AUSTRALIAN SPECIES OF THE FUNGAL GENUS
CORDYCEPS (Fr.) Link
(with critical notes on collections in Australian herbaria)

by

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SUMMARY

This paper embraces: a short history of the discovery of Cordyceps species in Australia; an artificial key to the 15 taxa (known to occur in the Commonwealth and believed to be specifically distinct); the synonymy for each species, list of collections represented in Australian herbaria, location of types, names of host-insects (where known), and sundry comments on identities and nomenclature; a bibliography concerning Australian collections of Cordyceps.

INTRODUCTION

Specimens of Cordyceps are no less intriguing to the modern botanist than when, two centuries ago, they were regarded as a lusus naturae—the transmutation from animal to plant kingdom. The permanency, with which “mummified” bodies of the host-insect retain their outward form, heightens the interest of these parasitic fungi. Another remarkable fact is that certain species may occur either in the perithecial (perfect) phase or in one or more quite dissimilar conidial states. Some kinds of entomogenous fungi produce only conidial fruiting bodies; these are classified under such form-genera as Isaria, Hirsutella, Hymenostilbe, Sporotrichum, Stilbum, &c., although their relationship (and perhaps identity) with undoubted members of Cordyceps is suspected.

The only comprehensive world revision of this genus since the 19th century is by Y. Kobayasi (1941) who recognized 137 species. Japan (34 spp.), North America (31), Brazil (31), Belgian Congo (24) and Java (17) appear to be the richest centres of development. Australia (including Tasmania) is credited with only ten species, according to Kobayasi; but these include C. taylori (Berk.) Sacc., which is most probably the largest “vegetable caterpillar” fungus in the world, its branched sporophores often attaining heights up to 1 foot. Kobayasi notes (1941, p. 216) that almost half the total species of Cordyceps are known solely by the original collection, which would suggest that most species are of quite rare occurrence; however, the lack of systematic collecting doubtless accounts for an astonishing paucity.
of herbarium specimens—at least in Australia. One or more species is known to occur in each of the Australian States except Western Australia, whence material of an isarioid growth on large cicada larvae (but apparently not \textit{Isaria cicadæ} Miq.) reached me during 1953. The eventual discovery of several \textit{Cordyceps} species in such a vast region as the Western State is only to be expected.

At least three different \textit{Isaria} have been recorded from insect larvae in eastern Australia, viz.: \textit{I. surmatodes} McAlpine (Sept., 1895) on a cockchafer beetle at St. Kilda, Vic.; \textit{I. cicadæ} Miq. [in \textit{Bull. Sci. phys. et nat. Neerl.} 1: 85, t. 1, fig. A (1838)], also \textit{Ann. Sci. nat.} ser. 2, 10: 378 (1838)—type from Bahia, Brazil] on a Victorian cicada specimen, but without definite locality, and \textit{I. suffruticosa} Cooke & Massee (1889) on a hairy caterpillar in New England district, N.S.W. The two latter records were published by M. C. Cooke (Aug., 1892, p. 383), and H. T. Tisdall (1893, p. 94) discusses an unidentified \textit{Isaria} found on a moth cocoon under a charred log at Nar-Nar-Goon, Vic.

It is now possible to extend the range of \textit{I. cicadæ} to Queensland, where excellent fruiting material was collected on the ground in eucalypt forest at Mt. Nebo, Manorina National Park, by Mr. and Mrs. A. B. Cribb in February, 1956. The highly branched conidiophores all emerge from the head of the small host-cicadas (apparently \textit{Melampsalta} sp.) and the flesh-pink to orange-reddish fertile heads (each about 2 mm. long) are aggregated like bunches of grapes. Under \textit{I. cicadæ}, Petch (1933, p. 65) lists as a synonym \textit{I. sinclairii} (Berk.) Lloyd, 1923, which is not uncommon in New Zealand, its type (at Kew) having come from Tauranga on Poverty Bay. Dingley (1953, p. 339) is not correct in writing “Petch stated that the perfect stage was \textit{Cordyceps sobolifera} (Hill.) Sacc.” Petch’s actual words (1933, p. 64) were: “\textit{Isaria sinclairii} is generally accepted as the conidial stage of \textit{Cordyceps sobolifera}, though no evidence of that relationship has been adduced, except that both grow on \textit{Cicada nymphs}.”

\textbf{Type} of \textit{Cordyceps sobolifera} (Berk.) Berk. & Broome, 1875, came from the West Indies and is, presumably, in the cryptogamic section of the Natural History Museum at Paris. This species, with usually solitary clubs surrounded by sterile, conidiophore-like “soboles”, extends to Mexico, Japan, China, Ceylon and Madagascar; so it might well be represented in the Australian region.

H. Tryon (1893, p. 54) reported the occurrence of a hyphomycetous fungus—probably \textit{Isaria} sp.—on a mummified scarabaeid beetle larva at Yanilla, Queensland, while the present writer has found white but barren isarioid growths (to 1 cm. high) all over the brown-woolly cocoon of a grass moth (\textit{Anthela acuta} Walk.) at Beenak, Vic. (May, 1935). The latter may possibly represent \textit{I. suffruticosa} Cooke & Massee, to which \textit{I. japonica} Yasuda ex Lloyd, 1917, is very closely allied if not conspecific. Mrs. K. Healey has recently found excellent examples of the same parasite on woolly moth cocoons at Tarra Valley National Park, Vic. (June, 1959).
Cordyceps is known to parasitize a wide diversity of hosts, including larvae of numerous genera of Coleoptera (beetles), Hemiptera (bugs and cicadas), Orthoptera (cockroaches and crickets), Lepidoptera (moths and butterflies), Hymenoptera (ants and wasps) and Diptera (flies). It is usual for fruiting bodies to emerge just behind the head of the host, but occasionally they appear between the anal or intermediate segments. Occurrences of Cordyceps on spiders are comparatively rare (e.g., the Japanese C. arachneicola Kobayasi, and tropical American C. caloceroides Berk. & Curt.), while a few boreal species—C. japonica Lloyd, C. jezoensis Imai, C. ophioglossoides (Fr.) Link, C. intermedia Imai and C. capitata (Fr.) Link—are restricted to underground fruiting bodies of the fungal genus Elaphomyces. Frequently each Cordyceps is peculiar to a single host or to several related species, yet the almost cosmopolitan C. militaris (Fr.) Link has been recorded for at least 13 genera of Lepidoptera, as well as on coleopterous pupae and the cocoons of certain Hymenoptera. Conversely, the large Victorian swift moth larva Oxycanus diremptus is known to be parasitized by at least four species of Cordyceps: C. gunnii (Berk.) Berk., C. hawkesii G. R. Gray, C. cranstounii Olliff and C. robertsii (Hook.) Berk. were all found on this grub within an area of a few square yards along Koonung Creek at Doncaster, Vic., by Mr. and Mrs. Paul Fisch in June, 1942, and more recently (June, 1959) the same four species were gathered on Oxycanus at Tarra Valley National Park, Vic., by Mrs. K. Healey (vide specimens in Melbourne Herbarium).

The writer has personally examined all Cordyceps exsiccatae housed in the National Herbaria at Melbourne and Sydney, the National Museums of Victoria and South Australia, the considerable material in the Botany Department of Melbourne University (amounting to 22 collections, including types of three species) and, by courtesy of Dr. N. T. Flentje (pathologist), eight of the twelve collections of Cordyceps in the Waite Agricultural Research Institute at Adelaide. He is also indebted to Dr. Winifred M. Curtis, Mr. R. C. Carolin and Mr. A. Musgrave (through Director J. W. Evans) for valuable information on the material housed in the respective herbaria of Hobart University, Botany Department at Sydney University and the Australian Museum (Sydney). There are no Australian specimens in the State Herbaria at Perth, Adelaide or Brisbane.

Special thanks are due to Dr. Alan B. Cribb (Botany Department, University of Queensland, Brisbane) who willingly placed at my disposal the four Cordyceps collections (1954–56) of his own fungal herbarium, and gave permission to publish any pertinent details. These collections (all by Cribb and his wife) comprise four distinct species—C. gunnii, C. hawkesii, C. robertsii and Isaria cicade Miq.—none of which have been recorded previously for Queensland; indeed, the genus Cordyceps would seem to have been hitherto quite unknown in that State. All three species came from rain forest along Coomera track in the Lamington National Park—presumably on the same large hepalialid moth larva (as happened at Doncaster, Vic., in 1942). It is possible that some other important collections exist in private herbaria; but, if so, details have eluded me.
RECORDING OF SPECIES FOR AUSTRALIA

Apparently the first species to be discovered in the Australasian region was *C. robertsi*, diagnosed as a *Sphaeria* by W. J. Hooker (1836) from New Zealand material, but later recorded for Tasmania (Rodway, 1920), found in Victoria (1942), in New South Wales (1947)* and Queensland (1955). Kobayasi (1941, p. 102) extends its range to Chile. The host in each instance is a large lepidopterous larva in the Swift Moth family, *Hepialididae* (e.g., *Oxycanus diremptus* and probably *O. fusco-maculatus*).

A second Australasian species was collected on the banks of Murrumbidgee River near Yass, N.S.W., in 1837; it was first described and figured as *Sphaeria innominata* by Rev. R. Taylor (1842), but has been universally known under the name *Cordyceps taylori* for the past century—the inadmissibility of the latter, and probably both epithets, will be discussed elsewhere. In 1896 *C. taylori* was rediscovered at Queanbeyan, less than 40 miles south-east from the type locality; in the meantime, however, no less than six independent collections had been made in the Otway Ranges, Vic. (1886–94), two between the Ovens and Mitta Mitta Rivers, two in the Strzelecki Ranges of South Gippsland and one labelled “Caulfield” (1870). This large and remarkable ascomycete is still known only from Victoria and south-eastern New South Wales.

The third Australian taxon to receive recognition was *C. gunnii*, described under the genus *Sphaeria* by Rev. M. J. Berkeley (1848) on the basis of a Tasmanian collection from Launceston district—not “Lancaster” as in the original description. This is the most widely distributed and by far the best known Australian species, occurring in all States except Western Australia and extending also to the North Island of New Zealand. Its large, usually simple, dark olive-green heads appear early in winter, mostly under *Acacia* trees (e.g., the Silver Wattle, *A. dealbata*), and fruiting bodies are well represented in herbaria. The first Victorian specimen would seem to be one taken at Studley Park, Melbourne, in 1857 by W. Kershaw and now in the possession of his great-grandson (R. C. Kershaw of West Tamar, Tas.); strangely enough, F. Mueller does not seem to have noticed the species before 1874, when it appears in his *Report* as Government Botanist (p. 12). Subsequent collections have been made almost throughout the cooler parts of the State—from Portland to Mallacoota.

*C. gunnii* was collected in New South Wales at least as early as 1888 (Shoalhaven River), on the Hunter River, then at several parts of the Blue Mountains, and later still in the National Park (south of Sydney) and in the Riverina district. Tepper and McAlpine (1897) recorded the species for South Australia on the basis of several collections from Kingston and Sellick’s Hill. By courtesy of the Director, South Australian Museum, the present writer has been able to examine three of these collections and he agrees with McAlpine’s identifications of 1897. Almost half a century later (in 1942 and 1943) *C. gunnii* was collected at Kingston again and

* Several collections from the Port Jackson area were recorded under the name of *Cordyceps selkirkii* by Olliff (1895).
the record published, together with a coloured illustration, by J. R. Harris (1946). No other species of the genus is known to occur in South Australia. The first, and only, Queensland collection would seem to be that of A. B. and J. W. Cribb—from Lamington National Park in the far south-east, May 1955.

*C. hawkesii* was described (as a *Sphaeria*) from Tasmania by G. R. Gray (1858). The type, presumably at British Museum (Natural History), has not been consulted; but similar, or perhaps identical, material was collected on the Snowy River near Orbost, Vic. (1890)—subsequently at Doncaster, Cockatoo, Olinda, &c.—at Coonamble, N.S.W. (about 1894), and lastly in the Lamington National Park, Queensland (May, 1954).

F. Mueller and Berkeley (1878) published a description and figure of *C. meneristitis* (the epithet erroneously rendered "menesteridis"), their type coming from the mouth of Yarra River, Vic.; M. C. Cooke (Aug., 1892) reduced it to a variety of the European *C. entomorrhiza* Link, and Kobayasi (1941, p. 140) made it a doubtful synonym of his own new Japanese species, *C. gracilioides*.

The *Stilbum formicarum*, described by Cooke and Massee (1889) from an ant collected at Cheltenham, Vic., was considered by T. Petch (1933, p. 67) as referable to a conidial state of the Brazilian *C. bicephala* Berk.

Only three species of *Cordyceps* were accorded an Australian distribution by Saccardo (1883) and Cooke (Aug., 1892) in their respective fungus floras of the world and of Australia. *Saccardo omitted* *C. hawkesii*—probably not having seen Gray's private and rather obscure pamphlet of 1858—and the latter authority, for some inexplicable reason, failed to mention *C. taylori*. D. McAlpine (1895) listed the four species known from Australia at that date (viz., *C. taylori*, *C. hawkesii*, *C. gunnii* and *C. entomorrhiza* var. "menesteridis"); he also admitted typical *C. entomorrhiza* for Victoria.

The next comprehensive account of Australian species appeared in June, 1895, by A. S. Olliff, Government Entomologist of New South Wales, who died six months later at the early age of 30. He provided illustrations and diagnoses for six species, believed to be new, making a total for the Commonwealth of ten. Although this attempt to name several apparently undescribed entities was praiseworthy enough, Olliff was not a botanist and his revision called forth adverse criticism. L. Rodway (1900) remarked:

Mr. Olliff . . . drew attention to the forms found in Australia, at the same time describing many forms as new species. I doubt if mycologists will accept them all. *C. selkirkii* and *C. coxii* are too close to *C. larvarum* [= *C. robertsi*] and *C. tricnena* owes its existence to an unfortunate oversight. . . .

And C. G. Lloyd's opinion (1920) concerning the same revisionist was expressed thus:

From the systematic account of *Cordyceps*, however, Mr. Olliff seems to us to be very local in his view, and his species, we believe, should mostly be referred to others.

*Saccardo later listed* *C. hawkesii* in *Sylloge Fungorum* 9 (*Supplementum Universale*): 1001 (1891).
One of Olliff's six "new" species (C. selkirkii) is almost certainly a form of C. robertsii, another (C. pieli) seems to be merely C. hawkesii, while a third (C. trictensure) is actually based upon the type illustration of C. taylori (published as Sphaeria taylorii Berk., 1843)! The remainder (C. scottiana, C. coxii and C. cranstounii) appear to be genuine novelties, worthy of specific rank, but their types have not been located and their circumscription must rest upon the original figures and rather inadequate descriptions. A possible type specimen of C. coxii is preserved in the Insect Gallery at the Australian Museum, Sydney; this has not been examined by the present writer.

C. scottiana is not known other than by the type collection (Hunter River, N.S.W., 1861) which may be among Berkeley's numerous fungi at Kew; the original specimens of both C. coxii and C. cranstounii came from Kurrajong Heights, N.S.W.; but collections conforming well to the descriptions of these entities have been made in Victoria during the past twenty years.

Also in 1895 G. Massee published another new species, C. henleyae, the type coming from Ovens River, Vic., in 1893. E. Cheel, as reported by Lloyd (1920), made the suggestion that C. henleyae was merely a branched condition of C. robertsii; it seems to connect this species with C. taylori, and, in my opinion, would be better placed as a form of the latter (with which it shares the same very large hepialid host-larva). In C. G. Lloyd's Synopsis of the Cordyceps of Australasia (1915), C. henleyae, C. taylori, C. gunnii, C. dovei [see below] and C. gracilis are considered as "good" Australian species; to the last-named Algerian species Lloyd referred C. meneristitis F. Muell. & Berk.

During the present century five species have been added to the Cordyceps flora of the Commonwealth—four from Victoria and one from Tasmania: C. dovei Rodway (1900) was presented from Mt. Bischoff, western Tasmania, and later noted in the North and South Islands of New Zealand; C. jurcata McLennan & Cookson (1923) and C. brittlebankii McLennan & Cookson (1926), both described from Ringwood, Vic.; C. aphodii Matthieson (1949) from Miner's Rest, near Ballarat, Vic.; and what appears to be a form of the boreal genotype, C. militaris Link, from chrysalids in the Otway Ranges, Vic. (first noted in Sept., 1935, and collected there again during the next two years). From time to time, there are found in Australia Cordyceps fruiting bodies which do not satisfactorily match the existing descriptions, and it is likely that a number of endemic species still awaits recognition—especially those on small or little-known insects.

Joan M. Dingley's monograph (1953) on the Hypocreales of New Zealand includes eight species of Cordyceps (three being new to science) and is the most recent treatment for a large region in the Southern Hemisphere. She assigns Cordyceps, and five other genera, to the family Clavicipitaceae. The three species (C. robertsi, C. gunnii and C. dovei) common to Australia and New Zealand are described in detail. Probably one or more of the four species, at present considered endemic in that Dominion, may extend to Australia.
ARTIFICIAL KEY TO AUSTRALIAN CORDYCEPS SPECIES.

1. Perithecia entirely immersed in stroma — 6
   Perithecia superficial or very prominently exserted — 2

2. Fertile portion of sporophore terminal, orange, obtuse, unbranched, 2–20 mm. long (on chrysalids of various Lepidoptera) — C. militaris
   Fertile portion not terminal, never orange; apex of sporophore sterile, often slender (on larvae) — 3

3. Stroma 3–10 mm. long, 1–2 mm. wide, pale ochraceous; perithecia darker, forming irregular, often lateral pads 3–5 mm. long and occupying the greater part of fructification (on cerambycid, or longicorn, beetle grubs—several to many, rarely only 1–2, sporophores crowded around neck of host) — C. dovei
   Stroma > 30 mm. long (and up to 20 cm.), bay brown; perithecia dark brown to blackish — C. coxi

4. Stipe glabrous, very slender, simple or forked; perithecia acute, 0·2–0·3 mm. long (on scarabeid, or cockchafer, beetle larvae) — C. coxii
   Stipe brown-tomentose toward base; perithecia obtuse (on large moth larvae) — 5

5. Fructification simple or slightly branched, slender, never > 3 mm. wide (usually 1–2 mm.) at junction with host; perithecia truncate, ± 4 per mm., 0·3–0·5 mm. long (host < 15 mm. thick) — C. robertsi
   Fructification usually much branched, antler-like and massive (or, if occasionally simple, then > 3 mm. wide at point of emergence from host); perithecia often ± apiculate, 5–6 per mm., 0·1–0·2 mm. long (host > 20 mm. thick) — C. taylori

6. Stipe hair-like, ± 5 cm. long, simple or once-forked, smooth, dark brownish; capitulum almost globose, 2–3 mm. long (on ants—the perithecial stage unknown in Australia, where small pink-headed conidiophores spring from various parts of host) — C. bicephala
   Stipe neither hair-like nor associated with ants — 7

7. Fructification very small (< 3 cm. long) but relatively stout, often multiple or branched; capitulum < 5 mm. long — 12
   Fructification > 3 cm. long, frequently single and simple; capitulum at least 5 mm. long (often more) — 8

8. Capitulum dark reddish-brown, 5–10 mm. long, with paler and usually acute terminal beak (4–8 mm.); stipe 1–2 mm. wide (on scarabeid beetle larvae) — C. brittlebankii
   Capitulum fertile up to the obtuse, rounded apex — 9

9. Stipe > 3 mm. wide (often up to 10 mm.), undivided, sometimes 20–30 cm. long; capitulum normally > 10 mm. long (on hepalid moth larvae) — 11
   Stipe < 3 mm. wide or irregularly much branched; capitulum to 10 mm. long — 10

10. Mouths of perithecia distinct and widely spaced (4–7 per mm.); stipe very flexuose, irregularly branched (with several yellow capitula) and lacerate (on hepalid moth larvae) — C. cranstounii
    Mouths of perithecia microscopic, > 7 per mm.; stipe undivided, smooth; capitulum brick-reddish or sepia, 5–8 mm. long (on tenebrionid beetle larvae) — C. meneristitis
    As for the last, but the yellow-brown capitulum ± 10 mm. long and host a lucanid beetle larva — C. scottiana

11. Living capitulum dark olive-green to blackish, ill-defined below where it merges gradually into the pale yellow stipe, usually with small longitudinal wrinkles or creases and protruding perithecial mouths in the dried state — C. gunnii
    Living capitulum bay or coffee-brown, well-defined and sharply distinct from the paler brown stipe, not wrinkled in drying — C. hawkesii

12. Capitula 3 per stipe, each 4–5 mm. long, red-brown, regularly ovoid, sharply contracting into a nipple-like apical point (identity of larval host unknown) — C. fureata
    Capitulum solitary, 3–4 mm. long, ochre-brown, sometimes ± distorted (on scarabeid, or cockchafer, beetle larvae) — 13

13. Perithecia ± scattered, obliquely inclined toward axis — C. aphodii
    Perithecia close and compact, obliquely inclined to axis — C. sp.
ALPHABETICAL ARRANGEMENT OF SPECIES, SYNONYMY, HOSTS, LOCATION OF TYPES, AND COLLECTIONS IN AUSTRALIA

The following standard abbreviations have been used for various herbaria (the numbers in brackets indicating collections of Australian Cordyceps material housed in each local herbarium):

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Herbarium/Institution</th>
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<tr>
<td>ADM (3)</td>
<td>South Australian Museum, Adelaide.</td>
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<tr>
<td>ADW (12)</td>
<td>Waite Agricultural Research Institute, Adelaide.</td>
</tr>
<tr>
<td>BDW</td>
<td>Botany Division, Department of Scientific and Industrial Research, Wellington, N.Z.</td>
</tr>
<tr>
<td>BM</td>
<td>British Museum (Natural History), London.</td>
</tr>
<tr>
<td>CANTY</td>
<td>Canterbury Museum, Christchurch, N.Z.</td>
</tr>
<tr>
<td>HO (10)</td>
<td>University of Tasmania (Botany Department), Hobart.</td>
</tr>
<tr>
<td>K</td>
<td>Royal Botanic Gardens (Herbarium), Kew, London.</td>
</tr>
<tr>
<td>LPS</td>
<td>Institute de Botanica C. Spegazzini, La Plata, Argentina.</td>
</tr>
<tr>
<td>MEL (40)</td>
<td>National Herbarium, Royal Botanic Gardens, Melbourne.</td>
</tr>
<tr>
<td>MELM (12)</td>
<td>National Museum of Victoria, Melbourne.</td>
</tr>
<tr>
<td>MELU (22)</td>
<td>University of Melbourne (Botany School).</td>
</tr>
<tr>
<td>NSW (9)</td>
<td>National Herbarium, Royal Botanic Gardens, Sydney.</td>
</tr>
<tr>
<td>PR</td>
<td>Botanical Department of National Museum, Prague, Czechoslovakia.</td>
</tr>
<tr>
<td>SYD (5)</td>
<td>University of Sydney (Botany Department).</td>
</tr>
<tr>
<td>US</td>
<td>National Museum and Smithsonian Institute, Washington (including Lloyd Herbarium, now under loan to Plant Industry Station, Beltsville, Md.).</td>
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Host: Aphodius howitti Hope (Coleoptera—Scarabaeidae).

Type: Miner’s Rest, near Ballarat, Vic. (J. Mathieson, Oct., 1946—MELU).

Other Collections: Miner’s Rest, near Ballarat, Vic. (J. Mathieson, July, 1945—MELU, asexual stage).

The author of the species gives a very detailed account of all stages of the parasite, its artificial culture from both conidiospores and ascospores, secondary parasites which attack it and the life history of the host-insect (a small cockchafer beetle in the family Scarabaeidae). C. aphodii has not been reported beyond the type area in Victoria, but a very similar, still undetermined, species from New South Wales is discussed on page 85.


C. australis (Spec.) Sacc. Syll. fung. 2: 571 (1883);
C. unilateralis Tul. supsp. australis Spec. in An. Soc. cient. argent. 12: 215 (1881)—TYPE (?LPS) on Pachycondyla striata from mossy trunks near Apiahy, southern Brazil (Dr. Püiggari);
Hymenosiphon melanopoda (Spec.) Petch in Trans. Brit. mycol. Soc. 16: 209 (1932);
Isaria melanopus Spec. Bol. Acad. Cienc. Cordoba 11: 620 (1889)—TYPE (LPS) on decaying beetle from mossy trunks near Apiahy, Brazil (Dr. Püiggari);
Stilbum formicarum Cooke & Massee in Grevillea 18: 8 (1889)—TYPE (K) on an ant, “Formica consobrina”, from sundew plant at Cheltenham, Vic. (C. French, ± 1888).
Host: Unknown (probably ant).
Type: Panure, near sources of Rio Negro, N.W. Brazil (R. Spruce, ± 1853 — K).

The synonymy given above reflects the opinion of T. Petch (1933, p. 67). It is generally conceded that the two taxa *C. bicephala* and *C. australis* (both described from Brazil) are conspecific, and it is practically certain that *Hymenostilbe melanopoda* (type of which came from the same tree-trunks as that of *C. australis*) is only a conidial stage of this species; but, since many distinct species of *Cordyceps* are known to parasitize ants, it is surely assuming too much to identify the single old Victorian collection of *Stilbum formicarum* with the perfect stage of a South American fungus? They may indeed be the same, but my doubt is expressed by the prefixing query to *C. bicephala* in this list of Australian *Cordyceps*.

E. B. Mains [Bull. Torrey bot. Cl. 76: 24–30 (1949)] supports Kobayasi (1941, p. 183) in taking up the name *C. australis* instead of the earlier *C. bicephala* Berk., because the latter was presumed to be based on a doubtfully mature specimen; but Berkeley’s diagnosis explicitly mentions both asci and sporidia, and, in any case, the International Code of Nomenclature does not sanction rejection of any name on a plea of immaturity for the type on which it is based. Petch, in his belief that only a single species was involved, had every justification for synonymizing *C. australis* under *C. bicephala*. Kobayasi has extended the range of this fungus to Uganda in East Africa, and Mains (l.c.) presents it as a common parasite in the Western Province of Liberia, West Africa, “killing ants by thousands”.

**C. brittlebankii** E. McLennan & I. Cookson in Proc. roy. Soc. Vict. n. ser. 38: 74, t. 5 fig. 5–6, t. 6 fig. 4–5 (1926).

* Host: *Heteronyx* sp. (Coleoptera—Scarabaeidae).
* Type: Ringwood, Vic. (I. Cookson, Apr. 1924 — MELU).
* Other Collections: Tyabb, Vic. (J. M. Raff—MELU).

The species has not been observed outside Victoria.


* Host: ?Lepidiota* sp. (Coleoptera—Scarabaeidae), also Cicadidae (Hemiptera).


* Other Collections: Concord, N.S.W. (F. C. Lovegrove, Aug., 1910—NSW); near Gembrook, Vic. (J. H. Willis, 1935—MEL); Between Daylesford and Trentham, Vic. (Judith Thiele, July, 1946—MEL); Alexandra, Vic. (C. G. Lane, Nov., 1907—MELM). [At the Entomological Branch of the N.S.W. Department of Agriculture, the writer has seen a collection of *Cordyceps*-bearing cockchafer larvae from Taren Point on Botany Bay (E. E. Mellenish, Dec., 1934); the fruiting bodies on these are imperfect, without perithecia, but most probably referable to *C. coxii*.]

Although type of *C. coxii* has not been examined, the original figures and description (brief as it is) accord well with later collectings of a distinctive *Cordyceps* on cockchafer larvae, which is here referred to that species.
Olliff (loc.) suggests that *C. coxii* "may prove to be an extreme variety" of his species *C. selkirkii*, the latter always parasitizing large moth larvae and differing in its longer, truncate, less crowded perithecia. The writer unhesitatingly supports Lloyd (1920, p. 912), Kobayasi (1941, p. 99) and Dingley (1953, p. 331) in relegating *C. selkirkii* to synonymy under *C. robertsii*, but he does not uphold Kobayasi's treatment of *C. coxii* as another straight synonym of "*C. larvarum*" [i.e., of *C. robertsii*].


*Host*: Oxycanus diremptus, and probably other species (Lepidoptera—Hepialidae).

*Type*: Kurrajong Heights, N.S.W. (T. Cranstoun, Mar., 1895 —? loc.).

*Other Collections*: Bola Creek, National Park, N.S.W. (A. Burges, July, 1947—MEL); Koonung Creek, Doncaster, Vic. (Mr. & Mrs. Paul Fisch, June, 1942—MEL, ADW No. 3142); without locality, Vic. (MELM); Tarra Valley Nat. Park, Vic. (Mrs. K. Healey, June, 1959—MEL).

The characteristic features of *C. cranstounii* are its lacerate (or irregularly byssaceous) stipe, multiple heads which are relatively short, obtuse, yellowish, with perithecial orifices large and widely spaced.

Type was not available for inspection, but the writer confidently refers the Bola Creek (N.S.W.) and Doncaster (Vic.) collections to this distinctive species.

Many fresh specimens from Doncaster were examined over a period of four months; but, although the fruiting heads of these had well-developed perithecia, in no instance could sporidia (or even differentiated asci) be found!


*C. aemonea* Lloyd *Mycol. Notes* 6: 932, fig. 1695 (1920)—TYPE (US) on *Aemona hirta* in rotting logs of *Melicytus ramiflorus*, Weraroa, New Zealand (G. H. Cunningham, No. 51, Sept., 1919); CO-TYPE (No. 78, BDW).

*Host*: (Coleoptera—Cerambycidae).

*Type*: In decayed trunk of *Nothofagus cunninghamii* at Mt. Bischoff, Tas. (H. Stuart-Dove—HO; photo. of type MEL).

Although six collections have been recorded from New Zealand (widely distributed through both islands), the only one known from Australia is that of the type which came from the high-rainfall area of western Tasmania. In its comparatively very small fructifications (with sterile apices and half-exserted perithecia), more or less crowded near the head of the beetle-host, *C. dovei* is almost unique. New Zealand populations differ slightly from the Tasmanian in having longer, more slender, less crowdedstromata (sometimes even single), with the fertile portions more distinctly lateral and sterile tips less truncated (sometimes acute). Lloyd recognized them as constituting a separate endemic species, *C. aemonea*, but Kobayasi (1941, p. 103) reduced this to synonymy and pointed out the trifling nature of the differences.

Host: Unknown larva.

Type: Ringwood, Vic. (E. McLennan & I. Cookson, Sept., 1922—MELU).

The species is known only by the single type collection.


(Plate IX, figs. 1–3).

Sphaeria gunnii Berk. in Lond. J. Bot. 7: 577, t. 22 (1848);

C. consumpta G. H. Cunn. in Trans. N.Z. Inst. 53: 377, t. 60 fig. 1 (1921)—TYPE (No. 230, CANTY) on buried larva of Porina sp. [= Oxycanus sp.] at Rotorua, N.Z. (A. Lush, June, 1920);

? C. craigii Lloyd Mycol. Notes 4: 527, fig. 718 (1915)—TYPE (US) on Porina enyssii [= Oxycanus enyssii] from old and abandoned kumara (Ipomoea batatas) beds at Auckland, N.Z. (E. Craig);


Host: Oxycanus spp. (Lepidoptera—Hepialidae).

Type: Franklin Village, near Launceston, Tas. (R. C. Gunn, No. 1800, Apr., 1846—K, NSW).

Other Collections:

Tasmania—Knocklofty, Hobart (? L. Rodway, June, 1895—HO); without locality (W. V. Fitzgerald, 1891—MEL); Strzelecki Peak, Flinders Island (J. H. Willis, Apr. 1954—MEL).

Victoria—? Dimboola (E. Muir, 1948—MEL); Bahgallah, near Casterton (R. C. Miller, June, 1885—MEL); Portland (J. A. Leach, June, 1906—MEL); Macedon (MELU); Apollo Bay (MELU); Port Phillip (C. French, June, 1869—MEL); Studley Park (W. Kershaw, 1857—Herb. R. C. Kershaw; F. M. Reader, June, 1885—Herb. Vict. Dept. Agric., Burnley); “Comelilla” (C. French, May, 1900—Herb. Vict. Dept. Agric., Burnley); Kew (MELU); Doncaster (P. Fisch, June, 1942—MEL, MELU); Dandenong (F. Gessner, 1892—MEL); Kallista (E. I. McLennan, Aug., 1949—MELU); Dandenong Ranges (MEL); Kalorama (Mrs. Peters, May, 1957—MELU); Mornington (MELU); Tyabb (Master Blackwood, Nov., 1920—MELM); Nyora (MELU); Korumburra (MELU); Orbost (MELU); Mallacoota (W. Hunter, Oct., 1955—MELU); Wangaratta (M. Ferris, June, 1956—ADW No. 7450); Tarra Valley Nat. Park (Mrs. K. Healey, June, 1959—MEL).

[Noted also as abundant at Emerald and Cockatoo.]

South Australia—Penola (C. Barrett, June, 1931—MELU); Sellick’s Hill (Dr. E. C. Stirling—ADM); Kingston (Dr. A. Engelhardt—ADM; J. B. Cleland, Aug., 1943—MEL; June, 1943—ADW Nos. 266–268; J. B. Cleland, July, 1942—ADW No. 3143; A. R. Naimes, Aug., 1945—ADW No. 3145).
New South Wales—Shoalhaven River (? W. Bäuerlen, June, 1888—MEL); Kurrajong Heights (SYDM); Bola Creek, National Park (J. McLuckie, A. Burges & N. White, June, 1932—SYD); Whitton, Murrumbidgee River (A. J. Foster, June, 1921—NSW No. 3486/21); near Albury (A. G. Hamilton, June, 1917—NSW).

[Noted also in the Blue Mountains and on Hunter River.]


The common big-fruited C. gunnii is very closely related to, and has been much confused with, C. hawkesii—or what the writer interprets as that species. In the latter fungus the capitulum is brownish (not dark green); remaining quite smooth and unaltered when dry. Furthermore, there is a sharp line of demarcation between the apex of stipe and fertile (perithecia-bearing) part of the sporophore; in C. gunnii, by contrast, the dark green (at length black and wrinkled) fertile portion grades insensibly into a yellow stipe and the perithecial mouths protrude slightly when specimens are dried. Joan Dingley (1953, p. 335) has reduced the names of Lloyd's two New Zealand species C. craigii and C. hillii (l.c.) to synonyms of C. gunnii, apparently without inspection of their types; but the original figures of both show rather well delimited capitula and might equally pass for C. hawkesii, hence the present writer's query prefixing the synonymy of these under C. gunnii. Miss Dingley kindly made available for examination two excellent specimens of Cordyceps from New Zealand, collected about 1920 by H. Hamilton on the larvae of Oxycanus enysii at Wireless Hill, near Wellington. These had been determined by Dr. G. H. Cunningham at C. craigii Lloyd; but they are certainly referable to a small form of C. gunnii, with which Dingley also identified this collection (1953, p. 335). Probably both C. gunnii and C. hawkesii occur in New Zealand.


(Plate IX, figs. 4–6).

*Spharia hawkesii* G. R. Gray Notices Insects ... Fungoid Parasites 8, t. 5 fig. 10–12 (1858).


Host: Oxycanus & Trictena spp. (Lepidoptera—Hepialidae).

Type: Near Launceston, Tas. (Mr. Hawkes, ca.1846—? BM).

Other Collections: Mussel Roe, N.E. Tas. (? L. Rodway—HO); Track to Marriott's Falls, Mt. Field National Park, Tas. (O. Rodway, Sept. 1924—HO); Koonung Creek, Doncaster, Vic. (Mr. & Mrs. Paul Fisch, June, 1942—MEL, ADW No. 3144); Perrin's Creek, Olinda, Vic. (Ina Watson, July, 1942—MEL); Mt. Evelyn Recreation Reserve along Olinda Creek, Vic. (A. B. Court, July, 1958—MEL); Tarra Valley Nat. Park, Vic. (Mrs. K. Healey, June, 1959—MEL); Snowy River near Orbost, Vic. (J. Cameron, 1890—MEL, as "C. cameroni" ms.); without locality, Vic. (MELM); Coonamble, N.S.W. (TYPE C. pieli, l.c.); Rain forest in Lamington National Park, Q'land (A. B. & J. W. Cribb, May, 1954—Herb. A. B. Cribb, Brisbane).
Until the actual type of C. hawkesii can be located and studied, its circumscription must depend upon G. R. Gray's three drawings and rather hazy account (l.c.). Gray was Senior Assistant at the Zoology Department, British Museum, and he stated unequivocally "Various examples ... are among the specimens sent by Mr. Hawkes to the British Museum"; yet C. G. Lloyd (Mar., 1915, p. 6) avers "I found no specimen of Cordyceps hawkesii in either of the museums at London"—one wonders whether his search extended to the Zoological Department as well as the Botanical? No other writer seems ever to have examined the original material of this parasite. The following points of departure from C. gunnii are emphasized by Gray: stipe irregular, flexuose, much more slender (in some examples no thicker than a straw), fulvous-woolly on the buried portion (especially toward soil surface), springing from "various portions of the body of the caterpillar", the terminal club not nearly so thick or dark as in C. gunnii. None of these features per se (except the woolly investment) is of much significance in a highly polymorphic fruiting body like that of C. gunnii, but Gray's figures do portray a fungus with sharply determinate fertile apices.

The name C. hawkesii is here applied, not without some misgiving, to a population having bay- to coffee-brown, often dilated or contorted, sharply defined fertile clubs that are always wider than their stipes; this fungus may grow in company with, but remains distinct from, C. gunnii. The writer believes it to be conspecific with Olliff's C. pieli (l.c.)—a name which might have to be taken up, if the type of C. hawkesii can ever be found and referred to some other taxon. Perithecial mouths are comparatively much broader than in C. gunnii, almost touch each other and do not protrude, while the filiform sporidia do not readily break up into secondary spores, each of which is ±2.5 mic. long (sporidia of C. gunnii soon separate into rectangular secondary spores 3–5 × 2.5 mic.—cf. 2.5–3 × 2 mic. given by Dingley, 1953). Both species have glabrous or, at most, only microscopically felted stipes—without a sign of the woolliness ascribed to C. hawkesii by its author. C. cranstounii and C. robertii are more or less woolly about the lower parts of the stroma, in Victoria inhabiting the same host as C. hawkesii, but they differ from it in many other respects.

C. meneristitis F. Muell. & Berk. in Gdnsr's Chron. ser. 2, 10: 794†, fig. 130 (1878)—ut "C. menesteridis" in err.

C. entomorrhiza (Fr.) Link var. "menesteridis" (F. Muell. & Berk.) Cooke Handb. Aust. Fungi 277 (1892);
C. gracilis sens. Lloyd Synops. Cordyceps Australasia 10 (1915), non certe Durieu & Montagne (1846);

Descriptio amplificata:

Stipes 2–5 cm. longus, 0–3 mm. crassus, paulum curvatus vel flexuosus, tenue farinaceo-squamulosus, superne pallidi-carneus, subter ochraceus. Capit fertile terminale, ellipsoideum, 5–10 × 3–5 mm., nitidulum, castaneo-fulvum (interne ochraceum), interdum gemenatum. Perithecia omnino immersa, ad partem latissimam 0.6–0.8 × 0.16–0.23 mm. Ostiolum minuta, atra, 60–80 mic. diam., 200–320 mic. disjuncta, ad apicem densiora. Ascii longe cylindrici 200–450 × 3–4 mic., capitibus subglobosis 3–4 mic. altis. Articuli ascosporarum 6–7 × 1–1.5 mic., quisque 3–septatus apparens. Status conidialis ignotus.
Host: Meneristes laticollis Boisd. & Lepispilus spp. (Coleoptera—Tenebrionidae).

Type: Mouth of Yarra River, Vic. (C. French, c. 1878—K, MEL).


According to the joint authors (l.c.), type was found “on the caterpillar of Meneristes laticollis Boisd.”—an obvious mistake for Meneristes laticollis, there being no insect genus “Menesteris”. Thus it is permissible to correct the genitive spelling of the epithet, from “menesteridis” to meneristitis. Moreover, the host is a tenebrionid beetle larva, not a “caterpillar”.

Cooke (l.c.) reduced C. meneristitis to a variety of the European C. entomorrhiza; but the latter has a filiform, toughly rigid stipe (not fleshy as in meneristitis), with blackish globoid capitulum (violet-coloured internally) and these two taxa are not closely allied at all. C. meneristitis has much more in common with C. gracilis—first described from Algeria, but ranging through Europe, China, the United States and Brazil—and C. G. Lloyd (Mar., 1915, pp. 10–11) merged it with this widespread species. C. gracilis, however, is a parasite on lepidopterous larvae and the stipe is characteristically clothed near the base with branched mycelial rhizoids or fibres. Kobayasi (1941, p. 143) tabulates the differences between the related species C. glaziowii Henn. (from Brazil), C. gracilis Durieu & Montagne and C. gracilioides Kobayasi (l.c., p. 140); under the last novelty, from Japan, he places as a doubtful synonym C. meneristitis (“menesteridis”), with the remark “sp. imperfecte cognita”. But C. meneristitis is now no less well known in Victoria than most other species of Cordyceps, and there do not seem to be adequate grounds for recognizing C. gracilioides as distinct. Except in the longer wider asci (600–700 x 6–6.5 mic.), Kobayasi’s description fits the Victorian plant admirably, so his name is listed above as a synonym of C. meneristitis—with prefixing query, because the present writer has had no opportunity to compare actual types.

Should some future worker decide that C. meneristitis (despite its different host and consistently bare stipe) is not sufficiently distinct from C. gracilis to justify specific rank, then the latter, older name must prevail. Incidentally, Kobayasi’s identification of the host in C. gracilioides (l.c., p. 141) as “Larvae of Cossidae (Coleoptera)” is absurd, Cossidae being a family of large wood moths (Lepidoptera) and having nothing to do with the Coleoptera (beetles).


Sphaeria militaris Fr. Syst. Mycol. 2: 323 (1823).

Host: Various genera of Lepidoptera, sometimes Coleoptera and even Hymenoptera.

Type: Apparently none.
Australian Collections: Apollo Bay, Vic. (F. J. Halsey, Sept., 1935—MELU; Miss M. Fawcett, Sept., 1937—MELU); Turton's Track, near Beech Forest, Vic. (May 1936—MELU).

Dr. Ethel I. McLennan, of the Botany School, Melbourne University, determined the three collections cited above (from Otway Ranges) as *C. militaris*—a variable fungus widespread through Europe, Asia and North America. Although these Victorian representatives have smaller-than-average stromata, they were correctly identified (in the writer's opinion). No other Australasian occurrence of *C. militaris* has been reported, but this orange-headed species is most likely to exist in other fern-gully habitats of southeastern Australia (including Tasmania).


(Plate VII).

*Sphaeria robertsii* Hook. *Icon. Plant.*, 1: t. 11 (1836);
*S. huegelii* Corda *Icon. Fungorum* 4: 44, t. 9 fig. 129 (1840)—TYPE (?PR) from New Zealand (Baron C. v. Hügel, 1834);
*S. forbesii* Berk. in *Lond. J. Bot.* 7: 578 (1848)—nomen nudum;
*Clavaria larvarum* Westwood in *Proc. ent. Soc. Lond.* 2: 6 (1836)—nomen nudum;
*Cordyceps huegelii* (Corda) Corda *Anleit. Stud. Mycol.* 207, t. F fig. 22 (1842);
*C. larvarum* Olliff in *Agric. Gaz.* N.S.W. 6: 410 (1895)—nomen superfl.;

Host: *Oxycanus* spp. and perhaps related genera (*Lepidoptera—Hepialidae*).

Type: New Zealand, without precise locality (Mr. Roberts—? K).

Australian Collections:

New South Wales—Kurrajong Heights (? H. Selkirk—SYDM, HO, as *C. selkirkii* Olliff); "Hotel Australia", Eden (Gabon, Mar., 1908—NSW No. 927/08, barren and dubious specimen); Road between Fitzroy Falls and Nowra (E. Cheel & J. B. Cleland, June, 1919—NSW); National Park (J. McLuckie & A. Burges, June, 1932—SYD); Bola Creek, National Park (A. Burges, Mar., 1947—SYD); National Park (C. M. Eardley & A. Burges, Apr., 1947—ADW No. 269).


Victoria—Tyrendarra, near Portland ("Pres. Trng. College Educ. Dept.", June, 1912—MELM); Koroi (R. T. M. Pescott, Aug., 1932—MELU, barren specimen); Koonung Creek, Doncaster (Mr. & Mrs. Paul Fisch, June, 1942—MEL, MELU, ADW No. 3146); Rye (Mrs. Paul Fisch, Sept., 1956—MEL); Tarra Valley Nat. Park (Mrs. K. Healey, June, 1959—MEL).

Tasmania—? loc. (Dr. Crivelli—MEL); "Southern Tasmania" (? L. Rodway, Nov. 1914—HO); Mt. Wellington, 200 ft.
J. H. Willis: Australian Species of the Fungal Genus Cordyceps

(? L. Rodway, Aug. 1924—HO); Cascades, Hobart (? L. Rodway, May, 1924—HO); Track to Lady Barron Falls, Mt. Field National Park (? L. Rodway, June, 1924—HO).

[Noted also at Willoughby (Sydney) and Rope’s Creek in New South Wales; at Warrandyte, Wonga Park and Kalorama (Dandenong Ranges) in Victoria.]

Charles Robin (1853, pp. 655-660) devoted six pages to his description of C. robertsii, in French, giving a remarkably detailed account of its anatomy and furnishing a coloured illustration. The synonymy set out by Joan Dingley (1953, p. 331) is unfortunately marred by at least five errors in the quotation of literary references. As pointed out by her (l.c., p. 332), Kobayasi erred in taking up the name C. larvarum (Westwood) Olliff, because its basionym Clavaria larvarum Westwood (1836) was a nomen nudum; but Sphceria robertsii Hook. (1837) was validly published, with short description and unmistakable drawing, so the legitimate name must be C. robertsii (Hook.) Berk.

The writer agrees with Kobayasi (1941, p. 99) and Dingley (l.c.) in reducing C. huegelii (Corda) Corda and C. selkirkii Olliff to synonymy under C. robertsii. Undivided stromata are the usual attribute of this species in New Zealand, but Australian populations are very frequently branched (the “C. selkirkii” form), and even the precise line of demarcation between C. robertsii and the usually much larger C. taylori sometimes appears hazy. Dingley (1953, p. 331) describes the perithecia of New Zealand collections as 0.4-0.5 mm. wide, whereas both Cunningham (1921, p. 378) and Kobayasi (1941, p. 102) give a measurement of 0.3-0.4 mm. The only two New Zealand specimens of C. robertsii in Melbourne Herbarium show the mature perithecia to be even narrower (0.15-0.2 mm.), just as in Australian examples; so the size of these receptacles would seem to be rather variable.


Host: Rhyssonotus nebulosus Kirby (Coleoptera—Lucanidae), apparently also cicada larve (Cicadidae).

Type: Ash Island, Hunter River, N.S.W. (A. W. Scott, Sept., 1861—?loc.). ICONOTYPE (by Mrs. Helena Forde) reproduced with original diagnosis (l.c.).

Known only with certainty by the type (if still in existence), description and original coloured figure (l.c.), C. scottiana must be very close indeed to the true, boreal C. gracilis Durieu & Montague; but it has much longer, yellowish-red mycelial strands at the base of stipe and inhabits a coleopterous (or hemipterous) not lepidopterous host. Lloyd (1920, p. 911) acclaimed it as “the only one of Mr. Olliff’s species that appears good to us”. Berkeley received specimens of what he proposed to call “Sphceria scottiana” from Mr. Scott (the collector), but does not appear to have published any description of them; it is possible for this material to be among his other very numerous fungal specimens at Kew. In the Insect
Gallery of The Australian Museum at Sydney is a specimen labelled "Cordyceps scottianus Olliff. Cooma, N.S.W. Melolonthid grubs". But it has not been possible to ascertain whether this collection is really conspecific with the original Hunter River material or, which is more likely, represents some other Cordyceps (perhaps C. meneristitis—already known from the Southern Tablelands). Pending a search for fresh material in the type area, the benefit of the doubt is accorded this taxon, and it is admitted here as a "good" species with one possible (if unproven) synonym.

Kobayasi (1941, p. 144) established a new species, C. heteropoda, for Japanese material hitherto referred by Kawamura (1929) to the Australian C. scottiana, and he took pains to tabulate (p. 147) the differences between the two. Because Kobayasi had to rely on the inadequate description of C. scottiana his conclusions are questionable. A curious misinterpretation of terms is obvious in his comparison of the palisade cells (which form a periphery to each fertile capitulum). The words "coated with a layer or envelope of oblong cells", in the case of C. scottiana, were taken "en bloc" from Olliff's diagnosis; however, by "cells" the latter author was referring to perithecia and certainly not to the hyphal matrix in which these receptacles are embedded! The only significant difference between C. scottiana and C. heteropoda is the larval host—stag beetle in the former, cicada in the latter population—and that, per se, does not constitute a reliable basis for speciation.


* Sphaeria taylori Berk. in Lond. J. Bot. 2: 209, t. 8 fig. 2 (1843); S. innominata R. Taylor in Tasm. J. nat. Sci. Agric. Statist. 1: 307–8, illust. (1842);
* Cordyceps trictenae Olliff in Agric. Gaz. N.S.W. 6: 410, t. 3 (1895);
* C. henleyce Massee in Ann. Bot., Lond. 9: 28, t. 1 fig. 1–12 (1895)—TYPE (K, MEL) on Trictena sp., Ovens River, Vic. (Miss M. Henley, 1893);
* C. melbourniensis Lloyd Mycol. Notes 7: 3: 1353, fig. 3153 (1925)—nomen provis.

Host: Trictena spp. (Lepidoptera—Hepialidae).

Type: *Murrumbidgee River, 10 miles from *Yass, N.S.W. (J. Allan, Mar., 1837—K).

Other Collections:

New South Wales—Queanbeyan (H. Selkirk, 1896—NSW No. 6895).

Victoria—Gerangamete, Otway Ranges (J. Davis, Nov., 1886 MELM; Carr, 1886—MEL; J. Price, July, 1886—MEL; H. Ireland, June, 1891—MEL); Apollo Bay (Mott, 1892—MEL; J. E. Syne, 1906—NSW No. 4095); Beech Forest (J. M. Reed, June, 1918—MELM; C. C. Brittlebank, 1926—SYD, as "C. melbourniensis"); Forrest (Sawmill Employees' Asso., Sept., 1912—MELM); Cape Otway Ranges (1894—MEL); Cape Otway (SYDM Nos. A48, K100, K349); J. caulfield (W. Kershaw, 1870—MELM); South Gippsland (per Editor "Australasian", June, 1892—MELM); Strzelecki Ranges (W. Johnstone, July, 1895—MEL); Snowy Creek, between Omeo and Tallangatta.

* Spelt "Murrumbidgee" and "Yap" in the original diagnosis.
Without doubt, the first validly published description of this taxon was under the name Sph(eria innominata, by Rev. Robert Taylor (1842). His material came from the same suite of specimens (Murrumbidgee River, 1837) which furnished Berkeley with the type of S. taylori—published the following year, apparently in ignorance that Taylor himself had already described this fungus in an obscure colonial journal. There would seem to be a clear case for making the new combination, Cordyceps innominata; yet, one hesitates to do so in deference to Article 77 of the International Code of Botanical Nomenclature (Stockholm, 1950), which demands the rejection of any name or epithet “when it is based on a monstrosity”. Now Taylor’s figure of Sph(eria innominata portrays a stroma with numerous, tightly aggregated (cauliflower-like) and apparently sterile branches—quite atypical of the fructification (spreading, antler-like and sparingly branched) that one is accustomed to associate with the name C. taylori. Was the type specimen of S. innominata a “monstrosity”? The present writer believes it was, and, if so, we can conveniently reject this name.

But, is the type (preserved at Kew) of Berkeley’s S. taylori any more normal? Among fungi, which are notoriously polymorphic, who is to decide whether any particular specimen satisfies the concept of a monstrosity or not?* The type figure of S. taylori also shows a densely branched, cauliflower-like stroma (without perithecia) and might well come under the category of a “monstrosity”—in which case Massee’s later name C. henleyae (l.c.) would be applicable; but even C. henleyae does not typify the usual fructification of this parasite, being etiolated with long narrow branches. Lloyd (Mar., 1915, p. 8) remarked:

“I am not satisfied that C. taylori is the same plant as our photograph. The type is preserved at Kew and it has 15-20 immature branches, resembling the head of a Medusa. There are several collections (as our figure) received at a later date, at Kew and the British Museum, and referred to this species. Not one of them had more than four primary branches, and are quite different in appearance to me from the original specimen.

Both of the forms mentioned by Lloyd have been found growing on the same large moth larva (Trictena sp.—probably T. argeniata) in the Otway Ranges, Vic., where sporophores vary from simple or once-forked to intricately and much-branched structures. The present writer does not doubt that these represent one and the same species.

An interesting speculation arises: could all the populations of “C. taylori” be interpreted as merely a vigorous and obese development of C. robertsiit, adapted to growth on a much larger host (Trictena instead of the usual Oxycanus)? The actual perithecial differences between these two entities are very slight, and the criteria for separating them seem rather artificial—viz., size, shape and degree of branching. E. Cheel, as reported by Lloyd (1920, p. 911), made the suggestion that C. henleyae was merely a branched condition of C. robertsiit; but, from its robustness and choice of host (Trictena), the writer would certainly identify it with C. taylori. The fact that in Victoria one may find branched specimens of undoubted C.

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* Regarding monstrous forms, see apposite remarks by C.G.G.J. van Steenis in Flora Malesiana 5th: clxxi (May 1957).
robertsii on Oxycanus and unbranched examples of C. tayloiri on Trictena—perithecia being variable in both—indicates a strong affinity between the two. Yet, to sweep all the forms of robust C. tayloiri into the synonymy of slender C. robertsii would presuppose far more knowledge of these intriguing fungi (and their life-histories) than we possess. For the present, the writer prefers to retain the familiar name C. tayloiri (even if strictly illegitimate) and apply it to those massive, usually branched growths on Trictena in mountain country, leaving the solution of a major taxo-nomenclatural dilemma to abler investigators of the future.

As pointed out by Rodway (1920, p. 116), Olliff’s C. trictence (l.c.) is simply an inadvertent re-description of type C. tayloiri, based upon the selfsame illustration that accompanied Berkeley’s original account of Sphaeria tayloiri (1843). Lloyd’s name “C. melbourniensis” (1925, p. 1353) is provisional and has no standing; it was suggested, as a comment, with the recording of a curious form of C. tayloiri collected by C. C. Brittlebank (presumably near Melbourne, but most probably from Beech Forest in the Otway Ranges).

C. sp. [aff. C. entomorrhiza (Dickson) Fr.].

Host: Othononius batesii (Coleoptera—Scarabaeidae).


The single collection consists of a number of mummified cockchafer larvae, each with several fructifications (1-4 cm. long) from various parts of the body integuments; two stipes carry mature spore-bearing capitula. In aspect, gross morphology, colouration, ascal and spore details, the material can hardly be distinguished from C. aphodii J. Mathieson; yet the more compact perithecia are definitely arranged at right-angles to the capitular axis, not obliquely as in that Victorian species. By this feature it approaches the European C. entomorrhiza—a much larger plant with blackish sub-globose capitula about 6 mm. wide. One is tempted to query the reliability of perithecial orientation, as a primary feature in classifying Cordyceps, and to wonder whether C. aphodii and the undetermined fungus from Graman (N.S.W.) may, in fact, be forms of the same species.

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Cordyceps robertsi (Hook.) Berk.
(Specimens from Koonung Creek, Doncaster, Vic., on larvae of Oxycanus diremptus, June, 1942)
—Photo, by courtesy H. T. Reeves.
Cordyceps cranstounii Olliff.

(Specimens from Koonung Creek, Doncaster, Vic., on larvae of Oxycanus diremptus, June, 1942)

—Photo, by courtesy H. T. Reeves.
Cordyceps gunnii (Berk.) Berk.—figs. 1–3;

(Specimens from Koonung Creek, Doncaster, Vic., on larvae of Oxycanus diremptus, June, 1942)

—Photo, by courtesy H. T. Reeves.

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