

THE GASTEROMYCETES OF AUSTRALASIA. XV.

THE GENERA MESOPHELLIA AND CASTOREUM.

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(Plate vi.)

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A study of the literature shows that those who have worked with the Gasteromycetes have had difficulty in classifying the genera *Mesophellia* and *Castoreum* (including *Diploderma*). Thus de Toni (1888, p. 48) placed *Mesophellia* under the subfamily Podaxineae, "*Diploderma*" under the Diplodermeae, and *Castoreum* under the Sclerodermeae; and this arrangement was followed by Cooke (1892, p. 222, 232, 242). Fischer (1900, p. 338, 342) placed *Castoreum* under his "Ungenuegend bekannte Gattungen" of the Sclerodermaceae, and "*Diploderma*" and *Mesophellia* under a similar section of the Calostomaceae. Lloyd (1905, p. 5) placed *Castoreum* and *Mesophellia* under his tribe 5-Anomalae (defined as "not allied to previous tribes or to each other"), but did not mention "*Diploderma*". And in later papers he frequently commented on the difficulty of assigning these genera to a satisfactory position, claiming that their spores and glebal colour suggested affinities with the Phallales, and their hypogaeal habit with the Hymenogastraceae. Dodge (1929) considered *Mesophellia* to be an Ascomycete, and placed the genus under the tribe Mesophellieae of the Elaphomycetaceae (one of the hypogaeal Tuberales).

As will be shown, these genera exhibit little relationship to the Sclerodermaceae, less to the Diplodermeae (as defined by de Toni), and none to the Calostomaceae, Podaxaceae or Elaphomycetaceae, but are in reality members of the Lycoperdaceae.

I have recently worked over 34 collections loaned by Dr. J. B. Cleland, Adelaide, and Mr. L. Rodway, Hobart, and from this material (representing about 160 plants altogether), have been able to work out the following particulars regarding the species of these two interesting genera.

Structure of the Mature Plant.

In *Mesophellia* plants are hypogaeal, being exposed apparently accidentally by marsupials or as a result of cultural operations. The peridium of the species studied is two- or three-layered, and encloses a pulverulent gleba of capillitium and spores. The exoperidium is in the nature of a firm, relatively thick (2-3 mm.) tissue composed exteriorly of sand, earth or vegetable debris cemented to a firm fibrous tissue in which the hyphae appear to be aggregated into fascicles. The exterior, especially, varies considerably in appearance, toughness and thickness, according to the substratum in which the plant has developed. The endoperidium is a firm, parchment-like membrane, about 0.25 mm. in thickness (2 mm. thick in *M. castanea*), composed of a pseudoparenchyma of closely woven, partly gelatinized

hyphae. Between these layers lies (in *M. arenaria* and *M. pachythrix*) a loosely woven layer, somewhat cellular in composition. Dehiscence occurs through the gradual weathering of these membranes.

The gleba is olivaceous in colour, and consists of a prominent central core, capillitium, and spores. This central core is the characteristic feature of the genus, and is held in place by lateral strands (trabeculae) of the same tissue, which extend to and are firmly attached to the inner wall of the endoperidium. (See the exception noted under *M. castanea*.) Although firm, this tissue can be cut readily with a razor, for it is not of a "texture of the finest grained hard wood" as stated by Lloyd (1905, p. 39), but rather of a "cheesy" consistency. Sections show it to be composed of partly gelatinized hyphae firmly compacted together. The trabeculae holding the core in position are few and large in *M. arenaria*, very numerous and slender (appearing as fine hair-like strands) in *M. pachythrix*, and delicate groups of capillitium threads in *M. castanea*. The function of the central core is unknown, but it is possibly merely undifferentiated primordial tissue, unused during development of the gleba. This belief is partly supported by the fact that the core varies considerably in size in different plants, being scanty in some, whereas in others it occupies the greater part of the gleba. Capillitium and spores occupy the space between the endoperidium and central core. The threads of the capillitium vary in thickness in different plants, ranging from 3 μ to 10 μ , small plants possessing thin hyphae, larger ones coarser threads. They are copiously developed, hyaline or tinted, septate, somewhat swollen at the septa, possess clamp connections, and are arranged in palisade fashion, with their long axes parallel with the trabeculae of the central core. The spores are elliptical, and each is provided basally with a short pedicel, the remnant of the sterigma by which it was attached to the basidium.

In *Castoreum* the peridium is of the same three-layered type; but the endoperidium is externally fibrous and does not consist of firmly cemented sand particles as in *Mesophellia*. In *C. cretaceum* the exoperidium is reduced to a tenuous layer of hyphae closely adherent to the endoperidium. In this genus the endoperidium is from 1 to 2 mm. in thickness. In *C. radicum* and *C. tasmanicum* it is leathery and tough, whereas in *C. cretaceum* it is woody and brittle. Dehiscence in all three species is effected by the apical portion becoming torn into lobes, which in *C. cretaceum* become lanceolate and upturned, giving to old plants a castellated appearance. A prominent rooting strand is present in *C. radicum* (in fact in the type collection this is prolonged into a cord several centimetres in length), and to a lesser extent in *C. tasmanicum*, but is apparently wanting in *C. cretaceum*. The capillitium is well developed, and composed of hyaline, septate threads, which lack the parallel arrangement present in *Mesophellia*.

Spores in the three species examined show the same general resemblance to *Mesophellia*, but are distinctly larger in *C. tasmanicum* and *C. cretaceum*. They are provided with a prominent gelatinous tunic, which gives to the spores, when mounted dry or in water, a wrinkled or warted appearance. Traces of this structure are present on the spores of *Mesophellia*, but can be seen usually only when spores are heated in lactic acid solution and stained with anilin blue or some similar reagent.

In *Mesophellia arenaria* and *Castoreum tasmanicum* (at least) the spores are borne on considerably inflated basidia (on short sterigmata) which are irregularly arranged around small glebal cavities. No definite hymenium is formed, the basidia being irregular in size and shape. Apparently two spores

are attached to each basidium, since I have not observed a greater number than this. I have not been able to examine immature specimens of the other species described in this paper.

Systematic Position of the Genera.

Such features as the pulverulent gleba, copious capillitium, and absence of a definite stem, indicate that these genera belong to the family Lycoperdaceae. The three-layered peridium of the majority of species shows their position lies between the tribes Lycoperdeae and Geastreae. Although it might be claimed that the central core of *Mesophellia* shows a relationship to the Geastreae, the nature of the two structures is entirely different, for in *Mesophellia* this structure is composed of pseudoparenchyma, whereas the columella of *Geaster* is formed of loosely woven hyphae. The different capillitium and spores strengthen the belief that both genera are sufficiently removed from genera of the Lycoperdeae and Geastreae to warrant their being placed under a separate tribe of the Lycoperdaceae. The genus *Abstoma* shows a general resemblance to *Mesophellia* and *Castoreum* in several particulars; resembling *Mesophellia* in the nature of the exoperidium, endoperidium and method of dehiscence, and *Castoreum* by the gelatinous (although coloured) tunic enclosing the spore. It differs in the nature of the threads of the capillitium. But as the relationships of *Abstoma* are more with those of *Mesophellia* and *Castoreum* than with other genera of the tribe Lycoperdeae, I believe it should be removed from its present position and placed with these two genera, under a third tribe of the Lycoperdaceae; and propose emending my previous classification of the family (1927, p. 253) as under:

- I. Tribe LYCOPERDEAE: Peridium 2-layered, dehiscing by an apical stoma (irregular or wanting in *Calvatia* and *Mycenastrum*); capillitium attached or free, simple or freely branched; spores globose, typically echinulate (rarely smooth); basidia clavate, sterigmate, 4-spored.
(Containing the genera 1. *Calvatia*, 2. *Lycoperdon*, 3. *Bovistella*, 4. *Bovista*, 5. *Disciseda*, and 6. *Mycenastrum*.)
- II. Tribe MESOPHELLIEAE: Peridium commonly 3-layered, indehiscent, or rupturing irregularly at the apex; capillitium unbranched; spores globose or elliptical, usually with a gelatinous tunic; basidia inflated, sterigmate, apparently 2-spored.
Spores globose, reticulated 1. *Abstoma* G. H. Cunn.
Spores elliptical, smooth or irregularly roughened.
Gleba with a central core 2. *Mesophellia* Berk.
Gleba without a central core 3. *Castoreum* Cke. et Mass.
- III. Tribe GEASTREAE: Peridium 4-layered, endoperidium dehiscing by an apical stoma; capillitium attached, unbranched; spores globose, typically echinulate; basidia sterigmate, 4-8-spored.
(Containing the genus *Geaster*.)

All genera of the tribe Mesophellieae are confined to this biological region. *Abstoma* is represented by *A. reticulatum*, confined to Australia, and *A. purpureum*, confined to New Zealand; *Mesophellia* and *Castoreum* each contain three species which are confined to Australia and Tasmania. Lloyd (*Myc. Notes*, 1924, p. 1305) recorded *Mesophellia* from California; but examination of the type (a portion of which was kindly forwarded by Dr. C. L. Shear) shows that Lloyd's *M. Taylora* was erected upon an unexpanded *Geaster*.

1. MESOPHELLIA Berkeley.

Trans. Linn. Soc., Bot., xxii, 1857, p. 131.—*Inoderma* Berk., *Jour. Linn. Soc., Bot.*, xviii, 1881, p. 386.—*Potoromyces* Muell. ex Hollos, *Noev. Koez.*, i, 1902, p. 155.
Plant subglobose or elliptical, solitary or caespitose, dehiscing by irregular

weathering of the peridium, hypogaeal. Peridium usually of 3 well developed layers; exoperidium firm, thick (1–3 mm.), brittle, exteriorly of sand, earth or vegetable debris firmly cemented together, interiorly of finely compacted fibrous tissue; central layer of loosely woven rather coarse hyphae arranged in a somewhat cellular fashion; endoperidium thin, 0.25 mm. (to 2 mm. thick in *M. castanea*), tough and parchment-like, pseudoparenchymatous, free from the exoperidium. Gleba of capillitium and spores, lying between the endoperidium and a central firm core which is held in position by trabeculae of the same tissue attached to the endoperidium; capillitium threads copiously developed, usually hyaline, septate, arranged in parallel series. Spores elliptical, smooth (or with a trace only of a gelatinous tunic), with a short, persistent basal pedicel.

Habitat.—Hypogaeal, growing solitary or caespitose, buried in sandy soils, becoming exposed by marsupials or as a result of cultural operations.

Type species, *Mesophellia arenaria* Berk.

Distribution.—Australia; Tasmania.

The genus is characterized by the peculiar, sclerotoid central core, which occupies the greater part of the gleba. This structure is held in place by lateral strands of the same tissue (trabeculae), attached to the wall of the endoperidium, and between them lie the capillitium and spores. The abundant hyphae of the capillitium are arranged in a conspicuous palisade manner, parallel with the trabeculae of the central core.

The genus contains three known species, which closely resemble one another. Separation may be effected by the nature of the central core, for in *M. arenaria* this is held in place by a few coarse lateral strands, in *M. pachythrix* the strands are very numerous and appear as slender, delicate, hair-like processes, whereas in *M. castanea* they are apparently absent, being represented by bundles of capillitium loosely intertwined. The numerous other species which have been recorded are synonyms of these, of species of *Castoreum*, or were based on unexpanded Geasters or Lycoperdons.

The claim made by Dodge (1929) that the genus belongs to the ascomycetous family Elaphomycetaceae is without foundation. I have examined immature specimens of *M. arenaria* (and also of *Castoreum cretaceum*) and find the spores to be attached by short stout sterigmata to inflated basidia which are irregularly arranged around small glebal cavities. That the spores are basidiospores is substantiated by the fact that in all species examined, of both genera, each is provided with a short basal stump or pedicel, which is the remnant of the sterigma by which it was attached to its basidium. Furthermore, the capillitium in all species is provided with clamp connections, a feature confined, to my knowledge, to the Basidiomycetes.

I have found the structures illustrated by Dodge and considered by him to be evidence of the fact that the genus is an Ascomycete. They are undoubtedly ascomycetous in origin, but as the mycelium from which they arise is coloured and closely septate, and as the spores are of a different shape, slightly smaller, smooth and not provided with stumps of pedicels, it is evident they belong to an ascomycete saprophytic or more probably parasitic upon the gleba.

1. *MESOPHELLIA ARENARIA* Berkeley. Pl. vi, figs. 1, 2, 6.

Trans. Linn. Soc., Bot., xxii, 1857, p. 131.—*Inoderma arenaria* Berk., *Journ. Linn. Soc., Bot.*, xviii, 1881, p. 386.—*Diploderma glaucum* Cke. et Mass., *Grev.*, xv, 1887, p. 99.—*D. sabulosum* Cke. et Mass., *Grev.*, xxi, 1892, p. 38.—*Potoromyces loculatus* Muell. ex Hollos, *Noev. Koez.*, i, 1902, p. 155.—*Mesophellia*

sabulosa (Cke. et Mass.) Lloyd, *Lyc. Aus.*, 1905, p. 40.—*Diploderma parvispora* Lloyd, *Myc. Notes*, 1919, p. 901.

Plant subglobose, or more frequently elliptical, 2–5 cm. long, 1–3 cm. diameter, solitary or caespitose. Exoperidium 1–3 mm. thick, firm but brittle, exteriorly of sand or earth particles cemented together, interiorly of coarse fibrous tissue; endoperidium thin, 0.25 mm., dingy white or pallid bay-brown, parchment-like, tough. Gleba olivaceous, seldom ferruginous; capillitium threads hyaline or tinted only, copious, unbranched, septate; central core attached by a few coarse, flattened trabeculae, which may attain a thickness of 2 mm. or more. Spores elliptical, $7-12 \times 4.5-6 \mu$, apex bluntly rounded, base acuminate, with a persistent stump of a pedicel, tinted, smooth (or with traces only of a gelatinous tunic).

Type locality.—Tasmania.

Distribution.—Australia; Tasmania. South Australia: Kangaroo Island, 10/24, Prof. T. G. Osborn* (2 coll.); same locality, 10/26, Prof. Wood Jones* (2 coll.); Mt. Compass, 5/26, J. B. Cleland*.—Western Australia: Applecross, near Perth, 2/28, H. Perry (Herb. Dept. Agr. W. Aus.).—Tasmania: Mt. Field, 2/20, L. Rodway* (det. by Lloyd as *M. castanea*); Brown's River, 1/28, J. B. Cleland* (3 coll.); no locality, L. Rodway (2 coll., det. by Lloyd as *M. castanea*); no locality, L. Rodway (det. by Lloyd as *M. arenaria*).

The species varies considerably in the nature of the exoperidium. This may be a strongly developed sand-case, consist of sand particles firmly cemented to the exterior of a well developed fibrous tissue, appear as a tenuous but brittle layer of earth mixed with hyphae or covering the exterior of a hyphal membrane, or be composed of vegetable debris cemented to the surface. I feel convinced, however, that these differences are not specific, but result from the nature of the substratum in which plants are growing. Apparently plants develop some little depth below the surface, for all collections examined are recorded as being hypogaeal, obtained from the vicinity of scrapings made by wallabies, bandicoots or rabbits, or turned up during ploughing operations. And this is supported by the fact that no external point of attachment is apparent.

As Lloyd (*Myc. Notes*, 1917, p. 639; 1921, p. 1057) has stated, and as the illustration by Cooke (1892, Pl. 15, f. 117) shows, *Diploderma glaucum* is but a synonym of this species. *Diploderma sabulosum* is likewise a synonym, since it differs only in the exoperidium being strongly covered with sand, a condition which, as I have shown above, cannot be considered specific. *Diploderma parvispora* was based on a half specimen forwarded to Lloyd by Dr. Cleland. I have examined the half retained by Dr. Cleland and find it to be typically a specimen of *M. arenaria*; for although the central core has disappeared, abundant remnants of the trabeculae remain fixed firmly to the endoperidium.

2. MESOPHELLIA PACHYTHRIX (Cooke and Massee). Pl. vi, figs. 3, 7.

Lloyd, *Lyc. Aus.*, 1905, p. 40.—*Diploderma pachythrinx* Cke. et Mass., *Grev.*, xviii, 1890, p. 50.

Plants subglobose or tuberous, to 3 cm. diameter. Peridial characters as in the preceding species. Central core attached to the endoperidium by very numerous, slender, thread-like trabeculae which average from 0.1 to 0.25 mm. diameter. Gleba olivaceous, capillitium copious, threads as in the preceding species. Spores elliptical, $7-9.5 \times 3-4.5 \mu$, apex bluntly rounded, basally acuminate,

* An asterisk denotes that the collection in question is in the herbarium of Dr. J. B. Cleland, The University, Adelaide, South Australia.

and furnished with a stump of a pedicel, tinted, smooth (or with traces of a gelatinous tunic).

Type locality.—Tarwin, Victoria.

Distribution.—Australia; Tasmania. South Australia: Near Dashwood's Gully, 10/29, J. B. Cleland*; Blackwood Gully, near Kuitpo, 4/29, J.B.C.*—Tasmania: No locality, L. Rodway* (det. by Lloyd as *M. arenaria*).

This differs from the preceding species in the smaller spores and in the fine trabeculae holding the central core in position. The latter are so numerous (several scores being present in a representative specimen) and of such fine dimensions that they were described originally as threads of the capillitium. Under the microscope they are seen to be composed of fascicles of hyphae partly gelatinized and firmly compacted together. Cooke and Massee described the spores as minutely warted; most are apparently smooth, though some exhibit, if examined dry or in water, small irregularities which are rudiments of the gelatinous tunic so characteristic a feature of the next genus, as may be seen if spores are mounted in lactic acid solution and heated.

3. MESOPHELLIA CASTANEA Lloyd.

Myc. Notes, 1917, p. 640.

Plants subglobose or depressed globose, to 3 cm. diameter. Exoperidium wanting; endoperidium 1.5–2 mm. thick, firm and woody, avellaneous. Gleba avellaneous; capillitium threads copious, of unbranched, septate, tinted hyphae; central core held in place by slender trabeculae composed of loosely woven fascicles of a few capillitium threads, numerous. Spores elliptical, tinted, $7-10 \times 3-5.5 \mu$, base with stump of a pedicel, with distinct traces of a gelatinous tunic present.

Distribution.—Australia. South Australia: Aldgate, C. C. Brittlebank (type in Lloyd herb.).

The species was erected upon a half specimen now in the herbarium of the late C. G. Lloyd at Washington, D.C. It differs from the preceding in the apparent absence of trabeculae; but these are in reality present, but so slender as to be invisible unless examined under the microscope. They appear as distinct strands of loosely woven parallel bundles of capillitium. Through the courtesy of Dr. C. L. Shear, I have been able to examine a fragment of the type, and from this and Lloyd's description, have drawn the particulars given above. There is now no trace of an exoperidium on the specimen, but the clean nature of the endoperidium suggests this has been lost during collecting or subsequently, for there is no reason to believe, as Dodge suggested, that this differs from others in the genus in the absence of this structure.

Excluded Species.

(a). *Mesophellia ingratisima* (Berk.) de Toni, in Sacc. *Syll. Fung.*, vii, 1888, p. 57. = *Inoderma ingratisimum* Berk., *Jour. Linn. Soc. Bot.*, xviii, 1881, p. 386.

As apparently no type exists (Lloyd, 1905, p. 40), and as the description is such that it is not possible to determine whether this belongs to *Mesophellia* or *Castoreum*, this name should be deleted from our records. The plant was said to be strongly scented, a feature noted by Dr. Cleland as present in collections of *Castoreum radicans*, and one which suggests the possibility of the latter being the plant referred to by Berkeley.

(b). *Mesophellia sabulosa* (Cke. et Mass.) Lloyd = *M. arenaria*.

(c). *M. Scleroderma* Cke. et Mass., *Grev.*, xiv, 1885, p. 11.—This is a synonym of a plant Lloyd named *Gallacea Scleroderma*, a member of the Hysterangiaceae.

2. CASTOREUM Cooke and Massee.

Grev., xv, 1887, p. 100.—*Diploderma* Link, *Mag. Ges. Nat. Freunde*, vii, 1816, p. 44, *pro parte*; ex Cke. et Mass., *Grev.*, xv, 1887, p. 99.

Plant subglobose, with or without a rooting strand, hypogaeal or epigaeal; dehiscing by irregular rupture of the apical portion into few or many irregular lobes or laciniae. Peridium usually of 3 layers; a thick exoperidium of closely woven hyphae (reduced to a tenuous layer in *C. cretaceum*); a central layer of loosely woven rather coarse hyphae; and an endoperidium which is tough, thick, leathery, pseudoparenchymatous and often suberized. Gleba coloured, of capillitium and spores, but without a central core; capillitium threads hyaline, not arranged in parallel fashion, well developed (scanty in mature plants of *C. cretaceum*), septate. Spores elliptical, covered with a loose or close-fitting gelatinous tunic, which gives to them an irregularly verrucose or wrinkled appearance.

Habitat.—Growing partially or completely buried in sandy soils.

Type species, *Castoreum radicans*.

Distribution.—Australia; Tasmania.

This genus is separated from *Mesophellia* by the absence of a central core, different method of dehiscence, and the prominent gelatinous tunic which covers the spores (present in rudimentary form in *Mesophellia*). The radicate strand is likewise a feature of the genus (absent from *C. cretaceum*) and, in the type collection, is prolonged into a strongly developed mycelial cord several centimetres in length. This would appear to be an abnormal condition, present only in the type collection, since in the plants described below, the rooting strand is reduced to a structure a few millimetres long.

Cooke and Massee (*Grev.*, xv, 1887, p. 100; *ibid.*, xvi, 1887, p. 2) and Lloyd (*Myc. Notes*, 1917, p. 641) placed species of the genus under *Diploderma*. But this name is invalid, for it was applied by Link to an unexpanded specimen of *Geaster (Astraeus) hygrometricus*. Consequently the name for the genus becomes *Castoreum*.

The genus is confined to Australia and Tasmania, and would appear to be limited to the following three species, the others recorded being synonyms of these, of *Mesophellia*, or based upon immature specimens of *Geaster* or *Lycoperdon*.

Key to the Species.

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|---|--|
| Spores 8-12 μ long | 1. <i>C. radicans</i> Cke. et Mass. |
| Spores 14-18 μ long. | |
| Exoperidium well developed, 1 mm. or more in thickness | 2. <i>C. tasmanicum</i> G. H. Cunn. |
| Exoperidium thin, represented by a tenuous layer of hyphae attached to the endoperidium | 3. <i>C. cretaceum</i> (Lloyd) G. H. Cunn. |

1. CASTOREUM RADICATUM Cooke and Massee. Pl. vi, fig. 10.

Grev., xv, 1887, p. 100.—*Diploderma avellaneum* Lloyd, *Myc. Notes*, 1917, p. 641.—*D. castoreum* Lloyd, *l.c.*, p. 642.—*D. radicans* (Cke. et Mass.) Lloyd, *Letter* 65, 1917, p. 11.

Plants subglobose, to 2 cm. diameter, attached to the substratum by a small basal rooting strand, dehiscing by the tardy rupture of the apical portion into two or three unequal lobes. Exoperidium to 2 mm. thick, of coarsely woven, rather coarse hyphae, externally partly covered with loosely adhering particles of earth or sand, or velutinate, bay-brown or umber, internally fibrous and bay-brown; endoperidium 1-2 mm. thick, tough and leathery, pseudoparenchymatous, bay-

brown. Gleba pallid ferruginous; capillitium threads hyaline, copiously developed, septate. Spores fusiform, $7-12 \times 4.5-6 \mu$, both ends rounded, or the apical end acuminate, base with a stump of a pedicel, covered with a coarsely and irregularly warted, close fitting, gelatinous tunic.

Type locality.—St. George's Bay, Tasmania.

Distribution.—Australia; Tasmania. Victoria: Portland, J. Dixon (type collection of "*Diploderma avellaneum*"; herb. Vic. Dept. Agr.).—South Australia: Willunga Hill, 5/26, J. B. Cleland*.—Tasmania: St. George's Bay, G. Wintle (Cke. et Mass., l.c.); Brown's River, 1/28, J. B. Cleland* (4 collections); Blackman's Bay, 2/28, L. Rodway*; no locality, L. Rodway*.

Diploderma avellaneum Lloyd is identical with *C. radicum*, as I have ascertained by examination of the "type" collection in the herbarium of the Victorian Dept. of Agriculture. *D. castoreum* was erected by Lloyd in error, as later he altered the name to *D. radicum*, his intention being to place *C. radicum* under *Diploderma*, which he persisted in using.

Although in the original description of *C. radicum* the spores were given as being $12 \times 5-6 \mu$, Lloyd (*Myc. Notes*, 1917, p. 642) claimed they were $16 \times 8 \mu$. In order to determine this point I requested Miss Wakefield to examine spores of the type at the Royal Herbarium, Kew; this she has kindly done and found them to be $10-12 \times 5-5.5 \mu$.

Dr. Cleland in his collecting notes recorded that plants were strongly aromatic when freshly gathered. It is probable that this odour attracts marsupials, which dig plants out of the ground, since most are collected in the vicinity of scrapings made by these animals.

2. CASTOREUM TASMANICUM, n. sp. Pl. vi, figs. 4, 8.

Plants subglobose, or depressed globose, to 3.5 cm. diameter, solitary or caespitose, attached by a small basal rooting strand, which may be well developed or almost wanting, dehiscing by the rupture of the apical portion into a few irregular lobes. Exoperidium 1-2 mm. thick, of closely woven hyphae, externally minutely velutinate, or partially covered with vegetable debris or earth, bay-brown or umber, internally fibrous, chestnut-brown; endoperidium 1-1.5 mm. thick, bay-brown or ferruginous. Gleba pallid ferruginous; capillitium threads copious, hyaline, septate. Spores elliptical, or elliptic-obovate, $14-18 \times 8-10 \mu$, tinted, apex rounded, base often truncate, with a stump of a pedicel, covered with an irregularly warted, prominent gelatinous tunic.

Type locality.—Brown's River, Tasmania.

Distribution.—Tasmania: Brown's River, 1/28, J. B. Cleland* (4 collections); no locality, L. Rodway*.

This species closely resembles the preceding, but is separated by the much larger spores. "*Diploderma*" *insolitum* Lloyd is said to possess spores of the same size, but appears to differ in the presence of certain peculiar bodies in the gleba. I am unable to verify these points, since no type material is available in Australia.

3. CASTOREUM CRETACEUM (Lloyd), n. comb. Pl. vi, figs. 5, 9.

Diploderma cretaceum Lloyd, *Myc. Notes*, 1920, p. 1057.—*D. dehiscens* Lloyd, *Myc. Notes*, 1925, p. 1361, *nomen nudum*.

Plants subglobose to shortly elliptical, 1-1.5 cm. diameter, without a rooting strand, dehiscing by the apex becoming torn into numerous (12-18) upright

laciniae. Exoperidium closely adherent to the endoperidium, appearing as a tenuous friable layer of loosely aggregated hyphal cells and earth particles; endoperidium 0.25–0.5 mm. thick, tough, woody, brittle, bay- or chestnut-brown, pseudo-parenchymatous. Gleba pallid olivaceous; capillitium threads scantily developed, fragile, thin, septate. Spores elliptical, $13\text{--}16 \times 5.5\text{--}7\ \mu$, apex acuminate, or rounded, base with a distinct persistent stump of a pedicel, covered with a coarsely verrucose, loosely fitting gelatinous tunic.

Type locality.—Mt. Field, Tasmania.

Distribution.—Australia; Tasmania. South Australia: Willunga Hill, 8/27, J. B. Cleland*.—Tasmania: Mt. Field, L. Rodway (type collection); no locality, L. Rodway (det. by Lloyd as *D. cretaceum*); no locality, L. Rodway ("type" collection of *D. dehiscens*); no locality, L. Rodway (det. by Lloyd as *D. dehiscens*).

This differs from the preceding species in several particulars, as absence of a rooting strand, tenuous exoperidium, method of dehiscence, and scanty capillitium. It resembles *Scleroderma* in the method of dehiscence and scanty capillitium, and this resemblance is strengthened by the fact that in one immature specimen the gleba was composed of tenuous tramal plates. The spores show that it is more closely related to the genus *Castoreum*. The capillitium is copiously developed in young plants, but as plants approach maturity, the threads appear to become gelatinized and tend to break up readily.

Diploderma dehiscens is a synonym of this species, as in the type collection of the latter are present plants which exhibit the same method of dehiscence, and in all other respects both appear to be identical.

Excluded Species.

(a). *Diploderma alba* Cke. et Mass., *Grev.*, xvi, 1887, p. 2.—This was probably based upon an unexpanded *Geaster* or *Lycoperdon*.

(b). *D. avellaneum* Lloyd = *Castoreum radiculatum*.

(c). *D. castoreum* Lloyd = *Castoreum radiculatum*.

(d). *D. cretaceum* Lloyd = *Castoreum cretaceum*.

(e). *D. dehiscens* Lloyd = *Castoreum cretaceum*.

(f). *D. fumosum* Cke. et Mass., *Grev.*, xvi, 1887, p. 2.—Probably based upon an unexpanded *Geaster* or *Lycoperdon*.

(g). *D. glaucum* Cke. et Mass. = *Mesophellia arenaria*.

(h). *D. insolitum* Lloyd, *Myc. Notes*, 1917, p. 641.—This species was erected upon the numerous persistent bodies of peculiar form present in the gleba. Otherwise it appears to resemble *C. tasmanicum*. As I have shown, material is no longer available for study in Australia, so that the identity of the species, and the nature of these bodies, must remain at issue until further material is forthcoming.

(i). *D. melaspermum* Cke. et Mass., *Grev.*, xx, 1891, p. 35.—Probably based upon some unexpanded puff-ball.

(j). *D. pachythrix* Cke. et Mass. = *Mesophellia pachythrix*.

(k). *D. parvispora* Lloyd = *Mesophellia arenaria*.

(l). *D. radiculatum* Lloyd = *Castoreum radiculatum*.

(m). *D. sabulosum* Cke. et Mass. = *Mesophellia arenaria*.

(n). *D. suberosum* Cke. et Mass., *Grev.*, xv, 1887, p. 100.—Probably based upon an unexpanded *Geaster* or *Lycoperdon*.

The spores of *D. alba*, *D. fumosum*, *D. melaspermum* and *D. suberosum* were stated to be subglobose, spinose or smooth, and usually deeply coloured, which

precludes their belonging to *Mesophellia* or *Castoreum*, but suggests they were based upon unexpanded specimens of *Geaster* or *Lycoperdon*.

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EXPLANATION OF PLATE VI.

Fig. 1.—*Mesophellia arenaria*, five-eighths natural size.—Showing the exterior covered with coarse sand particles.

Fig. 2.—*M. arenaria*, five-eighths natural size.—Showing the central core held in place by coarse trabeculae.

Fig. 3.—*Mesophellia pachythrix*, five-eighths natural size.—Specimen sectioned to show the prominent central core held in position by the very numerous and slender trabeculae.

Fig. 4.—*Castoreum tasmanicum*, five-eighths natural size.—Upper plant shows the rooting base, lower specimen the thick endoperidium and fibrous exoperidium.

Fig. 5.—*C. cretaceum*, five-eighths natural size.—Unexpanded plants on the right, expanded specimens on the left.

(Photographs by H. Drake.)

Fig. 6.—Spores of *Mesophellia arenaria*.

Fig. 7.—Spores of *M. pachythrix*.

Fig. 8.—Spores of *Castoreum tasmanicum*.

Fig. 9.—Spores of *C. cretaceum*.

Fig. 10.—Spores of *C. radicum*.

(Spores $\times 1000$.)



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