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Apodya Lactea, Cornu (Leptomitrus Lacteus, Agardh), One of the Saprolegniaceæ

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Among the plants collected to-day may be mentioned—*Draba incana*, L., very large; *Vicia sylvatica*, L., on rocks above the loch; *Potentilla salisburgensis*, Hænke, in fruit; *Saussurea alpina*, DC.; *Hieracium anglicum*, Fr.; *H. cerinthiforme*, Backh. in lit.; *H. prenanthoides*, Vill.; *Juncus castaneus*, L.; *Carex atrata*, L.; *Avena pratensis*, L., var. *alpina*, Smith; *Woodsia hyperborea*, Br.,—this fern was gathered both by Dr. Paul and Mr. Gunn.

Saturday, 7th August 1897.—To-day the members of the Club returned home. The Caledonian Railway officials again honoured the Club by providing a fine saloon carriage to bring the members from Killin to Edinburgh. Thus ended a most pleasant and, at the same time, a very profitable excursion.

It was, however, a great disappointment that neither on Beinn Heasgarnich nor on Ben Lawers did the members pick *Carex ustulata*. It is known to grow on the first of these mountains, and on Ben Lawers it was discovered by the famous botanist Don in 1810, and was not again gathered on Ben Lawers till 1892, when it was picked by Dr. Paul during an excursion of this Club. On both days, however, the members had far too little time to search properly for the plant.

APODYA LACTEA, CORNU (LEPTOMITUS LACTEUS, AGARDH), one of the SAPROLEGNIACEÆ. Described by ROBERT TURNBULL, B.Sc., Lecturer on Botany, School of Medicine of the Royal Colleges, Edinburgh. (With Plate.)

(Read 10th March 1898.)

During January 1898 I received specimens of *Apodya lactea*, from the Ringorm Burn, which flows into the Spey. The fungus was found attached to stones, decaying branches, grass, etc., in the bed of the stream, below the point where the effluent from a distillery entered. I also procured specimens from the Aberlour Burn; and the fungus is common in the Fiddich,—both streams receiving discharges from distilleries, and flowing into the Spey.

I am informed by Prof. J. W. H. Trail, of Aberdeen University, that the *Apodya* is found in the river Don, below certain paper works.

G. Massee, of Kew Gardens, states in the "British Fungi" (*Phycomycetes* and *Ustilaginæ*) that the fungus is found in ditches and rivers, attached to wood, aquatic plants, etc., and that it is not uncommon.

Prof. E. Warming, of Copenhagen University, says (p. 108, "Systematic Botany," Engl. transl. by Prof. Potter), that *Leptomitus lacteus*, Agardh, is frequent in the waste matter from sugar factories.

Since the fungus appears in streams which receive organic discharges, it must be regarded as an index of such discharges; in other words, it is an index of pollution.

Massee describes it (p. 129, op. cit.) as "forming tassel-like waving tufts, attached at the base, dirty white, and slimy; filaments up to 5 cm. long, and 6–12 μ thick, constricted at intervals, dichotomously branched, flaccid."

My observations confirm all these characters, except the thickness of the filaments and the nature of the branching. The average thickness of the filaments is 10–15 μ ; the young branches are about 5 μ thick; the older branches just below the constrictions may be as thick as 30 μ , while in one instance I found the width below the constriction to be 40 μ .

The branching in every case is lateral, and not dichotomous as stated by Massee, but the branches ultimately become as vigorous as the parent shoots, and simulate true dichotomy.

While the branches mostly arise singly, I have found and figured opposite branches, which are rare. The ordinary vegetative branches always arise immediately below the constrictions, as shown in the photographs.

Schenk, in his "Handbuch der Botanik," Band iv. fig. 62 p. 374, shows papillæ arising laterally from the middle of the zoosporangia; these are the papillæ by which the germinated zoospores ultimately escape.

Saccardo describes the fungus as follows:—"Hyphæ constricted at regular intervals, sparingly branched; zoosporangia formed from the terminal portions of the branches,

one or several superposed; zoogonidia maturing within the zoosporangium and not escaping until after germination."—*Leptomitus*, Agardh, Syst. Alg. p. 50; Sacc. Syll. vii. p. 265.

The only exception to this description is that the constrictions occur very irregularly.

When the fungus is alive, its highly granular protoplasm is in a state of very active circulation. Spherical or polyhedral cellulín-grains are found, usually singly, scattered throughout the filaments, but chiefly at the constrictions, and are mostly large enough to fill up the diameter of the filament.

"The cellulín-grains, discovered by Pringsheim in the hyphæ of various *Saprolegniaceæ*, have sometimes the form of round or polyhedral plates and are sometimes globular, and often show evident stratification. They are not coloured by iodine solutions, and are even insoluble in concentrated caustic potash solution, but soluble in concentrated sulphuric acid and in a solution of zinc chloride. Nothing is known of their chemical constitution."—(Botanical Microtechnique, by Dr. A. Zimmermann, Engl. transl. by Humphrey, p. 231; *vide* "Ueber Cellulínkörner, Ber. d. D. botan. Ges. 1883, p. 288,—Pringsheim.")

To preserve the fungus, and at the same time stain it for microscopic examination, I placed it in a one per cent. solution of osmic acid for twenty-four hours; this darkened the granular protoplasm and the cell walls, and thus improved them for photographic purposes, but the cellulín-grains were only very slightly darkened. The cellulín-grains seem to have a denser external layer and a less dense central portion, for the outer layer has the appearance of a thick cell-wall.

Although the chemical constitution of these cellulín-grains is unknown, it is probable that they are forms of reserve food material.

The zoosporangia seem to be developed as terminal shoots. The end of a hypha becomes densely granular and opaque, reaching a length of 200–220 μ and a breadth of 15–20 μ , then a constriction appears just behind the apex, and growth takes place both in front of and behind

the constriction; the older portion may ultimately lengthen to 260μ , while the apical portion may give rise to another constriction just behind its apex, and thus three superposed zoosporangia are formed. I have found two commonly, three rarely, superposed. At the constriction separating adjoining zoosporangia the passage becomes so narrow as to prevent the escape of zoospores from one sporangium into the other.

The zoospores (or zoogonidia) do not escape from the zoosporangia, but germinate inside the zoosporangia before escaping; the germinated zoospores are mostly spherical, and average 13μ in diameter.

I have not observed the sexual stage in any of the material examined. *Apodya lactea*, Cornu, is a saprophyte throughout its whole life, and thus differs from *Saprolegnia ferox*, which represents the most closely related genus in the same order, *Saprolegniaceae*. *Saprolegnia ferox*, the cause of salmon disease, is normally a saprophyte, living on dead fish, etc., but it is also a facultative parasite, and lives on the tissues of the living fish.

The food of *Apodya* is organic matter, both nitrogenous and carbonaceous; the fungus, in common with all the *Phycomycetes*, to which sub-class it belongs, is a rapid grower, and also as rapid in its decay.

Such a fungus, the existence of which depends on pollution, absorbs some of the organic matter from the water, but sooner or later it gives off decaying strands which readily putrefy in passing down the stream. It has been stated that the fungus floats on the surface, but I have found that, whether living or dead, it always sinks in still water.

In conclusion, the action of *Apodya* is threefold:—It removes oxygen from, and gives off carbon dioxide to, the water, during its own life; it takes the place of green plants which act beneficially by removing carbon dioxide from, and returning oxygen to, the water; it removes temporarily some of the organic polluting matter, and returns it to the water afterwards in a putrescent condition during the decay of its cast-off strands.

The photomicrographs have been taken from specimens mounted permanently in osmic acid, and for the careful

Fig. 1. $\times 300$.

Fig. 2. $\times 300$.

Fig. 6. $\times 250$.

Fig. 3. $\times 250$.

Fig. 4. $\times 300$.

Fig. 5. $\times 250$.

Fig. 7. $\times 300$.

Photomicrographs by
A. Turnbull.

APODYA LACTEA, CORNU.

developing of these I am indebted to my laboratory assistant, Mr. Wm. M. Miller.

Explanation of figures of *Apodya lactea*, Cornu:—

1. Lateral branch beginning below a constriction.
2. Lateral branch lengthening.
3. General appearance of fungus, showing branching, constrictions, granular protoplasm, and two highly refractive cellululin-grains (near the foot of the figure).
4. Rarer form of opposite branches. Observe large cellululin-grain at the base of the main filament, and another above the constriction.
5. Two pairs of zoosporangia.
6. Two zoosporangia, superposed, showing attachment to filament at base.
7. Old zoosporangium, showing germinated zoospores (zoogonidia) internally. Observe several cellululin-grains in the other filaments.

THE RELATION BETWEEN THE COLOUR OF DAFFODILS AND
THE COMPOSITION OF THE SOILS IN WHICH THEY ARE GROWN.
By A. P. AITKEN, D.Sc.

(Read 10th March 1898.)

At a recent meeting of the Society a discussion arose regarding the depth or brilliance of colour assumed by the same species of plant according to a variety of external circumstances, such as the height above the sea-level, the latitude, and the exposure. It seemed probable that the quality of sunlight which reached a plant would be most likely to cause colour differences of the kind in question. It was the experience of members of the Society accustomed to mountaineering that the colours of many of the commoner flowers found at all altitudes were brighter the higher the level at which they were grown. It seemed probable that this might be attributable to the different quality of light at higher levels where the sun's rays were filtered through a thinner stratum of atmosphere. It is well known that the atmosphere in our latitude not only absorbs fully one-third of the total light that should reach it from the sun, but that it also exercises a selective function in absorbing some of the light rays more than others, viz. those towards the violet end of the spectrum. That such a sifting of light might affect the intensity of