

estimated that 17 c.c. of toluene were present in the sample, *i.e.*, 21 c.c. of benzene and toluene together. This gives 1·6 per cent. benzene and 6·8 per cent. toluene in oil No. II. It is quite exceptional for the first approximation to differ so much from the true content as shewn by the blank test, and in order to confirm the figures a second blank test should have been performed. The paraffins were present to the extent of 4 per cent.

NOTES ON AUSTRALIAN FUNGI, No. III.

NIDULARIACEÆ AND LYCOPERDACEÆ.

BY

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THROUGH the works of C. G. Lloyd of Cincinnati on the Nidulariaceæ and the Australian Lycoperdaceæ, and through his kindness in identifying specimens for us, we have been able to review the specimens belonging to these two families in our own collections and in that of the National Herbarium, Sydney. The following paper is the outcome of our labours in this connection. Of the 121 species of Australian Lycoperdaceæ recorded by Cooke, 22 were Geasters. The remaining 99 species can now be reduced to 75 with 4 varieties.

NIDULARIACEÆ.**CYATHUS (Bird's-nest Fungus).**

- (1.) *C. stercoreus*, Detoni, Cheel, Report of the Botanic Gardens, Sydney, 1911 (1912), 12. Syn. *C. fimetarius*, Cooke, Handb. Aust. Fungi, No. 1213; Grant, **Rep. Bot. Gard. Sydney, 1901 (1902), 10**; Cheel, Proc. Linn. Soc. N.S.W., xxxii (1907), 204.

Specimens of this species have been identified by Lloyd (Nidulariaceæ, 1906, 20, and Letter No. 19, 1908), who includes as synonyms *C. Baileyi*, Mass., Grev., Vol. 23, (1892), 3, and in Bailey's Bot. Bull. No. viii (1893), 109. We have also specimens in the National Herbarium, Sydney, labelled *C. plumbagineus*, McAlp., which clearly belong to this species.

This species is very common on cow-dung and horse-dung in meadow land and on manure in plantations throughout the State, a very fine series of specimens being represented in our collections and in the National Herbarium from the following localities:—Sydney district, numerous collections (Jan., Feb., March, June, August, Nov.); Hawkesbury River (J. B. Cleland, Feb., 1911); Meryula, 25 miles east of Cobar and Mount Boppy, near Cobar (L. Abrahams); Hill Top (E. Cheel, May, 1913); Cobbity (J. H. Maiden, November, 1914); Seaham (S. A. Hanscombe, July, 1915).

The spores in Milson Island specimens, which were kindly identified for us by Lloyd, were pear-shaped ($35 \times 20.5\mu$), oval ($26 \times 22.5\mu$), or spherical (27 to 30μ) and in Penshurst specimens oval ($29 \times 23\mu$).

Some specimens from Barber's Creek, collected by J. H. Maiden, and from Delegate, collected by W. Forsyth, appear to belong to this species, but in both collections the peridioles are absent.

(2.) *C. vernicosus*, Tul.

This species has previously been recorded for Queensland, Victoria and Western Australia by Cooke (Handb., p. 218) and for Australia by Lloyd (Nidulariaceæ, 1906, p. 24).

At Goulburn, N.S.W. some specimens were collected by E. J. Rutherford, in July, 1911, and recorded by one of us (E. C., Rep. Bot. Gard., Sydney, 1911 (1912), 12), and we have also some specimens collected by the other of us (J.B.C.) near Adelaide, S.A., (spores $12 \times 8.5\mu$) and at Bibbenluke, N.S.W., in March, 1913, attached to stems of grass (mouldy smell on crushing; spores 12 to $13.8 \times 8.5\mu$).

(3.) *C. striatus*, (Huds.) Hoffm., Cheel, Rep. Bot. Gard., Sydney, 1912 (1913).

Jellore Creek, near Mount Jellore (E. Cheel, 1912).

CRUCIBULUM.

(4.) *C. vulgare*, Tul.

Specimens of this species were collected on the ground near dung at Orange by one of us (J. B. C.) in November, 1915, and have been identified for us by Lloyd, who adds that there is only one species of *Crucibulum* (Cooke gives *C. vulgare* and *C. simile* for Australia). Spores of these specimens are 8.5 to 10.4×3.4 to 4.8μ . We have also specimens of this species collected at Ohakune, New Zealand, in March, 1909, by one of us (E.C.), which are on dead wood.

LYCOPERDACEÆ.

Tribe Podaxineæ.

PODAXON.

(1.) *P. ægyptiacus*, Mont. Syn. *Podaxis indica*, L., in Cooke's Handb. Aust. Fungi, p. 223.

Previous records are:—Near Bourke by Baker (Proc. Linn. Soc. N.S.W., Vol. xxxi, (1906), 721), from Wittagoona, near Cobar, and Girilambone by one of us (E.C.) in Rep.

Bot. Gard., Sydney, 1910 (1911), 11. We have also additional specimens to record from Nyngan, collected by E. Mackinnon in February, 1911, and E. Breakwell, in May, 1914. It is recorded for Australia by Lloyd (Lycoperdaceæ (1905), 5, pl. 25, figs. 1, 2 and 3), who says that "at Kew, England, there is a poor specimen from Suttor River, on which the record of *P. indica*, Spreng. in Cooke's Handbook is based." The spores in our specimens are sub-globose, $12 \times 9\mu$.

Tribe Tylostomeæ.

TYLOSTOMA.

- (2.) *T. McAlpinianum*, Lloyd, Tylostomeæ, p. 15, (1906), pl. 78, and Letter No. 31.

Specimens collected in Meadow-land at Penshurst in June, 1907, were recorded by one of us (E.C.) in Proc. Linn. Soc. N.S.W., xxxii, (1907), 840, under the name *T. mammosum*, Fr. Duplicates were sent to Mr. Lloyd who has determined them as the above. Specimens collected at Reynella near Adelaide in July, 1914 (J.B.C.), have been identified by Lloyd also as this species. Spores of this latter collection are pale yellow, finely warted, 5.2 to 5.5μ in size. Another collection made at Dubbo, N.S.W., in July, 1915, has likewise been identified by Lloyd as *T. McAlpinianum*. In these specimens, however, there is a thick, warty yellow-brown epispore which is elliptical ($12 \times 10.4\mu$) or spherical (10.4 to 12μ) surrounding a spherical spore of 7 to 8.5μ in size. The capillitium is hyaline, 2.5μ thick. In addition to the above we have other specimens which appear to belong to this species from the following localities:—Goulburn (E. Cheel, April, 1908); South Head near Sydney (W. Craigie, August); Botanic Gardens, under pine-tree (E. Cheel, June); Nyngan (E. Mackinnon, August 1913).

(3.) *T. albicans*.

A *Tylostoma* with a very marked tubular mouth obtained near Morgan, S.A., in November, differs apparently from our specimens of *T. McAlpinianum* identified by Lloyd, and is, we think, this species which Lloyd records for Australia (S.A.). The tubular mouth is longer than the latter species—spores tuberculosely warty, 6 to 8.5μ .

(4.) *T. poculatum*.

Lloyd has identified as *T. poculatum* specimens collected on a sandy hillock near Forbes in August, 1915. The spores were flatly verrucose or almost polyhedral, yellow-brown, 7 to (occasionally) $8.5 \times 5.2\mu$. (Lloyd's measurements of them were 5 to 6μ). Another single specimen, collected at the same place, and probably the same species though the mouth is less fibrillose, has rough spores $5 \times 3.4\mu$.

CHLAMYDOPUS.

(5.) *C. Meyenianus*, Berk. (*Tylostoma maxima*, Cooke and Masee).

In the National Herbarium there are specimens of this species collected at Wittagoona near Cobar by Mr. L. Abrahams in September, 1910. Mr. Abrahams states that the specimens were found on "wind swept surface of hard clay."

The specimens collected by Mr. Abrahams are of special interest as previous to this collection, the only solitary specimen in existence from Australia was at Kew, England. It was originally collected on the Gascoyne River, W.A., by Mrs. Gribble, and according to Lloyd¹ there is "but one species known, originally from Peru, but found also in Western United States." Our specimens may be briefly described as follows:—Volva about 3 cm. long, with rather

¹ Mycol. Notes, p. 134, pl. 10, and Lycoperdaceæ of Australia, etc., p. 9 (1905).

laciniate lobes. Stipe 7 cm. long, 13 mm. thick, tapering downwards to 7 mm. Peridium 3 cm. in diameter, breaking up at the apex when mature irregularly, in similar manner to the *Calvatias*. Spores minutely warted, 7μ diam.

PHELLORINA.

(6.) *P. Delastrei*.

A specimen collected in December, 1913, by one of us (J.B.C.) either at Alawoona in the Murray Desert or at Overland Corner on the Murray River, both in South Australia, has been identified as this species by Lloyd. We have also two fine specimens collected at Nyngan, in red soil scrub-lands on Miowera Station, by Mr. W. W. Froggatt, in November, 1911, which seem to us to belong to this species.

Only one Australian specimen of this species was previously known, which according to Lloyd (*Lycoperdaceæ*, p. 10, 1905) is at Kew and was collected at Stewart's Range, Central Australia, by Charles Winnecke. Our Nyngan specimens may be described briefly as follows:—Peridium 4–5 cm. across, breaking up into scales and exposing the rusty coloured gleba and spores, the base forming a shallow socket. Stem solid, woody, more or less broken up into scales or shreds, up to 22 cm. long, 2 cm. thick at the base, gradually increasing in thickness up to $3\frac{1}{2}$ cm. in the upper part. Volva incomplete, but the remnants are about 2 cm. long. Spores granular, 6μ diameter.

BATTARREA.

Four "species" of this genus are recorded for Australia by Cooke (Nos. 1242–1245), none of which are given for New South Wales. *B. Muelleri*, Kalchb. and *B. Tepperiana*, Ludw. are both referred by Lloyd¹ as forms of *B. phalloides*.

¹ *Lycoperdaceæ of Australia*, p. 11, (1905).

(7.) *B. phalloides*, Dicks. (pl. 28, Lloyd) and *B. phalloides* var. *Stevenii*.

Lloyd, in his "Lycoperdaceæ of Australia," etc., points out that *B. Stevenii*, which has been recorded from Australia, is unquestionably only a form of *B. phalloides*, showing a more robust growth and thick lacerated scales on the stipe. This view is supported by our finding, growing together in the same locality (Alawoona, S.A., December, 1913) what appear to be the two forms. The smaller, more slender form, with a stem tapering downwards and covered with longer slender fibrillose scales, Lloyd identified as *B. phalloides*. The spores were smooth, 5.2 to 6.8μ in diameter. The characteristic "annulate cells" were 5.2μ in thickness. The more robust form, with heads nearly two inches in diameter, had much broader lacerated scales. The spherical spores of these plants were 2.5 to 5.5μ in size, minutely rough (oil immersion lens). One "plant" has two volvas and stems inserted into what appears to be one cap, though a slight line of demarcation seems to indicate the union of the original two caps, with nevertheless an apparently single circumscissile top. The following notes were made in the field and refer particularly to the latter form:—"Volva sometimes on the surface of the ground, sometimes buried several inches, $1\frac{1}{2}$ in. in diameter, greyish-brown. Stem $4\frac{1}{2}$ ins. high, elongating to 9 ins., yellowish-brown, fibrously scaly, the scales imbricated downwards, solid, white internally. Cap convex, 2 to $2\frac{1}{2}$ ins. in diameter, 1 in. high, cover double, the inner one soft and white, on the outside adherent greyish-brown remains of the volva. The cover on falling off leaves a thick mass (half inch deep) of cinnamon-coloured spores supported on a thin smooth convex white stratum, seen in the fresh state as a smooth white under surface."

We have also specimens of this species in our collections from Gular near Coonamble (J. B. Cleland, November, 1911)

which are perfect, not having shed their spores. The whole plant is pallid-white before the shedding of the spores takes place.

Previous records are Murchison River and Lake Albacutya (Cooke); Tumby Bay on the west coast of Spencer's Gulf, South Australia, Lloyd ("Two Rare Plants from Australia") and Port Lincoln, S.A., Lloyd (18). There are also according to Lloyd (Lycoperdaceæ p. 11, 1905), specimens at Kew, England, from Israelite Bay, W.A. F. M. Bailey records specimens from Gladfield, Queensland. *B. Stevenii* is recorded by Cooke for Western Australia, and Froggatt collected specimens in N. S. Wales (Lloyd, Letter No. 53, p. 4). Duplicates of the latter, from Brewarrina, September, 1911, are in the National Herbarium collection.

Two remnants of a *Battarrea* are recorded for Victoria by Lloyd (Mycol. Notes, No. 21, p. 245, 1906).

POLYSACCUM (PISOLITHUS).

Lloyd considers that the Australian forms are but varieties of one species, *P. pisocarpium*, though it is convenient to designate three extreme departures from the more typical forms as *crassipes*, *tuberosum* and *confusum*.

Intermediate forms connect these extremes with each other. Cooke's nine species are thus reduced to one with three varieties. We have met with the following:—

- (8) *P. pisocarpium*, Fr., Cooke's Handb., p. 243; Baker, Proc. Linn. Soc. N.S.W., xxxi, p. 720 (1906); Cheel in Rep. Bot. Gard., Sydney, 1909 (1910), 10, and 1910 (1911), 12.

We have specimens approaching the typical form, being sub-globose with a short rooting stem, from the following localities:—Governor's Domain, Sydney (E. Cheel, May, 1907, spores granulated 8 to 12 μ); Centennial Park (A. A. Hamilton, February, 1911); Gladesville (M. Flockton,

February, 1911); Neutral Bay, Sydney (J. B. Cleland, June, 1913, spores 8.5 to 10.3μ); Kurrajong Heights (J. B. Cleland, August, 1912, spores warty, 7 to 8.5μ); Flinders Island, Bass Straits (J. B. Cleland, November, 1912, in sandy soil, spores finely warty, 5 to 6.5μ , perhaps var. *confusum*); Mount Lofty, S.A. (J. B. Cleland, July, 1914, spores tuberculate, 10.4 to 12μ); Overland Corner, S.A. (J. B. Cleland, November, 1913, spores very rough, 8.5μ); Western Australia (Dr. F. Tidswell, June, 1909); Strelley River, N.W. of W.A. (J. B. Cleland, approaching var. *crassipes*.)

P. pisocarpium var. *crassipes*.

Peridium tapering into a strong thick rooting base.

Specimens of this form have already been recorded from New South Wales (collected by A. G. Hamilton and J. L. Boorman) by Lloyd in Letters No. 8 (1905), 17 (1907), and 23 (1908). In addition to the above we have a very fine series of specimens as follows:—Sydney district, numerous collections (Jan., April to August, Oct., Dec.); Kingwell, near Gosford (Rev. W. W. Watts, May, 1909); Jellore Creek (E. Cheel, April, 1912); Hill Top (E. Cheel, April, 1913); Bent's Basin (J. H. Maiden, June, 1915); Lawson (D. Wiles, June, 1910); Weston (V. Davis); Mount Lofty, S.A. (J.B.C., May, 1910).

P. pisocarpium var. *tuberosum*.

Globose with scarcely any stem.

(A. G. Hamilton, Lloyd's Letter No. 17, p. 3, 1907). We have a specimen from New South Wales, spores rough, 7 to 8.5μ).

P. pisocarpium var. *confusum*.

A form almost smooth, with very thin walls to the peridioles, and small spores.

North Shore, Sydney, April, 1914 (spores smooth or perhaps slightly rough, 5.2μ); New South Wales (spores very

finely rough under oil-immersion lens, 5.2 to 7μ). We have also specimens from East Hills (E. C., September, 1908) and Richmond (J. Staer, May, 1910), which are globose and stemless, smooth and pallid or whitish, which probably are identical with *P. album* (Cooke and Masee, Grev. xx, p. 30 and Cooke, Handb. Aust. Fungi, p. 245), specimens of which we have not seen.

SCLERODERMA.

Lloyd recognises six species of this genus, transferring one of Cooke's eight species, *S. umbrina*, to *Polysaccum* as being really *P. pisocarpium*.

(9.) *S. geaster*, Fries.

Lloyd has identified as an unopened specimen of this species, a plant found at the base of an old tree-trunk on burnt ground at Narrabeen in April, 1915, spores 7 to 8.5μ , shaggy. We have also specimens from Goulburn collected by one of us (E.C.) in April, 1908, and from the Centennial Park, Sydney, collected by A. A. Hamilton in May, 1910, which seem to belong to this species.

(10.) *S. flavidum*, Ellis. Lloyd, Letters Nos. 5, 7, 19 and 38; Lycoperdaceæ of Australia, New Zealand etc. (1905), p. 14, pl. 30, figs. 4, 5, and 6; Cheel, Rep. Bot. Gard., Sydney, 1909 (1910), 10, and 1910 (1911), 12.

This is very common in this State as well as in Victoria and South Australia. We have a very fine series of specimens in all stages of development from the following localities:—Sydney district, numerous collections (April to July); Sydney (J. B. C., spores 7.5 to 10.4 in some collections and 10.5 to 15μ in others); Jenolan Caves (J. H. Maiden, June, 1899); Blackheath and Mount Victoria (J. H. Maiden, April, 1906); Waterfall (A. A. Hamilton, May, 1908); Kingwell, near Wyong (Rev. W. W. Watts, April, 1909); Hawkesbury River (J. B. C., May, 1910, and July,

1912); Moss Vale (E. C., April, 1910); Hill Top (E. C., March, 1911, specimens very strobilate); The Oaks (J.B.C., June, spores 7.5 to 10.4μ , shaggy); Leura (T. Steel, February 1911); Lake Illawarra (E.C., April, 1912); Cronulla (E. Breakwell, May); Jellore Creek, foot of Mount Jellore (E. C., April); Terrigal (J.B.C., June, spores 7.5 to 10.4μ , shaggy); Austinmer (W. M. Carne, April, 1914); Mount Wilson (A. G. Hamilton, April, 1912); Mount Lofty, S.A. (J. B. C., May, 1910 and June, 1914), one of these plants had burst into four lobes, spores dark purple, densely echinulate, 10.4 to 12μ ; Mount Lofty, S.A. (J.B.C., spores 10.4 to 15μ); Murray River, S.A. (J.B.C., spores 10.4 to 15μ); Western Australia (Dr. F. Tidswell, June, 1909).

(11.) *S. cepa*, Persoon.

This species has been collected by Messrs. W. W. Froggatt, A. G. Hamilton, R. T. Baker and Miss M. Flockton, and recorded for this State by Lloyd in Letters Nos. 8 (1905) 17 (1907) and 23 (1908), and *Lycoperdaceæ* (1905), p. 14. The specimens collected by Mr. Baker are figured on Lloyd's plate 31, fig. 1, with a suggestion that they may be unexpanded specimens of *S. flavidum*. We have also specimens collected in the Botanic Gardens, Sydney (E. C., March, 1908); Kingwell near Wyong (Rev. W. W. Watts, May, 1909); Lilyvale (A. A. Hamilton, April, 1912); Taronga Park, Mosman (L. Abrahams, May, 1913); Neutral Bay (J. B. C., July, 1915); Mount Irvine (J. B. C., June, 1915). The spores of the latter specimens are 8.5μ in size, very rough.

(12.) *S. vulgare*, Fr. (*S. aurantium*, Pers.)

We have specimens collected in the Botanic Gardens by Mr. M. McGovern in May, 1899, and by E. C. in February, 1907 and March, 1908, which we refer to this species. The specimens are rarely found fully developed owing to being crushed under foot by the traffic on the lawns.

It has previously been recorded for this State under the name *S. aurantiacum*, Bull., by Mr. R. T. Baker, in Proc. Linn. Soc. N.S.W., xxxi, (1906), 720.

(13.) *S. vertucosum*.

This species is also common in the Sydney district. The spores are shaggy, 8.5 to 11.5μ . We have the following collections:—Sydney (J. B. C.); Hawkesbury River (J.B.C., June); Bulli Pass (J. B. C., April); Mount Lofty, S.A. (J. B. C., July).

GEASTER.

The Geasters have been dealt with in No. II of this series of papers.¹

MYCENASTRUM.

(14.) *M. corium* (Guersent), Desv. Syn. *M. olivaceum*; *M. phœotrichum*.

Lloyd points out (Lycoperdaceæ, p. 24) that the two synonyms above, given to Australian specimens, are based on the colour of the gleba which depends on the stage at which the plant is collected. In Cooke's Handbook, p. 241, it is recorded for Victoria and Queensland only, but one of us (E.C.) has recorded it for this State in Rep. Bot. Gard. Syd., 1908 (1909), 12, and 1909 (1910), 10. Specimens have also been identified by Lloyd in Letters No. 17, p. 2, and No. 31, p. 1, as this species, from specimens collected in this State by one of us (E.C.) and by Mr. W. W. Froggatt.

We have also additional specimens from the following localities:—Sydney district, several collections (Jan. and May); Goulburn (E. Cheel, April, 1908); Susan Island, Clarence River (T. McDonough, June, 1909); Wollongong (A. A. Hamilton, October, 1909); Wittagoona near Cobar (L. Abrahams, September, 1910, spores globose, warty, $8-11\mu$ diam., capillitium $5-10\mu$ thick, spiny at the tips);

¹ This Journal, Vol. XLIX, p. 199, 1915.

Hawkesbury River (J.B.C., June, 1912, spores rough, 10.3μ , capillitium thorny, 8.3μ in diameter); Bibbenluke (J. B. C., March, 1913, spores rough, 10.3μ , capillitium thorny, 8.5 to 12μ in diameter); Wagga, July, 1914, spores rough, 10.4μ); near Adelaide, S.A. (J.B.C., 1898).

CATASTOMA.

(15.) *C. anomalum*, Lloyd, Lycoperdaceæ, p. 27, 1905; Cheel, Rep. Bot. Gard., Syd., 1908 (1909), 13. *Bovista anomala*, Cooke and Masee, Grev. xviii, p. 6 (1889); Cooke's Handb., p. 234.

We have collected a number of perfect specimens of this species characterised by its protruding mouth, from various localities in the Port Jackson district and from Milson Island, Hawkesbury River (July). Mr. C. G. Lloyd (Letter No. 31, 1911) has kindly confirmed the identification.

The plants grow with their mouths upwards; spores spherical, warty, 5.2μ in diameter, capillitium threads 3μ in diameter. Specimens, also identified by Lloyd, found at Forbes in August, show protruding mouths when young, but these are less evident when old; spores bright yellow-brown, tuberculosely warty, 5.2 to 6μ , capillitium threads yellow-brown, branched, 3.5μ in diameter.

(16.) *C. abnormalis*?

Specimens collected in New South Wales by A. Green have been doubtfully referred to this species by Lloyd in Letter No. 19 (1908).

BOVISTELLA.

Lloyd places Lycoperdons with pedicellate spores in the genus *Bovistella*. He records seven species for Australia. We have met with the following:—

(17.) *B. aspera*, Lloyd, Letter No. 8 (1915), Lycoperdaceæ, p. 28 (1905) and (Mycol. Notes, No. 21, p. 247, 1906); Cheel, Proc. Linn. Soc. N.S.W., xxxix, p. 255 (1914).

The specimens recorded by Lloyd (*l.c.*) were collected in the Sydney district by the Rev. W. W. Watts. We have also specimens of this species collected at Como in February and Dubbo in August, 1908; Penshurst in May 1907 and February, 1911; Milson Island, Hawkesbury River, on cow-dung (spores smooth, 4.2 to 5μ , pedicels 14μ); N.S.W. (spores usually spherical, 5.5μ , sometimes oval, $8.9 \times 7\mu$). According to Lloyd there are specimens of this species at Kew, collected by Mueller at Haidinger Range in 1861.

The plant was originally described from Chile (*Bovista aspera*, Ann. Sci. Nat. 3-5-162). Lloyd further states that comparison of the specimens received from W. W. Watts with the types from Chile in the Museum at Paris shews some slight differences. The cortex of the Australian plant is not so strongly developed. The colour of the gleba is olive, while in the type it is brown. The pedicels of the spores of the Australian plant are longer.

(18.) *B. scabra*, Lloyd, Mycol. Notes No. 21, p. 248 (1906) and Letter No. 31 (1911).

Specimens of this species were collected at Penshurst (spores 5μ , pedicels $4-7\mu$), by one of us (E.C.), in March 1909, and were kindly identified by Lloyd as this species, who states that the plant has the general size, appearance and structure of *B. australiana*, and differs only in its cortex. It has also been recorded for Casterton, Victoria, and Norwood, South Australia, by Lloyd in Letter No. 8 (1905), and from other parts of Australia without specifying the particular State (but probably Victoria) in Letters No. 13 (1906) and No. 17.

(19.) *B. australiana*, Lloyd, Lycoperdaceæ, p. 28, (1905), Mycol. Notes, No. 21, p. 247 (1906), Plate 33, f. 1-5) and Letters No. 23, p. 3 (1908), and No. 38, p. 4 (1911).

The specimens recorded by Lloyd (*l.c.*) from Australia were collected by Mr. A. G. Hamilton, and Miss M. Flock-

ton. See also Letters No. 8 (1905), and No. 17 (1907) for other Australian records. We have the following specimens: Manly, April, 1915 (identified by Lloyd—covered with minute mealy warts, well-marked sterile base, black branching roots, spores smooth $5.2 \times 4.4\mu$, with pedicels 8.5μ long which are very hard to differentiate in a watery medium); Sydney, January, 1915 (spores 5μ , pedicels 8.5μ ; locality not noted (spores 3.4 to 4μ , pedicels 5 to 12μ); Sydney, April (spores yellow-brown, spherical, 4μ , pedicels 8.5μ); Mosman (spores 3.4μ , pedicels up to 17μ); Milson Island, November (spores 3.4 to 4μ , smooth, pedicels 7μ).

- (20.) *B. Gunnii*, Lloyd, Letter No. 8 (1905), Lycoperdaceæ, p. 29 (1905), and Mycol. Notes, No. 21, p. 247, (1906), pl. 70. Syn. *Lycoperdon Gunnii*, Berk., Hooker's Fl. Tasm. ii, p. 264.

Grange near Adelaide, July, 1914 (spores yellow-brown, tuberculate, 5μ in size, pedicels up to 14μ —specimens identified by Lloyd who says:—"I call the spores 'smooth' although they are slightly rough under a high power. All *Lycoperdon* spores are 'rough,' but we call those smooth that are not strongly rough under a $\frac{1}{4}$ in. objective"); New South Wales specimens have spores 4.2 to 5μ , pedicels up to 10μ in length (Milson Island, November, and other localities).

- (21.) *B. bovistoides*, Lloyd, Mycol. Notes, No. 21, p. 247 (1906), and Letters No. 8 (1905), No. 13 (1908), No. 38 (1911). Syn. *Mycenastrum bovistoides*, . . . *Grevillea*, Vol. 16, p. 26.

Specimens from Australia collected by Mr. A. G. Hamilton (probably in N.S.W.) have been identified by Lloyd.

- (22.) *B. rosea*, Lloyd, Mycol. Notes, No. 21, p. 248 (1906) and Letter No. 23 (1908).

Specimens of this species have been collected by Miss M. Flockton and identified by Lloyd.

- (23.) *B. glabrescens*, Lloyd, Lycoperdaceæ, p. 28 (1905).
Syn. *Lycoperdon glabrescens*, Berk., Fl. Tasm., ii, p. 264.

LYCOPERDON.

- (24.) *L. polymorphum*, Vitt., Lloyd, Lycoperdaceæ (1905) 29.
(25.) *L. cepæforme*, Kalchb., Lloyd, Lycoperdaceæ (1905),
Mycol. Notes, No. 21 (1906), 246, and Letters No. 8
(1905), No. 13 (1906), No. 17 (1907), No. 23 (1908), No. 35.

Specimens of this species have been forwarded by R. T. Baker, Rev. W. W. Watts, W. W. Froggatt and Miss Flockton, to C. G. Lloyd, and determined by him.

Atypical forms:—Hawkesbury River, November, 1914 (J.B.C.). Of this specimen Lloyd says "I should class this as *cepæforme*, although it has no sterile base, and strictly should be called large *L. pusillum*. This large form devoid of sterile base does not occur in Europe." Our notes of these fresh specimens shew that there was then evident a very slight basal layer and a definite root with branching mycelium. Spores smooth, 4.2 to 5μ , stumps of pedicels. Another collection, described in the same terms by Lloyd, has spores 4.4 to 4.8μ , no pedicels. We have the following additional collections:—Orange, October, spores 3.8 to 4μ ; Adelaide, July, spores smooth, 3.5μ .

Lloyd says of specimens with oval, finely warted spores, $5 \times 3.7\mu$ in size, collected at Milson Island in June 1912, "has not been separated from *cepæforme*, although the decidedly rough spores, slightly pyriform, and absence of sterile base should separate it. It has no name I believe."

- (26.) *L. pusillum*, Fr., Syst. Myc. iii, f. 33; Batsch ? see Kalchb., Grev. iv, 74, 1875; Cooke, Handb., p. 239; Lloyd, Lycoperdaceæ (1905) 30, pl. 65, f. 8, and Letter No. 19 (1908); Wakefield, Kew Bull. (1915), 374.

We have specimens of what appears to belong to this species collected at Penshurst in May, 1907, Dubbo in August, 1908 (spores $4\frac{1}{2}\mu$ with very minute stumps of pedicels present), and Forbes in August, 1915, with well-developed roots (spores smooth or very slightly rough, 5μ , sometimes rather oval, stumps of pedicels 1.8μ long). Specimens of this species have been recorded by Lloyd (*l.c.*) collected in Australia by A. G. Hamilton—these were probably collected in New South Wales.

(27.) *L. nigrum*, Lloyd, Lycoperdaceæ (1905) 30.

We have specimens of what appears to be this species collected at Major Bay, Concord—spores 3μ .

(28.) *L. subincarnatum*, Peck. Syn. *L. purpureum*, Lloyd, Letter No. 31 (1911).

Lloyd has kindly identified specimens for us. He says: "This is a peculiar species characterised by the little pits on the peridium like those of a thimble, and its hyaline, septate capillitium. It is rather rare in the United States and (excepting the common *L. pyriforme*) the only puff-ball we have that habitually grows on logs. We collected it in Samoa, and we believe that the scanty material representing *Lycoperdon purpureum* at Kew from Bonin Island is the same plant, but the 'type' is too poor to consider." On decaying logs, Otford (J. L. Boorman, March, 1901); Bulli (E. Cheel, April, 1910); Lilyvale (A. A. Hamilton, June, 1910); Mount Irvine, Blue Mountains, (J. B. Cleland, June, 1915—spores smooth, 3.5μ).

(29.) *L. pratense*. Lloyd, Lycoperdaceæ (1905) 31, pls. 34 and 71, fig. 1, 2), and Mycol. Notes No. 21 (1906), 249. Syn. *L. furfuraceum*, McAlp. non Schaeff., Rep. Dept. of Agriculture, Victoria, May 14th, (1898), and Proc. Linn. Soc. N.S.W., xxv, (1900) 702, pl. xlvii.

There are specimens of this in the National Herbarium from Melbourne, collected by McAlpine in July, 1900. We have also specimens from Flinders Island, Bass Straits, November (spores smooth or under oil-immersion lens slightly rough, 3.5 to 4μ); Adelaide (spores smooth, 3.5μ , small pedicels).

- (30.) *L. gemmatum*, Batch, Lloyd, Lycoperdaceæ (1905) 32, and Mycol. Notes, No. 21 (1906) 249.

We have fine clusters of this species taken by one of us (J.B.C.), growing in red clay at Lismore, N.S.W., in October 1913, and others from Port Hacking (E.C.) in August, 1915. The spores of the Lismore specimens are spherical, 3.5 to 4μ , appearing as very finely warted under an oil immersion lens. The spines have fallen off and the surface is minutely pitted. We also refer, to this species, specimens collected at Wilson's Creek, Helensburgh, W. Craigie, August, 1909; Dorrigo, J. L. Boorman, May, 1909; St. Mary's A. A. Hamilton, August, 1910; Leura, B. Carney, 1915. The spores of these collections are practically identical, being globose, smooth or very faintly warted, $3 - 4\mu$ diam.

- (31.) *L. pyriforme*, Schaeff., Lloyd, Lycoperdaceæ (1905) 33, and Mycol. Notes, No. 25 (1907) 318, and Letter No. 13 (1906); R. T. Baker, Proc. Linn. Soc. (1906) 720.

This species was found to be common at Mount Wilson, Blue Mountains, in June, 1915, growing on fallen rotten logs, spores smooth, 3.8μ . The shape of the plant is rather pyriform. The peridium is dark brown from fine spines, becoming brownish-white and slightly areolate as these fall off. We have also specimens collected in the Botanic Gardens. *L. pyriforme* (spelt *piriforme*) var. *flavum*. Lloyd, Letter No. 60, pp. 4 and 11 (1915). Type probably from Botanic Gardens, Sydney.

CALVATIA.

- (32.) *C. lilacina*, Lloyd, Lycoperdaceæ (1905) 35, pl. 35, f. 1, and Letters No. 8 (1905), No. 23 (1908) and No. 31 (1911). Syn. *Lycoperdon lilacinum*, Berk. in Cooke's Handb.; *Bovista lilacina*, Mont. et Berk. in Hooker's London Journ. Bot. (1845) 64.

We have examined a fine series of specimens of this species in the National Herbarium, and in our own collections. The plants are very variable and comprise the following:—Pear-shaped with a short stalk, $1\frac{1}{2}$ in. high, $1\frac{1}{4}$ in. in diameter, capillitium threads purplish 3.5μ in diameter, spores purplish, warty, 5.2μ in diameter, smaller ones of 3.5μ size being smoother, Hawkesbury River, April; young specimens, similar to the preceding, capillitium threads brown, 3.4μ in diameter, spores smooth, 5.2μ to 6.8μ , Lisarow, April; Sydney district, several collections (Feb., May to July, Aug., Nov.); State Nursery, Campbelltown (A. Grant, March, 1904); Penshurst (E. C., August, 1906, and May, 1907, spores 4μ); Mortdale (E.C., March, 1909); Brownsville near Dapto (E.C. April, 1912); Tuggerah (Mrs. F. Moore, 1916); Lucindale, S.A. (J. B. C., August, 1898). According to Berkeley and Broome (Ceylon Fungi, Journ. Linn. Soc. Bot., xiv, p. 78, 1873), this species is sold at Rangoon in the bazaars when young as an esculent.

- (33.) *C. Gardneri*, Berk.

One of us (J.B.C.), has collected a specimen (the locality has unfortunately not been noted and it is probably not a New South Wales specimen, but from South Australia or perhaps Flinders Island in Bass Straits) which C. G. Lloyd has identified as *C. Gardneri*. He says it is the first specimen he has had from Australia, though he has it from Japan, India, etc., and that it originally came from Ceylon. "Your specimen is more turbinate than other collections but with same gleba, spores, etc., I think same species."

We have another specimen collected in December in South Australia, between Morgan and Renmark on the river Murray. Our specimens are pear-shaped, $3\frac{1}{2}$ to 4 in. tall by 3 to $3\frac{1}{2}$ ins. broad. The cortex is thin, brownish to pallid, breaking away in flakes. The gleba of the specimen Lloyd has seen is a pale café-au-lait brown, the spores are 4.4 to 5μ , very finely warted, the capillitium 3 to 3.5μ in diameter, and there is no apparent sterile base. In the other specimen, which is otherwise almost identical, the gleba is of a distinct yellowish-brown—though not far removed in tint from the former specimen—the spores are 4.8 to 5μ , smooth and the capillitium 2μ in diameter.

- (34.) *C. rubro-flava*, Craigin, Lloyd, Mycol. Notes, No. 15, p. 149 (1903), No. 22, p. 11, No. 27 (1907) 347. Syn. *Lycoperdon australe*, forma major, Massee in letter to Cheel, Proc. Linn. Soc. N.S.W., xxxii (1907) 202.

According to Lloyd (*l.c.*) this species has a fairly wide range, specimens having been found in Brazil, Argentine and the United States of America. It appears to be found chiefly in cultivated plantations. It was originally found in this State by A. Grant, in April, 1899, at Wentworth Park. It has since been found abundantly in the Botanic Gardens, Sydney, by various collectors, and in the Centennial Park by one of us (E.C.), in March, 1901. The latter specimens were determined by Massee at the Royal Gardens, Kew, as *Lycoperdon australe*, f. major. Specimens collected in the Botanic Gardens, which appear to be identical with the Centennial Park specimens, were forwarded to Lloyd, who has determined them as *Calvatia rubro-flava*. Spores of the Botanic Gardens specimens are 4 to 5μ , smooth or perhaps slightly rough under a high power. We have specimens also from Neutral Bay, Sydney, growing under *Lantana* (March, 1916).

- (35.) *C. candida*. Lloyd, Letter No. 13 (1906) N.S.W., W. W. Watts.
- (36.) *C. olivacea*?. Lloyd, Letter 13 (1906), N.S.W., W. W. Watts. Syn. *Bovista olivacea*, Cooke and Masee. See also Bailey in Queensl. Agric. Journ., May, (1912), 358, 359.

MITREMYCES.

- (37.) *M. fuscus*, Lloyd, Lycoperdaceæ (1905) 41; Letters Nos. 7 and 8 (1905). Syn. *Calostoma fusca*, Berk., Cooke, Handb., p. 227; Baker, Proc. Linn. Soc. N.S.W. xxii, (1897) 239, and probably *Calostoma* sp. of R. T. Baker, *ibid.*, (1900) 14, and *Calostoma fusca*, Moss, of R. T. Baker, *ibid.*, (1906) 720.

The specimens recorded by Baker are from Hornsby, Dorrigo, Wentworth Falls and Katoomba. We have some fine specimens of this species from Conjola, collected by W. Heron, in May, 1890.

I. List of Australian Lycoperdaceæ recorded by Cooke with the identifications as made by C. G. Lloyd:—

- 1218 *Secotium acuminatum*. Its occurrence doubtful if based on the fragments seen by Lloyd.
- 1219 „ *coarctatum* = *S. coarctatum*.
- 1220 „ *melanosporum* = *S. melanosporum*.
- 1221 „ *erythrocephalum* = *S. erythrocephalum*.
- 1222 „ *Gunnii*. Based on a fragment, probably *S. coarctatum*, but spores a little larger.
- 1223 „ *scabrosum* = *S. scabrosum*.
- 1224 *Chainoderma (Secotium) Drummondii*.
- 1225 *Cyloderma platyspora*. Erroneous (Lloyd).
- 1226 *Mesophellia arenaria* = *M. arenaria*.
- 1227 „ *impatissima*. Type apparently lost.
- 1228 „ *scleroderma*, N. Zealand = *Gallacea scleroderma*.
- 1229 *Podaxis carcinomalis* = *P. carcinomalis*, prob. var. *elatior*.
- 1230 „ *indica (P. pistillaris)* = *P. pistillaris* (in this case probably *P. ægyptiacus*).

- 1231 *Podaxis axata* (*P. calyptratus*) = *P. Muelleri*.
 1232 *Gymnoglossum stipitatum* = *G. stipitatum*.
 1233 *Protoglossum luteum*. Probably a *Hymenogaster*. Cooke's figure is a different plant (Lloyd).
 1234 *Tylostoma mammosum* = *T. mammosum*.
 1235 „ *leprosum* = *T. mammosum* with its veil, probably.
 1236 „ *Wightii* = *T. Wightii* (no Australian specimen seen by Lloyd).
 1237 „ *maximum* = *Chlamydopus Meyenianus*.
 1238 „ *fimbriatum* = *T. granulosum*.
 1239 „ *brachypus* (*T. granulosum*) = *T. granulosum*.
 1240 „ *album* = *T. album*.
 1241 „ *pulchellum* = *T. pulchellum*.
 1242 *Battarreia phalloides* = *B. phalloides*.
 1243 „ *Stevenii* = *B. Stevenii*.
 1244 „ *Muelleri* = *B. Stevenii*.
 1245 „ *Tepperiana* = *B. Stevenii*.
 1246 *Calostoma lurida* = *Mitremyces luridus*.
 1247 „ *fusca* = „ *fuscus*.
 1248 „ *viridis* = „ *fuscus*.
 1249 „ *æruginosa* = „ *fuscus*.
 1250 – 1271 *Geaster*. These have been dealt with in our second paper.
 1272 *Diploderma glaucum* = *Mesophellia arenaria*, probably.
 1273 „ *suberosum*. Erroneous.
 1274 „ *pachythrinx* = *Mesophellia pachythrinx*.
 1275 „ *alba*. Erroneous.
 1276 „ *fumosa*. „
 1277 „ *melasperma*. „
 1278 *Bovista brunnea* = *B. brunnea*.
 1279 „ *Mulleri* = *Catastoma Muelleri*.
 1280 „ *hyalothrix* = „ *hyalothrix*.
 1281 „ *hypogaea* = „ *hypogaeum*.
 1282 „ *anomala* = „ *anomalum*.
 1283 „ *olivacea* = *Calvatia olivacea*.
 1284 „ *cervina* = *Catastoma*.

- 1285 *Lycoperdon lilacina*, = *Calvatia lilacina*.
- 1286 „ *violascens*. Belongs to 'atro-purpureum section,' specimens seen by Lloyd too old for specific identification.
- 1287 „ *bovistoides* = *L. bovistoides*, illustration resembles *Catastoma* but with a sterile base.
- 1288 „ *natalense* = *L. pratense*.
- 1289 „ *gemmatum* = *L. gemmatum*.
- 1290 „ *colensoi*, New Zealand = *L. gemmatum*.
- 1291 „ *pyriforme* = *L. pyriforme*.
- 1292 „ *glabrescens* = *Bovistella glabrescens*.
- 1293 „ *bovista* (*L. giganteum*) = *Calvatia gigantea*.
- 1294 „ *Fontanesii*, New Zealand = *Calvatia Fontanesii*.
- 1295 „ *cælatum* = *Calvatia cælata*.
- 1296 „ *Cookei* = *Bovistella*, probably.
- 1297 „ *Sinclairii*, New Zealand = *Calvatia Sinclairii*.
- 1298 „ *australe* = *L. pusillum*.
- 1299 „ *stellatum* = *L. stellatum*.
- 1300 „ *substellatum*. Type apparently non-existent or insufficient (Lloyd).
- 1301 „ *coprophilum* = *L. coprophilum*.
- 1302 „ *microspermum* = *L. pusillum*, apparently.
- 1303 „ *dermoxanthum* = *L. dermoxanthum*.
- 1304 „ *reticulatum*. Type apparently non-existent or insufficient (Lloyd).
- 1305 „ *tephrum* = *L. tephrum*.
- 1306 „ *pusillum* = *L. pusillum*.
- 1307 „ *mundula*. Type apparently non-existent or insufficient (Lloyd).
- 1308 „ *novæ zelandiæ* = *Calvatia lilacina*.
- 1309 „ *Gunnii* = *Bovistella Gunnii*.
- 1310 *Scleroderma geaster* = *S. geaster*.
- 1311 „ *bovista* = *S. texense*, probably.
- 1312 „ *vulgare* = *S. aurantiacum* and *S. cepa*.
- 1313 „ *verrucosum* = *S. verrucosum*.
- 1314 „ *pandanaceum*. No type found at Kew (Lloyd).

- 1315 *Sclerodeama aurea*. No type found at Kew (Lloyd).
 1316 „ *australe*. „ „ „
 1317 „ *umbrina* = *Polysaccum pisocarpium*.
 1318 „ (*Areolaria*) *strobilina* = *Phellorina strobilina*.
 1319 *Mycenastrum corium* = *M. corium*.
 1320 „ *phaeotrichum* = „
 1321 „ *olivaceum* = „
 1322 *Castoreum radicum* = *C. radicum*.
 1323 *Xylopodium australe* = *Phellorhina australis*.
 1324 „ *ochroleucum* = „ *strobilina*.
 1325 *Favillea argilacea* = *P. pisocarpium*, probably.
 1326 *Polysaccum pisocarpium* = „
 „ „ var. *acaule*.
 1327 „ *microcarpum* = *P. pisocarpium*.
 1328 „ *crassipes* = „ var. *crassipes*.
 1329 „ *turgidum* = „ „
 1330 „ *tuberosum* = „ var. *tuberosum*.
 1331 „ *marmoratum* = „ var. *crassipes*.
 1332 „ *confusum* = „ var. *confusum*.
 1333 „ *australe* = „
 1334 „ *album*.
 1335 „ (?) *degenerans*.
 1336 *Arachnion Drummondii* = *Arachnion Drummondii*.
 1337 *Paurocotylis pila*, New Zealand. Belongs to the Tuberaceæ.
 1338 „ *echinosperma*.

II. Corrected List of Australian Lycoperdaceæ based on Lloyd's works.

- | | |
|----------------------------------|-----------------------------------|
| 1 <i>Podaxon ægyptiacus</i> | 6 <i>Secotium erythrocephalum</i> |
| 2 „ <i>Muelleri</i> | 7 „ <i>coarctatum</i> |
| 3 „ <i>carcinamalis</i> , | 8 „ <i>melanosporum</i> |
| var. <i>elator</i> . | 9 „ <i>acuminatum</i> (?) |
| 4 „ <i>pistillaris</i> (probably | 10 „ <i>Rodwayi</i> . |
| <i>P. ægyptiacus</i> | 11 <i>Tylostoma albicans</i> |
| 5 <i>Gynoglossum stipitatum</i> | 12 „ <i>McAlpinianum</i> |

13	<i>Tylostoma mammosum</i>	28	<i>Phellorina australis</i>
14	„ <i>purpusii</i>	29	<i>Battarreia phalloides</i>
15	„ <i>Wightii</i> (?)	29a	„ „ var. <i>Stevenii</i>
16	„ <i>australianum</i>	30	<i>Polysaccum pisocarpium</i>
17	„ <i>album</i>	30a	„ „ var. <i>crassipes</i>
18	„ <i>Readeri</i>	30b	„ „ „ <i>tuberosum</i>
19	„ <i>egranulosum</i>	30c	„ „ „ <i>confusum</i>
20	„ <i>poculatum</i>	31	„ <i>degenerans</i> (?)
21	„ <i>subfuscum</i>	32	<i>Scleroderma geaster</i>
22	„ <i>granulosum</i>	33	„ <i>flavidum</i>
23	„ <i>exasperatum</i> (?)	34	„ <i>cepa</i>
24	„ <i>pulchellum</i> (?)	35	„ <i>texense</i>
25	<i>Chlamydopus meyenianus</i>	36	„ <i>aurantiacum</i>
26	<i>Phellorina delastrei</i>	37	„ <i>verrucosum</i>
27	„ <i>strobilina</i>		

Geaster.—A list of these has been given in No. 2 of this series.

38	<i>Bovista brunnea</i>	57	<i>Lycoperdon stellatum</i>
39	<i>Catastoma hypogaeum</i>	58	„ <i>gemmatum</i>
40	„ <i>anomalum</i>	59	„ <i>pyriforme</i>
41	„ <i>Muelleri</i>	60	„ <i>coprophilum</i>
42	„ <i>hyalothrix</i>	61	„ <i>tephrum</i>
43	„ <i>abnormalis</i> (?)	62	„ <i>subincarnatum</i>
44	<i>Bovistella aspera</i>	63	<i>Calvatia lilacina</i>
45	„ <i>australiana</i>	64	„ <i>cælata</i>
46	„ <i>glabreoscens</i>	65	„ <i>Gardneri</i>
47	„ <i>Gunnii</i>	66	„ <i>candida</i>
48	„ <i>scabra</i>	67	„ <i>olivacea</i>
49	„ <i>bovistoides</i>	68	„ <i>rubroflava</i>
50	„ <i>rosea</i>	69	<i>Castoreum radicans</i>
51	<i>Lycoperdon polymorphum</i>	70	<i>Arachnion Drummondii</i>
52	„ <i>nigrum</i>	71	<i>Mesophellia arenaria</i>
53	„ <i>cepæforme</i>	72	„ <i>pachythrix</i>
54	„ <i>pusillum</i>	73	<i>Mitremyces fuscus</i>
55	„ <i>dermozanthum</i>	74	„ <i>luridus</i>
56	„ <i>pratense</i>	75	<i>Paurocotylis echinosperma</i> (?)



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