

2.—THE HYMENOGASTRACEÆ OF TASMANIA.

Pl. III.

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The researches of systematic botanists in Australia have been chiefly directed to elucidate the members of the more conspicuous phyla. Inquiry into the Flowering plants, Gymnosperms, Pterydophyta, Bryophyta, and the larger marine Algæ has steadily progressed, though many forms belonging to most of these groups yet remain to be discovered and described. But when we come to the important groups of the freshwater Algæ and the Fungi we find information still in a very backward condition. There have been few workers in these groups and of these very few who have really specialised them. Most of the work has been done by students of the higher plants, who could not resist the temptation of collecting peculiar fungi they met with and sending them to Europe, where from time to time they have been recorded. The only works available to Australian students where a general review of the fungi has been attempted have been Hooker's "Flora Tasmania" and Cooke's "Australian Fungi." Besides these, McAlpine has published a classified list of Australian Fungi, and in the Royal Society's proceedings for 1897 appears a classified list of Tasmanian Fungi by myself. The freshwater Algæ of Australia have not yet had the advantage of even a classified list.

The publication of Cooke's "Australian Fungi" is really the first and only general account of the group, and stands as a base from which we could make further advance. There was no pretence that this book included even the majority of Australian species. It was published as a compilation of species known to date, with a full recognition of its incompleteness as a Handbook of Australian Fungi. Numbers of new species have been published since its appearance, and everyone who has made a study of this interesting group is well aware that the number of species yet to be described will probably run into thousands.

Cooke points out in his introduction to the Handbook that Australia is peculiarly rich in the Sub-class *Gastromycetes*. He says, after quoting figures:—"From this we conclude that *Gastromycetes* are unusually strong in Australia, certainly including some interesting genera not hitherto discovered elsewhere, but weak in subterranean species."

Discoveries since the publication of Cooke's work still bear out the general statement, but quite upset his conclusion that there is a paucity of underground *Gastromycetes*; so far from this being the case, Tasmania at least is so rich in these forms that if no more species are in future added from the mainland, it would still place the underground species for the Australian region as very high. Leaving the partially submerged groups, as *Scleroderma* and *Secotium*, on one side, and referring to what is generally known as underground forms, which is the sense intended by Cooke, we have in Tasmania twenty-one species, of which nineteen belong to the family of *Hymenogastraceæ*. This is in a described fungus-flora of under seven hundred species. In England, at the time of the publication of Massée's "*Fungus Flora*" (1892), there were 4,895 species, and the *Hymenogastraceæ* contained only twenty-three species.

Judging from these figures, we may conclude that in Tasmania at least, however backward may be the knowledge of other groups, we have described nearly, if not all, of our members of the *Hymenogaster* family; were it otherwise, we must possess a most astonishing number. The object of the present paper is to bring together our knowledge of this interesting family, information that is not at present at the service of local students. At the end of the paper a record will be included of the genus *Secotium*, because otherwise some of that group might be easily taken to be *Hymenogasters*, also because it is directly continuous with it.

For the information of those not acquainted with the systematic position of the family, some general statements may be permitted. There are many classes of fungi, but of these two stand out from the rest by containing all the species that attain a conspicuous size. These two classes are the *Ascomycetes* and the *Basidiomycetes*. In the first class the spores are borne in closed sacks or asci; in the second, the spores are borne upon basidia. A basidium is an enlarged cell upon which four, rarely fewer, or more, spicules are formed, upon the apex of each of which a spore

is developed. The Ascomycetes contain the little elf-cups so common everywhere; *Cyttaria* found on our Beech, *Morels*, the white mould of Roses, some underground species, and other forms which need not be considered further. In the Basidiomycetes the basidia are nearly always very numerous and closely packed upon the surface of gills, tubes, spines, or other apparatus for economically enlarging the surface, and, therefore, the spore output, but yet in some genera the surface is plain. We are familiar with gill-bearing forms in such *Agaries* as Mushroom and most Toadstools, with spinous forms in the Urchin, tube-bearing forms in Punk. In all these the layer of basidia forms a superficial membrane, and on account of this they are grouped together into a sub-class named Hymenomycetes.

But there is a large group of Basidiomycetes in which the basidia are not formed upon an exposed surface, but line convoluted tubes or spaces within the substance of the fungus, and the spores can only escape after maturity by the rupture or rotting of the outer case. This sub-class from the spore development taking place in a body that is enclosed within a coat of barren tissue is called *Gastromycetes*. We are all familiar with such forms in the Puffballs.

There is much variety amongst members of the *Gastromycetes*, and consequently they are divided into many families and genera. Most of the forms are superficial at maturity, and a common habit with these and some of the underground genera is for the spore-bearing portion to become dry and dusty at maturity, as in Puffball.

The family which is the subject of this paper consists of irregularly spherical, underground fungi, whose basidia line irregular chambers or convoluted tubes. The substance does not break down at maturity, and no provision is made for the exit of the spores. Dispersal takes place by rotting or more often subsequently to being eaten by small marsupials. Four parts of a tuber will be named. The outer barren coat is the peridium; the spore-bearing substance is the gleba; and there may be a sterile base; also, when the fungus is ripe, the barren part of the gleba between the spore spaces is the trama. The size of these fungi ranges from one to three centimetres diameter. The measurement of the spores is given in micromillimetres. A micromillimetre is $\frac{1}{1000}$ of a millimetre, or, roughly, $\frac{1}{25000}$ of an inch. Students may note that we have two underground tubers belonging to the Ascomycetes that may at first be mistaken for Hymenogasters. They are

Genabea tasmanica, Mass. et Rod. and *Stephensia varia*, Rod. The very evident spore production within asci will at once indicate where they belong. It will also be evident that classification is very artificial; this in our present knowledge of fungi is unavoidable.

The Hymenogastraceæ, therefore, are subspherical bodies, underground, or accidentally superficial at maturity, whose spores are produced on basidia which line the surface of irregular spaces in the substance of the gleba. The barren tissue of the gleba does not liquify or become in any way broken down at maturity. No special orifice is formed for the escape of spores, nor does the peridium burst at maturity, but the fungus depends for the dispersal of the contained spores upon rotting, or, more commonly, upon consumption by animals.

We have six genera of the family, and the following key will assist in their recognition:—

Spores spherical, nodulose or echinulate.

Peridium well developed. 1. *Hydnangium*.

Peridium, thin or none. 2. *Gymnomyces*.

Spores oblong, or if nearly globose, they are smooth.

Sterile base, none. Spores oblong, smooth.

Gleba gelatinous. 3. *Hysterangium*.

Gleba normal. 4. *Rhizopogon*.

Sterile base present. Spores seldom smooth. 5. *Hymenogaster*.

1. HYDNANGIUM, WALLR.

Peridium fleshy, sometimes thin, and membranous continuous with the trama. Gleba fleshy, crowded with irregular or tortuous spaces. Spores spherical, rough or echinulate, brown or pale. Sterile base well developed to quite obsolete.

Forms with a sterile base are sometimes placed in a separate genus, *Octaviana*, but this character is not always constant in individuals of the same species.

HYDNANGIUM TASMANICUM KALCHER.,

Subglobose, pale, 1-2 c.m. diameter. Peridium thick, continuous with the relatively thick trama. Spaces large,

1-3 m.m., irregular, dark brown, giving a marbled appearance in section. Spores brown, covered with very coarse nodules, 13 micron. Sterile base absent.

HYDNANGIUM AUSTRALIENSE, B. ET BR.

Subglobose, pale, 1-2 c.m. diameter. Peridium thin. Gleba pale, and exuding white fluid on section at least till old, becoming red-brown. Spaces numerous, small, tortuous, the trama thin. Sterile base sometimes slight in other specimens piercing the tuber to the apex. Spores pale yellow, coarsely warted, 10-12 micron.

HYDNANGIUM CARNEUM, WALLR.

An irregular tuber, 2-3 c.m. diameter, pale pink. Peridium very thin and delicate. Gleba friable, pink, hymenial spaces very crowded, rather large contorted, trama very thin. Sterile base present. Spores white, finely echinulate, 13-18 micron.

HYDNANGIUM ARCHERI, BERK.

"Obovate, small with a large sterile base, without febrils; gleba compact; spores globose, echinulate, 21-22 micron. diameter" (Cooke.) I have not met with this species.

2. GYMNOMYCES, MASS. ET ROD.

Peridium none or rudimentary. Gleba fleshy; hymenial spaces numerous, not much contorted, trama thin. Sterile base absent, except in a few isolated tubers. Spores hyaline, globose, rough, or echinulate.

GYMNOMYCES PALLIDUS, MASS. ET ROD.

("Kew Bulletin," June, 1898.)

Irregularly spherical, 2-3 c.m. diameter, nearly white, very fragile, with no apparent peridium. Gleba very pale; hymenial spaces about 1 m.m. diameter. Spores minutely warted, 9-10 micron.

In one specimen only amongst a considerable number was any sign of a sterile base found, and then it took the form of a slender process emerging from a depression.

GYMNOMYCES SEMINUDUS, MASS. ET ROD.

("Kew Bulletin," June, 1898.)

Very similar in form, size, and colour to the last, but of firmer consistency. Peridium thin, delicate, and silky. Gleba not very fragile, spaces small and irregular. Spores echinulate, 11-12 micron.

3. HYSTERANGIUM, VITT.

Peridium distinct, and not continuous with the trama. Gleba gelatinous, developing contorted hymenial cavities. Spores smooth, elliptical. Sterile base seldom present.

HYSTERANGIUM FUSISPORUM, MASS. ET ROD.

("Kew Bulletin," June, 1898.)

Subglobose, irregular, pale straw coloured, 1.5-2 c.m. Peridium very thin, membranous. A small sterile base is sometimes present. Gleba rather dense, pale, densely packed when mature with minute convoluted spaces. Spores smooth, broadly fusiform, with narrow acute ends, hyaline, 20-22 \times 8 micron.

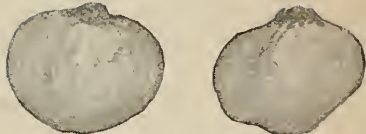
HYSTERANGIUM MEMBRANACEUM, VITT.

Irregularly spherical, white but readily marking with indigo if touched when young, very delicate consistency when fresh. Peridium thin, dry, white almost floccose. Gleba white when young, marking with indigo where cut, becoming pale brown when old. Spaces very small and numerous, convoluted. Sterile base present, and extending below into a root-like process. Spores elliptic, smooth, sometimes rather pointed at one end, 12 \times 5 micron.

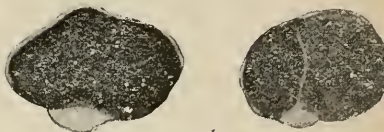
FIGS. 1 AND 2.



FIGS. 5 AND 5A.



FIGS. 6, 6A. AND 7.

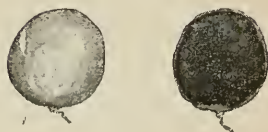


FIGS. 1A., 2A. AND 4.

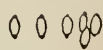


7.5 x 6 μ

FIGS. 9, 9A. AND 9B.

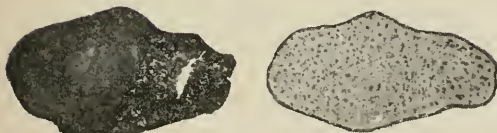


7 x 4 μ



11-13 x 5-6 μ

FIGS. 8, 8A. AND 8B.



12 x 18 μ



FIG. 9C.

FIG. 1-4—SECOTIUM GUNNII.

FIG. 8-8B.—HYSTERANGIUM VISCIDUM

FIG. 5-7—HYMENOGASTER VIOLACEUS.

FIG. 9-9C—HYSTERANGIUM AFFINE.

HYSTERANGIUM NEGLECTUM, MASS. ET ROD.

("Kew Bulletin," Sept. 1899.)

Irregular, 2-4 c.m. Peridium thick, smooth, fleshy sooty-brown. Gleba dense, dark rich brown, the spaces numerous, tortuous not as minute as in most species. Spores oblong, obtuse, smooth or obscurely rugulose, pale brown, $12-15 \times 8$ micron.

HYSTERANGIUM AFFINE, MASS. ET ROD.

("Kew Bulletin," June, 1898.)

More globose than most species, with the longer diameter erect and a root-like process from below, from under one to nearly two centimetres diameter. Peridium rather thick, fleshy pale brown. Gleba dense, somewhat greenish, spaces minute, tortuous, with generally much bluish gelatinous trama intervening. Sterile base very small. Spores pale, bluish green, oblong, not very obtuse, $11-13 \times 5-6$ micron.

VAR. IRREGULARE, MASS.—Less regular in form; peridium thinner; gleba brownish; spores very obtuse, 10×4 micron.

VAR. TENUISPORA, ROD.—Differs from the type in the thinner peridium, gleba darker, nearly black, and in the more slender spores, $12-14 \times 2.5-3$ micron.

HYSTERANGIUM CLATHROIDES, VITT.

Very irregular in shape, about 2 c.m. diamter. Peridium thin, floccose continuous, with surrounding mycelium. Gleba grey-hyaline, soft, almost waxy. Spaces not very tortuous nor crowded, narrow, pale brown. Spores oblong, pointed at both ends, smooth, pale brown, 10×5 micron.

HYSTERANGIUM VISCIDUM, MASS. ET ROD.

("Kew Bulletin.")

An irregular tuber, 3×1.5 c.m. Chocolate brown, with a viscid surface. Peridium gelatinous, rather thin. Gleba pale but dotted with the minute hymenial spaces, which are brown from the contained spores. Spores oblong, obtuse, papillate, yellowish brown, $14-15 \times 10$ micron.

4. RHIZOPOGON, TUL.

Peridium thick or thin, continuous with strands of mycelium which partially envelope the surface. Gleba dense, hymenial cavities very numerous, small, and contorted. Trama very thin subgelatinous. Spores oblong, smooth. Sterile base not developed. The genus is only separated from *Ilystrangium* by the mycelial strands arising from the surface.

RHIZOPOGON RUFESCENS, TUL.

Irregularly globose, 2-4 c.m. diameter. Surface pale at first, then pinkish brown. Peridium very thin, continuous with the trama and the surrounding mycelium, not generally apparent at maturity. Gleba white, sometimes cinerous, or brown when beyond maturity. Spores oblong, obtuse, smooth, 11×5 micron.

A common European species, found up to the present in Tasmania only beneath Austrian Pines. Probably introduced with that plant, and symbiotically associated with it.

5. HYMENOGASTER, TUL.

Peridium fleshy, generally thin. Gleba fleshy, the hymenial cavities small and irregular, trama thin, formed of elongated cells, not floccose nor gelatinous. Spores generally elliptic or fusiform, rarely nearly globose, generally rough, papillate, or sulcate, rarely smooth. Sterile base present, sometimes piercing the greater part of the gleba.

Like most genera of this family, not marked by any positive character. Distinguished by the consistence of the trama, sterile base, and elongated rough spores, with which are associated forms that appear to have a closer affinity here than elsewhere.

HYMENOGASTER ALBELLUS, MASS. ET ROD.

("Kew Bulletin," June, 1898.)

Irregularly globose, pale, 2-3 c.m. diameter. Peridium thin, cellular, distinct. Gleba pale brown, firm, the spaces not minute. Sterile base reduced to a flat cushion. Spores elliptic, obtuse, or with one or both ends narrow, yellowish brown, minutely warted, $16-17 \times 8-9$ micron.

HYMENOGASTER NANUS, MASS. ET ROD.

("Kew Bulletin," June, 1898.)

Irregularly globose, 1-3 c.m. Sooty brown, with a mucilaginous surface. Peridium rather thick, fleshy, the outer portion gelatinous, separable from the gleba. Gleba firm, light brown, spaces rather large. Sterile base well developed. Spores elliptic, subobtuse, brown, warted, $14-15 \times 8$ micron.

HYMENOGASTER RODWAYI, MASS.

("Kew Bulletin," June, 1898.)

Irregularly globose generally, 2-3 c.m. diameter, pale. Peridium very distinct, fleshy. Gleba dark brown, spaces small and irregular, showing an indistinct tendency to radiate from the sterile base towards the periphery. Sterile base usually conspicuous and giving off branching veins penetrating the gleba. Spores elliptic or lemon-shaped apiculate at one end, longitudinally ribbed, ribs simple, or forked and anastomosing, strong, converging at the ends, $20 \times 10-12$ micron.

HYMENOGASTER ALBIDUS, MASS. ET ROD

("Kew Bulletin," Sept. 1901.)

Irregularly globose, dirty white, 1-2 c.m. Peridium very thin floccose, continuous with the surrounding mycelium. Sterile base rudimentary or absent. Gleba pinkish white, turning light brown when dry, spaces tortuous, larger than in *H. Rodwayi*. Spores elliptic, pointed at one end, the other very obtuse; longitudinally ribbed or coarsely rugose, pale brown, $21-28 \times 14-18$ micron.

HYMENOGASTER VIOLACEUS, MASS. ET ROD.

("Kew Bulletin," June, 1898.)

Subglobose, violet and viscid, 2-3 c.m. Peridium thin but distinct. Gleba rather firm, brown. Spaces numerous, tortuous, about 1 m.m. diameter. Sterile base obsolete to very distinct in some specimens, a sterile vein running right through the gleba to the apex. Spores globose-elliptic, brown, minutely warted, 7×9 micron.

HYMENOGASTER LEVISPORUS, MASS. ET ROD.

("Kew Bulletin.")

Irregularly globose, white, 2-3 c.m. Peridium very thin, subfloccose, continuous with the surrounding mycelium. Gleba rather dense, pale brown, spaces small. Spores pale brown, spherical, or nearly so, smooth, 10-11 micron.

5. SECOTIUM.

In Cooke's "Handbook of Australian Fungi" *Secotium* is placed in *Lycoperdaceæ*, a family characterised by apical dehiscence and a disintegrated gleba at maturity. In *Secotium* the trama is persistent, arranged in crumpled plates, radiating from the columella and dehiscence occurs by a basal cleft round the stem. A typical *Secotium* has a well-developed stem, which pierces the gleba to the apex, and there expands, and is continuous with the peridium. In the lower part the surface of the peridium assumes the character of an arachnoid volva covering the groove. In some Tasmanian forms the stem is almost reduced to the sterile base of *Hymenogaster*, and then the fungus is seldom exposed above ground, except by accident. *S. Gunnii* often has the appearance of a deformed *Agaric*, and the natural position of the genus appears to be intermediate between the *Gastromycetes* and the *Agaric* family of *Hymenomycetes*.

From Tasmania four species have been described.

SECOTIUM ERYTHROCEPHALUM, TUL.

"Gregarious, rather long stemmed; stem erect, smooth, naked, white, narrowly fistulose; peridium innate, simple, even, smooth, carmine-red; cells unequal, large, septa thin, distinct, destitute of flocci, basidia arising from the walls bearing 2-4 spores; spores elliptic, even, brown on long sterigmata, 10-11 \times 5 micron."—Cooke's "Handbook." I have seen no specimen.

SECOTIUM GUNNII, BERK.

Irregularly globose, pale, smooth, 2-4 c.m. diameter; stem solid, short, thick, continuous with the peridium

above. Gleba pale brown, the tramal plates thin, radiating, and very distorted. Basidia clavate, tetrasporous. Spores brown, smooth, elliptic apiculate at one end, 7×4 micron.

SECOTIUM RODWAYI, MASS.

("Kew Bulletin," Sept., 1901.)

Subglobose, fleshy, cream-coloured, smooth or tomentose deeply excavated below. Stem very short, usually piercing the gleba to the apex, where it is continuous with the thin peridium, in some specimens much reduced above. Gleba rather dense, pale cream-coloured. Cystidia and Basidia pyriform about the same size. Spores globose, colourless, verruculose, 7-8 micron.

SECOTIUM SESSILE, MASS. ET ROD.

("Kew Bulletin.")

Subglobose, 2-3 c.m. diameter, pure white, and delicate. Peridium very thin. Stem short, usually vanishing in the gleba. Cystidia fusiform, much exceeding the basidia. Spores globose, colourless, minutely verruculose, 7-8 micron.
