands, an experiment was made to see whether seeds of this species would retain their vitality in sea-water long enough for it to be possible for them to survive an ocean journey between these continents and islands. A pod with seeds of *Acacia Farnesiana* from Boomarra, north of Cloncurry, in tropical Queensland, was placed in a bottle of sea-water, and it sank in a few days or after the water entered the pod. Free fertile seeds of this species will sink immediately. At the end of three months the seeds were taken out, and found to be in a perfectly sound condition, and after being placed in boiling water, four were planted. In about two weeks one of the seeds germinated, producing a healthy plant. At the end of three months one of the remaining seeds was taken out of the ground, placed in boiling water and replanted. In two weeks this germinated, and produced the plant shown in Plate XII.

Seeds of the same species, collected by Sir William Cullen near Barcaldine in Central Queensland, were perfectly sound after having been left in sea-water for five months. After 146 days, two of the seeds were taken out and planted after having been placed in boiling water, and both germinated readily. At the end of 190 days another seed was taken out, and was so hard and sound that when dropped into a cup from a height of nine inches it bounced out of the cup. This seed was at once planted, after having been placed in boiling water, and germinated readily.

These experiments demonstrate that seeds of *A. Farnesiana* will retain their vitality in sea-water long enough to be transported by an ocean current for thousands of miles. It would probably be necessary however that

they should be conveyed on pieces of driftwood or pumice, for the very long distances, but anyone familiar with the sea shore well knows that every flooded river carries vast quantities of debris into the ocean, and some of this is transported by currents far from its original home.

Charles Darwin visited Cocos Keeling Islands in 1836, and collected specimens of about twenty species of plants, the whole of which he considered "must have been transported by the waves of the sea." The collection included a specimen doubtfully identified as *Acacia Farnesiana*, which species has since been definitely recorded for the Islands.¹ Darwin also quotes from Holman's Travels to the effect that amongst other things found washed up on the Islands were "immense trees, of red and white cedar, and the blue gum-wood of New Holland."² He subsequently carried out a series of experiments to test how long various kinds of seeds would bear immersion in sea-water without losing their vitality.³

In an exhaustive work on various Insular Floras of the Atlantic, Pacific and Southern Oceans, W. Botting Hemsley, F.R.S., discusses oceanic dispersal of plants and quotes Professor Ch. Martins, of Montpellier, as having germinated a seed of *Acacia julibrissin*, (*Albizia julibrissin* according to Index Kewensis), and also of eight other species of plants, after having immersed the seeds in sea-water for ninety-three days.⁴ He also quotes Alphonse De Candolle, and Gustave Thuret as considering that oceanic currents, though effective in certain cases, exercise extremely little influence in the diffusion of plants.

¹ Journal of Researches into the Geology and Natural History of the Various Countries visited by H.M.S. Beagle, p. 541.

² Holman's Travels, Vol. iv, p. 378.

³ Gardener's Chronicle, 1855, and Journ. Linn. Soc. Lond., i, p. 130.

⁴ Report of the Scientific Results of the Voyage of H.M.S. Challenger, Botany, Vol. i, p. 283.

The problem has been carefully investigated over a very large area by Dr. Guppy. In speaking of the limited results obtained by testing the buoyancy in sea-water of a collection of seeds, he says that such results are sufficient, however, to illustrate the character of the sorting-process by which in the course of ages the plants with buoyant seeds or seed-vessels have been gathered at the coast. This is indicated, he writes:—

(1) “By the far greater proportion of species with buoyant seeds and seed vessels amongst the shore plants than among the inland plants.

(2) By the circumstance that almost all the seeds or fruits that float unharmed for long periods belong to shore plants.

(3) By the fact that when a genus has both inland and littoral species, the seeds or fruits of the coast species as a rule float for a long time, whilst those of the inland species either sink at once or float only for a short period.”¹

In regard to *Acacia Farnesiana* Dr. Guppy points out (p. 559) that it was introduced to the Hawaiian Islands by Europeans, and that pods of this species are now washed up on the beaches of the west coast of Oahu, one of the islands, and the seeds are to be seen germinating in numbers on the beach, the seedlings striking into the sand.

He also writes:—“The pods float unharmed in sea-water for four or five weeks, but the seeds, when freed, sink.”

Dr. F. Wood-Jones mentions that many hard seeds and seed-pods are washed ashore on Cocos-Keeling Islands.² He also has seen a tree come ashore from some far off land, carrying quite a wheelbarrow-load of fine earth in its buttressed trunk (p. 290). He adds:—“It is certain that such a tree would have many tenants when it started on

¹ Observations of a Naturalist in the Pacific between 1896 and 1899, by H. B. Guppy, M.B., F.R.S.E., Vol. II, Plant-Dispersal, p. 22, (1906).

² Coral and Atolls by F. Wood-Jones, B.Sc., F.Z.S., p. 171.

its voyage, and it is not unlikely that some would have the good fortune to survive the passage."

Dr. Wood-Jones tested the ocean currents at Cocos-Keeling Islands by sending adrift several sealed bottles each containing a note asking the finder to return it. After a little more than six months, a bottle was found just north of the equator, at Brava on the east coast of Africa, and the author writes:—"My little note came back again none the worse for its sea travel of over 3,000 miles." (p. 294).

The question of the original home of *Acacia Farnesiana* has been discussed by different writers¹ and must remain difficult of final solution, but from inspection of a chart showing the world's great ocean currents, it would seem possible that the species may have originated in America, from where it could have been transported by westerly currents to Australia, Asia, Africa, and intervening islands. This transportation may have been going on for many thousands of years, and great quantities of seeds perished in transit, and of those cast ashore only a small proportion may have been subsequently removed to a position suitable for growth. The period however, has been so vast during which this dispersal may have been in progress, that only the very smallest fraction of the numbers of transported seeds need have germinated in a new country for the species to have eventually become established therein.

Descriptions of Seedlings.

PUNGENTES—Uninerves.

ACACIA JUNIPERINA, Willd., "Prickly Wattle." Seeds from Woodford, Cheltenham, and Ulladulla. (Plate VIII, Numbers 1 to 5.)

Seeds dull-black, oval-oblong, 4 mm. long, 3 mm. broad, 2 mm. thick.

¹ B. Fl. Vol. II, p. 420.

Hypocotyl erect, terete, at first pale, later becoming brown, sometimes tinged with red, from 1 to 2 cm. long, 1 to 1·7 mm. thick at base, ·5 to 1 mm. at apex, glabrous.

Cotyledons two, sometimes three, and in the case of twin stems there are four, sessile, sagittate, oblong to ovate-oblong, at first erect but becoming horizontal in a few days, sometimes becoming revolute, 4 to 5 mm. long, 2 to 3 mm. broad, underside pale and stippled with brown towards apex or sometimes wholly brownish-red to dark red, usually with a raised line along centre, upperside green, glabrous.

Stem terete, pubescent, brown: first internode ·5 mm. long; second 1 mm. to 1 cm.; third 3 to 9 mm.; fourth 2 mm. to 1·2 cm.; fifth 1·5 to 6 mm.; differing in length in different individuals.

Leaves—No. 1. Abruptly pinnate, petiole 5 to 7 mm. long, glabrous; leaflets one to two pairs, obovate-oblong, acuminate, mucronate, 5 to 7 mm. long, 1 to 3 mm. broad, upperside green, underside paler, midrib fairly distinct especially in dried specimens, second nerve seen under lens, glabrous; rachis excurrent; stipules 1 to 2 mm. long, tapering to a fine point.

No. 2. Abruptly bipinnate, petiole 7 mm. to 1·2 cm. long, slightly channelled above, glabrous, excurrent; leaflets two pairs similar to those of the pinnate leaf but often smaller, glabrous; rachis 4 to 5 mm. long, glabrous, excurrent; stipules 2 mm. long. In one natural seedling from near Botany Bay, the second leaf was simply-pinnate.

No. 3. Usually abruptly bipinnate, but in two specimens, pinnate, petiole 8 mm. to 1·1 cm. long, glabrous, excurrent; leaflets two pairs, sometimes obovate; in two cases the leaflets were wanting and in their places were two spines; stipules spinescent, 3 mm. long, 1 mm. broad at base, sometimes sprinkled with white hairs.

Nos. 4, 5, 6 and 7, may be abruptly bipinnate, with one or two pairs of leaflets or they may be leafless pungent pointed phyllodes. In some cases numbers 5 and 6 may be phyllodes and No. 7 bipinnate.

No. 8 and upwards. Pungent pointed phyllodes.

UNINERVES—Armatae.

ACACIA ARMATA, R. Br., "Kangaroo Thorn." Seeds from Mount Ainslie, Canberra. (Plate VIII, Numbers 6 to 8.)

Seeds black, oblong, 4 mm. long, 2 mm. broad, 1.5 mm. thick.

Hypocotyl erect, terete, pale green, about 1.5 cm. long, 1 mm. thick at base, about .8 mm. at apex, glabrous.

Cotyledons sessile, sagittate, oblong, apex rounded, at first erect, but becoming horizontal in a few days, 5 mm. long, 2 mm. broad; outer or underside yellowish to pale green, with one or two parallel ridges along central portion; inner or upperside dark green, glabrous; usually remaining until after phyllodes appear.

Stem terete, pilose to pubescent, green; first internode .5 mm. long; second 2 to 3 mm.; third 5 mm. to 1 cm.; fourth 5 to 7 mm.; differing in length in different individuals.

Leaves—No. 1. Abruptly pinnate, petiole 4 mm. long, green, glabrous; leaflets three to four pairs, ovate acuminate, often mucronate, 4 mm. long, 2 mm. broad, pale green on both sides, oblique midrib sometimes seen without lens, second vein showing under lens; rachis 4 to 6 mm. long, glabrous, excurrent, stipules slender 1 to 2 mm. long.

No. 2. Abruptly bipinnate, petiole 8 to 9 mm. long, pilose, excurrent; leaflets two to three pairs, not strictly opposite, margins sometimes brownish-red, and with scattered hairs; rachis faintly pilose, excurrent; stipules straight, slender 1 to 2 mm. long.

Nos. 3 and 4. Abruptly bipinnate, petiole often vertically flattened, 1 cm. long, and up to 1 mm. broad, pilose; leaflets two to three pairs, with scattered hairs which are more numerous towards margins, midrib fairly distinct; rachis pilose, excurrent; stipules straight, slender 2 to 3 mm. long.

No. 5. Abruptly bipinnate, petiole more dilated than in Nos. 3 and 4, and with a strong nerve extending just below the centre, from base to apex, pilose to hispid; leaflets up to four pairs.

Nos. 6, 7 and 8. Usually reduced to obliquely pungent-pointed phyllodes, lanceolate, tapering towards the base, pilose, with a fairly prominent oblique midrib, and often with a second shorter and finer vein above, the two being confluent at the base, the margins hairy; stipules slender but becoming spinescent, 4 mm. long.

UNINERVES—*Brevifoliæ*.

ACACIA UNDULIFOLIA, A. Cunn. Seeds from Yerranderie.
(Plate VIII, Numbers 9 to 12.)

Seeds black, oval-oblong, 5 mm. long, 3 mm. broad, 1 mm. thick.

Hypocotyl erect, terete, pale red, about 2 cm. long, 1·5 to 2 mm. thick at base, 1 mm. at apex, swelling largely into the root, glabrous.

Cotyledons sessile, sagittate, oblong, apex rounded, at first erect, but soon becoming horizontal, revolute and cylindrical, falling early, 5 to 6 mm. long, 2 to 3 mm. broad; outer or underside light brownish-red, having 1 to 3 ridges along central portion; upperside pale, becoming green, glabrous; margins nerve-like, reddish.

Stem terete, pubescent; first internode 5 mm.; second 1 to 2 mm.; third and fourth 2 to 4 mm.; fifth 3 to 4 mm.; sixth 4 to 5 mm.; seventh 5 to 6 mm.

Leaves—No. 1. Abruptly pinnate, petiole 2 to 3 mm. pale green, becoming dark green, glabrous or slightly pilose; leaflets four to five pairs, oblong, acuminate, 3 to 4 mm. long, 1·5 to 2 mm. broad, at first reddish, becoming green, mid-rib showing under lens; rachis 5 to 6 mm. long, glabrous, excurrent; stipules almost reduced to scales, about 1 mm. long, glabrous.

No. 2. Abruptly bipinnate, petiole about 8 mm. long, hispid; leaflets four pairs, a little broader than those of the first leaf, margins ciliate; rachis 8 to 9 mm., pilose, excurrent; scales indistinct.

No. 3. Bipinnate, petiole 1 to 1·4 cm., hispid to pubescent, excurrent; leaflets four to five pairs, margins ciliate, the pinna sometimes unequally pinnate; rachis pilose, excurrent; scales pubescent.

Nos. 4 and 5. Bipinnate, petiole about 1·5 cm. long, becoming channelled above or vertically flattened, in the latter case with a strong nerve along the lower margin, pubescent; leaflets five to eight pairs, pilose, margins ciliate, the pinna sometimes unequally pinnate; rachis hispid, excurrent: scales pubescent.

No. 6. Bipinnate, petiole pubescent, vertically flattened and showing a prominent nerve either along the centre, or in the earlier stages near the lower margin of the young phyllode, fairly straight, and connecting with the base of the pinnæ, the upper margin convex; rachis hispid to pubescent, excurrent; scales pubescent.

No. 7. Bipinnate or sometimes reduced to an obovate phyllode, 1·7 to 2 cm. long, 7 mm. broad, with distinct central nerve, and nerve-like margins, and indistinct lateral veins, mucronate, hispid to pubescent.

Nos. 8 and upwards. Usually phyllodes.

UNINERVES—*Angustifoliæ*.

ACACIA VERNICIFLUA, A. Cunn. Seeds from Yerranderie.
Growing on Permo-Carboniferous sandstone and shale.
(Plate IX, Numbers 1 to 4.)

Seeds black, oblong, 3·5 to 4 mm. long, about 1·8 to 2 mm. broad, 1 mm. thick.

Hypocotyl erect, terete, pale green, about 1·3 to 2·5 cm. long, 1 to 1·5 mm. thick at base, about ·7 to ·9 mm. at apex, glabrous.

Cotyledons sessile, sagittate, oblong, apex rounded, about 5 mm. long, 1·5 to 2·2 mm. broad, at first erect but becoming horizontal within two or three days, outer or underside at first greenish yellow, becoming green in about a week, with one or two raised nerves from base along central portion, inner or upperside yellowish-green, becoming dark green in one week, glabrous; sometimes remaining until the phyllodes are present.

Stem terete, green, glabrous, or with a few scattered hairs; first internode ·5 mm.; second 2 to 3 mm.; third 3 to 7 mm.; fourth 5 mm. to 1 cm.

Leaves—No. 1. Abruptly pinnate, petiole about 4 mm., green, glabrous; leaflets two to three pairs, oblong, acuminate, 3 to 5 mm. long, 1·5 to 2 mm. broad, green above, underside paler, oblique midrib showing under lens; rachis 3 to 4 mm. long, green, glabrous, excurrent; stipules minute.

No. 2. Abruptly bipinnate, petiole 6 to 9 mm. long, sometimes with a strong nerve along the lower edge, green, glabrous or with a few scattered hairs, excurrent; leaflets two to three pairs, the terminal pairs opposite, the remainder sometimes alternate; rachis 3 to 6 mm. long, glabrous, excurrent; stipules reduced to scales 1 mm. long.

No. 3. Abruptly bipinnate, petiole about 1 cm. long, with a few scattered hairs, usually slightly flattened vertically,

with a strong nerve along the lower edge and sometimes decurrent on the stem; leaflets three to four pairs; stipules as in No. 2.



Fig. 2. *Acacia verniciflua*.

Showing strong nerve on petiole of bipinnate leaf. Nat. size.

No. 4. Sometimes reduced to a phyllode, or abruptly bipinnate with petiole from 1·5 to 2 cm. long, 2 mm. broad, with strong central nerve running to the base of the pinnæ, and a finer almost parallel nerve above, confluent with the lower one at the base; leaflets four to five pairs, oblong to obovate-oblong.

No. 5. Phyllodes from 2·5 to 3·5 cm. long and up to 1 cm. broad, lanceolate-elliptical, two-nerved, the lower one being the more prominent, and each having a system of lateral anastomosing veins, glabrous, not viscid, as in the succeeding forms.

UNINERVES—*Angustifoliæ*.

ACACIA LEPROSA, Sieb. Seeds from Healesville, Victoria.
(Plate IX, Numbers 5 to 7.)

Seeds black, oblong, 3·5 to 4 mm. long, 2 mm. broad, 1·3 mm. thick.

Hypocotyl erect, terete, reddish-green, 1 to 1·6 cm. long, 1·3 mm. thick at base, 1 mm. at apex, glabrous.

Cotyledons sessile, sagittate, oblong, apex rounded, 5 mm. long, 2 mm. broad, at first erect but becoming horizontal in a few days and later revolute, outer or underside pale green, later becoming brown, with one or two raised lines along central portion, margins reddish-brown to purple, inner or upperside dark green, glabrous; usually remaining until the phyllodes are present.

Stem terete or very slightly angular, pilose to pubescent; first internode 5 mm.; second 1 mm.; third 4 mm. to 1 cm.; fourth 1.3 to 1.5 cm., varying in length in different individuals.

Leaves—No. 1. Abruptly pinnate, petiole 5 to 6 mm. long, reddish-green, becoming green, excurrent, glabrous; leaflets two to three pairs, oblong, ovate-oblong or obovate-oblong, 5 to 6 mm. long, 3 mm. broad, upper side green, underside paler, margins sometimes reddish, oblique midrib fairly distinct, second vein showing under pocket lens, glabrous; rachis 3 to 7 mm. long, glabrous, excurrent.

No. 2. Abruptly bipinnate, petiole 8 mm. to 1.3 cm. long, pilose, excurrent; leaflets three to four pairs, usually obovate, margins red with a few scattered hairs; rachis 6 to 9 mm. long, faintly pilose, excurrent; stipules reduced to scales.

No. 3. Abruptly bipinnate, petiole 1.7 to 2.2 cm. long, pilose, usually slightly flattened vertically, sometimes with nerve showing between the lower margin and the centre, excurrent; leaflets four to five pairs, with scattered hairs on underside, and around the margins; rachis pilose, excurrent; stipules reduced to scales and soon disappearing.

No. 4. Abruptly bipinnate, petiole 2 to 2.3 cm. long, pilose to hirsute, vertically flattened, and showing a distinct nerve which is on the lower edge of the narrowed petioles, and along the centre of the broader or older ones, and sometimes decurrent on the stem; leaflets usually five pairs, sprinkled with hairs on the underside and along the margins, excurrent; rachis pilose, excurrent.

No. 5. Phyllode with central nerve and reticulating veins, tomentose when first appearing, and finally sprinkled with short hairs which are denser towards the base.

UNINERVES—RACEMOSÆ.

ACACIA SUAVEOLENS, Willd. "Sweet-scented Wattle."

Seeds from Ulladulla, growing on Permo-Carboniferous sandstone. (Plate IX, Numbers 8 to 10.)

Seeds black, oblong, 6 to 7 mm. long, 3 mm. broad, 2 mm. thick.

Hypocotyl erect, terete, pale pink, about 1 to 4 cm. long, 1·3 or rarely 2 mm. thick at base, 1 mm. at apex, glabrous.

Cotyledons sessile, oblong, apex rounded, sagittate, 7 to 8 mm. long, 3 to 3·5 mm. broad, at first erect, but becoming horizontal in a few days, and usually remaining until the phyllodes are present, outer or underside deep red, and showing distinctly, especially when dry, a raised central nerve, and a shorter almost parallel vein on each side thereof, the cotyledon being triplinerved and also having numerous reticulating and anastomosing veins, inner or upperside at first greenish-brown, becoming reddish-green and finally green, glabrous. (Fig. 1.)

Stem terete in the lower portion, angular above owing to the presence of decurrent leaf-stalks, brownish-green, or sometimes glaucous. First internode ·5 mm.; second ·5 mm.; third 1 mm.; fourth 1 mm.; fifth 2 to 3 mm., varying in length in different individuals.

Leaves—No. 1. Abruptly pinnate, petiole 4 to 8 mm. long, glabrous; leaflets three to four pairs, oblong to obovate-oblong, shortly acuminate, often mucronate, 5 to 7 mm. long, 2 to 3·5 mm. broad, the basal pair usually smaller, underside red or reddish-green, becoming pale green, central nerve distinct, second nerve and reticulating veins showing under lens, upperside reddish-green, becoming light green; rachis 8 mm. to 1·2 cm. long, glabrous, excurrent; stipules reduced to scales and soon falling.

No. 2. Abruptly bipinnate, pinna lyrate, petiole 1 to 1·6 cm. long, glabrous, excurrent; leaflets three to four pairs, pale green; rachis 1 to 1·3 cm. long, glabrous, excurrent; stipules reduced to scales.

No. 3. Abruptly bipinnate, pinna usually lyrate, petiole 2 to 2·7 cm. long, glabrous, excurrent; leaflets four pairs, obovate, two-veined; stipules reduced to scales.

No. 4. Abruptly bipinnate, pinna usually lyrate, petiole 2·7 to 3·1 cm. long; leaflets four to five pairs; stipules reduced to scales 1·5 mm. long.

No. 5. Abruptly bipinnate, pinna lyrate, petiole 3 to 4 cm. long, slightly flattened vertically, with nerve along lower margin; leaflets six pairs, the terminal pair sometimes each 1 cm. long, and 7 mm. broad.

No. 6. Abruptly bipinnate, petiole vertically flattened, 3 to 4 cm. long, and up to 2 mm. broad, with a prominent nerve partially or wholly along the lower margin from the stem to the base of the pinnæ, and decurrent on the stem, the upper margin nerve-like; leaflets six to seven pairs, the basal pair very small; stipules reduced to scales 1·5 mm. long.

No. 7. Usually a phyllode, linear lanceolate, 5 to 7 cm. long with a distinct midrib and nerve-like margins.

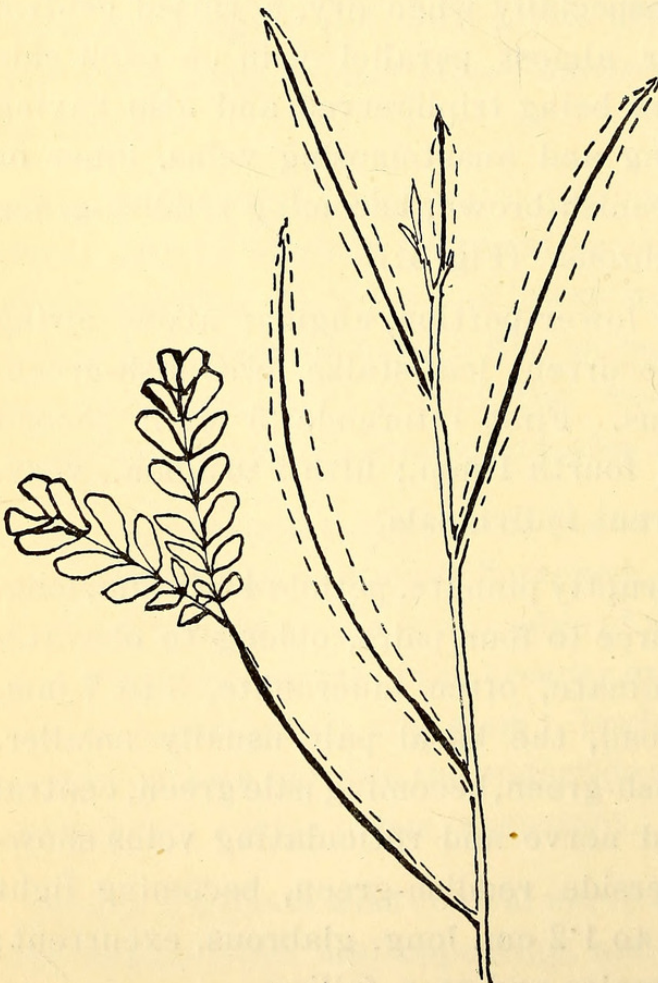


Fig. 3. *Acacia suaveolens*, showing development of nerve in phyllodes. Nat. size.

UNINERVES—Racemosæ.

ACACIA PROMINENS, A. Cunn. Seeds from Gosford—(J. H. Maiden). Growing on sandy soil. (Plate X, Numbers 1 to 4.)

Seeds black, obovate, 4·5 to 5 mm. long, 3·5 mm. broad, 2·5 mm. thick.

Hypocotyl erect, terete, pale brown to reddish-brown, 1·7 to 2 cm. long, 1·3 to 1·5 mm. thick at base, about 1 mm. at apex, glabrous.

Cotyledons sessile, obovate, slightly sagittate, 5 mm. long, 3 mm. broad, at first erect, becoming horizontal and revolute in a few days, and later cylindrical, falling off in a few weeks; outer or underside reddish-brown with one or two raised longitudinal lines; upperside dark green, glabrous.

Stem terete, at first reddish-brown with a few scattered hairs, later pubescent; first internode 5 mm., second 2 to 5 mm.; third 2 to 4 mm.; fourth and fifth 4 to 5 mm.

Leaves—No. 1. Abruptly pinnate, and showing before the cotyledons are two days old, petiole about 5 mm. long, reddish-brown, with a few scattered hairs; leaflets four to six pairs, oblong acuminate, sometimes mucronate, 5 to 8 mm. long, 1 to 2 mm. broad, upperside green, underside at first red, becoming pale green; rachis 7 mm. to 1·5 cm. long, brownish-green, usually glabrous or with a few scattered hairs.

No. 2. Abruptly bipinnate, petiole about 1 cm. long, at first pilose, often becoming pubescent, excurrent; leaflets four to six pairs, upperside green, paler underneath.

No. 3. Abruptly bipinnate, petiole 1 to 1·4 cm. long, at first pilose, becoming pubescent, slightly channelled above, usually with a prominent gland near the middle of the upper edge; leaflets six to nine pairs, upperside green,

underside reddish-green, becoming pale green; stipules green, oblong, acuminate, 1·5 mm. long, ·5 mm. broad at base.

Nos. 4 and 5. Abruptly bipinnate, petiole similar to that of No. 2, and with prominent gland; leaflets six to eleven and rarely thirteen pairs.

Nos. 6, 7 and 8. Either abruptly bipinnate, with petiole vertically flattened to scarcely 1 mm. broad, and with a prominent central nerve; or reduced to a phyllode, elliptical, mucronate, with central nerve, sometimes running obliquely to the apex with the lower margin nerve-like for about half its length, or with central nerve merging into the lower margin at about half the distance to the apex, the phyllode pilose.

UNINERVES—Racemosæ.

ACACIA VESTITA, Ker. Seeds from Mudgee—(L.F. Harper).
(Plate X, Numbers 5 to 8.)

Seeds black, obovate-oblong to oval-oblong, 5 to 6 mm. long, 3·5 to 4 mm. broad, 1·5 mm. thick.

Hypocotyl erect, terete, reddish to reddish-green, 1·7 to 3 cm. long, 2 mm. thick at base, 1 mm. at apex, glabrous, or the upper portion may become sprinkled with a few hairs.

Cotyledons sessile, very slightly auricled, overlapping the hypocotyl about 1 mm., obovate, 5 to 6 mm. long, 4 mm. broad, at first erect but becoming horizontal and revolute in a few days, cylindrical within a week, and falling in two or three weeks, outer or underside purple, usually with raised portion longitudinally along centre, upperside greyish-green, becoming green, glabrous.

Stem terete, or angular where leaf-stalks are decurrent on the stem, pubescent. First internode ·5 mm.; second 1 to 8 mm.; third 1 mm. to 1·4 cm.; fourth about 3 mm.; fifth up to 5 mm.; sixth up to 7 mm., varying in different individuals.

Leaves—No. 1. Abruptly pinnate, petiole 2 to 5 mm. long, hispid; leaflets three to four pairs, oblong-acuminate, usually mucronate, about 5 to 7 mm. long, and nearly 2 to 2.5 mm. broad, underside reddish-green, becoming pale green, upperside light green, midrib fairly distinct, second vein showing under pocket lens; rachis 7 to 8 mm. long, pilose, excurrent; stipules small.

No. 2. Abruptly bipinnate, petiole 3 to 5 mm. long, hispid, excurrent; leaflets four to six pairs, margins sometimes ciliate; rachis pilose, excurrent; stipules 1 mm. long.

Nos. 3 and 4. Abruptly bipinnate, petiole about 6 mm. long, hispid to pubescent, excurrent; leaflets and rachis similar to those of No. 2; stipules small.

No. 5. Abruptly bipinnate, petiole slightly flattened vertically, about 6 to 7 mm. long, pubescent; leaflets six to seven pairs, margins sometimes ciliate, rachis hispid, excurrent; stipules small.

No. 6. Reduced to a phyllode or abruptly bipinnate, with dilated, hispid, falcate petiole, the tapering, hispid, excurrent point being sometimes 3 mm. long, prominent central nerve running to the base of the pinnæ on upper margin of flattened petiole; leaflets about seven pairs, rachis hispid, excurrent.

No. 7. Usually a phyllode obliquely-elliptical 6 to 8 mm. long, 4 mm. broad, hispid, upper margin almost semicircular lower margin straighter and somewhat nerve-like, central nerve curving and prominent, mucronate; lateral veins numerous but indistinct.

PLURINERVES—Oligoneuræ.

ACACIA DAWSONI, R. T. Baker. Seeds from Queanbeyan.
(Plate X, Numbers 9 to 11.)

Seeds black, oblong, 3.5 to 4.5 mm. long, nearly 2 mm. broad, 1 mm. thick.

Hypocotyl erect, terete, light-brown, 1 to 1·5 cm. long, 1 mm. thick at base, ·5 mm. at apex, glabrous.

Cotyledons sessile, oblong, apex rounded, slightly sagittate, 4 mm. long, 1·5 to 1·7 mm. broad, underside pale green stippled with brown to reddish-brown, upperside at first pale green becoming dark green, glabrous.

Stem terete, glabrous. First internode ·5 mm.; second ·5 mm.; third 2 mm.; fourth 5 mm.; fifth 1 cm.

Leaves—No. 1. Abruptly pinnate, petiole 3 mm. long, glabrous; leaflets two pairs, oblong, acuminate, or obovate, 3 to 4 mm. long, 1·5 to 2 mm. broad; upperside green, underside paler, midrib and second vein showing under lens; rachis about 2 mm. long, glabrous, excurrent.

No. 2. Abruptly bipinnate, petiole 3 to 5 mm. long, usually slightly dilated, glabrous, excurrent; leaflets two pairs; rachis excurrent.

No. 3. Abruptly bipinnate, petiole 1·4 to 2 cm. long, vertically flattened and narrowed towards the base, showing two distinct veins confluent at both ends, the lower one the more prominent, glabrous; leaflets two pairs, oblique midrib fairly distinct, secondary and reticulating veins showing under pocket lens, often mucronate, green, glabrous.



Fig. 4. *Acacia Dawsoni*.

About one and a half times natural size.

No. 4. A phyllode, about 3·5 cm. long, 6 mm. broad, oblong-lanceolate, narrowed at the base, glabrous with two distinct nerves confluent at both ends, the lower nerve the more prominent and direct, the lateral veins much finer and almost parallel with the main nerves, the loopings at the ends of the lateral veins forming in places a sort of intramarginal vein.

PLURINERVES—Julifloræ—Stenophyllæ.

ACACIA ANEURA, F.v.M., "Mulga." Seeds from Bourke, (J. H. Maiden). (Plate XI, Numbers 1 to 3.)

Seeds shiny dark brown, ovate, flat, about 5 mm. long, nearly 4 mm. broad, 1.5 mm. thick.

Hypocotyl erect, terete, pale green, about 3 cm. long, 1.5 mm. thick at base, 1 mm. at apex, glabrous.

Cotyledons two, rarely three, sessile, obovate-oblong, apex rounded, sagittate, 6 to 7 mm. long, 4 to 4.7 mm. broad, obscurely triplinerved and with reticulate venation seen best in dried specimens, at first erect but becoming horizontal in a few days and usually remaining on the plant until the phyllodes appear; outer or underside pale green, sometimes with raised central nerve fairly distinct, upper-side dark green. On a plant with three cotyledons, one was of normal size and the other two were on the opposite side and smaller, being 5 to 6 mm. long, 2.5 to 3 mm. broad, each sagittate.

Stem terete or slightly angular where affected by decurrent leafstalks, green, thinly sprinkled with fine hairs. First internode .5 mm.; second 1 mm.; third 4 to 5 mm.; fourth about 1 cm.

Leaves—No. 1. Abruptly pinnate, usually very slow in developing, petiole 5 to 7 mm. long, pale green, glabrous; leaflets two pairs, the petiolule sometimes 1 mm. long, obovate-oblong, often mucronate, with sometimes a few hairs on margin, 6 to 9 mm. long, 3 mm. broad, upperside green, underside paler, midrib distinct, especially in dried specimens, secondary nerve and lateral venation more obscured; rachis about 6 mm. long, pale green, glabrous, excurrent; stipules reduced to small scales. One seedling had an opposite pair of pinnate leaves, each with two pairs of leaflets.

No. 2. Bipinnate, petiole in some cases slightly dilated, about 1 cm. long, pilose, excurrent; leaflets two to three pairs, in some cases not strictly opposite, light green.

No. 3. Bipinnate, petiole sometimes vertically flattened, up to about 3 cm. long, with two distinct nerves, the more prominent one being close to the lower margin, and extending directly to the base of the pinnæ, sprinkled with fine hairs; leaflets three pairs, mucronate, margins often obscurely ciliate; rachis pilose or almost glabrous, excurrent.

No. 4. May be a narrow linear phyllode about 4·5 cm. long, 3 mm. broad, with an oblique or recurved hispid point, finely striate, but with two nerves, and especially the lower, more conspicuous than the rest, sometimes minutely hoary, and more distinctly so when first appearing.

PLURINERVES—Julifloræ—Falcatæ.

ACACIA GLAUDESCENS, Willd., "Coast Myall." Seeds from banks of Nepean River, Mulgoa. (Plate XI, Numbers 4 to 6.)

Seeds black, oblong, about 4·5 to 5 mm. long, 1·5 to 2 mm. broad, 1·5 mm. thick.

Hypocotyl erect, terete, red, from about 1·3 to 2 cm. long, 1 mm. thick at base, ·5 mm. at apex, glabrous.

Cotyledons sessile, sagittate, oblong, apex rounded, 5 to 6 mm. long, 2 mm. broad, underside red, upperside green, glabrous.

Stem terete, or slightly angular where affected by the decurrent leaf stalks, pubescent; first internode ·5 mm.; second ·5 mm.; third ·5 to 1 mm.; fourth 1 to 2 mm.; fifth 3 to 5 mm.; sixth about 1 cm.; varying in different individuals.

Leaves—No. 1. Abruptly pinnate, petiole 2 to 3 mm. long, pilose or almost glabrous; leaflets two pairs, oblong,

acuminate, 4 to 5 mm. long, 1.5 to 2 mm. broad, upper side green, underside red, midrib fairly distinct, secondary vein showing under lens, glabrous with finely ciliate margins; rachis 2 to 3 mm. long, slightly pilose, excurrent; stipules reduced to scales.

No. 2. Abruptly bipinnate, petiole slightly dilated in some cases, from about 5 mm. to 1 cm. long, pilose to hoary, excurrent; leaflets two pairs, upper side green, underside red, margins reddish with a few scattered hairs; rachis pilose, excurrent.

No. 3. Abruptly bipinnate, petiole usually dilated, with a nerve along lower margin, pilose to hoary, excurrent; leaflets two to three pairs.

No. 4. Abruptly bipinnate, petiole vertically flattened, 1.5 to 2 cm. long, 2 mm. broad, with prominent nerve along lower margin and three or four finer veins above, pilose to hoary, excurrent; leaflets three to four pairs, upper side green, underside at first pale red, becoming green, margins slightly ciliate; rachis pilose, excurrent.

No. 5. Abruptly bipinnate, petiole vertically flattened, with prominent nerve along lower margin, and 8 or 9 finer ones above, some not extending the whole way.

No. 6. Abruptly bipinnate, petiole vertically flattened, hoary, 3.5 cm. long, 6 mm. broad, narrowed at both ends, with a prominent nerve about 2 mm. from the lower margin, and a second a little less prominent about 2 mm. above, thus dividing the petiole into three equal sections, each of which is finely striate with parallel nerves; leaflets four to five pairs; stipules reduced to hoary scales, about 1.5 mm. long, .5 mm. broad at base, tapering to a point.

Nos. 7, 8 and 9. Phyllodes with the two prominent nerves as in No. 6, and a third though slightly finer one about equidistant below them, the interspaces being finely striate,

while both margins are nerve-like. There appears to be some relationship between this central prominent nerve and the strong lower-marginal nerve which appears on the earliest dilated petioles. These nerves do not become confluent with the lower margin towards the base as in the case of *A. Cunninghamii*.

PLURINERVES—*Julifloræ*—*Falcataë*.

ACACIA CUNNINGHAMII, Hook. Locally called Curracabark.

Seeds from Barber's Pinnacle, Boggabri. (Plate XI, Numbers 7 to 9.)

Seeds black, oblong, about 4·5 to 5 mm. long, 1·5 to 2 mm. broad, 1·5 mm. thick.

Hypocotyl erect, terete, pale red, 1·5 to 3·6 cm. long, 1 to 1·4 mm. thick at base, ·6 to 1 mm. at apex, glabrous.

Cotyledons sessile, oblong, sagittate, 6 mm. long, 2 mm. broad, underside red, upperside green, glabrous.

Stem terete, or slightly angular where affected by the decurrent leaf-stalks, pilose to hirsute. First internode ·5 mm.; second ·5 to 3 mm.; third, fourth and fifth about 2 to 4 mm.; sixth about 1 cm.

Leaves—No. 1. Abruptly pinnate, petiole 2 to 5 mm. long, green, sprinkled with a few hairs; leaflets two pairs, oblong, acuminate, 4 to 9 mm. long, 2 to 3 mm. broad, upperside green, underside red, in some cases becoming reddish-green, midrib distinct, secondary vein showing under lens, margins sometimes red with a few scattered hairs; rachis 2 to 4 mm. long, glabrous, excurrent; stipules reddish, 1 mm. long.

No. 2. Abruptly bipinnate, petiole 6 mm. to 1 cm. long, green, pilose, sometimes becoming hoary, excurrent; leaflets two pairs, upperside green, underside red, often becoming pale green, margins often red, with a few scattered hairs; rachis pale green, pilose, excurrent.

Nos. 3 and 4. Abruptly bipinnate, petiole usually slightly dilated, with distinct nerve along lower margin, pilose to hoary, excurrent; leaflets three pairs on No. 3, four pairs on No. 4; rachis green, pilose, excurrent; stipules reduced to scales.

Nos. 5 and 6. Abruptly bipinnate, petiole vertically flattened from 1·2 to 2·5 cm. long, with a prominent nerve following the base of the lower margin for about one fourth the length of petiole, and beyond this point being slightly removed from the margin, the remainder of the petiole being finely striate with parallel veins; pilose to hirsute; leaflets four pairs.

Nos. 7 and 8. Phyllodes, oblong-falcate, narrowed at both ends, with two distinct nerves, the lower one the more prominent, and becoming confluent towards the base of the lower margin with another distinct nerve which follows the lower margin from the base for a short distance beyond the point of contact with the prominent nerve.

PLURINERVES—Julifloræ—Dimidiatæ.

ACACIA HOLOSERICEA, A. Cunn. Seeds from Croydon, North Queensland. (Plate XII, Numbers 1 to 4.)

Seeds black, oblong, 3 mm. long, nearly 2 mm. broad, 1·2 mm. thick.

Hypocotyl erect, terete, pale coloured, becoming brownish-green, from about 1·6 to 2·2 cm. long, ·8 mm. to 1·4 mm. thick at base, about ·5 to ·7 mm. at apex, glabrous.

Cotyledons sessile, oblong, sagittate, apex rounded, about 4·5 mm. long, 2 to 2·5 mm. broad, at first erect but becoming horizontal in a few days, and finally revolute, outer or underside pale green, with one or two raised lines along or near the centre, upperside green, glabrous.

Stem terete in the lower portion, but angular when affected by the decurrent nerves of the flattened petioles

and phyllodes, at first green and pilose, becoming hoary; first internode 5 mm.; second 2 to 3 mm.; third 3 mm. to 1 cm.; fourth 5 mm. to 1 cm.

Leaves—No. 1. Abruptly pinnate, petiole 2 to 3 mm. long, at first green, becoming reddish-green, glabrous; leaflets three pairs, oblong, acuminate, often mucronate, 3 to 5 mm. long, 2 to 3 mm. broad, margins often red, midrib usually distinct, second vein showing under lens, underside pale green, faintly hoary, upperside green, glabrous; rachis 4 to 5 mm. long, glabrous, excurrent; stipules minute.

No. 2. Abruptly bipinnate, petiole 6 mm. to 1 cm. long, at first green and glabrous, becoming pilose to hoary, excurrent; leaflets two to three pairs, the basal pair sometimes little more than rudimentary, oblong to obovate, underside pale green, very faintly hoary, margins often red, with a few scattered hairs; rachis glabrous, excurrent.

Nos. 3 and 4. Abruptly bipinnate, petioles up to 1 cm. long; leaflets four to five pairs.

No. 5. Abruptly bipinnate, petiole about 1 cm. long, slightly dilated, or channelled above, leaflets seven pairs; rachis 1.7 cm. long; stipules reduced to scales.

No. 6. Abruptly bipinnate, petiole 2.5 cm. long, vertically flattened, 2 mm. broad, narrowed at both ends, pilose, with a prominent nerve along the lower margin, decurrent on the stem, and connected with the base of the pinnæ, also having a fine, though distinct vein along the centre of the petiole, and confluent at both ends with the lower marginal nerve; leaflets eight pairs.

No. 7. Abruptly bipinnate, petiole 3 cm. long, vertically flattened, 6 mm. broad, narrowed at both ends, owing to the flange like broadening of the dilated petiole the prominent nerve in its central portion is slightly removed from the lower margin, but coincides with it for a short

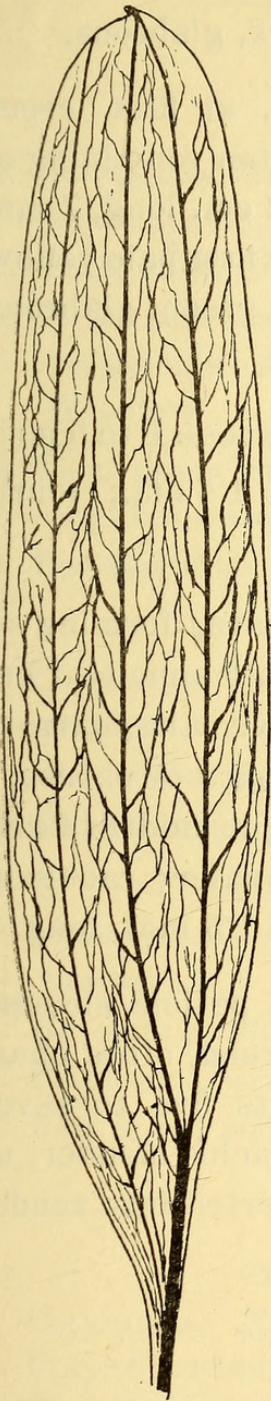


Fig. 5. *Acacia holosericea*.

Adult leaf showing convergence of three prominent veins towards lower margin. About two-thirds natural size.

distance at both ends, and extends from the base of the pinnæ to the stem where it becomes decurrent. There is also a fine nerve along the lower margin. This fine vein and the prominent nerve appear to correspond with the more prominent lower marginal nerve in No. 6. The finer though distinct central vein is scarcely confluent with the prominent nerve at either end; leaflets eight to ten pairs.

No. 8. A phyllode with two distinct nerves, equally prominent, confluent at the apex and also at the lower margin near the base, while a third slightly less distinct nerve follows on the lower margin, the whole being thinly sprinkled with short fine hairs, but very much less dense and conspicuous than the beautiful silky pubescence which appears on the usually triplinerved adult foliage.

BIPINNATÆ—Gummiferæ.

ACACIA FARNESIANA, Willd. Locally called Mimosa. Seeds from Boomarra, Cloncurry, North Queensland. (Miss K. Hillcoat.) (Plate XII, Numbers 5 and 6.)

Seeds brown, obliquely obovate, slightly concave on one side, 8 mm. long, 5 mm. broad, 4 mm. thick.

Hypocotyl erect, terete, pale coloured, 2·2 to 3·6 cm. long, 2 mm. thick at base, 1·5 mm. at apex, glabrous.

Cotyledons ovate, petiolate, auricled, at first erect, becoming horizontal in a few days and often remaining on plant for two to three months, up to 1·2 cm. long, 7 mm. to 1 cm. broad, fleshy, outer or underside at first pale yellow, becoming yellowish-green, upperside light green, glabrous; petiole 2 to 2·5 mm. long.

Stem terete, green, glabrous. First internode 1 to 5 mm.; second 8 mm. to 1·8 cm.; third 6 mm. to 1·4 cm.; fourth 7 mm. to 1·8 cm.

Leaves—Nos. 1 and 2. Abruptly pinnate, forming an opposite pair, petiole slender, from about 6 mm. to 1 cm. long, yellowish-green, glabrous; leaflets five pairs, narrow-oblong to obovate-oblong, shortly acuminate or obtuse, 3 to 7 mm. long, 1·5 to 2 mm. broad, oblique midrib fairly distinct, upperside light green, underside paler; rachis up to 2 cm. long, slender, glabrous; stipules 1·5 mm. long.

Nos. 3, 4, 5 and 6. Abruptly bipinnate, petiole slender, from about 6 mm. to 1·5 cm. long, pale green, often channelled above, glabrous, excurrent: leaflets five to seven pairs, similar to those of Nos. 1 and 2; rachis slender, up to 2·5 cm. long, excurrent; stipules converted into tender spines up to 4 mm. long.

* * * * *

In all the above descriptions the measurements quoted of the various parts of the seedlings are either the average lengths or the extremes so far met with, but in some cases the variation is so considerable that it seems likely further investigation may show that the greatest extremes of length have not yet been recorded.

EXPLANATION OF PLATES.

PLATE VIII.

Acacia juniperina, Willd.

1. Cotyledons, first and third leaves pinnate, second and fourth bipinnate, stipules. Ulladulla.
2. Three cotyledons and pinnate leaf. Cheltenham.
3. Twin stems from one seed, each stem with two cotyledons and one pinnate leaf, hypocotyl bifurcated just beneath cotyledons. Woodford.
4. Twin stems from one seed, cotyledons (four) dropped, hypocotyl bifurcated at base. Woodford.
5. Pod and seeds. Ulladulla.

Acacia armata, R. Br.

6. Cotyledons, pinnate leaf, bipinnate leaves, phyllodes, stipules, and root nodules. Mount Ainslie, Canberra.
7. Cotyledons, pinnate and bipinnate leaves.
8. Pod and seeds.

Acacia undulifolia, A. Cunn.

9. Pinnate leaf, bipinnate leaves and phyllodes. Yerranderie, Burragorang.
10. Revolute cotyledons and pinnate leaf.
11. Cotyledons, with pinnate leaf just showing.
12. Part of pod and seeds.

PLATE IX.

Acacia verniciflua, A. Cunn.

1. Cotyledons. Yerranderie.
2. Cotyledons and pinnate leaf.
3. Pinnate leaf, bipinnate leaves and phyllodes.
4. Pod and seeds.

Acacia leprosa, Sieb.

5. Cotyledons, pinnate and young bipinnate leaves. Healesville, Victoria.
6. Cotyledons, pinnate leaf, bipinnate leaves and phyllodes.
7. Pod and seeds.

Acacia suaveolens, Willd.

8. Cotyledons and pinnate leaf. Ulladulla.
9. One cotyledon, pinnate leaf, bipinnate leaves and phyllodes.
10. Pod and seeds.

PLATE X.

Acacia prominens, A. Cunn.

1. Cotyledons with pinnate leaf showing. Gosford, (J.H. Maiden).
2. Revolute cotyledons and pinnate leaf.
3. Bipinnate leaves and phyllodes. Pinnate leaf dropped. Gland showing on some of upper phyllodes.
4. Pod and seeds.

Acacia vestita, Ker.

5. Cotyledons. Mudgee, (L. F. Harper).
6. Cylindrical cotyledons and pinnate leaf.
7. Pinnate leaf, bipinnate leaves and phyllodes. Nodules on roots.
8. Part of pod and seeds.

Acacia Dawsoni, R. T. Baker.

9. Cotyledons, pinnate and bipinnate leaves. Queanbeyan.
10. Pinnate leaf, bipinnate leaves and phyllodes.
11. Pod and seeds.

PLATE XI.

Acacia aneura, F.v.M.

1. Cotyledons (three), pinnate leaf and young bipinnate leaves. Bourke, (J. H. Maiden).
2. Cotyledons, pinnate leaf, bipinnate leaves and phyllodes.
3. Seeds.

Acacia glaucescens, Willd.

4. Cotyledons, pinnate leaf, and two bipinnate leaves. Mulgoa.
5. Pinnate leaf, bipinnate leaves (with one pinna broken off No. 3), and phyllodes.
6. Pod and seeds.

Acacia Cunninghamii, Hook.

7. Cotyledons and pinnate leaf. Boggabri.
8. Bipinnate leaves and phyllodes. Pinnate leaf dropped.
- 9 Half length of pod and seeds.

PLATE XII.

Acacia holosericea, A. Cunn.

1. Cotyledons with tip of pinnate leaf showing. Croydon, North Queensland.
2. Cotyledons and pinnate leaf.
3. Pinnate leaf, bipinnate leaves and phyllodes. Nodule on root.
4. Spirally twisted pod and seeds.

Acacia Farnesiana, Willd.

5. Cotyledons, opposite pair of pinnate leaves, bipinnate leaves and stipules. Boomarra, Cloncurry, North Queensland, (Miss K. Hillcoat). The seed from which this plant grew, was left in sea-water for three months, then placed in boiling water and planted. After three months it was taken up, placed in boiling water and again planted, when it at once germinated.
 6. Pod and seeds.
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Cambage, Richard Hind. 1915. "Acacia seedlings, Part I." *Journal and proceedings of the Royal Society of New South Wales* 49, 81–121.

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