

# **NATURAL HISTORY OF THE DANISH LICHENS**

**ORIGINAL INVESTIGATIONS BASED UPON  
NEW PRINCIPLES**

**BY**  
**OLAF GALLØE**  
**PH. D.**

**PART VI**



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**EJNAR MUNKSGAARD**  
**COPENHAGEN . MCMXXXIX**







DANISH LICHENS



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*Omnis vera cognitio speciei  
e cognitione individui. .*



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EJNAR MUNKSGAARD  
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## INTRODUCTION

The present volume, Part VI, deals exclusively with lichens belonging to the group *Cyanophili*. This group is distinguished by its genera and species being chiefly, but not exclusively, provided with *Cyanophyceæ* as gonidia. Accordingly, there is as much reason to separate this group of lichens from other *Ascolichenes* as to separate the latter group as a whole from the *Ascomycetes*. And logical as it would be to dispose the *Ascolichenes* into their proper taxonomical places among the *Ascomycetes*, just as logical it would be to abolish the group of *Cyanophili* and intercalate its genera and species among other *Ascolichenes* and *Ascomycetes*. But for the present it may prove rather useful to describe the cyanophilous lichens separately, though the distant goal of taxonomical investigations must be to arrange the species in such a way that their phylogeny is rendered directly perspicuous, i. e. to arrange them—not in 'families' or other large or small systematic groups—but in phylogenetic series or 'Stammbäume', visualizing the descent of each species from its prototype.

In this country we have but a modest number of cyanophilous lichens, too few to give any comprehensive idea of the phylogeny or taxonomic position of the group. Therefore, if we were to form a well founded opinion concerning the place of our species in the whole group and their phylogeny, it would be necessary to know—to the finest details—at least—all other *Cyanophili* of foreign countries and their closely allied species among chlorophilous lichens. Such a knowledge of the intimatest natural history of the species is, however, quite out of the question at present and will not be procured till lichenologists all over the world will devote their efforts to examining all the species in their finest, morphological as well as anatomical, details, and picture them completely, considering that verbal descriptions as such are too imperfect for a comparative natural history and a real and well-founded phylogenetic taxonomy to be based upon them.

From the knowledge of the morphology and anatomy of the cyanophilous lichens, available at present, it is evident that our Danish species are of polyphyletic origin.

*Pyrenopsis* and *Thyrea* are usually referred to the same 'family', *Pyrenopsidaceæ*, as closely allied genera. Morphologically and anatomically, however, they differ very



much. Whether they really are closely allied, or from what other lichens or ascomycetes they may be descended, we cannot at present know with any certainty, because their near relations are too incompletely examined, and particularly too poorly pictured, in the lichenological literature.

*Porocyphus*, *Polychidium*, and *Ephebe* are likewise referred to one family, *Ephebaceæ*. Even these genera, however, seem to differ so widely in structure, anatomically as well as morphologically, that their mutual connection is very dubious, as is evident from a careful examination of the pictures given here. They differ especially so much in the structure of their apothecia that their relationship is thereby rendered little probable. But we are not as yet able to imagine from what other lichens or ascomycetes each of them may be descended.

The structure of the apothecium in *Lichina* really reminds of the apothecium of *Porocyphus* in several features; possibly we may be justified in considering the micro-coralline thallus of the latter genus as a prototype of the micro-thamnoblastic thallus of *Lichina*. That the two genera house different gonidia does not disprove their relationship in any decisive way. We are well acquainted with analogous differences in genera still more closely allied (e. g. in *Peltigera* and *Peltidea*).

*Collema* and *Leptogium* are in fact so closely allied that they pass imperceptibly into one another. From what other lichens or ascomycetes they may be descended is difficult to say, but it does not seem improbable that they may be allied to some species of *Gyalectaceæ*. Their apothecia and spores remind not a little of those occurring in e. g. *Pachyphiale* and *Bryophagus* (vide Part III, Plates 17—25).

*Placynthium* reminds somewhat of the genus *Belimbia* among the chlorophilous lichens and may possibly be descended from that genus; there is especially a rather great likeness between *Placynthium nigrum* and *Belimbia melana* (vide Part II, Plates 77—78).

*Crocynia*. *Crocynia neglecta* was formerly—and with full right—referred to *Lecidea* and is no doubt descended from that genus. Whether it is at all related to our other cyanophilous genera is doubtful. *Crocynia lanuginosa* reminds of *Crocynia neglecta* in anatomical structure, but whether it is really related to the latter species is not certain, as its apothecia are unknown. Both species are chlorophilous.

*Parmeliella*. This genus is lecideine as regards the structure of the apothecia and may naturally be considered as a genus derived from species of *Lecidea* which have exchanged their *Chlorogonidia* with *Cyanogonidia*.

The most primitive of our species is *Parmeliella lepidiota*, while *Parmeliella plumbea* stands on a higher level of differentiation with its pronounced microphylline thallus (analogous to the genus *Psora*, which likewise seems to be derived from *Lecidea*).

The species of *Pannaria* have lecanorine apothecia and may no doubt be regarded as being directly descended from either *Lecidea* or *Lecanora*. Which of the alternatives has been realized in nature can scarcely be settled with any certainty.

*Pannaria nebulosa* stands at the lowest stage of differentiation; next follow, with

increasing degrees of differentiation, *Pannaria pezizoides*, *rubiginosa*, and *coeruleobadia*.

*Massalongia* has an indistinctly lecanorine apothecium with few gonidia. Anatomically and morphologically it ranges with *Pannaria*, but the spores are two-celled. Possibly it is descended from another genus than *Lecidea*—possibly from a *Catillaria-Bilimbia*, or directly from an ascomycete.

In all its structural details the genus *Psoroma* is so very similar to *Lecanora* that it had better be referred to that genus, from which it is no doubt descended.

Anatomically our species of *Lobaria* have so much in common with *Massalongia* that it may be considered probable that they are descended from the latter genus. A common feature of the two genera is that the calyx does not go upwards round the vertical sides of the hymenium, which therefore is directly covered by a thalline cortex. This structural feature is likewise found in the genera *Solorina*, *Nephroma*, and *Peltigera*. The spores of *Lobaria scrobiculata* and *Massalongia carnosa* greatly agree in structure too, just as *Massalongia* bears a rather fair resemblance to our other species of *Lobaria*. In this work the species are arranged from the most primitive species to the most differentiated species: *Lobaria scrobiculata*, *laetevirens*, *amplissima*, *pulmonaria*.

*Solorina*. The most primitive species is *Solorina sponogiosa* with a crustaceous-microphylline thallus and sessile apothecia; *Solorina saccata* is more advanced with a polyphyllous thallus and immersed apothecia. The relationship between this genus and *Peltigera*, both of which genera are referred to the same 'family', is scarcely intelligible when considering the very great difference of their spores. But, as mentioned above, the genera *Massalongia*, *Lobaria*, *Solorina*, *Nephroma*, and *Peltigera* resemble each other in their calyces being so poorly developed that it does not surround the vertical sides of the hymenium. Possibly, *Massalongia* might be looked upon as the ancestor of *Lobaria*, as the two genera have sessile apothecia, while *Solorina sponogiosa*

species of *Solorina*, partly of *Nephroma* and *Peltigera*. It must, however, be admitted that a smooth transition between the spores of *Solorina*, *Nephroma*, and *Peltigera* is not directly evident. It is to be hoped that the connection between the mentioned genera will be more perspicuous when in future other lichenologists will devote themselves to examining and especially picturing the lichens in question so exactly that it may be rendered possible through a direct inspection of the pictures to settle whether there is any relationship between them or not. For the present time I have but my own limited researches of our Danish lichens to rely upon, and therefore the connection suggested here must of necessity be very hypothetical.

The apothecia of *Nephroma* are developed on the lower surface of the thallus, while those of *Peltigera* are situated on its upper surface. This difference, great and striking as it may seem, is really of less importance, as the distal meristematic edge of the lobes of thallus, lying before and outside the gonidia, may be rightly considered as belonging to the lower surface of the thallus. In that case the resemblance



of the two genera is greatly increased as the primordia of apothecia in the species of both genera examined by me are developed just in this meristematic tissue constituting the transition from the upper to the lower surface of the thallus lying *outside the gonidia*, as shown in Fig. 424, 426, 428, 450, 527, and 530.

In *Nephroma* the spores are brownish, short, and few-celled. In some species of *Peltigera* the spores are likewise rather few-celled and occasionally slightly brown. I place these species at the beginning of my descriptions, as they seem to be primitive in other respects too.

As a further resemblance between *Nephroma* and *Peltigera* may be added that in *Peltigera rufescens* I succeeded in finding adventive apothecia on the lower surface of the thallus — as in *Nephroma*.

In the preceding volumes crustaceous lichens have exclusively been dealt with, together with some few lichens, close relations of crustaceous lichens, provided, however, with squamulose, microphylline thalli, viz. the lecideine species *Psora ostreata* and *Psora demissa* Rutstr., moreover the lecanorine species *Placodium circinatum* Pers., *Placodium saxicola* Poll., *Placodium cartilagineum* Ach., *Candelariella vitellina* Ehrh., *Candelaria concolor* Dicks. *Acarospora fuscata* might be added to these species. Common to all these species is the occurrence of a rhizoidal zone spreading into the substratum and producing squamules of thallus, which may be looked upon as a kind of transformed areoles; instead of growing vertically and centrically upwards from the substratum these areoles proceed in growing more or less laterally, at the same time often growing centrifugally (as regards the centre of the thallus), overlapping and overshadowing each other. Interesting transitional forms of thalli exist, connecting granular or areolate crustaceous thalli with the markedly squamulose-microphylline thalli, *vide f. inst. Aspicilia contorta* Ach. (Part V, Plate 9, Fig. 47) and in part also *Lecidea flexuosa* (Fr.) Nyl. (Part I, Plate 24, Fig. 57). Through these squamulose thalli there is a very smooth transition from the purely crustaceous, through the microphylline, to the more broadly lobed, foliaceous lichens — as we shall meet them for the first time in the present volume.

Among our cyanophilous lichens we find several very interesting phylogenetic series of lichens, beginning with purely crustaceous forms and continuing into distinctly foliaceous lichens, thus giving an important and perspicuous account of the origin of the foliaceous thallus. The following series may be pointed at as illustrations, but otherwise the student is referred to the explicit descriptions under each species respectively.

1. *Collema*. Among our Danish species of *Collema*, *Collema glaucescens* takes up the lowest station as the most original and primitive species, having a thallus composed of numerous small lobules, each of which was originally formed as a small granule issuing from the rhizoidal layer and later on assuming the character of more pronouncedly foliaceous lobes. From this species there is a series of intermediate species to the highest foliaceous and monophyllous species as *f. inst. Collema rupestre*.

2. *Leptogium*. The most primitive among our species is probably *Leptogium microphyllum*, which species is so markedly microphylline that it might be considered a merely crustaceous lichen. All our other species are far more foliaceous.

3. *Pannaria*. Our most primitive species is *Pannaria nebulosa* with a granular-crustaceous thallus of numerous small granules resting on a common rhizoidal layer. From this species the finely microphylline *Pannaria pezizoides* is presumably derived; *Pannaria rubiginosa* and *Pannaria coeruleobadia*, both of which are far more broadly lobed, are the highest developed species.

4. *Solorina*. *Solorina spongiosa* with its granular-crustaceous thallus is the most primitive species. *Solorina saccata* is far more markedly foliaceous with its polyphyllous thallus, composed of several foliaceous lobes.

5. *Peltigera*. None of our species is crustaceous or really microphylline; even the most diminutive species have rather conspicuous lobes of thallus. But even among these macrophylline species, however much they may seem to be removed from primitive crustaceous prototypes, it is still possible to discern an evolution beginning with primitive species such as *Peltigera venosa* and *Peltigera spuria*. Both of these have a thallus composed of numerous, rather small lobes directly protruding from the soil-substratum and at the base cohering through a common rhizoidal layer spreading in the ground. So far these species are analogous to f. inst. *Collema glaucescens*, the lobes of which are of a similar origin. In the more broadly lobed species the thallus usually has the shape of a rosette, big and stately, composed of lobes, the origin of which it is difficult or impossible to ascertain in fully developed specimens. In not a few cases I succeeded in detecting that such a rosette (*vide e. g. Peltigera canina*) had started its existence in the likeness of a small lobe of thallus, at the base fixed to the substratum and from there spreading over the ground while repeatedly branching and finally resulting in the lobes assuming the form of a regular, orbicular rosette, which next spreads centrifugally over the substratum. A thallus, so fully developed, imparts a false idea of having a really centric structure, having grown equally in all directions from a central, germinative point as f. inst. a *Gyrophora pustulata*. In reality, however, the thallus originally had an absolutely lateral structure.

When dealing with other foliaceous lichens (*Parmelia*, *Physcia*, etc.) in future volumes of this work we shall learn that this type of lateral and pseudo-centric thalli is very common among the named genera.

Accordingly, we must discriminate between two types of foliaceous thalli: the polyphyllous thallus and the monophyllous thallus.

The *polyphyllous thallus* is — as in *Collema glaucescens* — composed of several lobes, each of them being originally formed as relatively independent lobes, while they all cohere at the base by means of a common rhizoidal layer. To this primitive type we shall have to refer even the genus *Cladonia*, the primary squamules of which — as will be described at its proper place — are formed in a mode analogous to that occurring in *Collema glaucescens*.

The *monophyllous thallus* begins its existence as a single unbranched, basifixed

lobe of thallus, and by degrees it assumes, through repeated branching, the ordinary shape of a rosette occurring in so many foliaceous lichens; accordingly, this type is not a truly centric but a pseudo-centric and lateral type of thallus.

The fully developed thallus of foliaceous lichens does not usually offer us any chance of detecting whether it is of polyphyllous or monophyllous origin. Thus it is of great taxonomical and phylogenetic importance that young specimens of each species should be submitted to careful examinations, and it must be emphatically underlined that researches of this kind will offer powerful contributions to a real and scientifically founded idea concerning the phylogeny of the respective species — the ultimate object of taxonomy.



# PYRENOPSIS





## PYRENOPSIS IMPOLITA.

TH. FR.

(Plate 1—2).

On granite. *Almindingen, Bornholm* 1884. *HELLBOM* 1884.

The thallus is crustaceous, black, with a thin margin of radiating, recently formed, small areoles but without any distinct, free hyphæ. Methathallus is granular-areolate, with thinner and thicker areoles. The thicker areoles have an irregular outline and a rather even surface. The hyphæ of the thallus are scantily developed, at any rate in some places. The gonidia are greatly prevailing. The principal gonidia are *Gloeocapsa* cells with thick, red cell-walls, but filaments of *Stigonema* also occur among these, and finally occur not a few Cyanophyceæ of a *Microcystis*-like aspect. Thin colourless hyphæ without haustoria are spreading among the algæ and penetrating their gelatinous walls. The thallus is homoeomerous; still, the hyphæ are most abundant in the basal parts of the thallus on the substratum.

The apothecia are formed singly in each of the big areoles. They have a well developed, colourless stipes, above passing gradually into a sub-hymenial tissue representing a calyx, which, however, has very poorly developed sides and no proper margin. The hymenium consists of thin paraphyses, the apices of which are almost colourless and not thickened. Asci are clavate, their walls thin at the top; in the only ripe ascus observed in my sections there were five globular, colourless spores, 7—10  $\mu$  in diameter.

In order to reach the right interpretation of the phylogeny of this species it is of some importance to emphasize that the apothecia may be considered either as immersed in the big areoles or as apothecia with a thalline margin. One interpretation is no better than the other; both of them are of equal validity until the other species of this genus and its close relations have been subjected to an anatomical examination, by which the question will be settled.

One single pycnidium was observed; it was immersed, with a colourless peritheciium of short cells, from the inner side of which conidiiferous hyphæ were radiating towards the centre. The apical cell of each hypha cuts off a conidium.

Note. According to *LOTHAR GEITLER* (in litteris) this '*Microcystis*' mentioned above cannot be determined with any certainty; in this description, therefore, I put a mark of interrogation at that name to indicate its dubiousness.



THYREA





## THYREA PULVINATA.

SCHAER.

(Plate 3).

A Swedish specimen from *Visby, Gotland*. DU RIETZ. In HELLBOM's list of the lichens of *Bornholm* this species is recorded from a locality between *Hammershus* and *Allinge*. However, no specimen of this species is left in HELLBOM's herbarium deposited in the Botanical Gardens of *Gothenburg* in *Sweden*. Whether therefore HELLBOM's record is correct cannot now be settled with any certainty.

In order to show the structure of this species some pictures are given here, based upon examination of two Swedish specimens gathered by DU RIETZ in *Gotland*.

The thallus has the form of a minute tuft of blackish colour, in part whitish-pruinose, fixed to the substratum by a small central umbilicus. The whole of the tuft consists of a single — repeatedly branched — lobe, at the base fixed to the substratum by the above-mentioned umbilicus and provided with branched lobes forming together the whole of the tuft, which accordingly is of a monophyllous origin. The mode of branching of the lobes can be better shown in the figures.

The thallus is provided with *Xanthocapsa*-gonidia with thick gelatinous cell-walls. Near the upper and lower surfaces of the thallus the gonidia are greatly crowded and have brown walls. In the interior of the thallus gonidia are almost entirely absent; their gelatine, however, is left, and in this gelatine the hyphæ branch, running chiefly lengthwise in the lobes of the thallus and going from there outwards to the surfaces of the thallus, where the apical cells of the hyphæ repeatedly branch dichotomously and come into contact, each of them with one algal cell. Here and there dead, empty gonidia occur, still being in contact with their adhering hyphæ. However, it does not seem probable that the symbiosis of the alga and the hypha always ends in the alga being killed. On the contrary, most often the gonidia repeatedly divide, and at each division the new-formed gonidial algæ are attacked by new-formed hyphæ, which penetrate into the gelatinous walls of the algæ, where they stop growing at a short distance from the cytoplasm. The latter gets slightly depressed in front of the apex of the hyphæ but is not penetrated by it.

The anatomical conditions observed in my microtome sections fully agree with the observations on the symbiosis, published by LOTHAR GEITLER.

On the surfaces of the thallus the hyphæ do not develop any cortex.

Apothecia and pycnidia did not occur in the specimens examined.





POROCYPHUS



## POROCYPHUS AREOLATUS.

FLÖT.

(Plate 4—5)

On granite. *Hammeren, Bornholm.* HELLBOM 1884.

The thallus is crustaceous, black. At the margin there are precurrent, young primordia of areoles. The methathallus is areolate, with indistinct inter-areolate connecting tissues. The areoles have an irregular outline and are confluent; their surface is finely granular. In anatomical sections each areole is seen to be composed of extremely minute, coralline, brown branches, the surfaces of which are deeply dark-brown, while their interior contains short-celled hyphæ branching in the gelatinous cell-walls of *Scytonema*, which latter serves as gonidia. Between these dark coralline portions of the thallus is an 'inter-coralline' tissue of short-celled, colourless hyphæ with scanty colonies of a very small-celled *Cyanophycea* of a *Microcystis*-like appearance, mingled with scanty threads of *Scytomena*.

The apothecia are orbicular, with a very narrow disc and a thick margin; each of them is formed in one of the dark coralline portions of the thallus. The apothecia consist of a colourless calyx without a stipes, composed of short-celled hyphæ situated partly beneath and partly round the sides of the hymenium. At the outside the calyx is covered by a *margothallinus*. The paraphyses are long-celled, not thickened at the tips, and—in thin sections—almost colourless. Asci are long, cylindric, constricted at the top. They contain eight colourless, one-celled spores, about 14—16  $\mu$  long.

Pycnidia were not observed.





EPHEBE





## EPHEBE LANATA.

L.

(Plate 6—7—8).

**Specimen 1.** On granite, in part growing among mosses. *Almindingen* in *Bornholm*. L. K. ROSENVINGE.

The thallus is formed as a centrifugally growing, dwarfy tuft, composed of black — or in places greyish — procumbent, profusely and irregularly branched podetia; in some places the podetia are rather regularly dichotomous. The youngest of the branches are extremely thin and ascendant, while the older ones are stouter and often dark and felted owing to numerous slender branches or to gonidia protruding from the surface. Undoubtedly, each branch may die out at the base and continue growing at the top.

The gonidial alga is a *Stigonema*, in the gelatinous cell-walls of which the hyphæ are spreading. The explanation of the figures gives detailed information of these conditions. In the youngest branches of the thallus the cells of *Stigonema* are placed axially, enveloped by longitudinal hyphæ; the latter gradually issue transverse hyphæ penetrating between the cells of *Stigonema*. In the older portions of the thallus the gonidia are chiefly placed near the surface, covered by a thin layer of hyphæ, while the axial portions are occupied by the hyphæ. Branches of *Stigonema* may everywhere penetrate through the thin cortex and in time be transformed into fresh branches of thallus. In the procumbent podetia the gonidia are often placed somewhat dorsiventrally, being more numerous at the biological upper surface.

Apothecia and pycnidia were not observed, either in this or in any other Danish specimen examined by me.

**Specimen 2.** Collected by L. K. ROSENVINGE in the same locality as specimen 1.

This specimen resembles specimen 1 in all details and is only mentioned here because the basal portions of the tuft were filled in part with grains of sand, fixed to the hyphæ as shown in the figures.

This tuft also showed how branches, which are turned downwards according to

their morphological position, adhere to the substratum by means of their disciform, widened tips.

**Specimen 3.** A Swedish specimen, from *Bohuslän*, legit A. H. MAGNUSSON.  
This specimen was provided with apothecia, of which the figures give information.

# POLYCHIDIUM





## POLYCHIDIUM MUSCICOLA.

Sw.

(Plate 9—10).

On a roof thatched with *Psamma arenaria*. *Kandestederne, Jutland*.

The thallus has the shape of a small tuft growing centrifugally among the moss on a roof thatched with *Psamma arenaria*. The basal parts of the tuft are mingled with sand deposited by sand-drifts frequent in that country. The thallus is composed of chiefly erect branches, the basal parts of which are evanescent, while the other parts are richly and irregularly branched and interlaced mutually and with the moss. The youngest tips of the branches are regularly dichotomous, but rather soon this regularity is effaced by the two branches growing with unequal rapidity. The free tips of the branches are almost black when dry and somewhat brownish when moist. The basal parts hidden in the basal parts of the tuft are usually lighter brownish.

The cortex of the branches is distinct and pseudo-parenchymatic, most often one-layered and with brownish outer cell-walls. Beneath the cortex is the gonidial layer, which likewise is pseudo-parenchymatic without intercellular spaces and provided with gonidia. The latter are usually identified with *Scytonema*. The axial portions of the branches are poor in, or entirely devoid of, gonidia, while their hyphæ are more stretched and likewise without intercellular spaces.

The apothecia are formed in the tips of the branches. When young they are somewhat concave but gradually become plane, with plane dark-brown discs and a reddish-brown proper margin. They have a distinct calyx, which at the base gradually passes into the axial tissues of the branches and is composed of light hyphæ without intercellular spaces running from the bottom of the calyx partly perpendicularly upwards, partly radiating into the sides of the calyx, in the inner portions of which they run upwards to the surface of the apothecium, where they form a reddish-brown *margo proprius*. The inner portions of the calyx are formed of small cells, while the outer portions are big-celled and gonidia-less, thus representing a pure *margo proprius*. The calyx gradually passes into a light hypothecium

with slightly conspicuous ascogenous hyphæ. The paraphyses are long-celled, scarcely thickened at the brown tips.

The asci are rather short, inflate; their walls are but slightly thickened above. They contain eight two-celled, or rarely four-celled, colourless spores, 28—30  $\mu$  long.

Pycnidia were not observed.



LICHINA



## LICHINA CONFINIS.

AG.

(Plate 11—12).

**Specimen 1.** On boulders at the sea-shore. *Hirtsholmene*, July 1935. O. HAGERUP.

The thallus is small, tufty, spreading centrifugally over the substratum, composed of creeping, prostrate, branched podetia bearing on their upper sides numerous branches of secondary order; these branches are slightly subulate when sterile, while the fertile ones are clavately swollen. The colour is dark blackish-brown. The thallus has no intercellular spaces. The surface of the branches is covered by a very thin brown cortex of one layer—or in places—two layers of hyphæ. The hyphæ of the gonidial layer are more stretched. The gonidia belong to the genus *Calothrix*. There are no haustoria. The central parts of the branches have a colourless, gonidialess, long-celled, axial strand of hyphæ.

The apothecia are formed at the apices of the branches which become clavately swollen when fertile. They have a small punctiform or slightly widened yellowish disc surrounded by a dark margin of the same colour as the thallus.

The calyx has no stipes but is formed directly by the axial strand of hyphæ, which is abruptly transformed into colourless hyphæ of the calyx. These hyphæ run upwards through the sides of the calyx, above forming a narrow, colourless but distinct proper margin inside the surrounding margo thallinus. Ascogenous and paraphysogenous hyphæ issue from the bottom of the calyx. The paraphyses are long-celled, with scarcely thickened and almost colourless tips. Asci are long and slender; their walls are not thickened at the top. They contain eight approximately globular or ovoid 1-celled, colourless spores, about 14—20  $\mu$  long.

In this specimen pycnidia were found at the apices of the branches of the thallus; such branches are also clavate. The pycnidia have a colourless wall of concentric, short-celled hyphæ, directly connected with the central strand of the hyphæ of the thallus. From the inner side of the wall of the pycnide issue long-celled, radial, conidiiferous hyphæ, each cutting off at its apex a small, ovoid conidium.

**Specimen 2.** *Hirtsholmene*, Herbarium LIEBMANN.

This specimen differs from specimen 1 only in being of a somewhat lighter greyish-green colour, while it agrees with it in the structure of thallus, apothecia, and pycnidia, which latter were rather abundant.

**Specimen 3.** *Hirtsholmene*. O. HAGERUP.

This specimen, which was gathered in the same locality as specimen 1, agrees with that specimen in all respects; it had, however, somewhat broader apothecia with more distinctly visible discs.



COLLEMA



## COLLEMA GLAUDESCENS.

HOFFM.

(Plate 13—14).

On the ground in a clay-pit near *Ousted Kirke* by *Horsens*. I. P. PEDERSEN.  
March 11th 1887.

The thallus is small, oval in outline, composed of numerous granules formed separately in a common system of colourless, rhizoidal hyphæ. When quite young each granule is globular or oval, formed of a colony of *Nostoc*, taken in and penetrated by hyphæ from the rhizoid zone. Gradually the granules first become clavate and then more flat and foliaceous, spreading more distinctly centrifugally from the middle of the thallus, and their margins become somewhat isidialike crenate with irregular, short branches.

When fully developed each granule is homoeomerous, formed of long-celled, branched hyphæ penetrating the gelatinous walls of the *Nostoc*-colonies. The gonidia, however, are somewhat more numerous near the upper and lower surface of the thallus than in its interior. A genuine cortex is not differentiated, but here and there the hyphæ are more densely crowded, especially at the lower surface of the thallus, thus giving rise to cortex-like tissues. Numerous long and long-celled, colourless rhizoidal hyphæ, which in places are anastomosed, issue from the lower surface of the thallus. The rhizoidal hyphæ spread in the substratum, forming fresh grains of thallus — as mentioned above — where they come into contact with free *Nostoc*-colonies lying on the surface of the ground.

Apothecia occur in great numbers; they are approximately orbicular, with brown discs and thick, crenate, thalline margins. They have a thin but distinct calyx of almost colourless hyphæ running below the hymenium and from there going upwards round the margin of the hymenium; externally the calyx is covered by the thick thalline margin. The paraphyses are thin and long-celled, their tips are brown but not thickened. The asci are shortly clavate, with walls thickened at the top. In the present specimen each of them contained four spores, frequently provided with three transversal walls (a single spore, however, had four walls) and some few longitudinal walls. The spores measure about 28—38  $\mu$  in length.



One pycnide was found in this specimen. It had a very thin wall formed of short, colourless cells; from its interior short-celled, conidiiferous hyphæ radiate towards the centre of the pycnide.

## COLLEMA CRISPUM.

ACH.

(Plate 15).

On the ground. *Møens Klint*. W. TOUSSIENG.

The thallus is slightly irregularly elliptic in outline and is composed of irregularly incised lobes with crenate margins. The lobes are homoeomerous; the *Nostoc*-gonidia are, however, somewhat more densely crowded near the surface and the free edges of the lobes. The hyphæ are long-celled and thin-walled. The colour of the thallus is due to a pigment deposited in the surface of the gelatinous walls of the *Nostoc*-chains. Scattered, colourless rhizoidal hyphæ issue from the lower surface of the thallus.

One apothecium or some few apothecia are formed in each lobe. They are numerous, densely crowded, almost orbicular, with a concave brown disc surrounded by a rather thick, crenate thalline margin.

Calyx is rather thin, without a stipes, formed of some few layers of colourless hyphæ running horizontally under the hymenium and from there going vertically round the sides of the hymenium. The thalline margin is thick and high with the same inner structure as the other parts of thallus.

The paraphyses are long-celled, with slightly thickened tips; the brown colour of the epithecium is chiefly deposited in the upper parts of the hymenial gelatine.

The asci are long, rather broadly clavate, with walls greatly thickened at the top. They contain eight colourless spores with three transversal walls and one or two longitudinal walls, about 30  $\mu$  long.

Pycnidia were not observed.

## COLLEMA PULPOSUM.

BERNH.

(Plate 16—17).

On the ground, a southern slope of the *Furø*, *Seeland*. C. GRÖNLUND.

The thallus is nearly ellipsoid. The lobes differ very much in form, size, and mode of branching and are imbricate in several places. Their colour is dark-greenish to blackish-grey; when moist they are of a brighter green colour.



Thallus is homoeomerous, composed of chains of *Nostoc* embedded in a thick gelatine; at the upper and lower surface of the thallus the chains are far more numerous and more densely crowded than in the interior. The gelatine is interwoven with hyphæ, which form in the interior of the thallus a very open mesh-work of irregularly running, long-celled, thin-walled, colourless, and richly anastomosed hyphæ. At the upper and lower surface of the thallus the hyphæ run more regularly, standing almost perpendicularly to the surface, in which they branch profusely between the *Nostoc*-chains and become more short-celled and inflate. Here and there the cells form a nearly cortex-like tissue covering the gonidia, especially so at the lower surface of the thallus; numerous rhizoidal hyphæ issue from such cortex-like tissues.

Where two lobes of the thallus come into contact with each other, they may coalesce so completely that they form a unity, in which it is impossible to point out any trace of antagonism between the lobes; not even a distinct borderline is to be seen.

The apothecia are developed near the margin of the lobes. At first they are immersed, but later on they become slightly pedicellate when their margins grow free over the surface of the thallus. To begin with, the disc is concave; later on it becomes plane or even slightly convex and brown, surrounded by a thick entire thalline margin.

Calyx is thinly cup-shaped, composed of colourless long-celled hyphæ, radiating from the bottom of calyx in all directions and running upwards along the sides of the hymenium. There are no traces of a stipes. Calyx is surrounded by a thick margo thallinus of the very same structure as the other parts of the thallus.

In calyx is situated the sub-hymenial tissue composed of somewhat more short-celled colourless paraphysogenous hyphæ and short, thick ascogenous hyphæ. The paraphyses are long-celled, scarcely thickened at the tips, around which the hymenial gelatine is brownish.

Asci are long, narrow; their wall is somewhat thickened at the top. They contain each eight colourless, muriform spores, about 24  $\mu$  long.

Pycnidia were not observed.

## COLLEMA TENAX.

Sw.

(Plate 17—18—19).

**Specimen 1.** On the ground. *Teglværksskoven* at *Nyborg, Funen*. SCHUMACHER's herbarium.

The thallus is rather smooth, appressed, bluish-green, composed of irregularly branched lobes. As to the mode of branching the pictures are referred to. Inside it is homoeomerous, although both the hyphæ are more crowded and the *Nostoc*-

gonidia more numerous near the surfaces than in the interior of the thallus. The pigment of the thallus is—just as in other species of *Collema*—diffused and confined to the gelatine of the upper and lower surfaces. Colourless rhizoids issue, either singly or gathered in bundles, from the lower surface.

The apothecia are adnate, with a reddish-brown plane disc surrounded by a thick, even thalline margin. The calyx is thin, cup-like, composed of some few concentric layers of colourless, rather short-celled hyphæ running horizontally below the hymenium and from there going upwards along its sides, finally forming a proper margin inside the thick thalline margin, which latter has the same structure as the rest of the thallus. Distinct ascogonia are seen in the sub-hymenial tissues. The paraphyses are long-celled, slightly thickened at the tips, which are surrounded by a reddish-brown hymenial gelatine.

Asci are cylindric-clavate; their walls are slightly thickened at the tops; they contain eight colourless, muriform spores, about 22—30  $\mu$  long.

The pycnidia have a very thin, colourless wall, formed of two or three layers of concentric hyphæ, from which numerous short-celled, conidiiferous hyphæ run towards the centre of the pycnide. The conidiiferous hyphæ cut off pleurogenous conidia. The ostiole of the pycnide is surrounded by brown, short-celled hyphæ.

**Specimen 2.** On clayey ground. *Vesterborg* in *Laaland*. August 1865.E. ROSTRUP.

The thallus is lowly tufted, dark-olivaceous, composed of irregularly branched lobes, which are appressed at the circumference of the thallus but slightly more ascendant at the centre. The lobes are either smooth or granulose knotty both along the edges and on the surfaces. The anatomical structure of the thallus is entirely as in specimen 1.

Thick rhizoidal hyphæ, between which colonies of protococcoid *Chlorophyceæ* were found, issue from the lower surface of the thallus.

The discs of the apothecia are brown, somewhat immersed and surrounded by an even thalline margin protruding above the level of the surface of the thallus.

The calyx is cup-shaped, composed of almost colourless, dense, short-celled hyphæ running chiefly parallel to the underside of the hymenium and continuing upwards round the margin of the hymenium. The paraphyses are long-celled, with scarcely thickened, brown tips. Asci are clavate, their walls slightly thickened at the top; they contain eight colourless, muriform spores, about 26—30  $\mu$  long.

The pycnidia betray themselves as small, punctiform, red dots on the surface of the thallus. They are almost globular, with a thin, colourless perithecial wall, from the inside of which colourless, short-celled conidiiferous hyphæ run towards the centre. They cut off short, rod-like conidia, which lie free in multitudes in the interior between the hyphæ. The ostiole of the pycnide is surrounded by reddish-brown, short-celled hyphæ.



Note. This specimen was formerly determined by E. ROSTRUP as a *Collema cheileum* ACH. on account of its morphological habit. Anatomically, it agrees so closely with *Collema tenax*, specimen 1, that I consider it better to refer it to that name.

## COLLEMA FURVUM.

ACH.

(Plate 20).

**Specimen 1.** On the ground; the ruins of *Ørkild Slot* near *Svendborg*, *Funen*. E. ROSTRUP.

The thallus is of a slightly irregular, elliptic circumference, tufty, almost black, composed of very irregularly branched, in part imbricate lobules, the mode of branching of which is better presented in the pictures than in a verbal description. On the upper as well as on the lower surface there are extremely small granular isidia.

The thallus is homoeomerous, built of long-celled, colourless hyphæ, which in places are a little more densely branched near the upper and lower surface of the thallus than in its interior parts. The chains of *Nostoc* are evenly distributed in the gelatine; they are, however, a little more crowded near the surfaces than in the interior.

Apothecia and pycnidia were not found, either in this specimen or in any other Danish specimen.

**Specimen 2.** On the ground among moss. *Møens Klint*. E. ROSTRUP.

The present small specimen, which anatomically fully agrees with specimen 1, is pictured here to show the habit of the species at a very young stage of development. For details, *vide* the pictures.

## COLLEMA RUPESTRE.

Sw.

(Plate 21—22).

**Specimen 1.** On granite. *Hammershus*, *Bornholm*, Herbarium LIEBMANN.

The thallus is irregularly elliptic in circumference, dark-brownish or blackish-green, composed of thin lobules, of which some are rather long, with a narrow base and fan-like branching margins. If one individual lobe is inspected from the margin towards the centre of the thallus, it will appear as richly branching, with big, broad, rounded, and in part overlapping and imbricate lobes. The lobes are highly rugose and pustulate with numerous short isidia on both the upper and lower surfaces. In

several places the thallus is fixed to the substratum by short, thick rhizoids. The thallus is homoeomorous, although the *Nostoc*-chains are more crowded at the lower and upper surfaces than in the interior. The hyphæ, too, are more richly branched near the surfaces than in the interior.

Apothecia and pycnidia did not occur in this specimen and are on the whole rare in Danish specimens.

**Specimen 2.** On a boulder in a brook in *Brænderup Skov, Funen*.

This specimen is much smaller than specimen 1, but otherwise it has the same structure. It is pictured here, because it is provided with apothecia and pycnidia.

The apothecia are small, rather regular, with a plane, reddish-brown disc and a rather thin, slightly uneven thalline margin. The calyx is thin, cup-shaped, formed of a colourless, dense tissue of short-celled hyphæ continuing upwards along the sides of the hymenium. On the outside it is covered by a thalline margin of the same structure as the thallus; the latter has—in the present specimen—hyphæ of a still more cortex-like aspect near its surface. The ascogonia are not very distinct.

The paraphyses are not thickened at the tips, which are surrounded by a brown hymenial gelatine. Asci are clavate, their walls somewhat broadened at the top; they contain eight colourless spores with 5 or 6 uniserial cells, about 30—38  $\mu$  long.

The ostioles of the pycnidia are somewhat protruding above the level of the surrounding thallus. They are globular, with a thin perithecial wall, from which issue short-celled conidiiferous hyphæ with pleurogenous conidia.

**Specimen 3.** On a boulder in a brook in *Elling Skov at Horsens*. October 19th 1886. J. P. PEDERSEN.

This specimen is a little bigger than specimen 2 and completely agrees with it in its outer and inner structure. It is mentioned here because its thallus is provided with small squamules on the upper surface. Some few, entirely sterile apothecia occurred. For details the pictures are referred to.



# LEPTOGIUM



## LEPTOGIUM MICROPHYLLUM.

ACH.

(Plate 23).

On the periderm of *Betula*, growing over a specimen of *Bacidia incompta*. *Silkeborg*.

The thallus has an oval outline and is composed of numerous short and small lobules, spreading radially over the substratum or raised imbricately one over the other; the edges of the lobules are somewhat incised and crenate; their surfaces are granular. The portions of the thallus which are in contact with the substratum issue colourless rhizoidal hyphæ penetrating into it. When dry the thallus is black and fragile; when moistened it is green and gelatinous.

There is no distinct cortex, although the hyphæ are a little more crowded at the surface than in the interior. Likewise, the *Nostoc* gonidia are a little more crowded in the upper and lower surface of the thallus than in the interior.

The apothecia are numerous, orbicular, with a slightly concave, reddish-brown disc surrounded by a yellowish margo proprius, covered by a thick, even or crenate, margo thallinus.

The calyx is cup-like, formed of big-celled, dense, and faintly brownish tissues, downwards gradually passing into the ordinary hyphæ of the thallus, upwards passing into the short-celled, sub-hymenial paraphysogenous and ascogenous hyphæ. The ascogenous hyphæ are distinct. The sides of the calyx surround the sides of the hymenium, finally forming a yellow margo proprius. At the outside the apothecium is surrounded by a thick margo thallinus of the same structure as the rest of the thallus.

The paraphyses are long-celled, with not thickened, brown tips. Asci are stretched-clavate, with walls thickened at the top; they contain colourless, muriform spores, about 26—28  $\mu$  long.

## LEPTOGIUM MICROSCOPICUM.

NYL.

(Plate 24).

On the bark of an old *Salix*. *Skovmøllen, Skaarup, Funen*. E. ROSTRUP.

The thallus is very small, brown, formed as a small, radially growing, coralline tuft. At the margin of thallus the branches are partly procumbent, partly provided with erect or ascendant, small, round branches on the upper surface; the tips of the branches are frequently somewhat capitate.

The cortex is formed of one layer of cells of a faintly brown colour. Inside the cortex the hyphæ are long-celled, colourless, penetrating the gelatinous cell-walls of the *Nostoc*-gonidia.

Bundles of colourless, rhizoidal hyphæ, at the base spreading over the substratum, issue from the lower surface of the thallus.

Apothecia and pycnidia were not observed in the present specimen, nor in any other Danish specimen examined by me.

## LEPTOGIUM SINUATUM.

HUDS.

(Plate 25—26).

On the ground, among mosses. *Hammershus, Bornholm*. C. GRØNLUND.

The outline of the thallus is approximately orbicular; when dry the thallus is brown, composed of lobes, which by repeated branchings widen towards their ends from a narrower base. The lobes are adjacent-ascendant, thin, finely rugose, sinuose, and with irregular lobules, partly broad and partly very narrow. The cortex is one-layered, with brown cell-walls. The interior of the thallus is homoeomerous, composed of chains of *Nostoc* and colourless hyphæ, which latter are rather regularly arranged at the edge of the thallus. Rhizoids of parallel, colourless bundles of hyphæ, adhering to the stems of mosses mingled with the tuft, issue here and there from the under-surface of the thallus.

The apothecia are numerous, small, orbicular, and occasionally formed at the very edge of the lobes. When dry the discs and the thick margins are of almost the same colour as the thallus. When moistened the disc is deeply reddish-brown, surrounded by a thick *margo proprius* concolourous with the disc and moreover surrounded by a *margo thallinus*. When quite young, before breaking out from the interior of the thallus, the calyx has a distinct stipes, which later on is somewhat effaced, for which reason the calyx of the fully ripe apothecium becomes cup-like,



composed of concentric, colourless, densely crowded hyphæ continuing upwards round the hymenium, where finally they form a thick *margo proprius*, easily to be recognized in a moistened apothecium on account of its peculiar colour (*vide* above). In the sub-hymenial tissues there are distinct ascogenous hyphæ.

The paraphyses are long, slender, with slightly thickened brown tips. Asci are long, constricted at the base, but otherwise cylindric-clavate, with walls thickened at the top. They contain eight colourless, muriform spores, about 26—36  $\mu$  long.

Pycnidia were not observed.

## LEPTOGIUM SUBTILE.

SCHRAD.

(Plate 27).

On the ground, among moss. *Aborrebjerg, Møen*. August 23rd 1887. TOUSSIENG.

Thallus is small, composed of numerous small, imbricate lobules of a brownish-grey colour and with incised margins.

Both the upper and the lower surface has a big-celled pseudo-parenchymatic cortex of very light-coloured cells. From the margin and the lower surface of the thallus rhizoids issue here and there; the rhizoids partly bind the lobes together, partly adhere to the moss and the mineral grains of the substratum. Inside, the thallus is homoeomerous, made up of rather densely interwoven hyphæ penetrating the gelatinous cell-walls of the *Nostoc*-gonidia.

The apothecia are at first punctiform, constricted; later on they widen, gradually becoming somewhat concave, with a light brown disc and a thick, entire margin, the inner portion of which is a brown proper margin surrounded by a thalline margin of the same colour as that of the thallus.

There is no stipes. Calyx is deep, cup-shaped; its bottom is made up of colourless, pseudo-parenchymatic hyphæ smoothly passing into the more stretched hyphæ of the sides of the calyx. Above, the calyx forms a thick, swollen *margo proprius* of a light brownish colour surrounded by a *margo thallinus*. The ascogenous hyphæ of the sub-hymenium are not very distinct.

The paraphyses are slightly incrassate at the tips, with a brownish epithecium. Asci are clavate, their walls incrassate at the top. They contain eight colourless, muriform spores, about 16—20  $\mu$  long.

One pycnide was observed. It had a wall of short-celled hyphæ, from which issued conidiiferous, short-celled hyphæ radiating towards the centre of the pycnide. These hyphæ cut off short, pleurogenous, ellipsoid conidia.

## LEPTOGIUM PALMATUM.

HUDS.

(Plate 28).

**Specimen 1.** On sandy soil among moss. The sea-shore between *Vallo* and *Køge*, *Seeland*.

The thallus is low, cushion-shaped, composed of densely crowded, somewhat ascending lobes, all of which presumably are derived from one original thallus, although their continuity cannot any longer be stated with certainty, as it proves impossible to isolate any single lobe in its full length to its place of origin. Each lobe is in reality rather broad when unrolled, but apparently it is considerably narrower, its margin being very much incurved (from the morphological upper surface downwards into the lower surface). The lobes are very irregularly branched with rather narrow, corniculate tips. The older portions of the lobes are greenish-grey, while the tips are brown. When moist the thallus as a whole is lighter and more transparent.

Where the lobes touch each other, or where they are interlaced with the moss-stems, they adhere mutually by means of hyphæ issuing from the surface of the thallus and acting as hapters.

The cortex consists of one layer of cells, the outer walls of which are sometimes distinctly brown, especially so in the young brown lobes. Inside, the thallus is homoeomerous, formed of chains of *Nostoc*, in the gelatinous walls of which numerous hyphæ are spreading.

Apothecia and pycnidia were searched for in vain in the present specimen as well as in all other Danish specimens.

**Specimen 2.** On sandy soil. *Fakse*, October 1886. W. TOUSSIENG.

This specimen is pictured here because it rather distinctly shows the tuftlike shape of the thallus. Otherwise it fully agrees in structure with specimen 1.

## LEPTOGIUM LICHENOIDES.

(L.) (Zahlbr.)

(Plate 29—30—31).

**Specimen 1.** On the boulders of a stone-fence. *Frederiksdal* 1926. O. GALLØE.

When dry the thallus is brownish-grey; when moistened it is dark-brown. It spreads over and in the interior of a tuft of moss, with the stems of which it grows in competition. At the circumference of the tuft of moss the lobes of the thallus are rather horizontal while at the centre they are more erect. At their bases all the lobes of the thallus are dying out, while at their ends (or apices) they branch irregularly or with a slight tendency to dichotomy. The large branches are rather broad and



flat but gradually pass into ever thinner and isidia-like laciniae, which occasionally issue even from the upper and lower surface of the large lobules. Often the lobules are reticulately incrassate. The old lobes at the centre of the tuft of moss are entirely transformed into innumerable isidiose branches, and every trace of dichotomy has disappeared. By and by the lichen kills the moss by overgrowing and suppressing it.

Both sides of the thallus have a one-layered cortex of big cells, each of them representing the top cell of a hypha coming from the interior of the thallus. The cells of the upper cortex is often composed of smaller and more intensively brown cells than those of the lower cortex. Inside the cortex the interior parts are homoeomerous, formed of chains of *Nostoc*, in the gelatine of which the thin and colourless hyphæ are branching.

When being mutually in contact the lobes of the thallus may come into open connection with each other as the cortex seems to disappear or to be altered. Where the thallus is in contact with the moss, it envelops it with hyphæ, which do not, however, penetrate into the moss but gradually cause it to die off.

*Apothecia* and *pycnidia* did not occur in this specimen, no more than in numerous other specimens growing in the same locality.

**Specimen 2.** On a boulder, spreading over moss; in a brook in *Elling Skov* near *Horsens*.

The thallus is of a considerably looser tufty character than in specimen 1. Its lobes are more procumbent and, when dry, of a lighter greyish-green. Otherwise its structure coincides with that of specimen 1 in all essentials. It is mentioned here on account of its numerous small *apothecia*. These are raised high above the level of the thallus, and have an orbicular outline, with a plane ochraceous disc surrounded by a proper margin of the same colour and—at the outside—covered with a *margo thallinus* of the normal colour of the thallus. The calyx has a short, thick, colourless stipes of a dense, small-celled tissue, going upwards round the hymenium and above ending in a well developed *margo proprius*, the basal parts of which are covered with a thin *margo thallinus*. The paraphyses are long-celled, with yellow and somewhat thickened tips. *Asci* are cylindric, clavate, with walls slightly thickened at the top; they contain—in the present specimen—five colourless, muriform spores, about 34—36  $\mu$  long.





# PLACYNTHIUM



## PLACYNTHIUM NIGRUM.

HUDS.

(Plate 32—33).

On mortar. Ruins of *Asserbo Slot, Seeland*. July 19th 1896. E. ROSTRUP.

The thallus is crustaceous, consisting of a margin and an interareolar thallus, both bluish-black, in which the dark, sordidly brown areoles are developed.

The margin and the interareolar thallus are composed of radiating hyphæ, the tips of which are colourless while the older parts are bluish-black. In this 'hypothallus' the areoles arise as small granules, each consisting at first of a single chain of cells of a *Cyanophyceæ*—by GEITLER identified as a *Dichothrix orsiniana*. This alga is gradually enveloped by a layer of pseudo-parenchymatic hyphæ from the 'hypothallus.' The newly established granule is either bluish-black or more often lighter or darker brown. During its further growth the granule retains a brown cortex of short cells and inside this an inner, homoeomerous, colourless, pseudo-parenchymatic tissue, in which the cell-chains of the alga are embedded. In the 'hypothallus' fresh granules are constantly formed; gradually they will grow over each other with the result that the oldest of them will be suppressed; by this process both hyphæ and alga-chains gradually become brown—presumably a symptom of decay.

All the grains of the thallus are connected partly with each other (through hyphæ issuing from their cortex), partly with hyphæ from the 'hypothallus' from which they have arisen.

The apothecia are developed in the grains of the thallus, one in each grain; they are orbicular, with a plane, black disc and a thick, smooth, and slightly lighter coloured margin.

Stipes is short but distinct, formed of small, pseudo-parenchymatic cells, distinctly separated at the base of the stipes from the other, considerably bigger cells of the granule. Stipes continues into a thick calyx, the hyphæ of which run upwards and outwards towards the surface of the apothecium, where it forms a pure margin proprius. From the bottom of the calyx a sub-hymenial, brownish, short-celled tissue is developed, made up of paraphysogenous hyphæ and of little distinct asco-genous hyphæ. The paraphyses are long-celled; their tips are blue but not

incrassate. Their blue colour agrees with the colour of the top-cells of *margo proprius*.

*Asci* are short and thick; their walls are but slightly incrassate at the top. They contain eight colourless *spores*, which are two-, three-, or often four-celled, 12—16  $\mu$  long.

*Pycnidia* were not observed.



CROCYNIA



## CROCYNIA NEGLECTA.

(NYL.) HUE.

(Plate 34).

A Swedish specimen.

The thallus is crustaceous, light greyish, composed of granules, at the base cohering by means of a common, colourless medulla, which continues downwards into a brown felt of rhizoidal hyphæ.

The cortex of the granules is thin, short-celled, with slightly brownish walls. Next follows a gonidial layer of long-celled, loosely interwoven hyphæ, containing cystococcoid gonidia; no haustoria were seen.

Beneath this layer follows a medulla, composed of colourless, long-celled, loosely interwoven hyphæ, passing abruptly downwards into a thick, brown felt of long-celled, brown hyphæ.

Apothecia and pycnidia were not found in this specimen.

## CROCYNIA LANUGINOSA.

HUE.

(Plate 35).

On a rocky wall over moss. *Kodalen, Bornholm*. August 7th 1867. C. GRØNLUND.

The thallus is membranaceous, soft, yellowish-greenish, closely appressed to the moss of the substratum and attached to it by its felty lower surface. The margin is irregularly lobed with lobes of a very varying size and with a minutely incised edge. The central part of the thallus is somewhat pertuse owing to its lobulate origin. The whole of the surface is finely soresiose and uneven. The margin of the thallus has a slightly homoeomerous structure, being formed of a very loose long-celled tissue with numerous intercellular spaces but without any distinct differentiation into cortical, gonidial, and medullary layers. The metathallus is more differentiated, as the gonidia, which seem to be of a *cystococcoid* type, are gathered into groups

near the surface of the thallus. At a small distance from the margin of the thallus the lower surface is formed as a rather thick felt of brownish hyphæ attaching the lichen to the substratum.

A p o t h e c i a and p y c n i d i a were not observed.

The sorediose surface of the thallus suggests that this species propagates by soredia.



# PARMELIELLA



## PARMELIELLA LEPIDIOTA.

SMRFT.

(Plate 36).

In HELLBOM's: Bornholms lufvar *Parmeliella lepidiota* is recorded from *Bornholm*. As no specimen of this species, however, is found in Danish collections of lichens, I here give pictures and description of a specimen found in *North America*.

The thallus is very minutely crustaceous-microphylline, composed of crowded, extremely small squamules connected at the base by a common, thick felt of bluish-black rhizoidal hyphæ. It is evident that the squamules at the margin of the thallus originally were scattered and independent small bodies (Fig. 218), each of them incised, brown, and finely crenate. The youngest parts of the margin of the squamules are formed as small, whitish or bluish, soredia-like bodies lacking the brown pigment of the older parts, presumably owing to their vivid growth. Whether these bodies actually loosen and function as soredia is questionable; in the present specimen there were no signs of such a function. The central parts of the thallus are formed of very densely crowded squamules provided with similar, numerous soredia-like bodies.

The upper surface of the squamules has a cortex of pseudo-parenchymatic hyphæ, of which the upper layers are colourless while the deeper layers are brown. The hyphæ of the gonidial layer are thin, rather long-celled, without haustoria.

The gonidia are *Nostoc* or *Polycoccus*-type. The medullary hyphæ are a trifle thicker than those of the gonidial layer, and rather long-celled. In the deeper layers of the medulla they run tolerably parallel to the lower surface of the squamule and are sometimes slightly brown. They are abruptly replaced by sordidly bluish-brown hyphæ forming a thick felt on the lower surface. Such squamules as are overrun and covered by other squamules or by apothecia gradually become brownish, and their gonidia are discoloured and finally disappear.

The apothecia are formed in the squamules. When fully ripe they have a brown, somewhat convex disc without a macroscopically distinguishable proper

margin. The plurality of the apothecia are surrounded by small, young, gonidia-provided, soredia-like grains of thallus, imparting a false idea of a thalline margin. Anatomical sections show a totally different structure.

The apothecium gradually overgrows and suppresses the squamule of thallus from which it has issued and has in fact a lecideine structure. There is a well developed *stipes-calyx* of very faintly brownish, rather short-celled, densely crowded hyphæ, together forming a thick tissue under the hymenium and running from there upwards round the hymenium, where it changes its structure and becomes long-celled and brown-walled, finally ending in thick, coarse, bluish-brown hyphæ of much the same structure as that of the felt-hyphæ at the lower surface of thallus. This margin of apothecium is quite gonidia-less and sharply separated from the macroscopically visible small soredia-like bodies, which in several places give a false impression of the existence of a thalline margin round the apothecium.

The *paraphyses* are long-celled, with brown, swollen tips. The *asci* are narrowly clavate; their walls thickened at the top. They contain eight colourless, one-celled *spores*, about 14—24  $\mu$  long.

## PARMELIELLA PLUMBEA.

### LIGHTF.

(Plate 37—38).

On the periderm of *Quercus*. *Hørbylund Krat* to the west of *Silkeborg*, *Jutland*. August 7th 1887. TOUSSIENG.

The circumference of the *thallus* is elliptic; with a margin formed of radiating, brownish-greyish lobules, gradually branching when spreading over the substratum. The central parts of the thallus present a confusion of small imbricate lobes attempting to grow over each other. The lower surface of the thallus is a dense felt of bluish-black rhizoidal hyphæ, also protruding beyond the margin of the thallus. Quite young specimens, which might have elucidated the structure of the thallus at its youngest stages of development, have not, unfortunately, been at my disposal. The upper surface of the thallus has a cortex of erect, rather small-celled, densely interwoven hyphæ, the upper cells of which are faintly brown from a non-granular pigment. The hyphæ of the *gonidial layer* are short-celled, without haustoria. The gonidial alga is a *Nostoc*. Medulla is loose in texture, with colourless hyphæ; from this tissue protrudes the thick rhizoidal felt of long-celled hyphæ with blue cell-walls.

The *apothecia* are numerous, especially at the central parts of the thallus. They are rather regularly orbicular, or slightly sinuose, with a reddish-brown plane disc surrounded by a thick, entire *margo proprius* of the same colour as the disc. *Stipes* is well developed; above, it passes into a very thick *calyx*. Both



stipes and calyx are formed of dense, colourless hyphæ running from stipes upwards and outwards into the surface of the reddish-brown *margo proprius* of the apothecium; accordingly, the latter is purely lecideine. The hymenium consists of long-celled *paraphyses*, the tips of which are slightly swollen and reddish-brown. *Asci* are short, clavate, their walls thickened above; they contain eight colourless, one-celled *spores*, about 18—22  $\mu$  long.

At the central parts of the thallus occurred several old, very high apothecia, i. e. provided with a high tissue of stipes-calyx. The sterile hymenia of these apothecia are divided into several small, secondary discs, each with a proper margin of its own. Their structure is shown in details in the pictures. Analogous, evidently senile deformations are mentioned in other species in this work (e. g. in *Lecanora subfusca*, *atra*, *carpineae*; *Buellia parasema*; *Diploschistes scruposus*). They call to mind the formation of the apothecia and proliferations in the genus *Cladonia*.



PANNARIA





## PANNARIA NEBULOSA.

(HOFFM.) NYL.

(Plate 39).

On the ground. *Tisvilde*. September 1904. O. GALLØE.

The outline of the crustaceous thallus is oval. The thallus is composed of small, bluish-green, roundish granules, connected at the base by rhizoidal hyphæ spreading in the substratum. Each granule is undoubtedly formed by a rhizoidal hypha taking in colonies of algæ. The granules overrun each other and mutually compete with each other, with the result that several of them are stretched vertically.

The granules are almost homoeomerous, formed of short-celled hyphæ mingled with small colonies of *Nostoc* of the *Polycoccus*-type. In most places the algæ of the granules are covered by a thin, light-yellowish cortex, but here and there the cortex is lacking, and the algae are seen — under low magnifying powers — as dark dots.

The apothecia are formed one in each granule; they are slightly immersed or scarcely raised above the surface of the thallus, and they are in all anatomical details of the same structure as the apothecia of *Pannaria pezizoides*, to which species *Pannaria nebulosa* is often referred. The calyx is of a dense texture, without a distinct stipes, stretching upwards round the hymenium and outwards covered by the surrounding thallus. There are numerous ascogenous cells beneath the hymenium. The paraphyses and the asci are of much the same structure as in *Pannaria pezizoides*, although the asci and the spores are a little smaller, about 16  $\mu$  long.

Pycnidia were not observed.

Whether this species is an independent species or only a modification of *Pannaria pezizoides* is not known.

## PANNARIA PEZIZOIDES.

WEB.

(Plate 40—41).

On the edge of a ditch, in part spreading over moss. *Store Klinteskov, Møen*, August 20th. TOUSSIENG.

The thallus is regularly elliptic; when seen with the naked eye it appears

crustaceous; under low magnifying powers it proves to be composed of extremely minute, imbricate squamules, cohering at the base. The edges of the squamules are light-greyish, while their older parts are more light-brownish. In the suppressed portions of the squamules the gonidia gradually die off. The free edges of the squamules are very finely incised.

The cortex is dense and light-brown at the upper surface, while at the lower surfaces of the squamules the hyphæ are rather densely crowded but not formed as a genuine cortex. Long-celled, brown rhizoidal hyphæ issue from the lower surface of the thallus. The interior of the squamules is looser in texture, without being distinctly differentiated into gonidial and medullary layers. Still, the gonidia are perhaps a little more crowded near the surface of the thallus. The gonidial alga is a *Nostoc*.

The apothecia are closely appressed to the thallus. At first they are somewhat concave, with a light-brown disc surrounded by a crenate margin; later on they often become angular by mutual pressure, and finally they become irregularly sinuose and slightly convex, with a reddish-brown disc and a crenate thalline margin of the same colour as the thallus. They have no distinct stipes but a distinct calyx, formed of dense, colourless tissues without intercellular spaces, continuing upwards along the sides of the hymenium. In the calyx the hymenium is placed. At the outside the calyx is surrounded by a well developed *margo thallinus*, the interior of which has quite the same anatomical structure as the interior parts of the squamules, while its superficial parts (or downwards turned parts, respectively) are covered with a cortex of the same structure as that of the upper surface of the squamules of the thallus. The paraphyses are long-celled, with scarcely thickened, brown tips. Asci are stretched, clavate, with walls thickened above. They contain eight colourless, 1-celled spores, about 20—24  $\mu$  long.

Pycnidia were not observed.

## PANNARIA RUBIGINOSA.

THUNB.

(Plate 41—42).

On the periderm of *Populus tremula*. Hald. C. A. GAD.

The thallus is elliptic in outline, composed of numerous, imbricate, sordidly greenish-grey, incised squamules connected at the base by a common, thick bluish-black felt of rhizoids.

The cortex of the squamules is pseudo-parenchymatic; its upper cell-layers are evanescent; the greater part of the cells have brown walls, while the deeper layers are colourless. The hyphæ of the gonidial layer are loose in texture, without haustoria. The gonidia are *Nostoc* of *Polycoccus*-type. The medulla is very



loose in texture, formed of long-celled, thin, in part brownish hyphæ, especially so in the middle parts of medulla. The lower surface of the squamules have a somewhat cortex-like, thin tissue of hyphæ, from which the very thick felt of rhizoidal hyphæ issues. The felt is composed of longcelled, branched hyphæ.

The apothecia are formed by ones or by some few in each squamule. At first they have a small, somewhat concave, brown disc, surrounded by a thick, slightly crenate thalline margin concolourous with the thallus. Later on the apothecia may become sinuose, with a rather even thalline margin and a reddish-brown disc.

The stipes is well developed, composed of erect, colourless hyphæ. Above, the stipes passes into a well developed calyx of colourless hyphæ continuing upwards round the sides of the hymenium. Externally, stipes-calyx is surrounded by a thick, well developed thalline margin of the same structure as the cortex and the gonidial layer of the other parts of the thallus.

The ascogenous hyphæ are little conspicuous. The paraphyses are long-celled, with slightly thickened, brown tips. The asci are rather broadly clavate, their walls but slightly thickened at the top; they contain eight colourless, one-celled spores, about 18  $\mu$  long.

Pycnidia were not observed.

## PANNARIA COERULEOBADIA.

SCHLEICH.

(Plate 43).

On the periderm of *Fagus silvatica*. Vinding Skov near Salten Langsø, Jutland.

The thallus is composed of numerous small squamules, at the base connected by a common, thick, bluish-black felt of rhizoids. The squamules at the margin of the thallus are imbricate, small, light-brownish, incised, and with finely crenate edges. The squamules in the central parts of the thallus are crowded and overlapping; their edges are so densely crenate that the whole of that part of the thallus seems densely sorediose with bluish-grey soredia.

The cortex is pseudo-parenchymatic; the upper cells are brown while the deeper layers are colourless. The hyphæ of the gonidial layer are thin, long-celled, without haustoria. The gonidia are *Nostoc* or *Polycoccus*-type. The medullary hyphæ are thin, loosely interwoven, long-celled, and colourless. Below, the colourless medulla is abruptly replaced by a bluish-black felt of rhizoidal, long-celled hyphæ.

The soredia, by far covering the greater part of the thallus of the present specimen, are formed by the lobes of thallus branching repeatedly and vividly, so that their finely crenate edges are transformed into bluish-grey soredia, which latter consist of *Nostoc*-colonies, accompanied by some very scanty short-celled hyphæ.

Apothecia and pycnidia were not observed.





# MASSALONGIA



## MASSALONGIA CARNOSA.

DICKS.

(Plate 44—45).

A Swedish specimen. '*In silva mixta ad rupem Kjestad.*' *Värmland, Sverige.*  
Legit HUGO MAGNUSSON.

HELLBOM records this specimen from *Bornholm*, but no authentic specimen of it is incorporated in HELLBOM's herbarium in *Gothenburg*. In this volume I therefore describe a specimen gathered by HUGO MAGNUSSON in *Värmland* in *Sweden*.

The circumference of the fully developed thallus is nearly orbicular; the thallus itself is composed of radiating lobules, which are partly somewhat appressed to the substratum, partly slightly ascendant. Each lobule may gradually die off at the base—there being thus some chance of one specimen eventually dividing into several individuals. The mode of branching of the lobules is better seen in the pictures than from a verbal description. The colour of the surface is brown, while the lower surface is whitish.

The upper surface of the thallus has a cortex of big cells. The uppermost cells gradually die off, thus forming a colourless cuticle, just beneath which the non-granular, brown pigment of the cortical walls is situated. At the edge of the lobules cortex gradually passes into the non-corticate lower surface of the thallus. Under the apothecium, however, there was a tissue of cortical structure. The gonidial layer is loose in structure, composed of long-celled hyphæ with numerous big, intercellular spaces. The gonidia are usually referred to *Scytonema*, but in the present specimen they are considerably altered and scarcely recognizable as *Scytonema*-cells, but are almost *Nostoc*-like or better *Polycoccus*-like as in *Peltigera*.

Medulla is composed of loosely interwoven, long-celled hyphæ. From the lower surface of the thallus issue dark-brown rhizoidal hyphæ, between which normal filaments of not yet taken in *Scytonema* occurred here and there.

The apothecia are placed on the upper surface of the thallus. They are appressed, rather regularly orbicular, with a plane, reddish-brown disc and a lighter-brownish margin, which in moistened state is almost concolourous with the disc.

There is no stipes but a dense, thick, colourless calyx continuing upwards round the hymenium, where it finally passes into the cortex going from the surface of the thallus upwards round the apothecium. A direct continuation of the medulla of the thallus occurs under the calyx. The gonidia, too, continue into the apothecium, which thus may be called slightly lecanorine. Just below the hymenium there are distinct ascogenous hyphæ. The tips of the paraphyses are swollen and brown. Asci are clavate and thin-walled. They contain eight colourless, two-celled spores tapering at both ends, about 26—28  $\mu$  long.

Pycnidia occur partly on the surface, partly at the edges of the lobules and betray themselves as small red spots of the same colour as the disc of the apothecium. Their perithecial walls are very thin and colourless; the branched conidiiferous hyphæ cut off pleurogenous conidia.



PSOROMA



## PSOROMA HYPNORUM.

DICKS.

(Plate 46—47)

**Specimen 1.** On the ground. *Borris Heide* in *Jutland*. June 1904. O. GALLØE.

The thallus is not distinctly bordered and is composed of small, scattered or densely crowded, brown squamules connected in the substratum by rhizoidal hyphæ. When young the squamule is at first oval or roundish; later on it may be orbicular with crenate margin, but finally it grows laterally and becomes crenate along the embryonic edge. At the base it is fastened to the substratum by rhizoidal hyphæ, while the rest of the squamule may be without rhizoids. The cortex is formed of erect, big-celled hyphæ, at the edge of the thallus smoothly passing into the thin cortex of the lower surface, which latter is formed of hyphæ running parallel to the lower surface. The interior of the squamule is formed of loosely interwoven, long-celled hyphæ; the gonidial and medullary layers are not clearly separated, although the gonidia are gathered preferably near the surface of the squamule. The gonidia are cystococcoid.

The rhizoidal hyphæ are long-celled and brown.

The apothecia are formed one in each squamule. Their circumference is rather regularly orbicular, at first concave, later on plane, with a reddish-brown disc surrounded by a thick, crenate *margo thallinus*. When fully developed the apothecia entirely conceal the squamules from which they have issued, being thus placed apparently directly on the substratum.

The calyx has no stipes and is built of colourless, dense hyphæ running preferably parallel to the lower surface of the hymenium and from there upwards along the hymenium, surrounding it with a thick *margo proprius*; the latter is moreover surrounded with a thick thalline margin, the outer surface of which is covered with a cortex of the same structure as that of the squamules of the thallus. Brown rhizoidal hyphæ issue here and there from the lower surface of this thalline margin. Inside the cortex there is a loose tissue of the same structure as that of the gonidial-medullary layer of the squamules.

The paraphyses are long-celled, with slightly thickened, brown tips. Asci are stretched, their walls somewhat thickened at the top. They contain eight colourless, 1-celled spores, about 18—20  $\mu$  long.

Pycnidia were not observed.

**Specimen 2.** On the ground. *Ferslev Hede* in *Jutland*. J. BRANTH.

This specimen has quite the same structure as specimen 1 and is chiefly pictured here because it is coloured green in the spaces between the squamules, not owing to the lichen itself but to a layer of *Cyanophyceæ* occurring there. Besides, it is very distinctly seen in this specimen how the apothecia issue by ones in each squamule.



LOBARIA



## LOBARIA SCROBICULATA.

(SCOP.) D. C.

(Plate 48—49).

**Specimen 1.** On the periderm of *Quercus. Hald Egeskov.*

The lobes of thallus are broad, the upper surface light-green, the under surface light-brownish with still lighter dots. The mode of branching is seen in Fig. 297. The lobes are scrobiculate, with numerous sorals on their surfaces and along the edges.

The upper cortex is pseudo-parenchymatic, very faintly brownish, in places provided with a thick cuticle of dead, colourless cells (Fig. 299). The hyphæ of the gonidial layer are thin, long-celled, without haustoria. The gonidia are a *Nostoc* of the type of *Polycoccus*. The medullary hyphæ are like those of the gonidial layer. The cortex of the lower surface of thallus is thinner than the upper cortex, pseudo-parenchymatic, and slightly brownish; it continues downwards into stretched-celled hyphæ.

The soralia are whitish; the soredia are composed of colonies of *Nostoc*, surrounded by short-celled hyphæ (Fig. 298).

The apothecia at first appear as small, light protuberances on the upper surface of thallus (Fig. 297); later on they open, presenting a reddish-brown disc, surrounded by a margin of the same colour as the thallus. Beneath the hymenium there is a poorly developed calyx of small-celled, rather dense and nearly colourless hyphæ, which downwards are replaced by medullary tissues (Fig. 302); calyx does not continue upwards round the hymenium. Externally the apothecium is covered by a cortex of the same structure as that of the ordinary cortex on the upper surface of thallus. Gonidia are only found in basal parts of the apothecium (Fig. 298). The paraphyses are long-celled, with brownish, almost cylindric tips. Asci are rather broadly clavate; they contain eight colourless, two- or four-celled spores, about 60—80  $\mu$  long.

Pycnidia were not observed.

**Specimen 2.** On the periderm of *Quercus*, among moss. Frær Purker, Jutland. O. GALLØE.

This specimen is sterile; anatomically it completely agrees with specimen 1. Some pictures are given here to elucidate the reticulate and scrobiculate lobes of thallus (Fig. 304), the brown lower surface (Fig. 305), and its general habits (Fig. 303).

## LOBARIA LAETEVIRENS.

LIGHTF.

(Plate 49—50).

On the periderm of *Fagus silvatica*. Møens Klint. Herbarium J. VAHL.

The thallus is monophyllous, with papyraceous, irregularly incised, and somewhat wrinkled lobes (Fig. 310); when dry the upper surface is brownish-grey, the lower surface pale-brownish, tomentose, with scattered rhizines. The central parts are considerably darker. When two lobes touch each other, they often coalesce.

The cortex of the upper surface is thick; its deeper layers are somewhat pseudo-parenchymatic, while the upper layers are more cuticle-like and colourless.

The hyphæ of the gonidial layer are colourless, long-celled, without haustoria. The gonidia are cystococcoid. The hyphæ of the medullary layer are long-celled and arranged lengthwise in the lobes. The cortex of the lower surface of thallus is nearly pseudo-parenchymatic, continuing downwards into slender, tomentose hyphæ, which here and there are grouped as rhizines.

The apothecia are numerous at the centre of the thallus. When very young they appear as small, semiglobular protuberances with a depression at their tops. Later on they become regular or sinuose, with a plane, reddish-brown disc, surrounded by a thick margin of the same colour as the thallus. Internally they have a rather well developed calyx of rather dense, small-celled, slightly brownish hyphæ, upwards continuing rather indistinctly round the hymenium and downwards passing into the ordinary gonidial and medullary tissues. Externally the calyx is covered by a marginal thallinus of ordinary thalline structure. The ascogenous hyphæ beneath the hymenium are little conspicuous.

The paraphyses are long-celled, their tips slightly incrassate and brown. Asci are rather broadly clavate, with walls somewhat thickened at the top. They contain eight colourless, 2-celled spores, about 30—36  $\mu$  long.

The pycnidia are big, occurring by ones or some few together in protuberances of the thallus. They have a thin, dense perithecium, from the inside of which issue radial, stretched, short-celled, conidiiferous hyphæ, each of them cutting off pleurogenous and acrogenous, rod-like conidia.



## LOBARIA AMPLISSIMA.

L.

(Plate 51—52—53).

**Specimen 1.** On the periderm of *Fagus silvatica*. Silkeborg Vesterskov. J. BRANTH.

The thallus is monophyllous, with rigid, regularly branched lobes, the upper surface of which is leather-brown, smooth, while the lower surface is light-brown, with a dark centre and a brownish tomentum. The older portions of the lobes are somewhat wrinkled. As to anatomical structure it fully agrees with specimen 2 (which *vide*). The present specimen had no apothecia but some few pycnidia.

**Specimen 2.** On the periderm of *Quercus*. Kalgaards Vig near Silkeborg.

This specimen is a little smaller than specimen 1 and a little darker-brown, otherwise agreeing in inner structure with specimen 1. It is pictured here, because it is fertile and provided with *cephalodia*.

The cortex is pseudo-parenchymatic, with brown cell-walls; above there is a colourless, dead, thick cuticle. The hyphæ of the gonidial layer are slender, long-celled without haustoria. The gonidia are cystococcoid. Medulla is long-celled, loose. The cortex of the lower surface is thick and a little looser than the upper cortex, and brownish; downwards it continues into a tomentum, the hyphæ of which are gathered into distinct rhizines here and there.

When very young the apothecia are semi-globular and closed; later on they have a punctiform depression above, and next the brown discs appear. When fully ripe the apothecia are somewhat irregularly sinuose, with a faintly granular thalline margin round the rather plane, reddish-brown disc. Internally they have a thin calyx of small-celled, nearly colourless hyphæ, which cover the bottom of the hymenium but do not distinctly continue upwards round the hymenium. The rest of the interior of the apothecia is formed of medullary hyphæ. Beneath the calyx there are small groups of gonidial algæ. Externally the apothecium is provided with a thalline margin of ordinary thalline structure.

The paraphyses are long-celled, with brown, scarcely thickened tips. Asci are clavate, with walls somewhat thickened above; they contain eight colourless, 2—4 celled spores, about 42—52  $\mu$  long.

Pycnidia are somewhat raised above the surface of the thallus, big, with a thin, small-celled perithecium, issuing very long, short-celled conidiiferous hyphæ with pleurogenous and acrogenous, rod-like conidia.

Cephalodia are abundant; they are shrub-like, densely branched. Their structure is shown in Fig. 320, 321, 322, 327, 330, 333, and 334.

## LOBARIA PULMONARIA.

(L.) HOFFM.

(Plate 54—55—56—57—58).

**Specimen 1.** On the periderm of *Fagus*. Rold Skov, Jutland. O. GALLØE.

The thallus is large, with richly branched, pitted-reticulate lobes. The upper surface is smooth and brownish-green, the lower surface is felted and brown. The blisters of the lower surface, which correspond to the pits of the upper surface, are largely of a rather light colour at their tops and without felt, while the furrows between them are rather dark and felted.

The cortex of the upper surface is composed of dense, colourless hyphæ; the uppermost cells, however, have faintly brownish cell-walls. The hyphæ of the gonidial layer are loose in texture and long-celled; haustoria were not met with. The gonidia are cystococcoid.

The hyphæ of the medulla are horizontal, long-celled, running chiefly lengthwise in the lobes. The cortex of the lower surface is thinner than that of the upper surface but of the same structure. From it a dense felt of long-celled, rather short hyphæ protrudes, for which reason the lower surface gets a velvet-like appearance.

The apothecia are formed partly at the very edges of the lobes, partly on their upper surfaces. When quite young they are concave, with a reddish-brown disc surrounded by a thin and slightly lighter margin; gradually they become planer. The calyx has no stipes and is thin, formed of short-celled, rather densely interwoven hyphæ, which continue somewhat indistinctly upwards round the sides of the hymenium. Beneath the calyx follows a loose medulla of the same structure as that of the rest of the thallus. Externally the calyx is surrounded by a margin of the same structure as the thallus. When an apothecium is formed at the edge of a lobe, one side of it may have the structure of the lower surface of the thallus, thus lacking gonidia. The ascogenous hyphæ are not very conspicuous. The paraphyses are thin, with brown, scarcely thickened tips. Asci are clavate, somewhat constricted at the base, and with walls thickened at the tops. They contain eight 2—4 celled colourless spores, about 26—32  $\mu$  long.

The pycnidia are little protruding but big. They have a thin perithecium of some few layers of long-celled, colourless hyphæ, from which numerous short-celled, conidiiferous hyphæ issue with pleurogenous or acrogenous, rod-like conidia.

Soralia occur here and there along the edges of the lobes and on the surfaces of the ridges; they are built as those in specimen 2, to which is referred. Isidia were found here and there; they protrude chiefly from the ridges of the thallus.

**Specimen 2.** On the periderm of *Quercus*. Hald Skov, Jutland. GAD.

This specimen has the same structure as specimen 1 and is exclusively pictured here to show the numerous soralia occurring along the ridges of the thallus.

**Specimen 3.** On the periderm of *Fagus*. Skjørping, Jutland. O. GALLØE.



This specimen has the same anatomical structure as specimen 1, but it is sterile, and it is pictured here because it is richly set with small squamules along the edges of the lobes.

**Specimen 4.** *Sæbygaard Skov, Jutland.*

This specimen has the same anatomical structure as specimen 1, and it is pictured here because it is richly set with big apothecia on the upper surface of the thallus — a rather uncommon phenomenon.

**Specimen 5.** *Sønderskov near Aabenraa.*

This specimen fully agrees with specimen 1.

I give here some pictures of endogenous chephalodia, which may be found in almost every specimen of *Lobaria pulmonaria*, but in this specimen they are easily found. The chephalodia most often present themselves as small protuberances on the top of the blisters on the lower surface of the thallus. Usually they have the same colour as the surrounding tissues, but sometimes they may have a small, dark, central dot owing to the reflection through the cortex of the bluish-green colour of their *Cyanophyceæ*. The upper cortex, gonidial layer, medulla, lower cortex and felt of the chephalodia are like those of the other parts of the thallus. But the cystococcoid gonidia may be absent in places above the *Nostoc* colonies of the chephalodium. The *Nostoc* colonies are big, coherent, lobed colonies, the central portions of which are pale and richly provided with colourless hyphæ, while the peripheral portions are deeply bluish-green and poor in hyphæ. Evidently the *Nostoc* cells die out in the central portions of the colonies, while the peripheral portions continue growing.

**Specimen 6.** *Addit Skov, Jutland. June 1871. E. ROSTRUP.*

This specimen is built as specimen 1, but it is pictured here because it is strongly infested by a parasitic fungus, *Celidium Lichenum* SCHROET. This parasite is situated in the disc of all the apothecia of the specimen and there forms black crusts of hyphæ which finally produce numerous small apothecia of a structure which can be seen in the figures and are elsewhere described, a. g. by KEISSLER (RABENHORSTS Kryptogamenflora, VIII Band, Die Flechtenparasiten). The infested apothecia of *Lobaria* are all sterile.

On the lower surface of this specimen there occurred some few apothecia-like protuberances provided with a black disc, surrounded by a lighter 'margo' of a brownish colour, but without gonidia, because the protuberances stand on the gonidia-less lower surface of the thallus. From the 'disc' of this protuberance — in the present case — long, straight, parallel hyphæ run through the thallus upwards to the upper surface of the thallus, where a small, black dot of a structure, agreeing with that of the 'disc' of the lower surface, was likewise situated. The interpretation of this peculiar protuberance cannot be undertaken with any certainty. Whether it represents an apothecium disorganized by a *Celidium* infection and formed abnormally on the lower surface of the thallus, or whether it represents the final stage of deve-

lopment of the *cecidia* mentioned below, cannot be settled with certainty in the present case. I feel, however, most inclined to accept the latter interpretation.

In this specimen numerous cecidia were also found on both sides of the thallus.

The cecidia of the upper surface begin as small isidia-like, brown protuberances, at first quite normal in the structure of the cortex, gonidial layer, and medulla. But gradually they grow very big, become button-shaped, of the size of the apothecia or still bigger, and their inner structure is transformed: the cortex gets very thick, being formed of light, parallel hyphæ of a faintly brownish colour. Gradually, the gonidia completely disappear. The medulla seems to remain unaltered.

The cecidia of the lower surface has much the same morphological appearance. In the inner structure they fully agree with those of the upper surface, gonidia wanting in all cases as the lower surface is never provided with gonidia.

The abnormally thickened cortex of both types of cecidia contains here and there dots of brown hyphæ, from which an apparently smooth transition into the colourless hyphæ may be traced.

In the present case it has proved impossible to trace the acting cause of the formation of these cecidia. In the cecidia themselves it has been found impossible to point out with any certainty alien parasitic hyphæ among the hyphæ of the *Lobaria*—an obstacle to the solving of the problem unfortunately often arising in the study of the lichen-parasites.

That there may exist alien, parasitic hyphæ resembling the hyphæ of *Lobaria* to the point of being undistinguishable from them, is by no means excluded.

It seems reasonable to consider the cecidia as caused by the indistinguishable hyphæ of *Celidium*, since all the apothecia are attacked by this fungus, so much more as the hyphæ of *Celidium* cannot be distinguished in the apothecia until they are transformed into the hymenium-producing black crusts on the discs of the apothecia.



SOLORINA



## SOLORINA SPONGIOSA.

SM.

(Plate 59—60).

On the ground in a meadow near *Ranum* in *Jutland*. TH. JENSEN.

When seen with the naked eye the thallus appears crustaceous and brown. Under low magnification it proves to be composed of roundish, somewhat incised squamules with numerous small, isidia-like protuberances. At the base the squamules cohere by means of colourless, long-celled hyphæ; otherwise they are densely crowded and overlapping.

The surface of the grains of thallus is covered by a brownish cortex of pseudo-parenchymatic hyphæ. The gonidial layer is formed of thinner, more long-celled hyphæ without haustoria. The gonidia are a *Nostoc* of polycoccoid type. The medullary hyphæ are loosely interwoven, long-celled, colourless, gradually passing into the rhizoidal hyphæ.

Young apothecia were abundant in this specimen, while ripe apothecia were very few in number. When very young and small the apothecia are deeply cup-shaped (Fig. 373), with yellowish disc and margin. At this stage of development (Fig. 376) they have a disc formed of yellowish, rather long-celled hyphæ,—the future paraphyses, beneath which there is a short-celled, colourless, sub-hymenial tissue, presenting as yet no clear ascogenous hyphæ and absolutely no asci. Externally and at their base these apothecia are covered by a calyx of hyphæ, which are a little denser and more short-celled than the ordinary medulla and gradually are replaced by ordinary, long-celled hyphæ in the external portions of the apothecia. The proper margin itself has cortex-like tissues at its top edge (Fig. 377). Beneath the apothecium no cortex is differentiated as yet.

When fully developed (Fig. 372 and 374) the apothecia are rather regular, with a reddish-brown, rather plane disc and a light, gonidialess margin. The latter is covered by a cortex and continues downwards into a calyx of the same structure as found in the young apothecia, in addition, however, provided with a cortex on its lower surface (very distinctly seen in Fig. 374). The whole of the apothecium, including its lower cortex (*vide* Fig 374), rests on a colourless medulla. Whether the apothecia are

originally formed in the interior of a squamule of thallus or may arise directly in the medullary-rhizoidal tissues connecting the squamules could not be settled with certainty in the present specimen.

The paraphyses are long-celled, straight, with brown, not-widened tips. Asci are big, with cell-walls incrassate at the top; they contain each 4 two-celled, dark-brown spores, about  $44\ \mu$  long.

Pycnidia were not observed.

## SOLORINA SACCATA.

L.

(Plate 61—62)

On the ground, among moss. *Møens Klint*, July 23rd 1888. F. BØRGESSEN.

The thallus is irregularly oval in outline and is formed of numerous lobes, each of them issuing from the rhizoidal hyphæ spreading on the ground,—thus being of polyphyllous origin. The mode of branching is shown in Fig. 380. The surface of the lobes is brownish on either side. The lower surface is provided with rhizines.

The upper cortex is composed of pseudo-parenchymatic cells. The hyphæ of the gonidial layer are erect, long-celled, without haustoria. The gonidia are cystococcoid. The medulla is formed of horizontal, long-celled hyphæ. The rhizines issue from the medullary layer (Fig. 382, 384, and 385). The lower surface of thallus has a cortex only beneath the apothecia.

In the interior of the thallus occur endogenous cephalodia (Fig. 385),—groups of colonies of *Nostoc* embedded beneath the ordinary chlorogonidia, which latter gradually disappear above the cephalodia; below the cephalodia there is a thin lower cortex (Fig. 389).

The morphological development of the apothecia is seen in Fig. 381. At all stages they appear as cup-like, deeply sunk depressions in the thallus, provided with a reddish-brown disc, surrounded by a veil of the pierced cortex (Fig. 381). The hymenium grows radially, by degrees causing a bursting of the adjacent portions of the cortex of the thallus. Beneath the hymenium there is a calyx, formed of small-celled hyphæ (Fig. 390), with rather small ascogenous hyphæ. Beneath the latter tissue there is a thin layer of gonidia, below which follows the ordinary medulla and the lower cortex (Fig. 382), downwards replaced by medullary-rhizoidal layers.

The paraphyses are stretched, long-celled, with brown, not-thickened tips. Asci are big, with thickened top-walls. In the present specimen they contained four big, brown, two-celled spores, about  $44\text{--}50\ \mu$  long.



# NEPHROMA



## NEPHROMA PARILE.

ACH.

(Plate 63).

On the periderm of *Quercus. Rindsholm Egekrat.*

The thallus is monophyllous, branched as shown in Fig. 393. The upper surface of the lobes is smooth, chestnut-brown; the lower surface is lighter, with fine, retiformly arranged veins and here and there provided with rhizines (Fig. 393).

The cortex of the upper surface is brown, pseudo-parenchymatic, with a cuticle of dead, compressed cells. The hyphæ of the gonidial layer are long-celled, colourless, without haustoria. The gonidia belong to a *polycoccus*-like *Nostoc*. The medullary hyphæ are horizontal, colourless, long-celled, loosely interwoven. The lower cortex is thinner than the upper cortex, and — like the latter — brownish. Bundles of light or somewhat dark rhizines issue from the lower cortex. Not a few soralia occur on the surface of the thallus (Fig. 394).

Where two lobes of thallus come in contact, they may coalesce; in that case the cortex disappears at the point of contact, and the analogous tissues will coalesce: cortex with cortex, medulla with medulla (Fig. 395).

Apothecia and pycnidia were not observed.

## NEPHROMA LAEVIGATUM.

ACH.

(Plate 64—65).

On the periderm of *Quercus. Jerup Krat, Skagens Odde, 1904. O. GALLØE.*

The thallus is monophyllous, with lobes branched as shown in Fig. 401. The margins of the lobes are in part crenate (Fig. 401); here and there groups of very short isidia occur partly on the intact surface, partly, too, along casual fissures in the cortex (Fig. 401). The upper surface is brownish-grey, the lower surface is more purely yellowish-brownish, finely reticulate-wrinkled. The cortex of the upper surface is pseudo-parenchymatic, the middle layers are brownish, while the deeper

layers are colourless; it is covered by a colourless cuticle of dead, compressed cells. The hyphæ of the gonidial layer are colourless, without haustoria. The gonidia belong to a *polycoccoid Nostoc*. The medullary hyphæ are colourless, long-celled, loosely interwoven, arranged lengthwise in the lobes. The cortex of the lower surface varies rather much in height and is pseudo-parenchymatic. A short tomentum, only visible under the microscope, issues from the lower surface (Fig. 404).

The apothecia are formed in short lobules along the edge of the lobes. On the upper surface these lobules are wrinkled and slightly lighter than the rest of the surface. On their lower surface the apothecia are situated. The disc is plane, dark-brown, regularly oval or somewhat sinuose, surrounded by a thin, light margin, which structurally is identical with the cortex of the lower surface (Fig. 404 and 409). At first the disc is turned downwards, but at last the lobules may become resupinate, the disc thus being turned upwards.

The periphery of the hymenium borders directly on the surrounding ordinary cortex (Fig. 408 and 409); the thin calyx occurring beneath the hymenium is formed of small-celled hyphæ, which do not continue upwards round the sides of the hymenium.

The paraphyses are long-celled, with slightly widened, brown tips. Asci are clavate, with top-walls slightly thickened; they contain eight somewhat brownish, 4-celled spores, about 19—22  $\mu$  long.

Pycnidia were not observed.

## NEPHROMA RESUPINATUM.

### L.

(Plate 66—67).

On bark. *Hoffmannsgave, Funen*.

The thallus is monophyllous; the mode of branching of the lobes is shown in Fig. 412; the margin of the lobes is minutely lobulated and crenate (Fig. 414). When dry the upper surface of thallus is coloured approximately as in *Nephroma laevigatum* (which see); here and there it is slightly wrinkled and very finely tomentose, especially so in the foremost portions. The lower surface is more purely and distinctly tomentose (Fig. 413 and 417).

The cortex of the upper surface is pseudo-parenchymatic, with a tomentum of long-celled, colourless hyphæ. The hyphæ of the gonidial layer are slender, long-celled, loosely interwoven, without haustoria. The gonidia belong to a *polycoccus-like Nostoc*. The medullary hyphæ are long-celled, loose, arranged lengthwise in the lobes.

The lower cortex has the same structure as the upper cortex; it is, however, thin-



ner. Beneath, it is covered by a coarse tomentum of bundles of hyphæ, which act as rhizines in places where they are in contact with the substratum (Fig. 415 and 421).

The apothecia are formed in special, short lobules along the margin of the big lobules, but, besides, in two cases young apothecia were found in the surface of the thallus, far from the margin (Fig. 412), above). As to shape and size they greatly remind of the apothecia of *Nephroma laevigatum*, and the same holds good of their inner structure. At first the apothecia are turned downwards, but later on they become resupinate, with discs turned upwards.

The hymenium borders directly on the ordinary cortex; a calyx of small-celled, brownish hyphæ does not continue upwards round the sides of the hymenium (Fig. 423).

The paraphyses are long-celled, with brownish and slightly incrassate tips. Asci are rather shortly clavate. They contain eight, faintly brownish, 4-celled spores, about 18—22  $\mu$  long.

Pycnidia were not observed.



# PELTIGERA





## PELTIGERA VENOSA.

L.

(Plate 68—69).

On the ground, on a clayey slope at *Fursøen*, between *Frederiksdal* and *Fiskebæk*.  
FR. J. MATHIESEN.

The whole specimen consists of about 30 small lobes, of the habit shown in Fig. 424, all of them irregularly arranged inside an elliptic outline of about  $11 \times 9$  cm. The lobes near the margin of the ellipse usually grow centrifugally, relatively to the central parts of the ellipse, while the other lobes vary to some extent as to the direction of growth; some of them even grow towards the centre. Any strict evidence of the several apparently independent lobes representing one individual unity does not exist.

It is possible, but not at all probable, that they may all be independent individuals. It would be very important to ascertain by experiment whether this species has a polyphyllous thallus — which I am inclined to believe — or whether each lobe represents an independent individual. Anatomically they all agree.

Each lobe protrudes from the ground and is fixed at the base through coarse, brown rhizoidal hyphæ, partly penetrating the soil, partly at the base of the lobes united to a thick strand of chiefly parallel hyphæ, together forming the base of the lobe itself and partly continuing into the dark veins of the thallus. On the upper surface of this dark basal part of the lobe light, gonidia-provided tissues are formed. In the lobe examined here there were three such portions sharply separated from each other. Each of these probably represents an independent primordium of a lobe of thallus, thus confirming the suggestion that the whole of the thallus has a polyphyllous origin. But a little more forward the base of the lobe is continued by one distinct lobe only, the two other primordia of lobes thus remaining undeveloped.

The outline and the mode of branching of the fully developed lobe is better seen in the pictures than described in words. It is brown above, somewhat lighter beneath, and provided with thick, brown veins but without rhizines.

The cortex is big-celled, the upper cell-layers brown-walled, the deeper ones colourless. The hyphæ of the gonidial layer are thin, long-celled, colourless,

without haustoria. The gonidia are cystococcoid. The medullary hyphæ are chiefly longitudinally arranged, long-celled, and colourless.

The apothecia are placed at the margin of the lobes. The youngest stage of development examined by me is pictured in Fig. 426. It consists of some few ascogenous hyphæ embedded among some short-celled, thin-walled sub-hymenial cells, above which there is a hymenium of paraphyses but as yet no asci. Beneath this 'sub-hymenium' the tissues are somewhat brownish and arranged like a calyx below and upwards round the hymenium, gradually passing into very thick-walled, brown hyphæ going round the margin of the lobe, where they are abruptly separated from the more small-celled and much lighter cortex of the upper surface of the thallus; downwards they continue into the brown tissue forming the veins of the under surface.

Later on the connection between the apices of the paraphyses and the covering brown hyphæ is loosened, and then this veil bursts, the apothecium being thus exposed. When ripe it has the appearance of Fig. 425 and Fig. 427.

There is a slightly brownish calyx of rather loose hyphæ running chiefly concentrically beneath and around the sides of the hymenium, where they gradually pass into the stouter brown hyphæ. The paraphyses are slender, long-celled, brown at the scarcely widened tips. The asci are narrowly clavate, with eight slightly brownish, usually 4-celled spores, about  $36-48\ \mu$  long.

*Peltigera venosa* is evidently a primitive species, perhaps even the most primitive of the species of *Peltigera*.

## PELTIGERA HORIZONTALIS.

L.

(Plate 70—71).

On the ground, among moss. O. GALLØE.

The thallus consists of rather large, greyish-green, or in places brownish, lobules, which branch out from a narrow base, becoming fan-like at the margin. The upper surface is smooth, without tomentum. The lower surface is light at the margin, with light ribs and scanty rhizines, but at a short distance from the margin the ribs gradually become considerably broader and darker, while the light-coloured spaces between the ribs become very narrow.

The cortex is big-celled; the walls of its upper cell-layers are brown but without any tomentum; the deeper cells are colourless. The cells of the gonidial hyphæ are thin and rather long-celled. The gonidia are a *polycoccoid Nostoc*. The upper layers of the medulla are formed of rather thin, colourless, long-celled hyphæ running parallel to the longitudinal axis of the lobes; deeper down the hyphæ gra-



dually become much thicker. The rhizines are built of parallel, dark-brown, long-celled hyphæ.

The apothecia originate on rather short lobes, most often turned in such a way that their discs become horizontal. The disc is reddish-brown, orbicular or elliptic, the longitudinal axis at a right angle to the longitudinal axis of the lobes of the thallus; it is surrounded by a smooth, light margin.

The calyx is poorly developed, built of thin hyphæ, which are rather dense just below the hymenium but become looser in texture deeper down towards medulla. The hyphæ run tolerably parallel to the underside of the hymenium, continuing from there upwards round its sides, where it gradually assumes the character of a cortical tissue.

The paraphyses are somewhat thickened and brown at the tips. Asci are clavate, their walls slightly thickened at the tips. The spores are light-brownish and 4-celled, about  $36 \mu$  long.

## PELTIGERA MALACEA.

ACH.

(Plate 72—73—74).

**Specimen 1.** On the ground. In the old fortifications round *Copenhagen*. JOHANNES GRØNTVED, September 7th 1920.

This specimen is apparently a fragment of a larger specimen and is composed of very few lobules, the mode of branching of which is shown in Fig. 449 and 450. The upper surface is light-brownish grey when dry, dark shining, blackish-green when moistened. Beneath, the margin of the thallus is light-brownish grey with narrow lighter interspaces between the thick, broad, confluent veins. Towards the centre the thallus is somewhat darker and provided with some few dark rhizines.

The cortex is big-celled, the upper cells with brown walls. The gonidial layer has thin, rather long-celled hyphæ without haustoria. The gonidia are *Nostoc* of *Polycoccus*-type. The medulla is very thick, formed of chiefly longitudinal, long-celled, thin-walled hyphæ. The rhizoidal hyphæ are long-celled with faintly brown walls.

The apothecia are rather abundant, placed on the tips of short lobules, somewhat transversely elliptic almost as those in *Peltigera horizontalis*, with a deeply reddish-brown disc surrounded by a paler margin. There is a thin, faintly brownish calyx of loosely interwoven hyphæ running chiefly parallel to the under surface of the hymenium, where they continue upwards round the hymenium, finally to pass into the surrounding tissues. The paraphyses are long-celled with faintly thickened, brown tips. The asci are narrowly clavate with walls but slightly thickened

at the top. They contain long, light spores, which are more stretched and thinner than those of *Peltigera horizontalis*, about 60—68  $\mu$  long.

In this specimen a hypogenous cephalodium occurs, formed of colonies of *Polycoccus* enclosed in a tissue of the same character as medulla and with a cortex of big, brown cells, from the surface of which rhizines penetrate into the substratum.

**Specimen 2.** On the ground. *Vinderød Skov* at *Frederiksværk*. E. ROSTRUP.

In all essential features this specimen agrees with specimen 1, except for its slightly longer and spatulate lobes of thallus and its somewhat longer, apothecia-bearing lobules, for the sake of which it is pictured here.

## PELTIGERA POLYDACTYLA.

NECK.

(Plate 75).

On the ground. *Hindsgavl Skov*, July 26th 1867. E. ROSTRUP.

The thallus is composed of lobes, which from a narrow base widen at their free ends, where they are divided into rather numerous digitate branches, the edges of which may be slightly sinuose and in places beset with small squamules. The upper surface is smooth, without tomentum, light and rather uniformly brown. Beneath, the lobes are light with numerous rather broad veins, which are light at the margin, gradually becoming darker-brown towards the base, and with long, dark rhizines which at first are thin and later on brush-like.

The cortex is big-celled; the upper cells have brown walls while the deeper cells are colourless. The hyphæ of the gonidial layer are thin and long-celled, without haustoria. *Nostoc*-gonidia. The medullary hyphæ are much stouter than those of the gonidial layer and chiefly run lengthwise in the lobes. The walls of the rhizoidal hyphæ are of a deep dark-brown colour.

The apothecia are placed on the upper side of the digitate lobules; they are stretched, with entire or slightly lobed margins, light and smooth beneath. The disc is round, surrounded by a narrow, light brim of *velum*. The side-margins of the apothecia are curved downwards. There is a somewhat indistinct, thin calyx, of thin, short-celled, very faintly brownish hyphæ with intercellular spaces, chiefly running parallel to the under surface of the hymenium, from where they continue upwards round the sides of the hymenium; there the hyphæ gradually become much denser and with much longer cells, by degrees passing into the adjacent cortex of the upper surface of the thallus. Distinct ascogenous hyphæ are found in the thin,



sub-hymenial tissues. The tips of the paraphyses are brown and slightly swollen. The asci are narrowly clavate, their walls but little thickened at the top. The number of spores is usually difficult to ascertain with full certainty; there seems to be 6—8. The spores are very light-brown or colourless; in the examined cases they were 40—60  $\mu$  long, with 4—8 cells.

## PELTIGERA SPURIA.

ACH.

(Plate 76—77).

On the ground. *Halskov Birch*-plantation, May 1922. F. MATHIESEN.

In the present specimen the thallus is composed of densely crowded, small lobules, each protruding separately from the ground and all of them probably belonging to one and the same individual, being connected by common rhizoidal hyphæ. The lobes are small (1—3 centimetres), constricted at the base but somewhat widened and branched at the top. Their surface is lighter- or darker-brown; at the top it is very finely tomentose; at the base it is smooth, here and there with greyish soralia. Beneath, the lobes are light, and even at the free end, but at a short distance light ribs begin, turning dark towards the base of the lobe. In the examined specimen there were no distinct rhizines.

The upper layers of the cortex are very big-celled, with brown walls and in part provided with a colourless tomentum. The gonidial layer is long-celled, loose and colourless. Haustoria were not observed. The gonidia are *Nostoc* of *Polycoccus*-type. The medullary hyphæ are much thicker than those of the gonidial layer and chiefly running lengthwise. The lowest hyphæ at the bottom of the ribs are again slightly thinner and (in the brown portions of the ribs) provided with partly brown cell-walls.

The soralia represent bare portions of the gonidial layer from which soredia are loosened, composed of small colonies of *Nostoc* in connection with some few hyphæ.

The apothecia are stretched, with downwards curved side-margins and dark-reddish discs surrounded by a colourless brim of veil-hyphæ. Beneath, the apothecia are even (i. e. without ribs) and very finely tomentose.

The calyx is thin, indistinct, composed of loosely interwoven, slightly brownish hyphæ of much the same structure as those of the gonidial layer and chiefly running parallel with the underside of the hymenium, from where they continue upwards round the sides of the hymenium, gradually becoming denser and more big-celled than at the bottom of the calyx; finally they pass into the adjacent cortex of the upper surface of the thallus. The ascogenous cells are little conspicuous in the thin

sub-hymenial tissues. The tips of the paraphyses are brown and slightly swollen. The asci are narrowly clavate with walls faintly thickened at the top. The number of spores is usually difficult to state with certainty; frequently, however, there seems to be six in each ascus; they are light-brownish, and in the numerous cases measured they were about 54—56  $\mu$  long.

## PELTIGERA APHTOSA.

L.

(Plate 78—79).

On the ground. *Rønbjerg Strand* near *Løgstør*. TH. JENSEN.

The lobes of thallus are rather broad and membranaceous, brownish-green. The marginal portions of the lower surface of thallus are rather light, with broad, light veins, between which are seen narrow depressions. At some distance behind the margin the veins unite to a thick, blackish felt, from the underside of which scattered, dark rhizines issue.

The cortex is pseudo-parenchymatic, composed of chiefly erect hyphæ continuing upwards into short tomentum-hyphæ (Fig. 490 and 494). The hyphæ of the gonidial layer are slender, rather long-celled, without haustoria, and erect. The gonidia are cystococcoid or dactylococcoid.

The upper layers of the medulla consist of lengthwise arranged hyphæ; in the deeper layers the hyphæ are more erect and tomentum-like (Fig. 490). In the central portions of thallus the lower medullary hyphæ form a very thick and dark felt, from which rhizines issue (Fig. 491).

Numerous epigenous, button-like cephalodia occur on the upper surface of thallus. They are at first almost orbicular; later on they become, occasionally, slightly crenate.

The cephalodia arise in the following way: the tomentum-hyphæ take in colonies of *Nostoc*, which happen to be lying on the surface. The hyphæ entangle the colonies of *Nostoc* and cover them with a thin, loose cortex, at the same time penetrating the colonies with colourless, short-celled hyphæ (Fig. 494). Later on, when the cephalodia increase in size, the connection between the lower surface of the cephalodia and the upper surface of thallus becomes very intimate as the cortex of thallus becomes less distinctly pseudo-parenchymatic and is replaced by more filiform, stretched hyphæ connecting the cephalodia with the cortex of thallus. The chlorogonidia gradually disappear, entirely or in part, beneath the cephalodia, possibly on account of the overshadowing caused by the cephalodia.

Apothecia and pycnidia were not found in this specimen.

## PELTIGERA RUFESCENS.

WEIS.

(Plate 80—81—82).

**Specimen 1.** On the ground. *Asserbo, Sjælland.* O. GALLØE.

The lobes of thallus are opaque, greyish along the margins, while the central and older portions are brownish. Their mode of branching is shown in Fig. 496 and 498. Beneath they are mainly light, with veins which are white towards the foremost ends of the lobes, while the older portions are brownish-black with long concolorous rhizines. Internally, anatomically, specimen 1 fully agrees with specimen 2 as to apothecia, spores, and all other details. Structurally, it also agrees with *Peltigera canina*, for which reason it will not be described here. The specimen is pictured here exclusively because it is provided with adventive apothecia issuing from the lower surface of the normal apothecia (Fig. 496 and 499). In structure the adventive apothecia fully agree with the ordinary apothecia as to paraphyses, spores, and calyx; in accordance, however, with their morphological position the sides of the hymenium are not surrounded by cortical hyphæ but by the ordinary tomentum hyphæ occurring on the lower surface of thallus (Fig. 501). For further details the explanation of the figures and Plate 80 are referred to.

**Specimen 2.** On the ground near *Fursøen.* H. MORTENSEN.

The lobes of thallus are opaque and brownish above, provided with groups of isidia, partly occurring on the very surface, partly along the margins. Beneath they are rather light, with veins, the foremost ends of which are light and provided with light rhizines, while the older portions of the lobes have somewhat darker veins and rhizines. The branching of the lobes is shown in Fig. 503.

The cortex is pseudo-parenchymatic, with brown cell-walls, and covered by a colourless cuticle of compressed dead cells. The hyphæ of the gonidial layer are long-celled, slender, without haustoria. The gonidia belong to a polycoccoid *Nostoc*. The medullary hyphæ are colourless, thicker than those of the gonidial layer, arranged lengthwise in the lobes. In the veins of the lower surface they are dark and gradually pass downwards into the rhizines, in which they frequently are anastomosed.

The apothecia are placed in separate, short lobules. They are slightly oblong, with downwards incurved margins. They have a thin calyx of short-celled, thin, somewhat loosely interwoven hyphæ, completely as in *Peltigera canina*; calyx follows the whole of the basal portions of the hymenium but does not continue upwards round the sides of the hymenium. The paraphyses are slender, long-celled, with brown and slightly thickened tips, — completely as in *Peltigera canina*.

Asci are clavate, with slender, light, pluri-locular spores, — completely as in *Peltigera canina*. The spores are about 50  $\mu$  long.



## PELTIGERA CANINA.

L.

(Plate 83—84—85—86—87—88).

**Specimen 1.** On the ground, among moss. *Frederiksdal Skov* 1937. O. GALLØE.

This small specimen is the smallest and youngest I have found and is pictured here to show the thoroughly monophylline origin of the thallus of *Peltigera canina*.

The thallus is very small, formed of one single lobe protruding from the surface of the ground and already divided into three lobules. When growing older these first lobules will gradually—by subsequent branching—assume an oval outline as found in the following specimen.

As to colour, ribs, and rhizines, as well as in its inner structure, this specimen fully agrees with the other specimens (*e.g.* specimens 2 and 3) described here, for which reason it need not be described here.

**Specimen 2.** On the ground, among moss. *Frederiksdal Skov* 1937. O. GALLØE.

This specimen is considerably larger and older than specimen 1. This specimen, too, evidently proved to be of a monophylline origin, fixed as it was by one sole, original, basal part, from which the whole of the thallus had developed by repeated branching. Thus, according to its origin the whole of the thallus is to be regarded as one single, richly divided lobe. As to colour, branching, rhizines, internal structure, and apothecia it fully agrees *e.g.* with specimen 3, for which reason it need not be described in details here.

**Specimen 3.** On a stone-fence, among moss. *Frederiksdal*. O. GALLØE.

This specimen is large and well developed. It is so rich in lobes, to a great extent growing over each other, that its centre of germination can no longer be pointed out with any certainty; still, there is no reason whatever to doubt its monophylline origin. Here, as in most cases, it is absurd to describe the form of the 'lobes' without giving an accurate definition of the meaning of that term. In taxonomic works botanists usually offend against the principle that the conception of the 'lobe' should be clearly defined. According to the monophylline origin of the present thallus the description of one lobe should be identical with the description of the whole of the thallus since the latter represents but one lobe.

But as such a description is best made by giving a picture of the whole specimen, the picture in Fig. 519 is referred to. How this profusion of branches has been formed is seen *e.g.* in Fig. 521, which shows the branching of the marginal parts of a lobe and its further mode of branching; it is shown there how the finest, newly formed branches of the lobule continue branching when growing centrifugally further, the whole growth resulting in a profusion of divisions of the thallus as shown in Fig. 519.

The upper surface of the thallus is very finely tomentose through threadlike, elongated cortical hyphæ. The colour of the surface is in places greyish with a faint shade of brown owing to a brown pigment deposited in the walls of the upper cells



of the cortex. The lower surface is light, whitish, with numerous light, netlike, confluent ribs, which near the margin of the thallus bear numerous white rhizines, the tips of which, however, gradually turn darker, brown.

The apothecia are developed in short branches along the margin of the thallus. The youngest recognizable apothecia appear as small, knot-like incrassations at the margin of the lobes. At this stage of development a rather dense and short-celled tissue intermingled with numerous big ascogenous cells is to be seen in the interior of the knots; above this tissue the first beginnings of long-celled paraphyses are seen developing just beneath the cortex, which latter in the examined case was already loosening from the tips of the paraphyses. Around this primordium of apothecium there was an enveloping layer of tomentum-hyphæ of quite the same structure as those occurring on the upper and lower surface of the thallus. When later on the asci have been formed, the cortex covering the apothecium is broken. The fully ripe apothecium has a rather distinct but thin calyx of small-celled, faintly brown hyphæ lying beneath the hymenium and round its vertical sides, where they gradually pass into the adjacent, more big-celled tissues.

The paraphyses are densely crowded, long-celled, with slightly widened brown tips. The asci are rather thin-walled, with long, narrow, almost colourless spores, about  $48\ \mu$  long. (Fig. 537).

**Specimen 4.** On a stone-fence, facing north-west, growing among moss. *Fredriksdal*. February 1937. O. GALLØE.

This very large and well developed specimen is pictured here, because in spite of its considerable size it still showed a distinctly lateral and monophylline origin. It had numerous apothecia and numerous young primordia of apothecia. Its inner structure fully agreed with that of specimen 3.



# PLATES

PLATE 1.

PYRENOPSIS IMPOLITA.

TH. FR.

Fig. 1. Portion of thallus, the free margin of which is turned upwards in the picture. Note the difference between the thin portions and the thicker areoles. Numerous, apparently confluent, apothecia occur in the areoles. ( $\times 21$ ).

Fig. 2. Apothecia with surrounding thallus; the latter is red owing to the occurrence of *Gloeocapsa*-gonidia. Deeper down in the thallus are seen other, bluish, *Cyanophyceæ*. ( $\times 111$ ).

Fig. 3. Vertical section of thallus, with *Gloeocapsa*-gonidia and very scanty and indistinct hyphæ. ( $\times 558$ ).

Fig. 4. Portion of the surface of thallus, with *Gloeocapsa*-, *Stigonema*-, and *Microcystis*(?)-like *Cyanophyceæ*, and some few hyphæ. ( $\times 1129$ ).

Fig. 5. Colony of *Microcystis* (?), isolated from the thallus, in which it occurs rather frequently. ( $\times 1222$ ).

Fig. 6. Hyphæ from a somewhat higher level of thallus than that in Fig. 7; among the hyphæ a colony of *Microcystis* (?). ( $\times 1005$ ).

Fig. 7. Hyphæ from the basal parts of thallus. ( $\times 1129$ ).



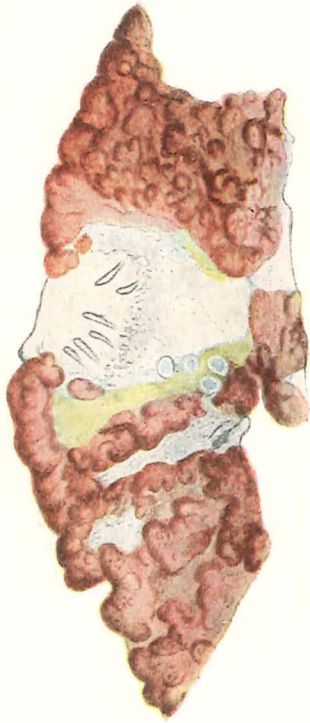


Fig. 2

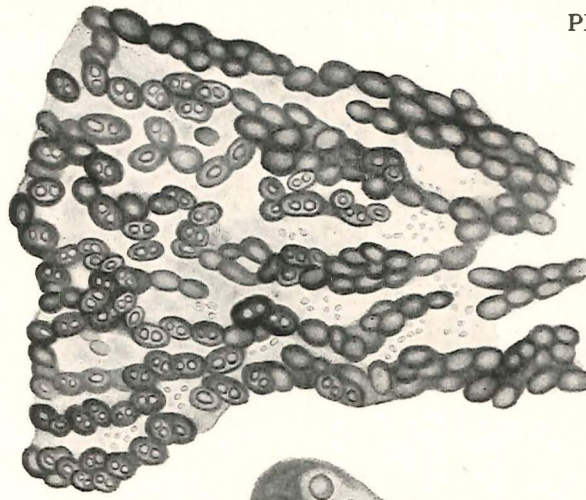


Fig. 3

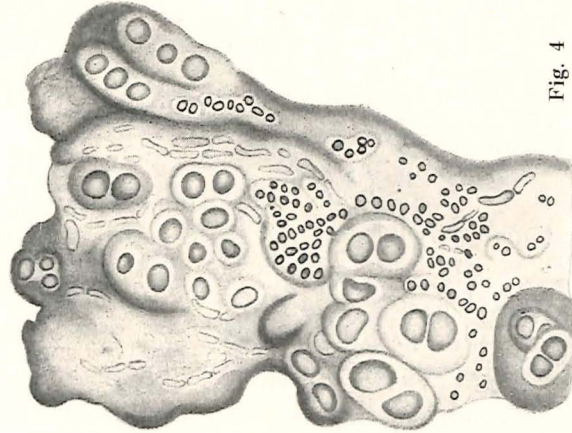


Fig. 4

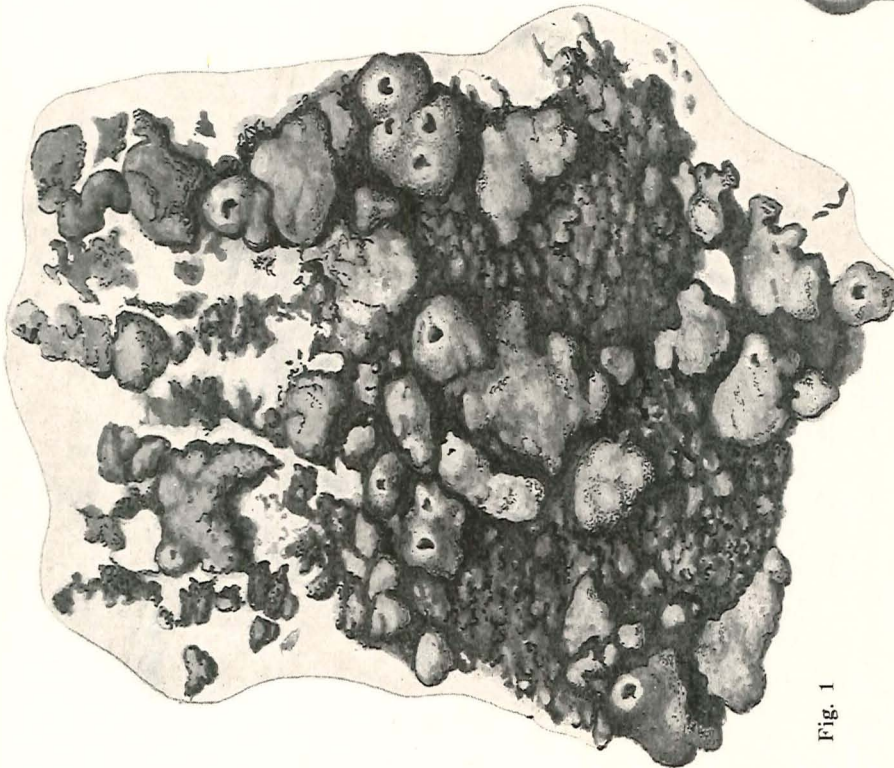


Fig. 1

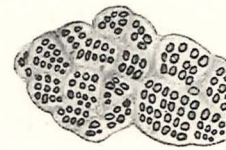


Fig. 5

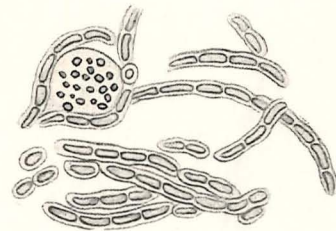


Fig. 6

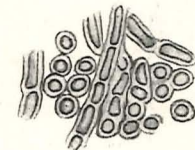


Fig. 7

O. Galløe del.

PYRENOPSIS IMPOLITA TH. FR.

PLATE 2.

PYRENOPSIS IMPOLITA.

TH. FR.

Fig. 8. Section of *Stigonema*, occurring here and there in the thallus, and some few hyphæ. ( $\times 1053$ ).

Fig. 9. *Stigonema*, isolated from *Pyrenopsis*. Beside the *Stigonema* a small colony of *Microcystis* (?). ( $\times 1053$ ).

Fig. 10. Margin of apothecium, with asci, paraphyses, tissues of the calyx, and with the surrounding thalline margin, composed of scanty hyphæ between the *Gloeocapsa* and *Microcystis* (?) -gonidia. ( $\times 697$ ).

Fig. 11. Ripe ascus with spores. ( $\times 741$ ).

Fig. 12. Pycnide, embedded in the thallus, the gonidia of which are *Gloeocapsa* and *Stigonema* (at the right). ( $\times 651$ ).

Fig. 13. Conidiiferous hyphæ and perithecial hyphæ. ( $\times 1159$ ).

Fig. 14. Horizontal section of thallus, with *Gloeocapsa*-gonidia and interspersed hyphæ. ( $\times 1053$ ).



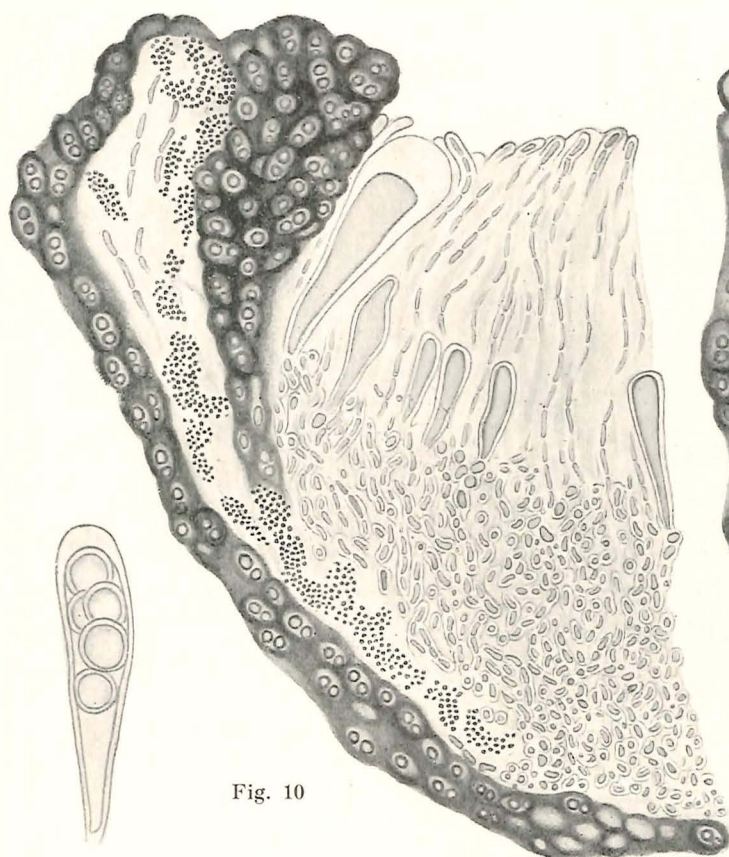


Fig. 10

Fig. 11

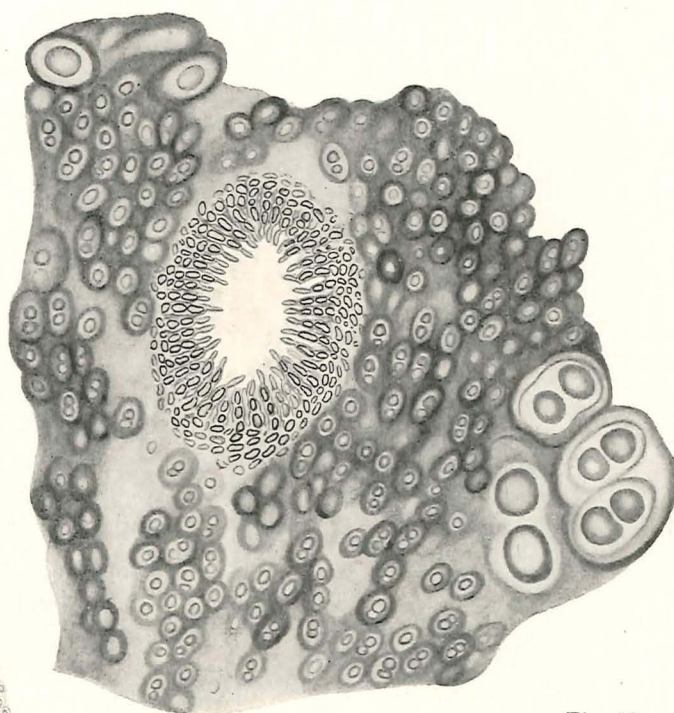


Fig. 12

Fig. 14

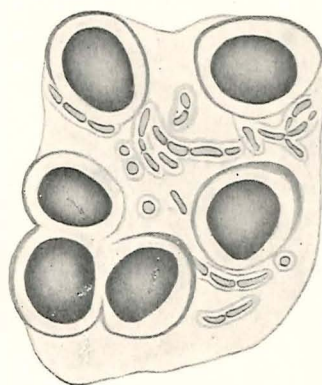


Fig. 8

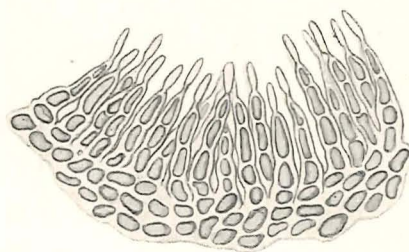


Fig. 13

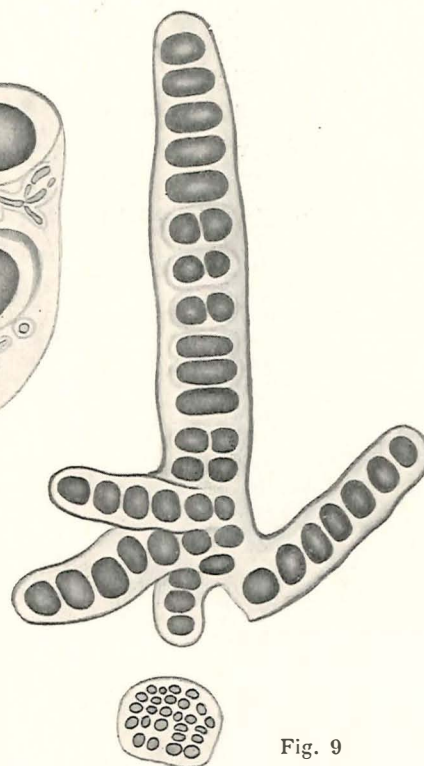


Fig. 9

*O. Gallæ del.*

*PYRENOPSIS IMPOLITA* TH. FR.

PLATE 3.

THYREA PULVINATA.

SHAER.

(A Swedish specimen).

Fig. 15. Entire thallus. ( $\times 7$ ).

Fig. 16. Entire thallus, seen from below. The light spot at the bottom of the picture is the point of attachment of the thallus. ( $\times 7$ ).

Fig. 17. A thallus, the point of attachment of which is at the bottom of the picture. ( $\times 7$ ).

Fig. 18. Longitudinal section of a lobe of thallus. ( $\times 154$ ).

Fig. 19. Portion of the same section as in Fig. 18. ( $\times 690$ ).

Fig. 20. Surface of thallus. Above the section are seen isolated *Xanthocapsa*-cells with adherent hyphæ. ( $\times 1164$ ).

The anatomical pictures given here show the structure of the specimen pictured in Fig. 15 and 16.



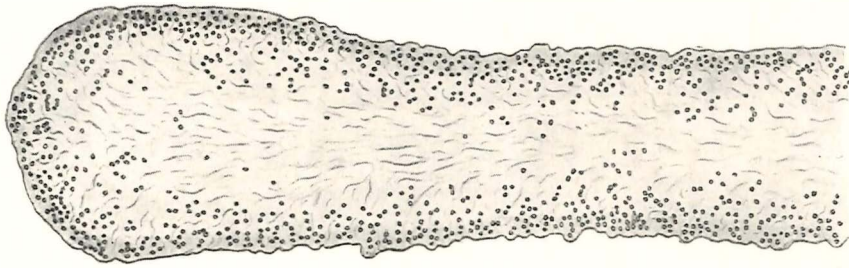


Fig. 18



Fig. 17

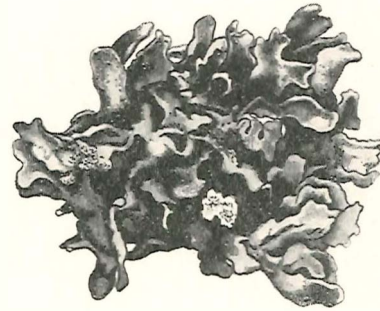


Fig. 16

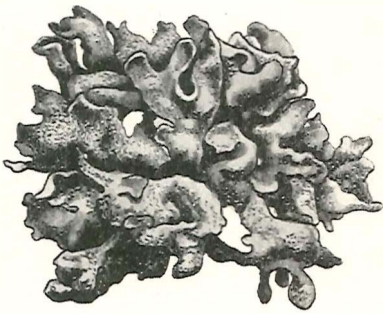


Fig. 15

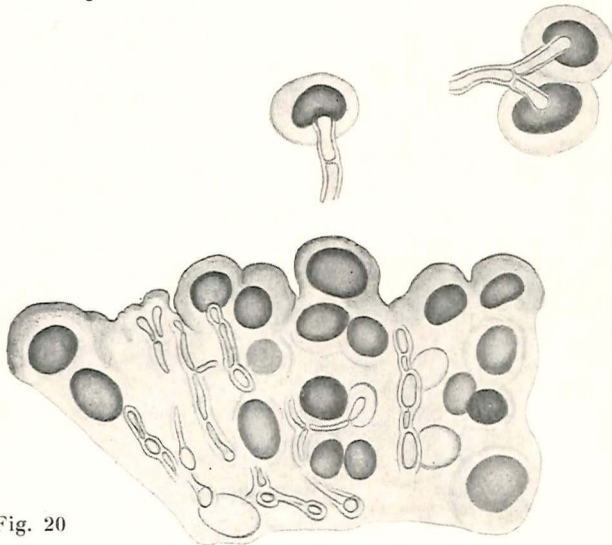


Fig. 20

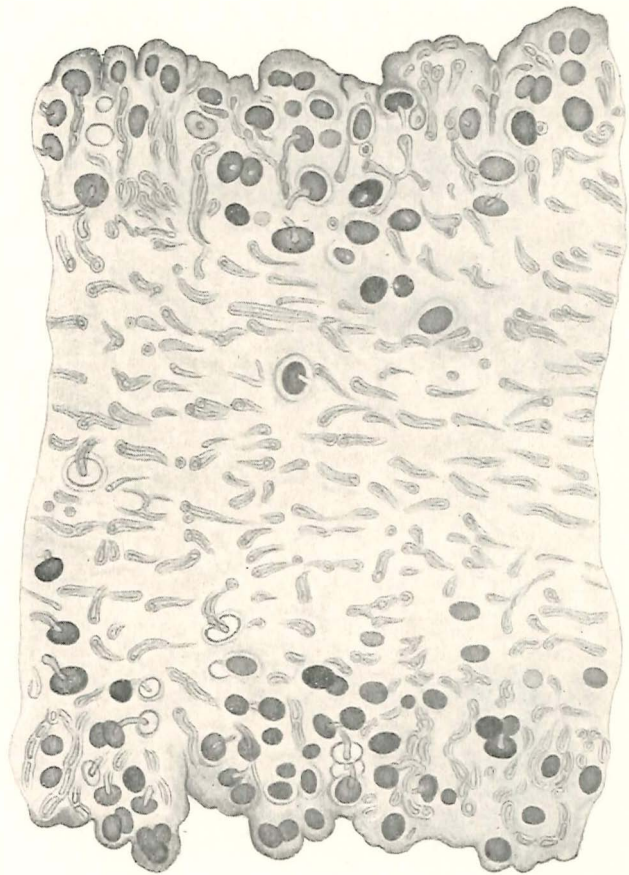


Fig. 19

*O. Galløe del.*

THYREA PULVINATA SHAER.  
(A Swedish specimen).

PLATE 4.

POROCYPHUS AREOLATUS.

FLOR.

Fig. 21. Thallus on the granite substratum. ( $\times 22$ ).

Fig. 22. A dark portion of thallus from the surface of an areole, with *Scytonema* and colourless hyphæ. Beside this picture the colourless hyphæ with interspersed cells of *Microsystis* (?) and isolated filaments of *Scytonema*. ( $\times 710$ ).

Fig. 23. *Microcystis* (?) surrounded by colourless hyphæ, from the intercoralline tissue. ( $\times 1150$ ).

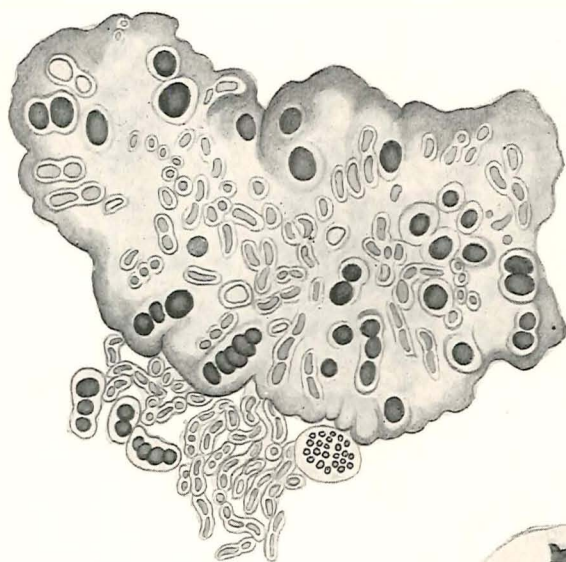


Fig. 22

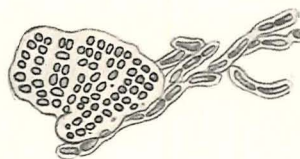


Fig. 23

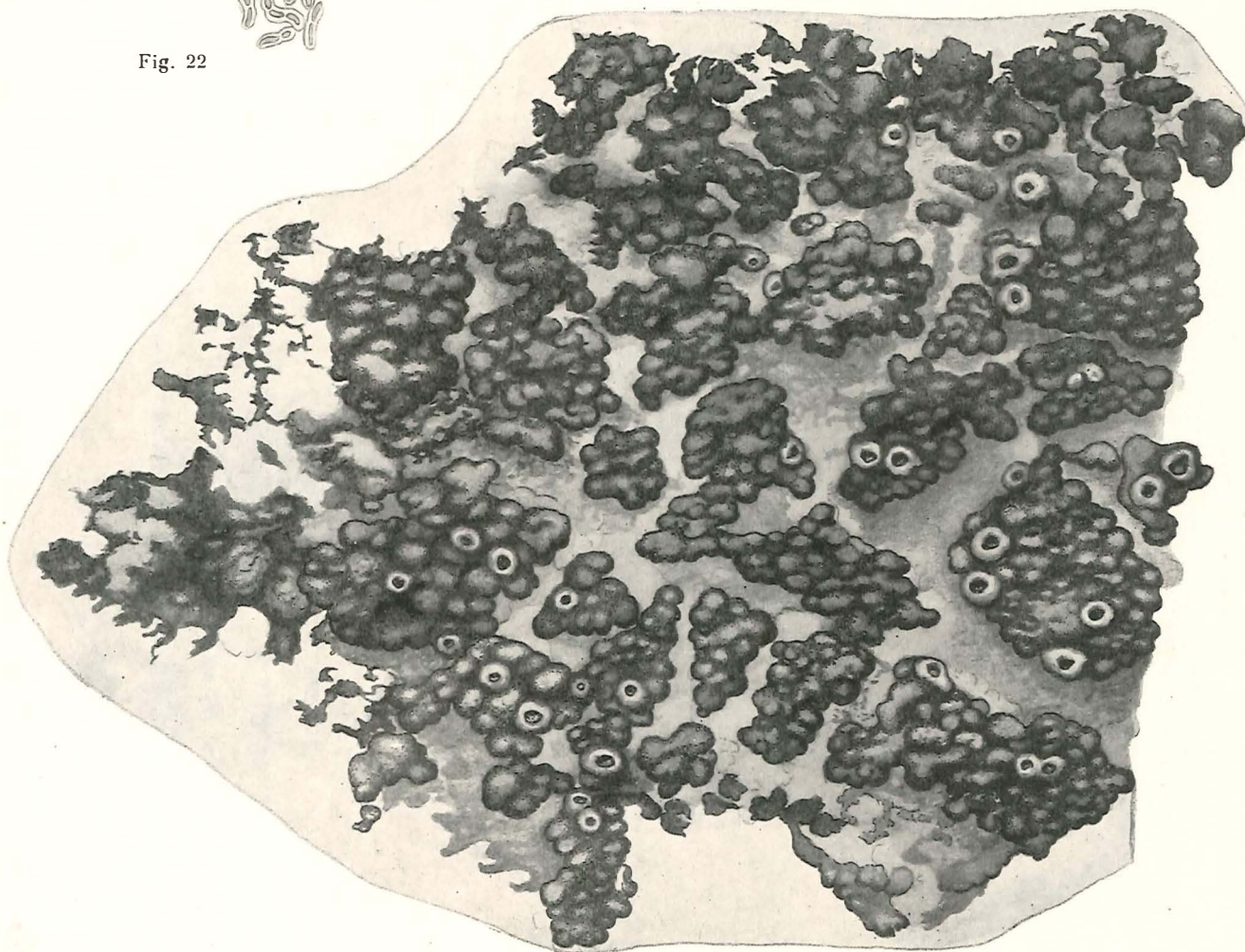


Fig. 21

*O. Galløe del.*

POROCYPHUS AREOLATUS FLÖT.



PLATE 5.

POROCYPHUS AREOLATUS.

FLOT.

Fig. 24. Section of thallus, showing dark-brown coralline portions with *Scytonema* as gonidia, and, between these, the colourless portions of thallus, made up of hyphæ and scattered filaments of *Scytonema* and *Micro-Cyanophyceæ* (*Microcystis*?). ( $\times 149$ ).

Fig. 25. Margin of an apothecium, formed in the interior of one of the coralline portions of thallus, which latter remains as a *margo thallinus* round the hyphæ of the calyx. Below in the figure portions of two other dark portions of thallus, and of inter-coralline colourless tissue with *Microcystis*(?)-gonidia and scanty hyphæ. ( $\times 703$ ).

Fig. 26. Asci and paraphyses. ( $\times 734$ ).



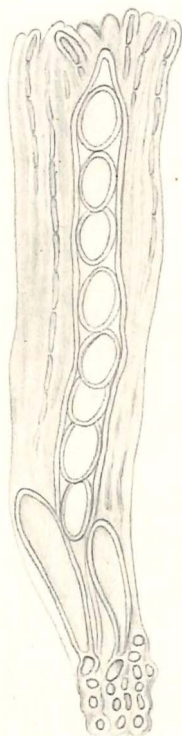


Fig. 26

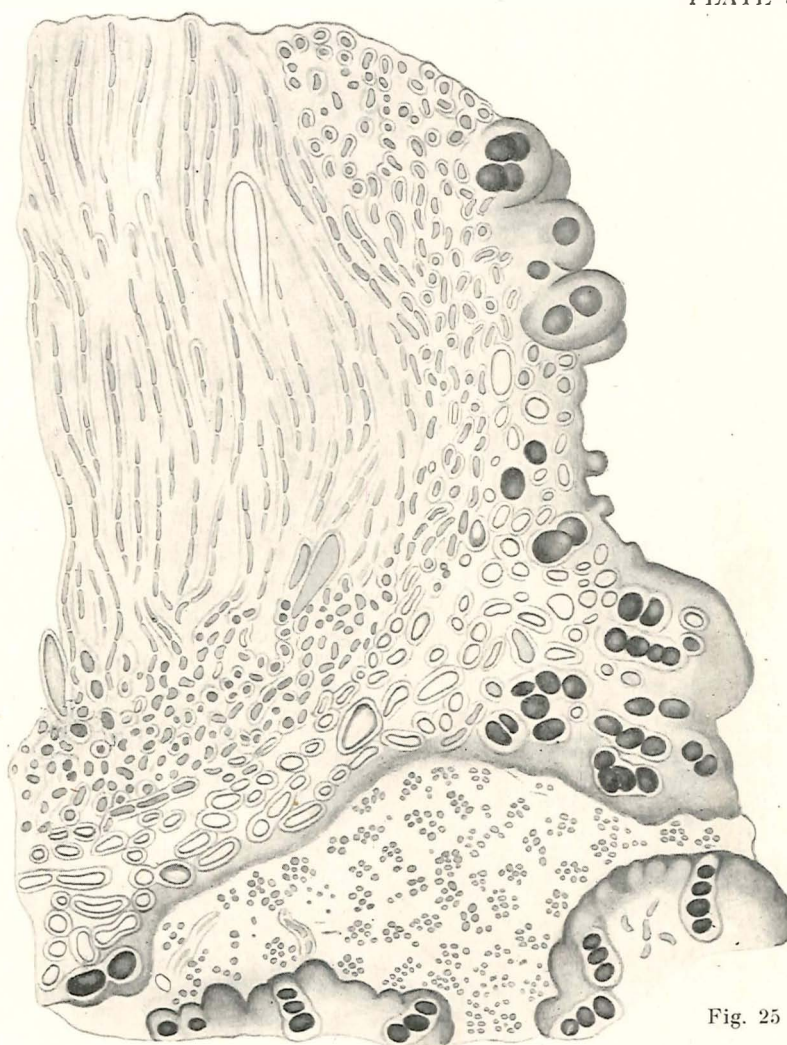


Fig. 25

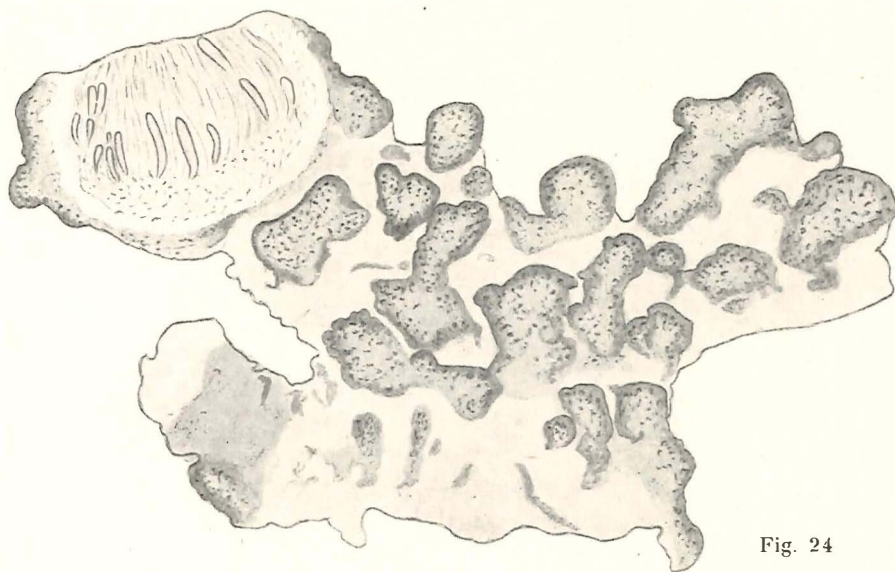


Fig. 24

O. Galløe del.

POROCYPHUS AREOLATUS FLÖT.

VI P 2a

PLATE 6.

EPHEBE LANATA.

L.

**Specimen 1.**

Fig. 27. Portion of a tuft, seen from above, intermingled with moss. ( $\times 4$ ).

Fig. 28. Portion of a procumbent-ascendent branch of thallus, painted in moistened state. ( $\times 33$ ).

Fig. 29. Tip of a branch; the hyphæ are embedded in the gelatinous cell-walls of *Stigonema*. ( $\times 685$ ).

Fig. 30. Portion of an older branch. The axial portions are chiefly composed of hyphæ. ( $\times 697$ ).

Fig. 31. Portion of branch of thallus, with groups of *Stigonema* cells. From the side of the branch protrudes a branching group of *Stigonema* filaments still not lichenized. ( $\times 166$ ).



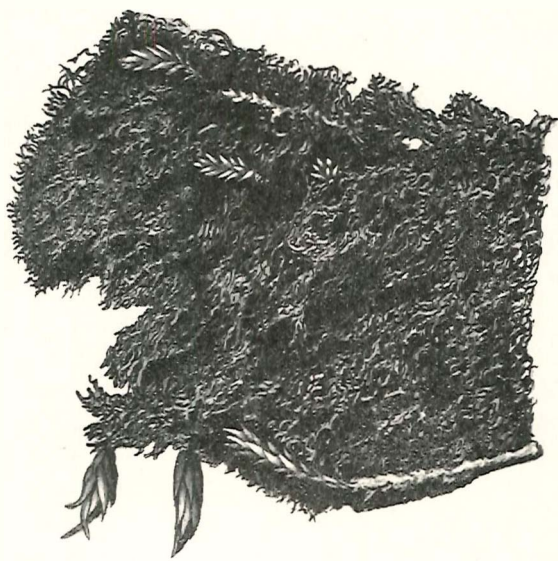


Fig. 27

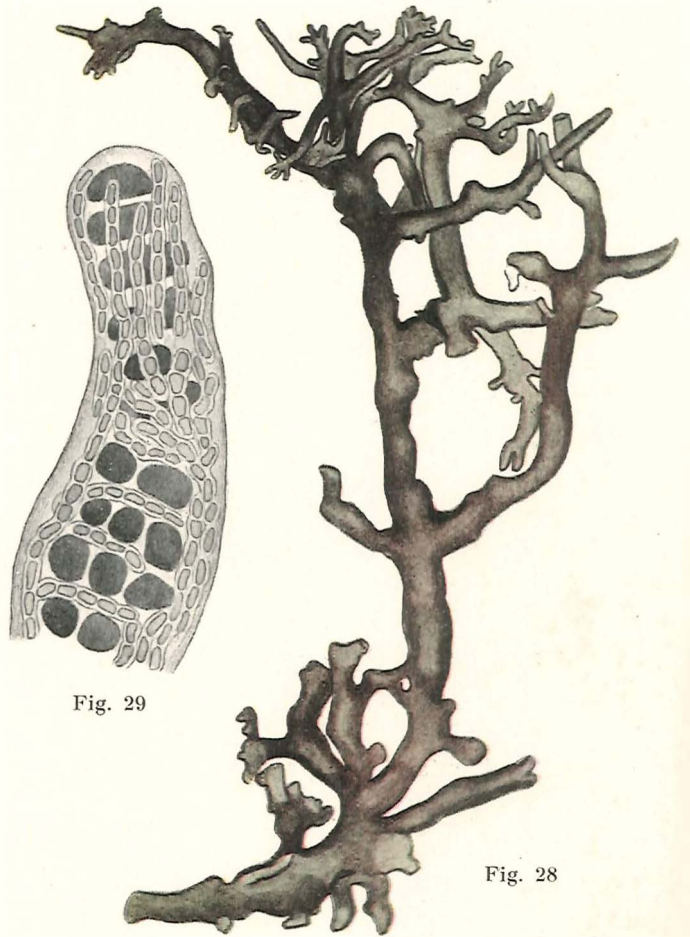


Fig. 28

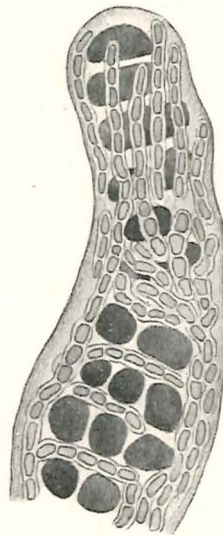


Fig. 29

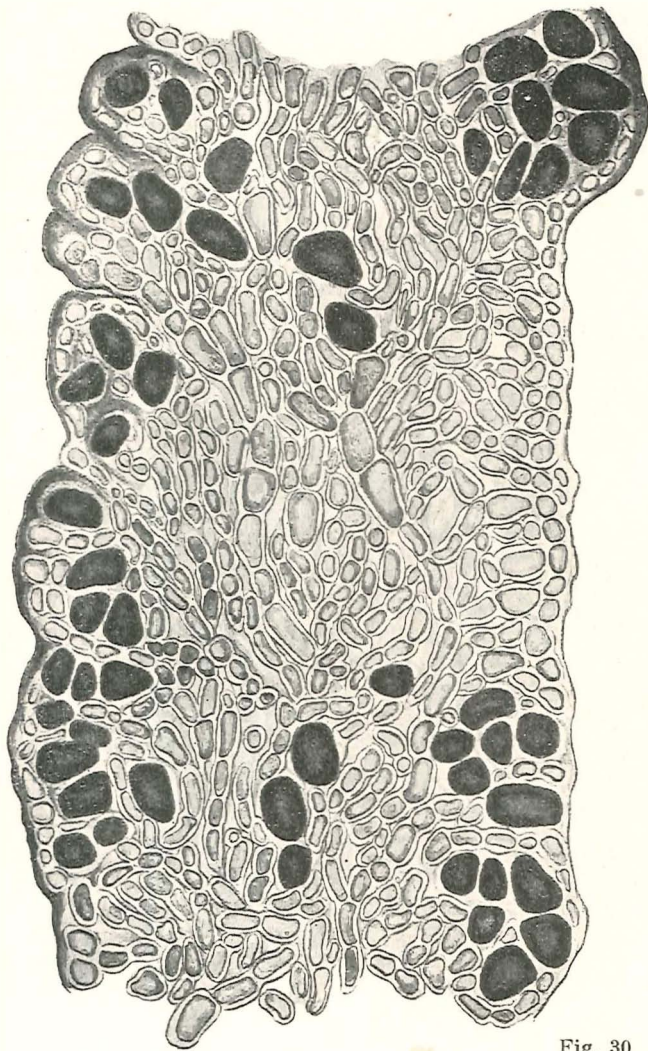


Fig. 30

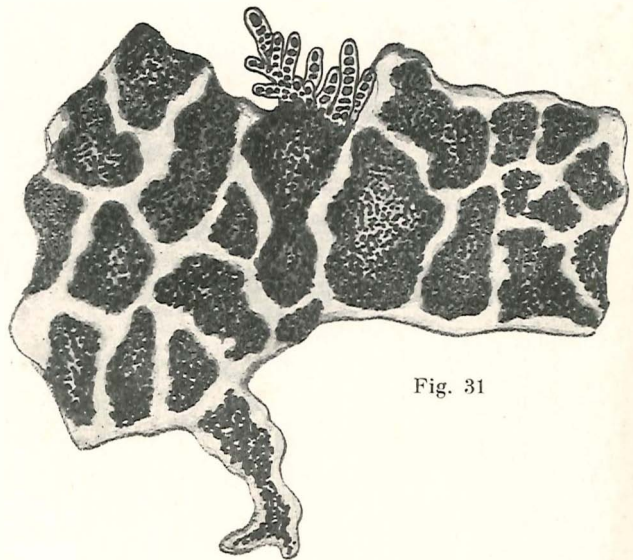


Fig. 31

O. Galløe del.

EPHEBE LANATA L.  
(Specimen 1).

PLATE 7.

EPHEBE LANATA.

L.

**Specimen 1.**

Fig. 32. Transverse section of a branch; above in the picture beginning lateral branches. ( $\times 685$ ).

Fig. 33. To the left in the section the surface of the branch, with *Stigonema* gonidia. To the right in the picture protruding hyphæ branching among other, accidental, cyanophilous algæ covering the surface of the thallus. ( $\times 719$ )).

**Specimen 2.**

Fig. 34. Procumbent branch with adhering grains of minerals. ( $\times 85$ ).

Fig. 35. Branch of thallus, turned downwards and adhering to the substratum. ( $\times 90$ ).



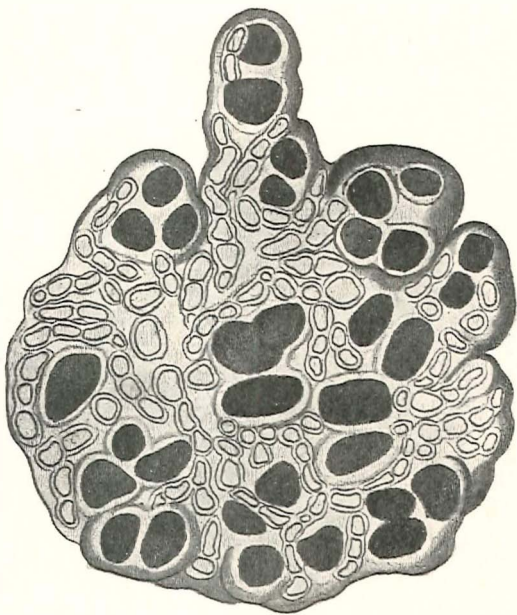


Fig. 32

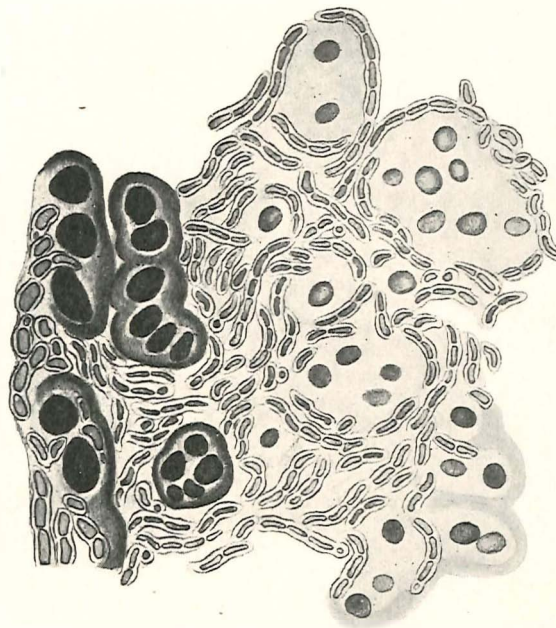


Fig. 33

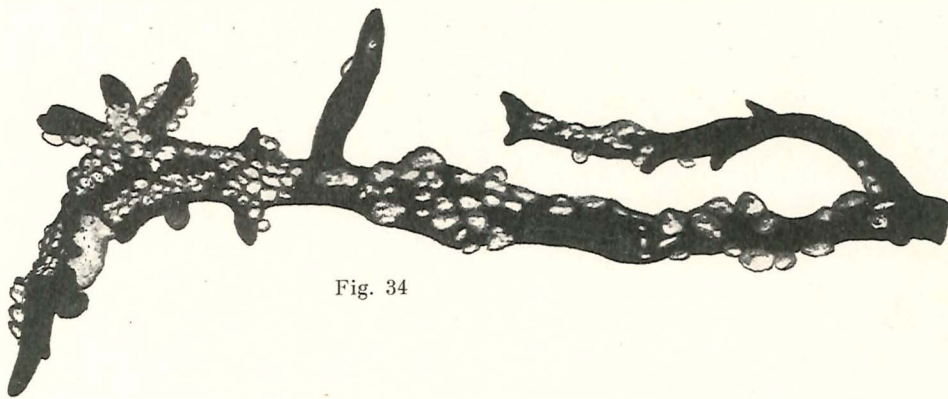


Fig. 34



Fig. 35

*O. Gallae del.*

EPHEBE LANATA L.  
(Specimen 1, 2).

PLATE 8.

EPHEBE LANATA.

L.

**Specimen 3.**

Fig. 36. Branches of thallus with incrassate portions, in which several apothecia with punctiform discs are embedded. ( $\times 80$ ). One ripe ascus and two unripe asci with a fragment of sub-hymenial tissue. ( $\times 747$ ).

Fig. 37. Longitudinal section of podetium with an apothecium. The latter has a perithecium-like wall composed of hyphæ with dark tips. In the present specimen some few paraphyses seemed to occur, embedded in a common hymenial gelatine. The existing structural conditions can scarcely be interpreted in any other way, although the existence of paraphyses is usually denied by other investigators. ( $\times 620$ ).

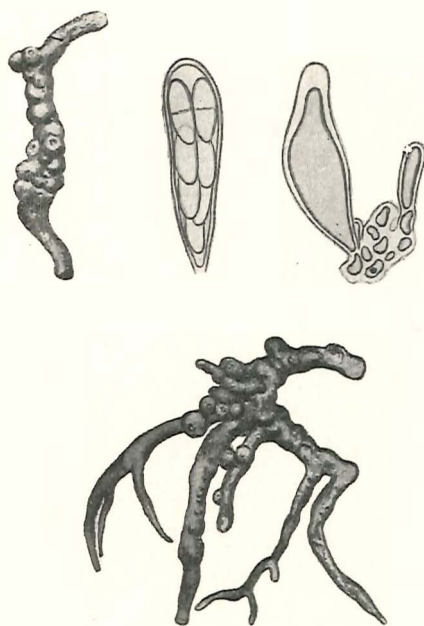


Fig. 36

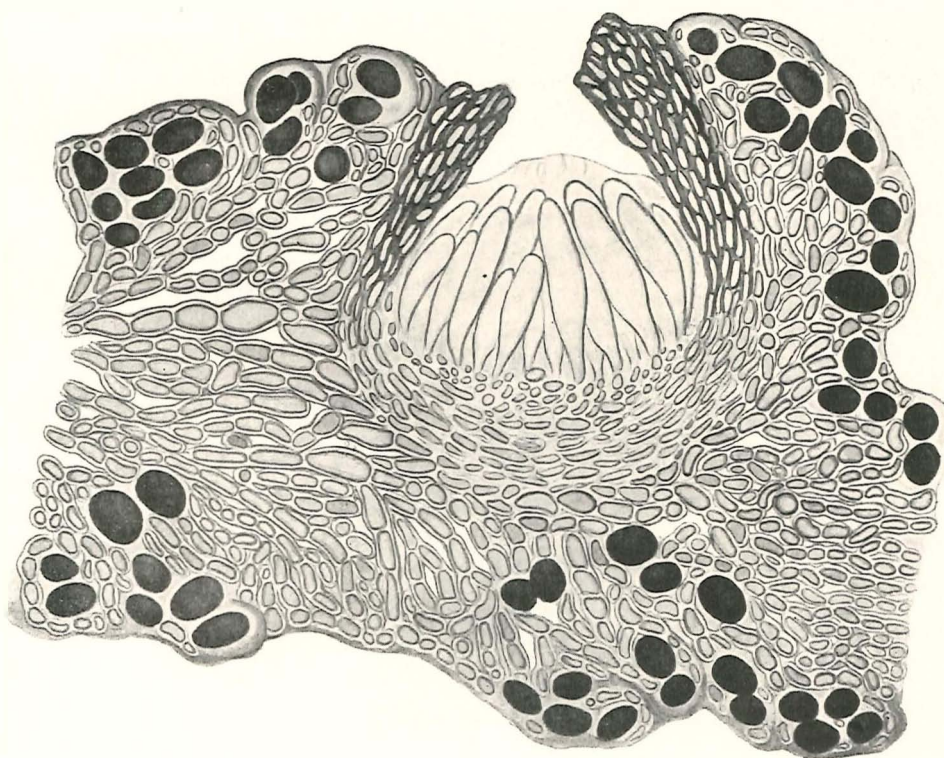


Fig. 37

*O. Galløe del.*

EPHEBE LANATA L.  
(Specimen 3).

PLATE 9.

POLYCHIDIUM MUSCICOLA.

Sw.

Fig. 38. Portion of thallus, seen from above, intermingled with moss; painted in moistened state. To the right, an apothecium. ( $\times 16$ ).

Fig. 39. Branch of thallus, moistened. ( $\times 43$ ). To the right and to the left, two regularly dichotomous tips of branches. ( $\times 65$ ).

Fig. 40. An erect branch, dying out at the base. ( $\times 23$ ).

Fig. 41. Tip of a branch, with a young apothecium. ( $\times 75$ ).



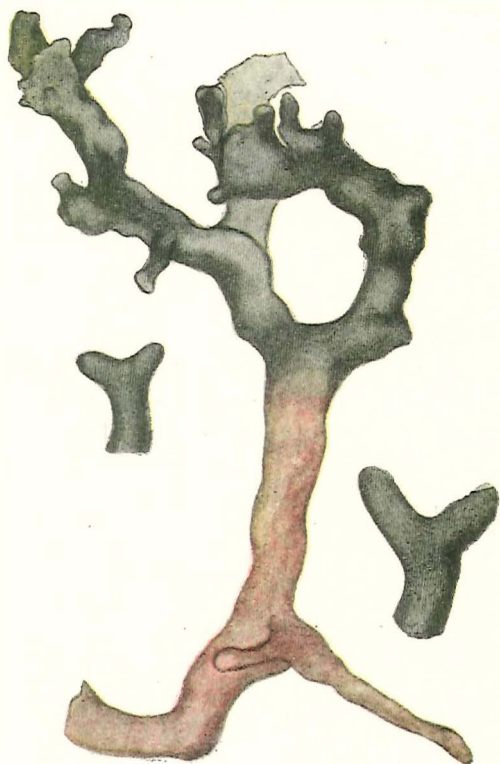


Fig. 39

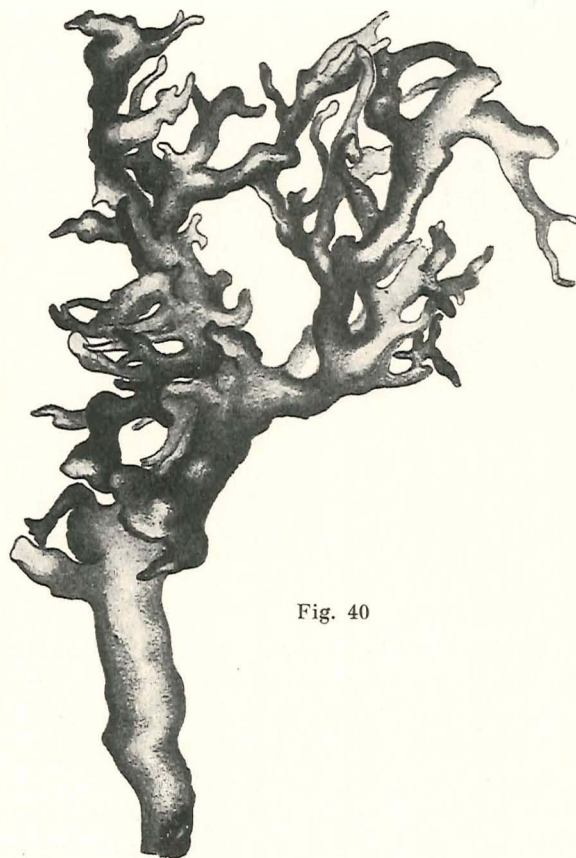


Fig. 40

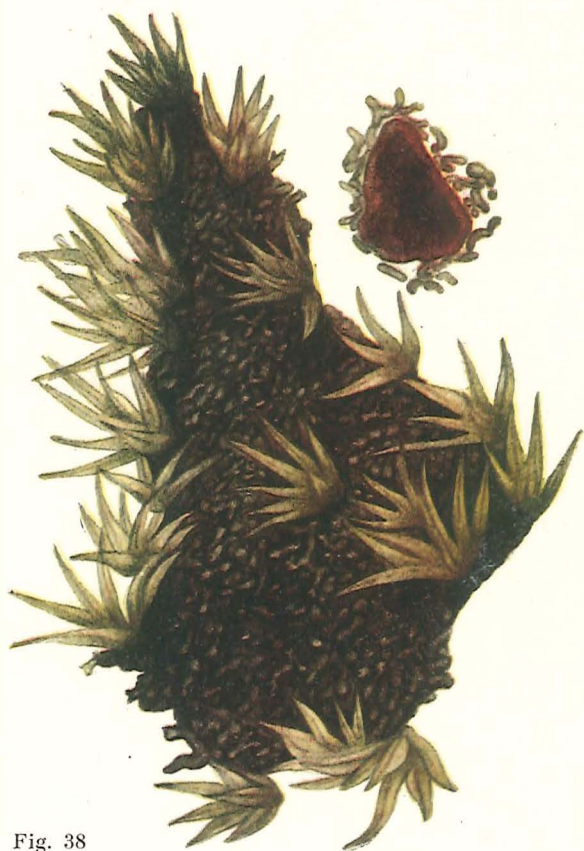


Fig. 38

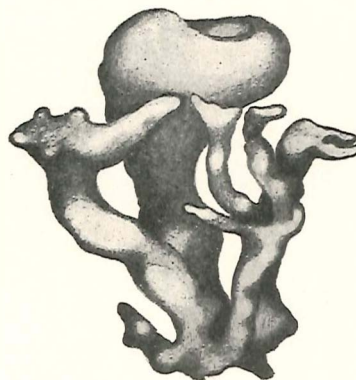


Fig. 41

*O. Galløe del.*

POLYCHIDIUM MUSCICOLA Sw.

PLATE 10.

POLYCHIDIUM MUSCICOLA.

Sw.

- Fig. 42. Longitudinal section of a branch of thallus, with an apothecium. ( $\times 78$ ).  
Fig. 43. Longitudinal section of a branch of thallus. ( $\times 720$ ).  
Fig. 44. Transverse section of a branch of thallus. ( $\times 720$ ).  
Fig. 45. Cortex of a branch of thallus; surface-view. The cell-walls are brown. ( $\times 744$ ).  
Fig. 46. Above, two ripe asci. Below, ripe spores. ( $\times 840$ ).  
Fig. 47. Margin of apothecium; the tips of the paraphyses and the outer walls of cortex are brown; all the other tissues are light. ( $\times 727$ ).



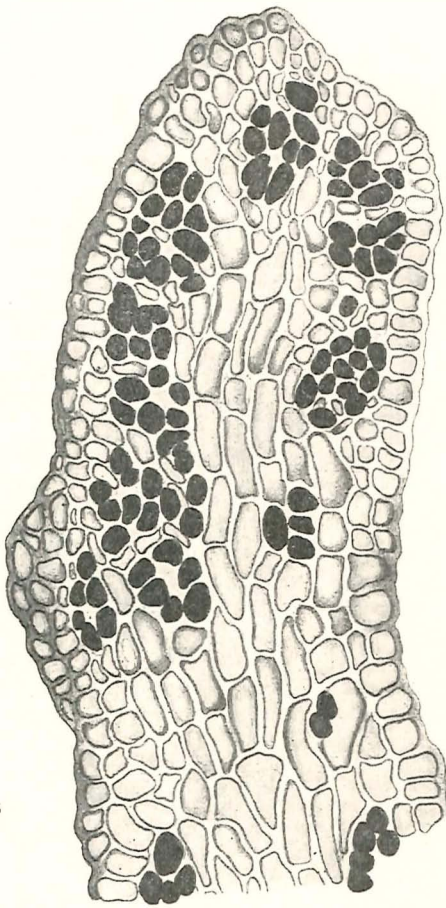


Fig. 43

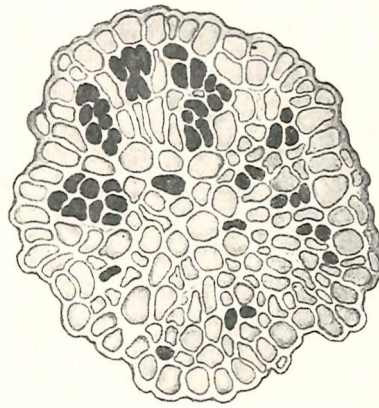


Fig. 44

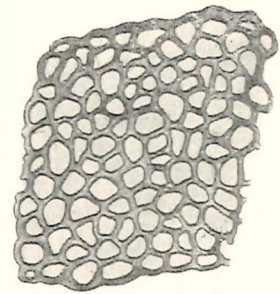


Fig. 45

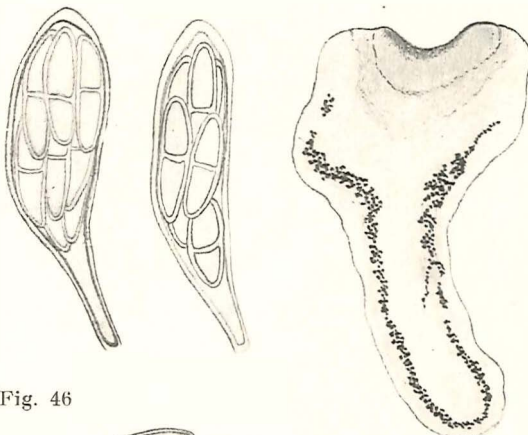


Fig. 46

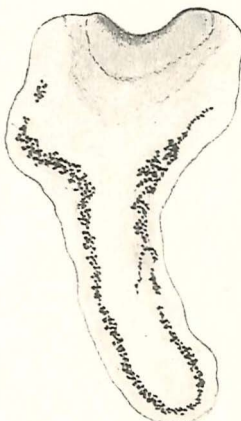


Fig. 42

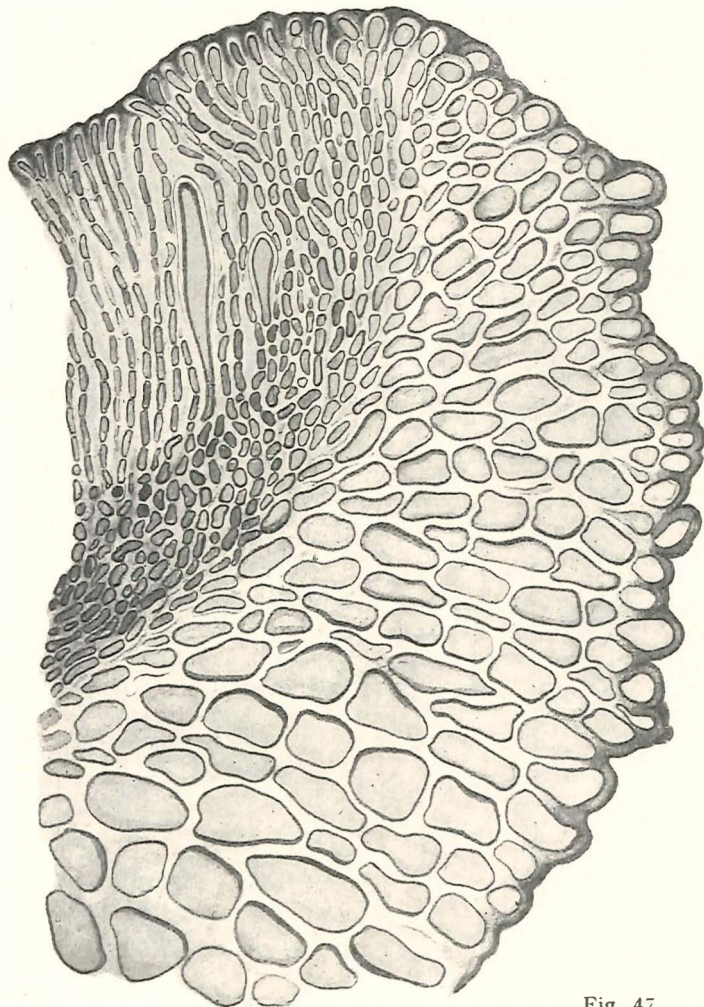
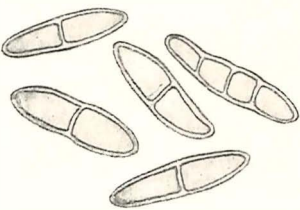


Fig. 47

*O. Gallæ del.*

POLYCHIDIUM MUSCICOLA Sw.

PLATE 11.

LICHINA CONFINIS.

Ag.

**Specimen 1.**

- Fig. 49. Entire, tuft-like thallus, seen from above. ( $\times 20$ ).  
Fig. 50. Procumbent branch of thallus, with erect, lateral branches. ( $\times 30$ ).  
Fig. 51. Longitudinal section of branch of thallus. ( $\times 620$ ).  
Fig. 52. Transverse section of branch of thallus. ( $\times 42$ ).  
Fig. 53. A sector of Fig. 52. ( $\times 620$ ).  
Fig. 54. A small portion of Fig. 52. ( $\times 1053$ ).  
Fig. 55. Longitudinal section of a branch of thallus, with an axial, gonidialess strand of hyphæ, and an apothecium at the top. ( $\times 78$ ).  
Fig. 56. Longitudinal section of a branch of thallus, with an apothecium provided with a rather broad disc. ( $\times 78$ ).  
Fig. 57. Stretched hyphæ from the axial strand of hyphæ of the branches of thallus. Two of the hyphæ are anastomosed. ( $\times 1053$ ).  
Fig. 58. Margin of apothecium, with *margo thallinus* (to the left) and colourless *calyx-margo proprius*, and part of hymenium (paraphyses) to the right. ( $\times 822$ ).



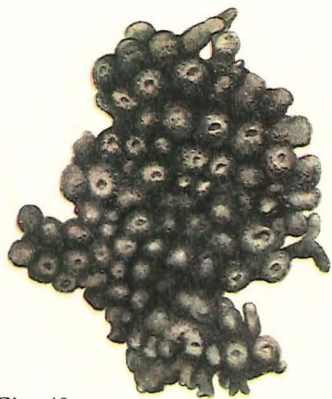


Fig. 49

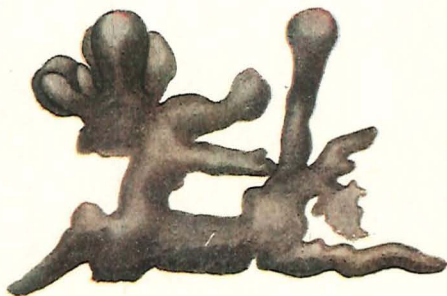


Fig. 50

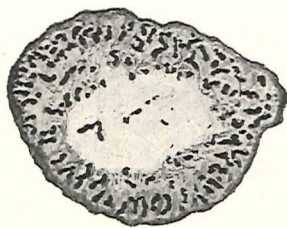


Fig. 52

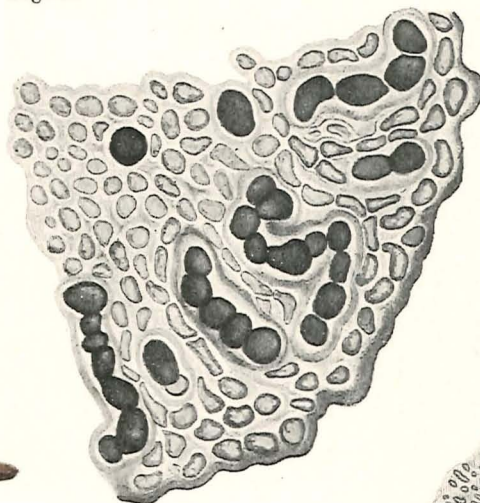


Fig. 54

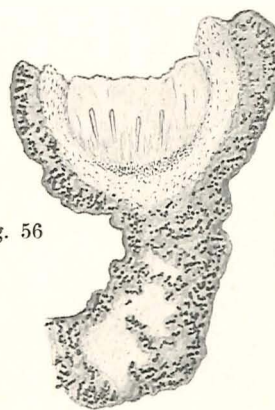


Fig. 56

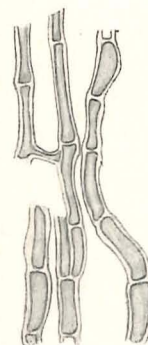


Fig. 57

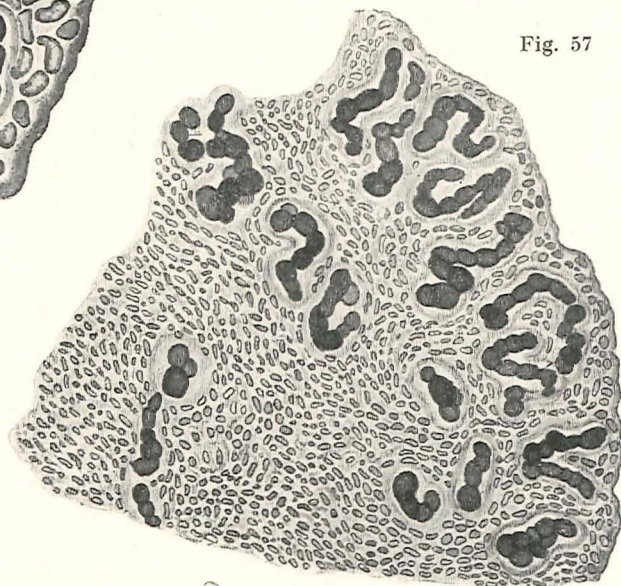


Fig. 53

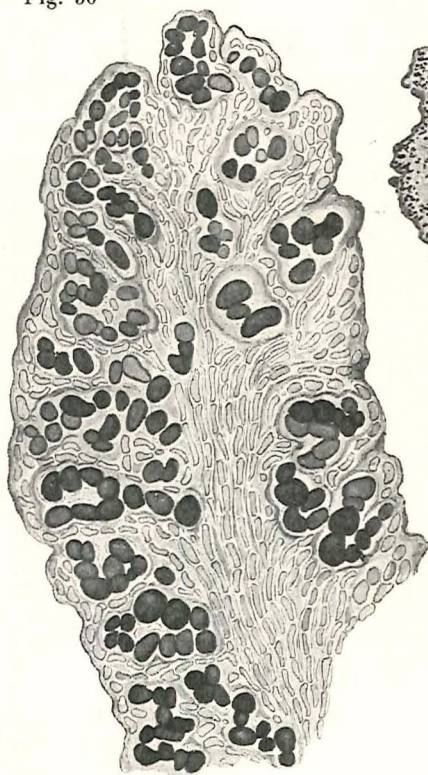


Fig. 51

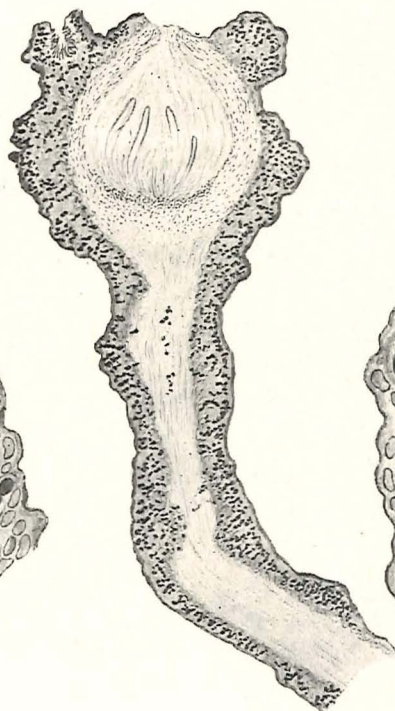


Fig. 55

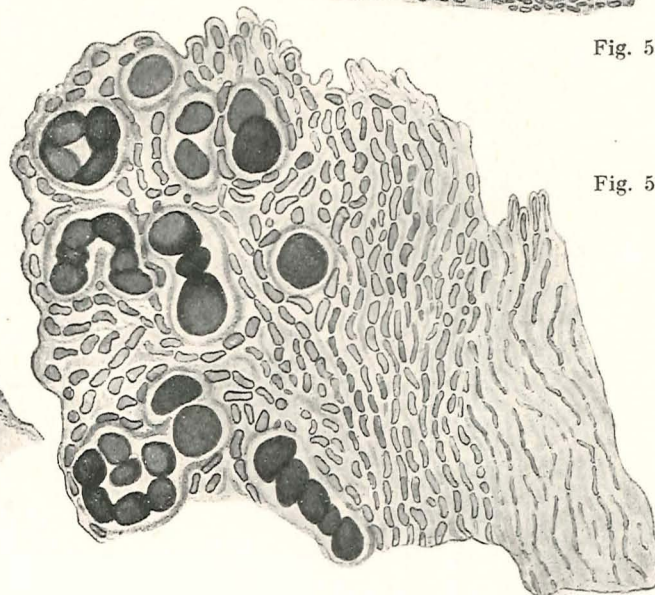


Fig. 58

*O. Galløe del.*

LICHINA CONFINIS AG.  
(Specimen 1).

PLATE 12.

LICHINA CONFINIS.

AG.

**Specimen 1.**

Fig. 59. To the left, a young ascus and the bases of two paraphyses, issuing from the sub-hymenial tissue. To the right, sub-hymenial tissue and bases of paraphyses. ( $\times 1053$ ).

Fig. 60. Above, a young ascus and two fully ripened asci. ( $\times 736$ ). Below, the boundary between the long-celled axial strand of hyphæ of the branches of thallus and the short-celled tissue forming the bottom of the calyx of the apothecium. ( $\times 990$ ).

Fig. 61. Pycnide. ( $\times 140$ ).

Fig. 62. Conidiophori with conidia. ( $\times 723$ ).

**Specimen 2.**

Fig. 63. Entire tuft of thallus. ( $\times 13$ ).

Fig. 64. Extra-axial section of apothecium, cut in such a way that the axial strand of the branch of thallus has been removed. Numerous shedded spores lie on the surface of the hymenium. ( $\times 140$ ).

Fig. 65. Horizontal branch, with lateral branches. ( $\times 58$ ). Below, longitudinal section of the same. ( $\times 58$ ).

**Specimen 3.**

Fig. 66. Below, an entire tuft of thallus, seen from above. ( $\times 20$ ). Above, two apothecia. ( $\times 90$ ).



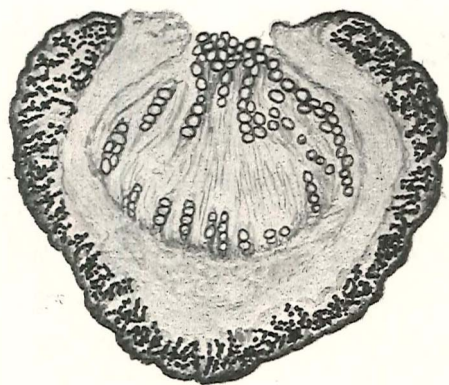


Fig. 64

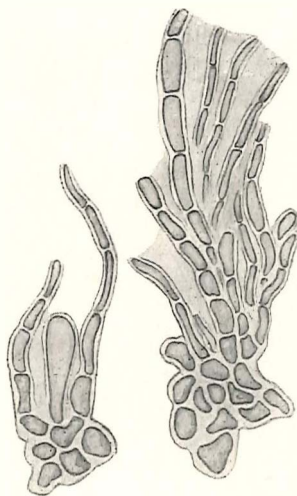


Fig. 59

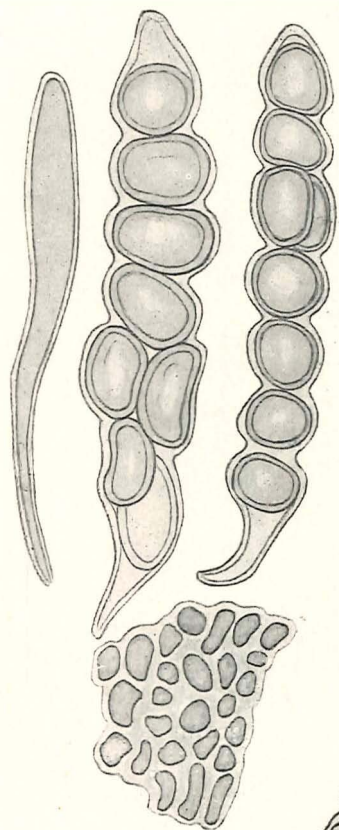


Fig. 60

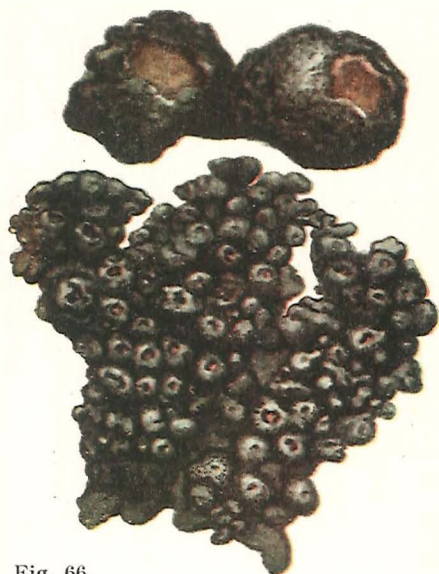


Fig. 66

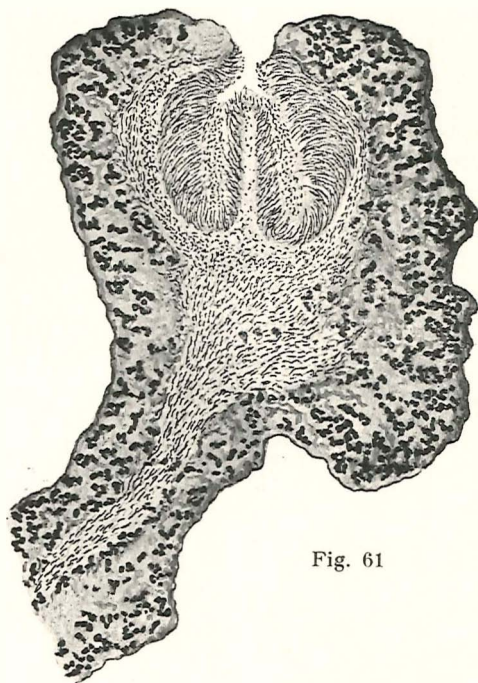


Fig. 61

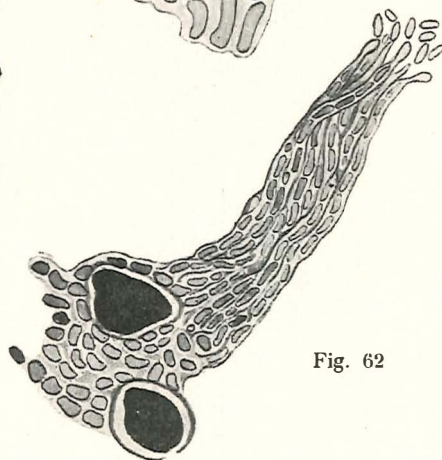


Fig. 62

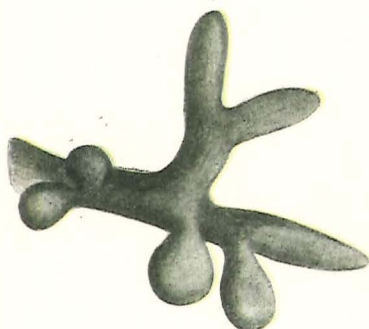


Fig. 65

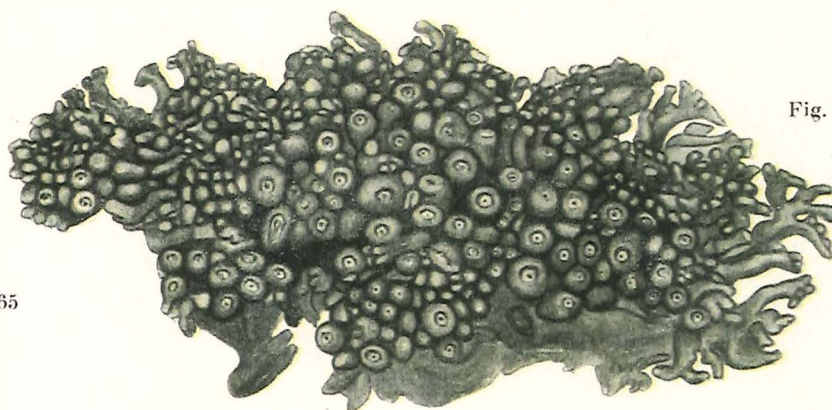


Fig. 63

*O. Galløe del.*

LICHINA CONFINIS AG.  
(Specimen 1, 2, 3).

PLATE 13.

COLLEMA GLAUDESCENS.

HOFFM.

Fig. 67. Entire plant, with apothecia. ( $\times 6\frac{1}{2}$ ).

Fig. 68. Vertical section through a portion of the thallus, with the underlying substratum. The thallus is composed of very young, recently formed grains and of several slightly older grains, all of them connected at the base by common, colourless rhizoidal hyphæ. ( $\times 90$ ).

Fig. 69. Young colony of *Nostoc*, found lying on the ground between young grains of thallus. This colony has not been lichenized as yet. ( $\times 747$ ).

Fig. 70. Young grain of thallus, consisting of a colony of *Nostoc*, penetrated by scanty hyphæ, which latter pass into rhizoidal hyphæ at the bottom of the picture. ( $\times 566$ ).

Fig. 71. Rather old lobe of thallus, with an apothecium. ( $\times 32$ ).

Fig. 72. Lower surface of thallus, with rhizoidal hyphæ. ( $\times 690$ ).

Fig. 73. Lower surface of thallus, with a free *Nostoc* lying between the rhizoidal hyphæ. ( $\times 600$ ).

Fig. 74. Rhizoidal hyphæ. ( $\times 602$ ).

Fig. 75. Two grains of thallus, the left one with an apothecium. ( $\times 35$ ).





Fig. 67

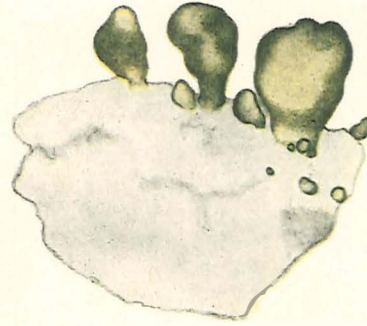


Fig. 68



Fig. 69

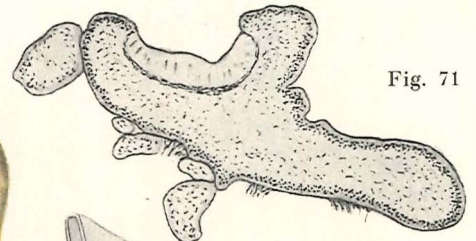


Fig. 71

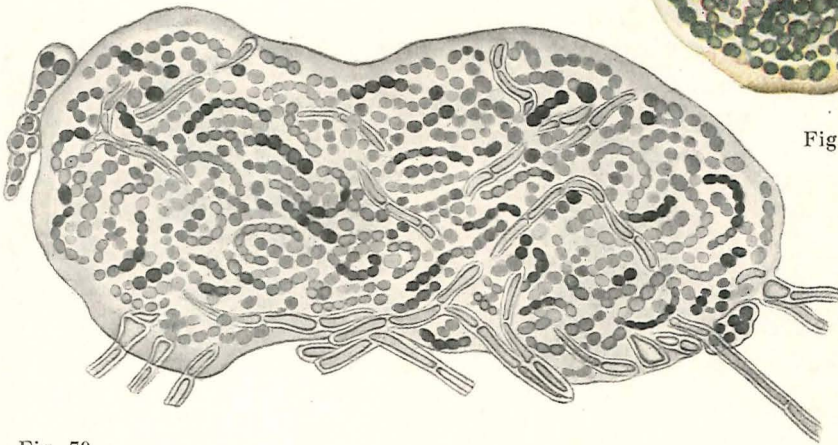


Fig. 70

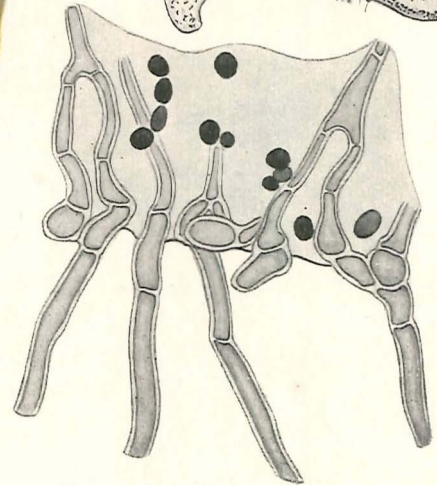


Fig. 72

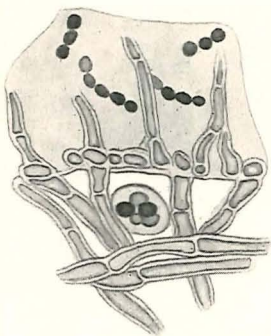


Fig. 73

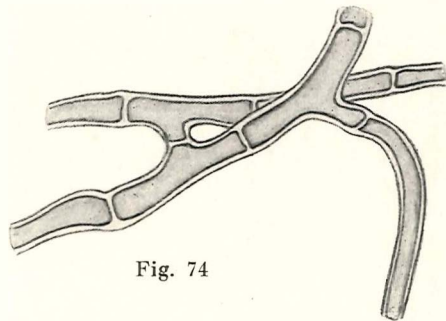


Fig. 74

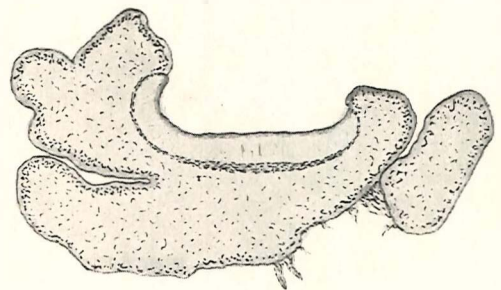


Fig. 75

*O. Galløe del.*

COLLEMA GLAUDESCENS HOFFM.

PLATE 14.

COLLEMA GLAUCESCENS.

HOFFM.

Fig. 76. Margin of apothecium, where calyx passes into *margo thallinus*. ( $\times 620$ ).  
Below, a medullary hypha. ( $\times 728$ ).

Fig. 77. Horizontal section of a portion of the hymenium, showing asci and paraphyses cut across; to the right in the figure the hymenium borders on calyx, which latter sends free hyphæ into the thalline margin. ( $\times 620$ ).

Fig. 78. Ripe ascus, tips of paraphyses, and isolated spores. ( $\times 728$ ).

Fig. 79. Vertical section of a pycnide. ( $\times 620$ ).



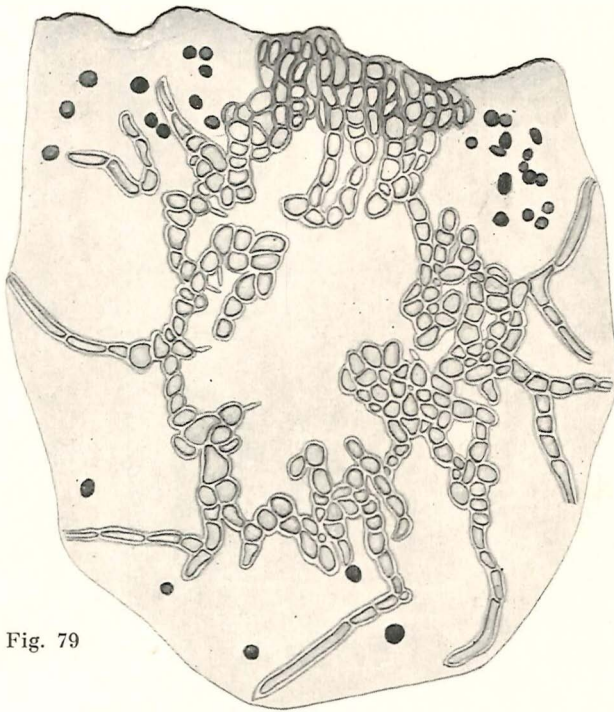


Fig. 79

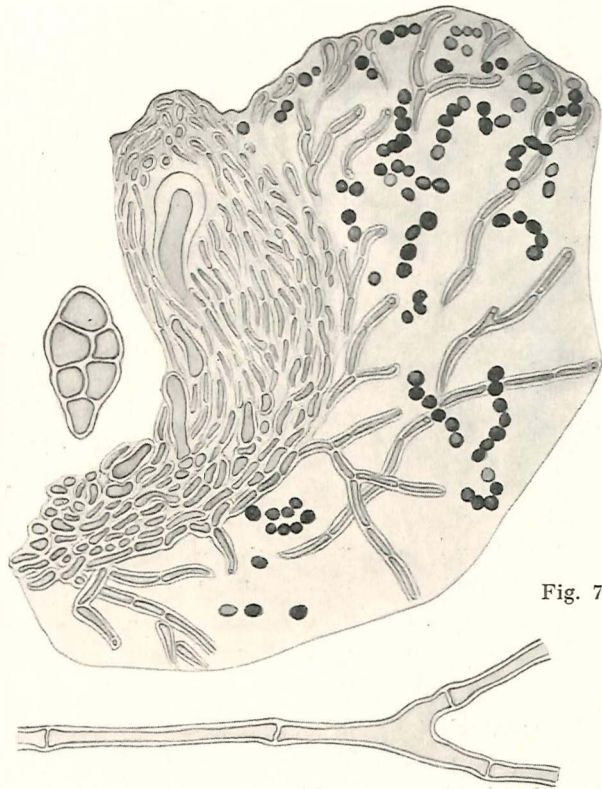


Fig. 76

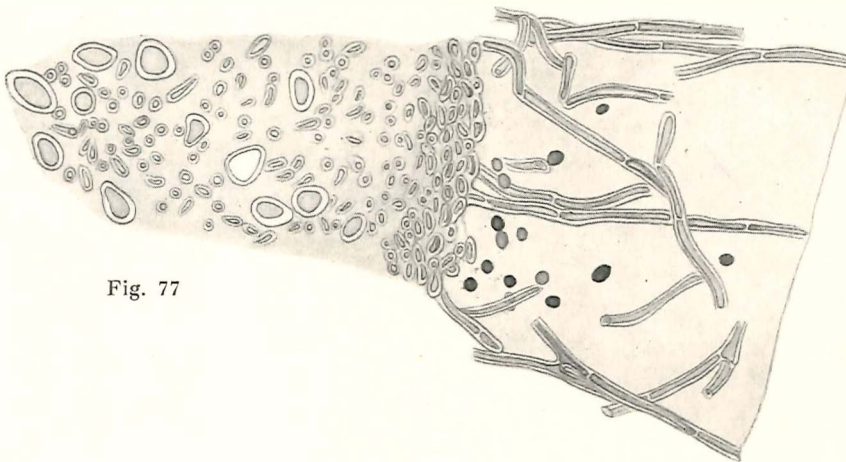


Fig. 77

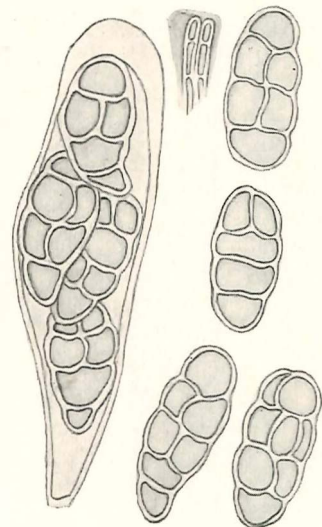


Fig. 78

*O. Galløe del.*

COLLEMA GLAUCESCENS HOFFM.

PLATE 15.

COLLEMA CRISPUM.

ACH.

- Fig. 80. Entire thallus, with apothecia. ( $\times 4\frac{1}{2}$ ).  
Fig. 81. Longitudinal section of a lobe of thallus, with an apothecium. ( $\times 32$ ).  
Fig. 82. Transverse section of a lobe of thallus, with two apothecia. ( $\times 32$ ).  
Fig. 83. Longitudinal section of the margin of thallus. ( $\times 140$ ).  
Fig. 84. Vertical section of the upper surface of thallus and of the portions lying somewhat deeper. ( $\times 620$ ).  
Fig. 85. Vertical section of the lower surface of thallus, from which a rhizoidal hypha issues. ( $\times 620$ ).  
Fig. 86. Lower surface of thallus. ( $\times 1053$ ).  
Fig. 87. Boundary between *calyx* (to the left in the picture) and *margo thallinus*. ( $\times 1053$ ).  
Fig. 88. Hymenium with a young ascus. Ascogenous hyphæ are seen beneath the hymenium. ( $\times 725$ ).  
Fig. 89. Ripe ascus. ( $\times 840$ ).



Fig. 80

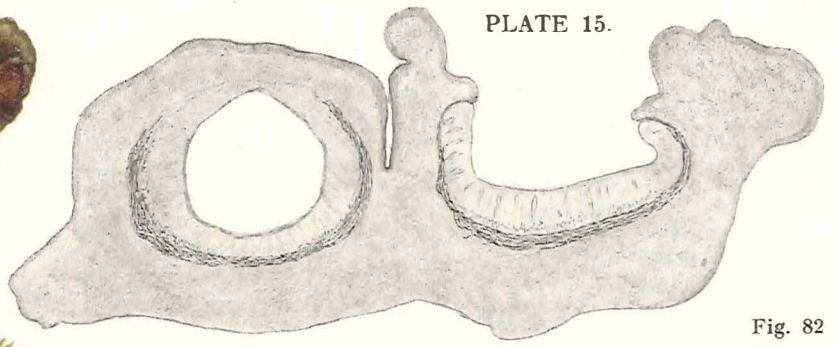


Fig. 82

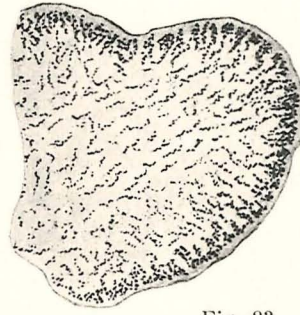


Fig. 83

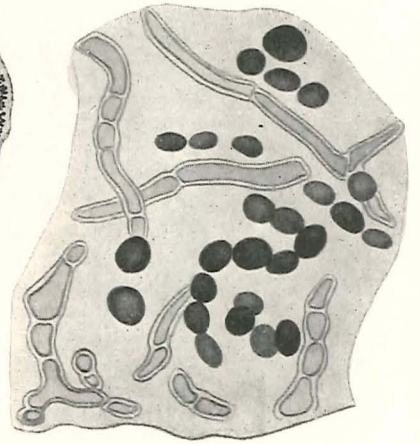


Fig. 86

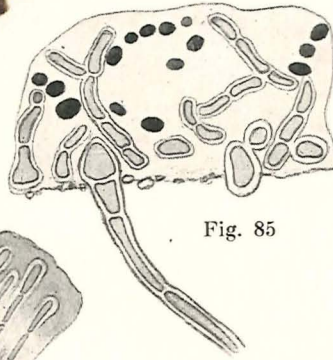


Fig. 85

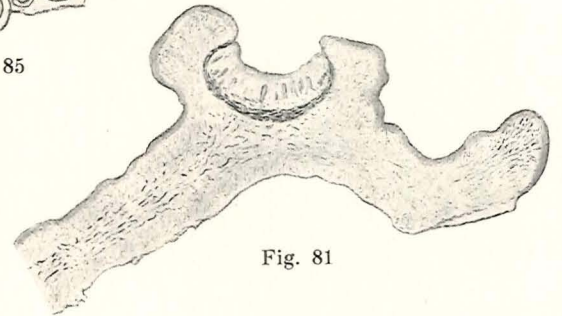


Fig. 81

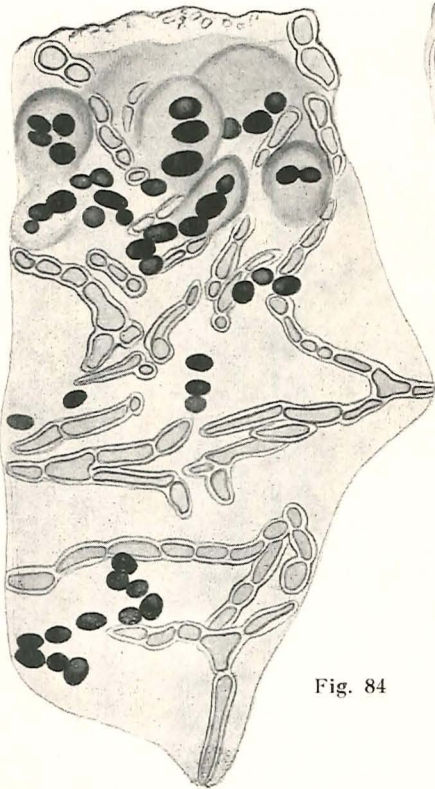


Fig. 84

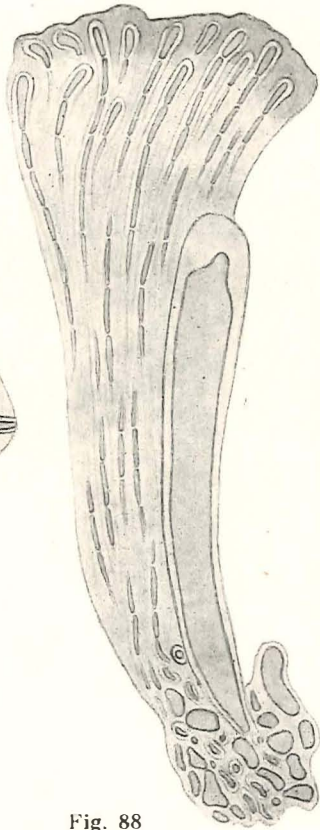


Fig. 88



Fig. 89

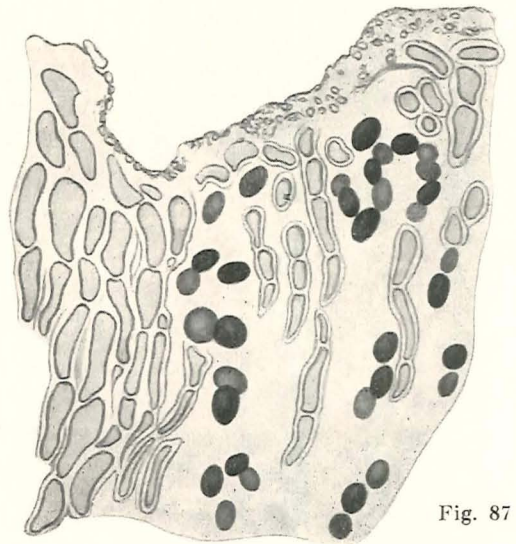


Fig. 87

PLATE 16.

COLLEMA PULPOSUM.

BERNH.

- Fig. 90. Thallus growing among moss. ( $\times 5\frac{1}{2}$ ).  
Fig. 91. Two lobes of thallus, entirely coalesced. ( $\times 20$ ).  
Fig. 92. Young apothecium, as yet without asci. ( $\times 20$ ).  
Fig. 93. Margin of thallus, with apothecium. A primordium of an apothecium is seen in the interior of thallus. ( $\times 32$ ).  
Fig. 94. Portion of the lower surface of thallus, with rhizoidal hyphæ. ( $\times 620$ ).  
Fig. 95. This section is seen from the interior of thallus outwards towards the lower surface of thallus and shows partly single cells of *Nostoc*, partly hyphæ running towards the lower surface of thallus, where they end in inflate cells, which in spots form a rudimentary cortex. ( $\times 1077$ ).



Fig. 90



Fig. 91

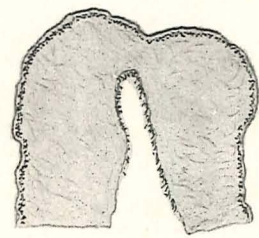


Fig. 92

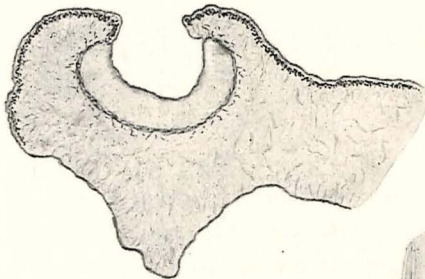


Fig. 95

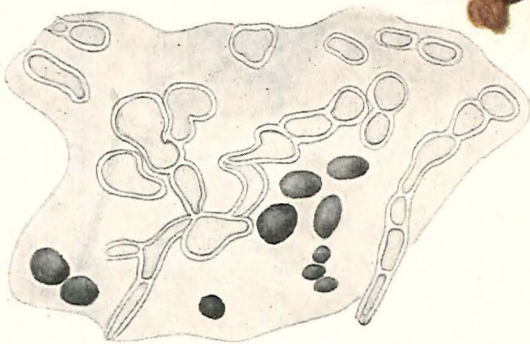


Fig. 94

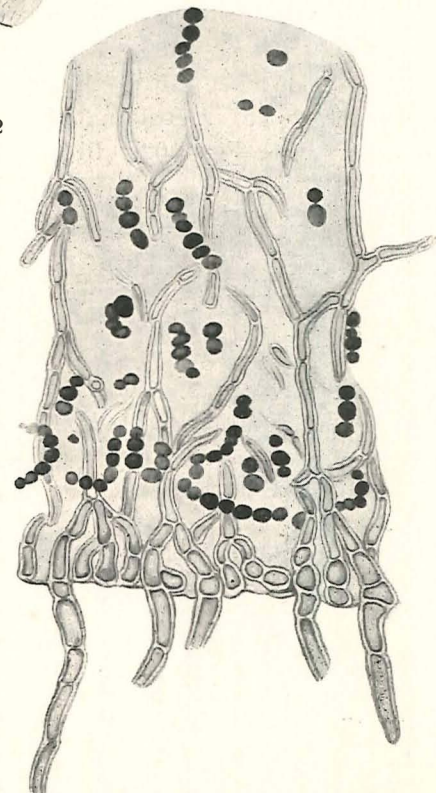


Fig. 93

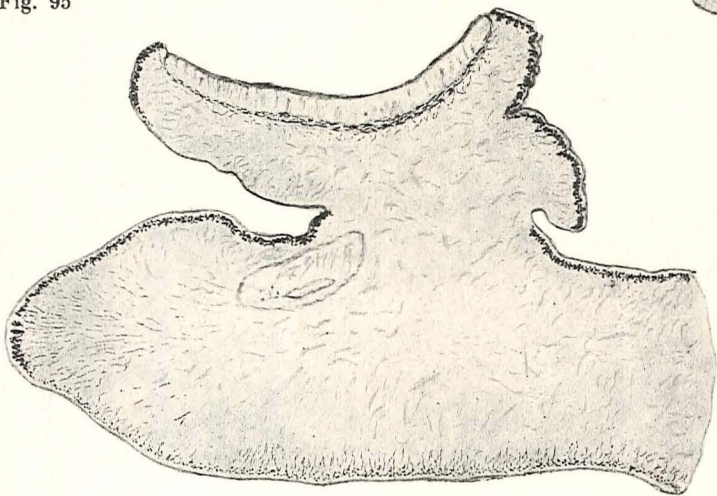


PLATE 17.

COLLEMA PULPOSUM.

BERNH.

Fig. 96. Margin of apothecium. ( $\times 600$ ).

Fig. 97. Hymenium of a very young apothecium, as yet having no asci. ( $\times 600$ ).

At its bottom this section shows two *Nostoc*-cells with their gelatine, and the calyx, which latter is composed of long-celled, concentric hyphæ formed by the hyphæ coming from the interior of thallus. Above the calyx the sub-hymenial tissue with ascogonia. ( $\times 664$ ).

Fig. 98. To the left three ripe spores ( $\times 725$ ); to the right the hymenium and the sub-hymenial tissue with ascogonia. ( $\times 620$ ).

COLLEMA TENAX.

Sw.

**Specimen 1.**

Fig. 99. Entire individual, with apothecia. ( $\times 6$ ).

Fig. 100. An isolated conidiiferous hypha. ( $\times 744$ ).

Fig. 101. Upper surface of thallus. A finely granular substance — not subjected to closer examination — is deposited round the tips of some of the hyphæ. ( $\times 697$ ).

Fig. 102. Brown hyphæ, covering a pycnide not yet opened. ( $\times 715$ ).



Fig. 97

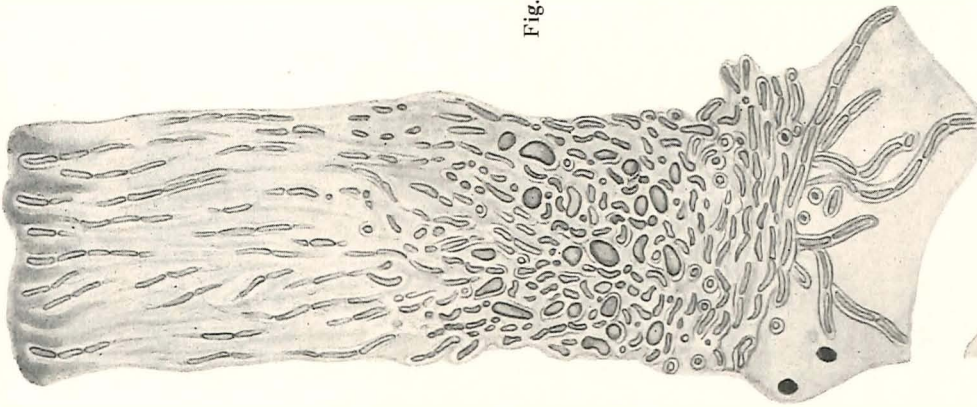


Fig. 102

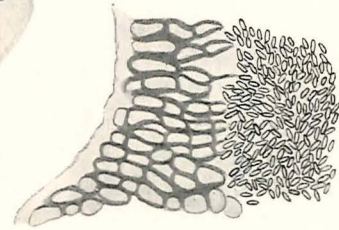


Fig. 96



Fig. 101

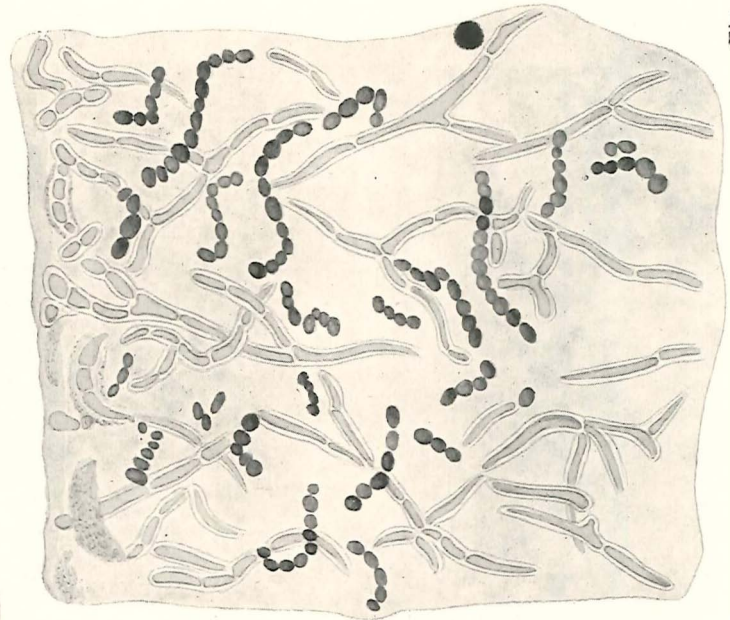


Fig. 100



Fig. 99

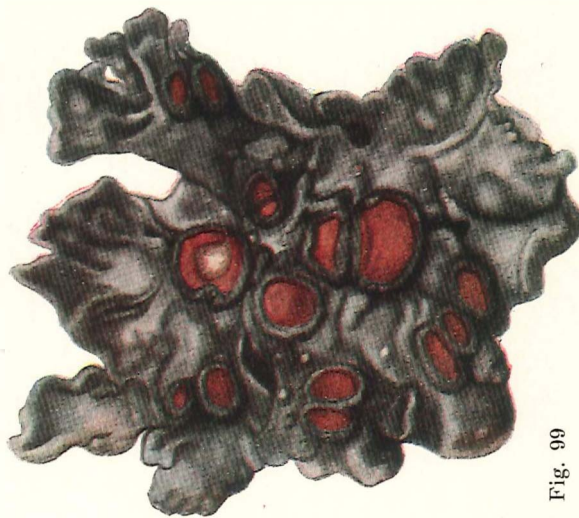
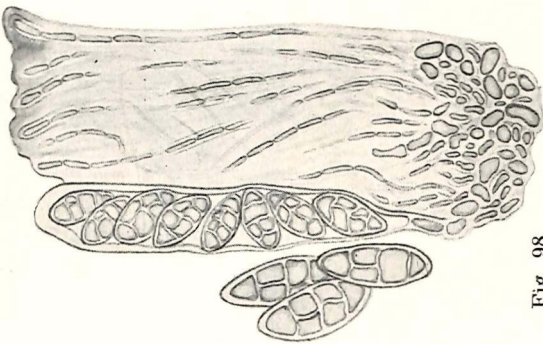


Fig. 98



O. Galløe del.

COLLEMA PULPOSUM BERNH.  
COLLEMA TENAX SW.  
(Specimen 1).

PLATE 18.

COLLEMA TENAX.

Sw.

**Specimen 1.**

Fig. 103. Lower surface of thallus, from which bundles of colourless, rhizoidal hyphæ issue. ( $\times 697$ ).

Fig. 104. Longitudinal section of a lobe of thallus, with an apothecium. ( $\times 156$ ).

Fig. 105. Boundary between the calyx of the margin of apothecium, above assuming the character of a reddish-brown proper margin, and the surrounding *margo thallinus*. ( $\times 697$ ).

Fig. 106. Below in the picture horizontal hyphæ of calyx, which above pass into paraphysogoneous and ascogenous cells. Besides, a ripe ascus and paraphyses, the latter with hymenial gelatine, which is reddish-brown above. ( $\times 600$ ).

Fig. 107. Ripe spores. ( $\times 840$ ).

Fig. 108. Two pycnidia. ( $\times 140$ ).

Fig. 109. Perithecial tissue of the pycnide, with the conidiiferous hyphæ issuing from it. ( $\times 1053$ ).

**Specimen 2.**

Fig. 110. Margin of thallus, moistened and gelatinous. The lobes are very irregularly branched; some of them are smooth while others are granular-nodulose at their edges as well as at their surfaces. ( $\times 3$ ).

Fig. 111. An isolated smooth lobe, showing the mode of branching. There are one apothecium and two punctiform pycnidia. ( $\times 18$ ).

Fig. 112. Upper surface of thallus. ( $\times 1053$ ).



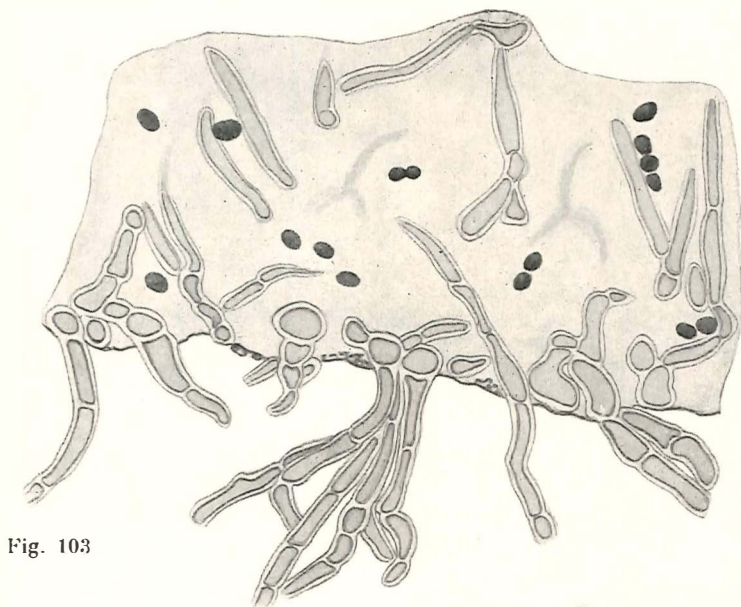


Fig. 103

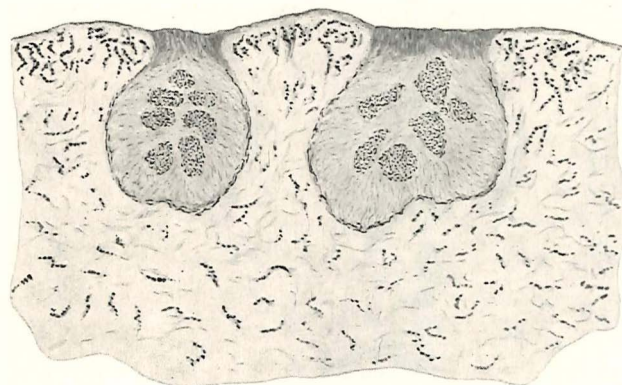


Fig. 108

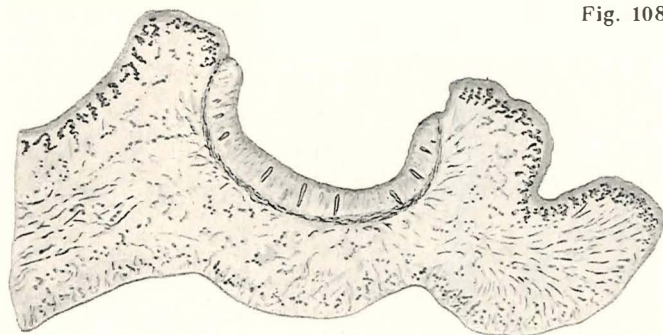


Fig. 104

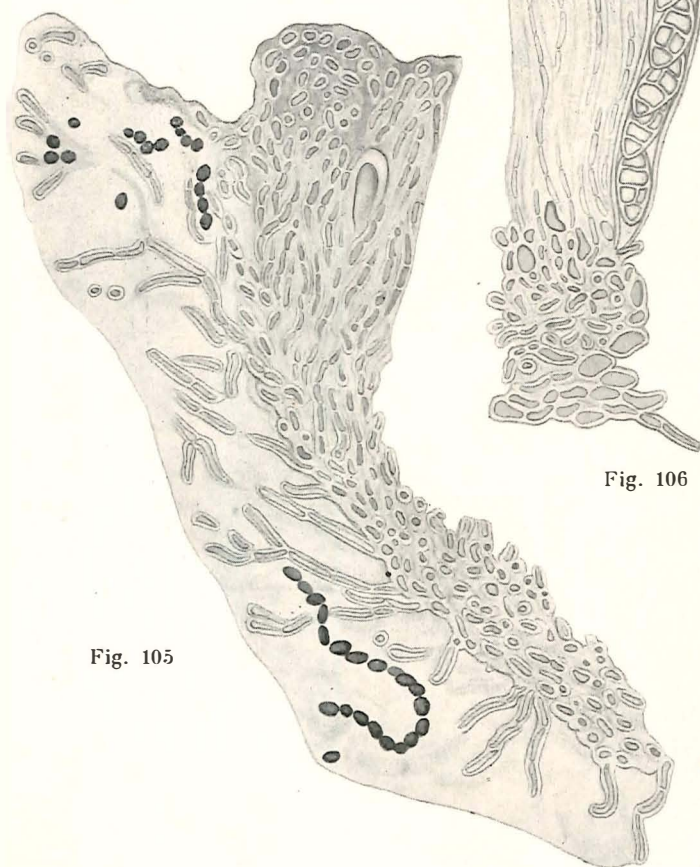


Fig. 105

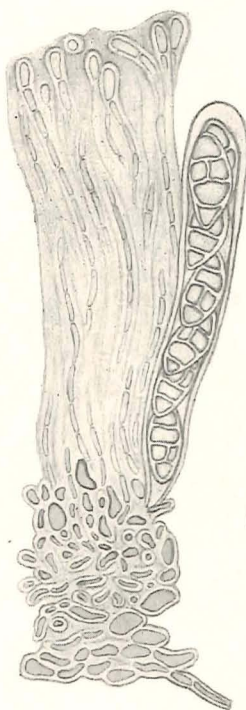


Fig. 106

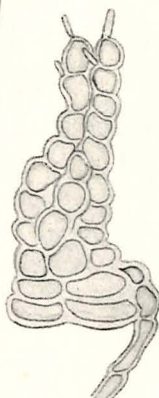


Fig. 109



Fig. 107

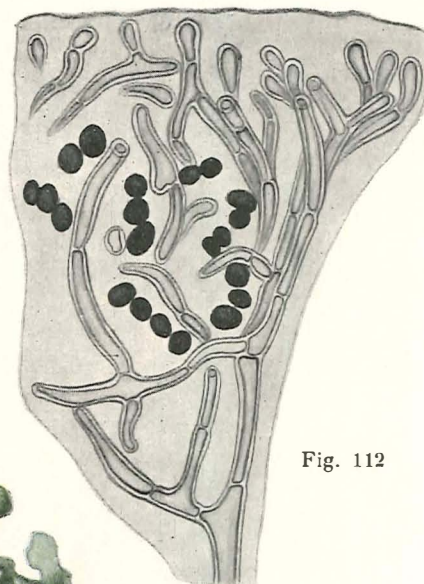


Fig. 112

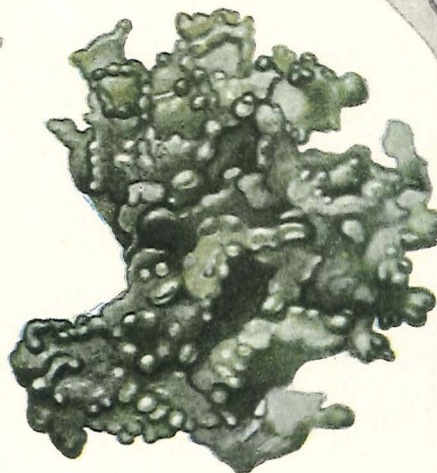


Fig. 110



Fig. 111

*O. Galløe del.*

COLLEMA TENAX Sw.  
(Specimen 1, 2).

PLATE 19.

COLLEMA TENAX.

Sw.

**Specimen 2.**

Fig. 113. Transverse section of a lobe, with an apothecium. ( $\times 30$ ). Thick rhizoidal hyphæ issue from the lower surface of the thallus, enclosing between them colonies of *Chlorophyceæ*. Of the latter three groups are seen below in the picture. ( $\times 1053$ ).

Fig. 114. Lower surface of the thallus. ( $\times 997$ ).

Fig. 115. Boundary between the margin of apothecium and the surrounding thalline tissues. ( $\times 620$ ).

Fig. 116. Open pycnide, with numerous conidia lying between the conidiiferous hyphæ. ( $\times 603$ ).

Fig. 117. Conidiiferous hyphæ. ( $\times 1053$ ).

Fig. 118. Ripe ascus and paraphyses. ( $\times 753$ ).



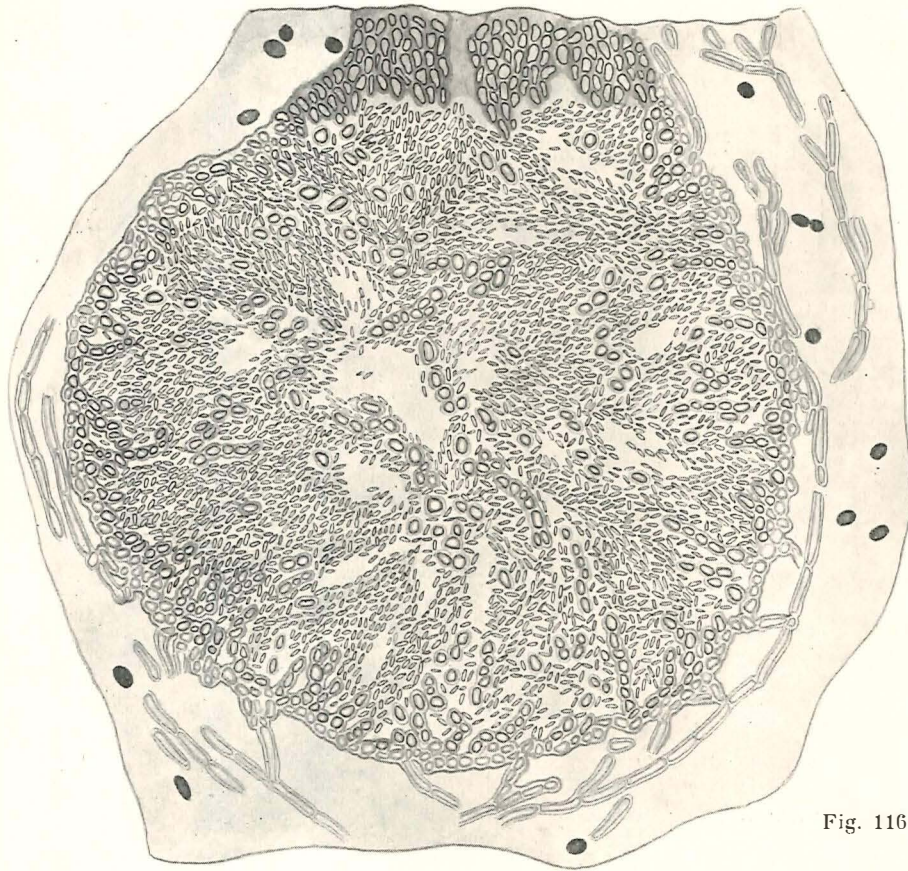


Fig. 116

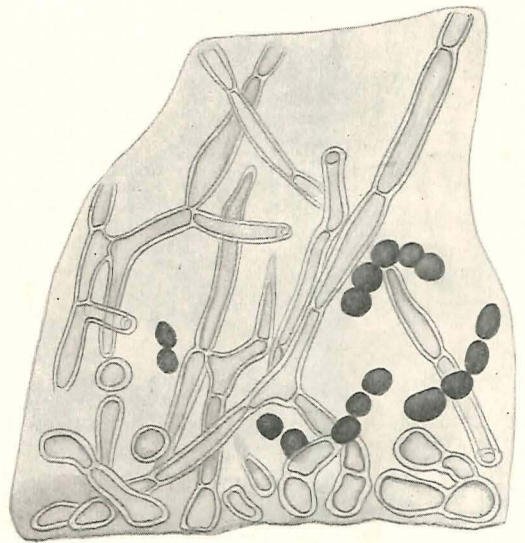


Fig. 114

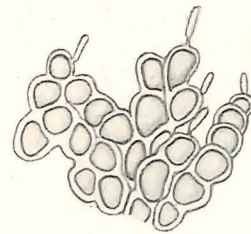


Fig. 117

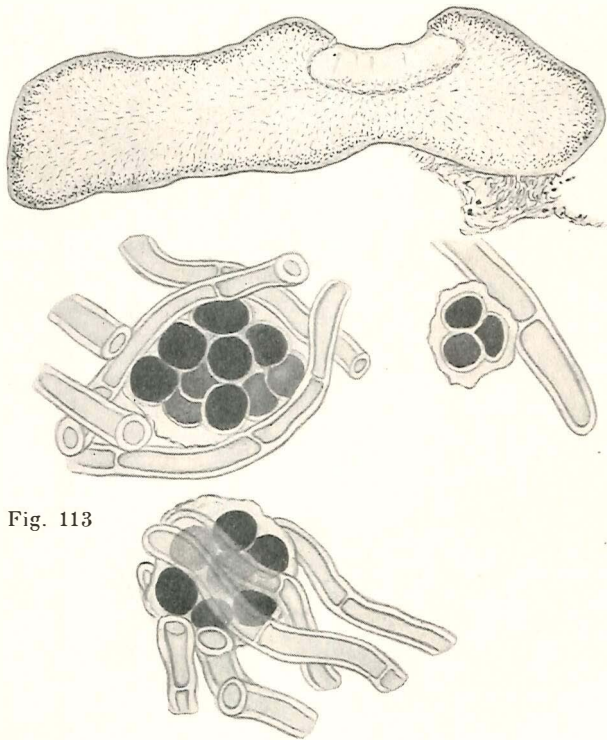


Fig. 113

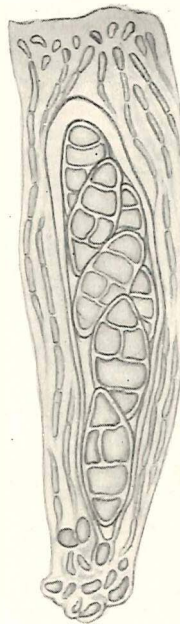


Fig. 118

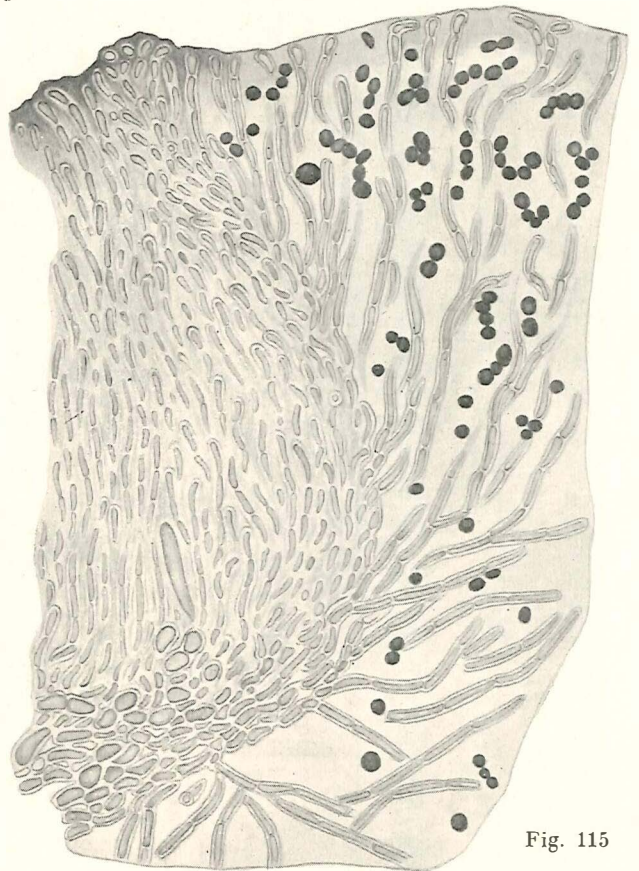


Fig. 115

●. Galløe del.

COLLEMA TENAX Sw.  
(Specimen 2).

PLATE 20.

COLLEMA FURVUM.

ACH.

**Specimen 1.**

Fig. 119. An isolated lobe of thallus (in dry condition), showing the mode of branching. ( $\times 3$ ).

Fig. 120. Longitudinal section of lobe, with isidia on both sides. ( $\times 92$ ).

Fig. 121. Entire section, showing the upper and lower surfaces of thallus. ( $\times 620$ ).

Fig. 122. Upper surface of thallus, with isidia. ( $\times 1009$ ).

**Specimen 2.**

Fig. 123. Entire specimen (in dry condition). ( $\times 3$ ).

Fig. 124. To the left: the foremost margin of a lobe (the free edge turns to the right); a bundle of rhizines, beset with grains of sand, issues from the lower surface. ( $\times 3$ ).

Central figure: the foremost edge of a lobe, showing the mode of branching. The free edge of the lobe turns upwards. ( $\times 3$ ).

Right figure: lobe of thallus, seen from the lower surface, with grains of sand adhering to a bundle of rhizines. ( $\times 3$ ).

The three figures are pictured from a moistened, gelatinous specimen.





Fig. 119

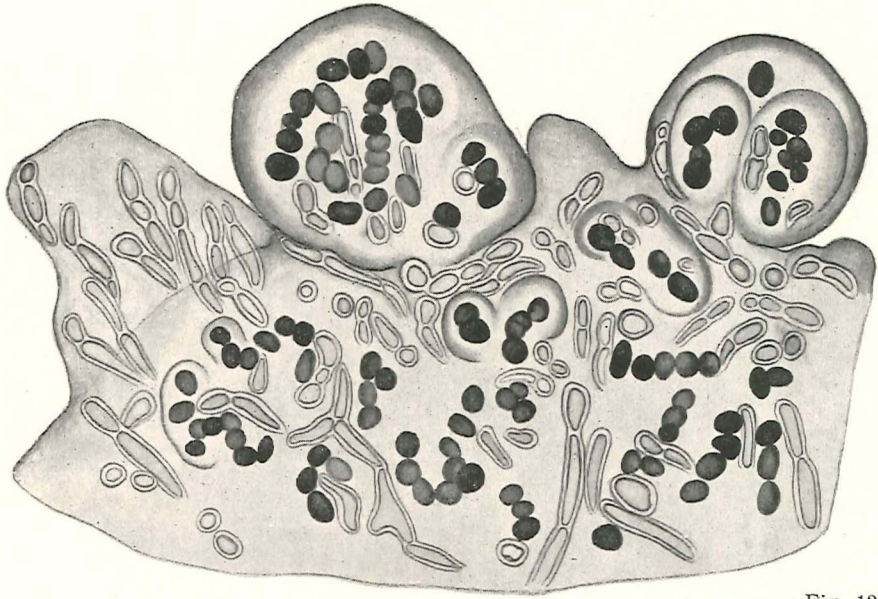


Fig. 122

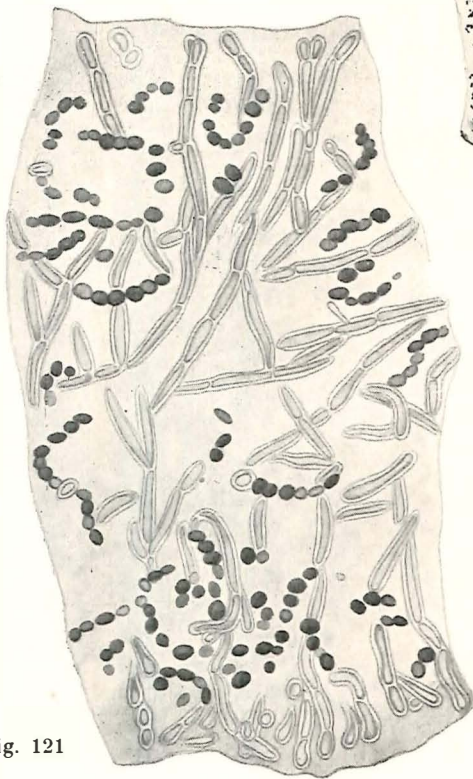


Fig. 121

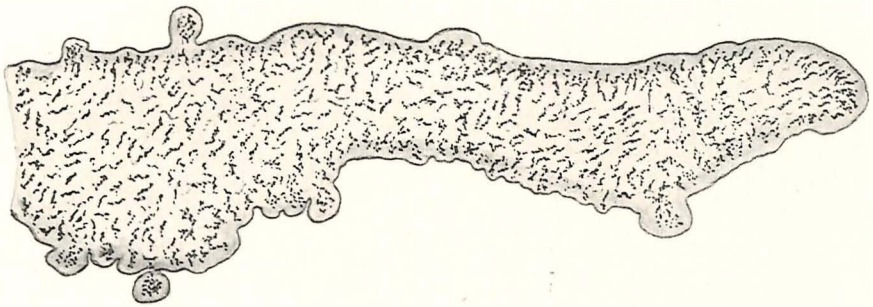


Fig. 120



Fig. 123



Fig. 124

*O. Galløe del.*

COLLEMA FURVUM ACH.  
(Specimen 1, 2).

PLATE 21.

COLLEMA RUPESTRE.

Sw.

**Specimen 1.**

Fig. 125. Portion of thallus, moistened. ( $\times 4\frac{1}{2}$ ). The smaller picture represents a wrinkle of the thallus with numerous small protuberances issuing from it. ( $\times 18$ ).

Fig. 126. Portion of the lower surface of a lobe, the free edge of which turns upwards in the picture. This lobe is painted in dry condition and is therefore wrinkled. ( $\times 5$ ).

Fig. 127. Portion of a transverse section of a lobe, showing wrinkles and isidia. ( $\times 140$ ).

Fig. 128. Bottom picture: the upper and the under surfaces of thallus. ( $\times 620$ ). Top picture: hyphæ from the upper surface of thallus — plane view. ( $\times 1053$ ).

Fig. 129. Portion of the lower surface of thallus, with free rhizines. ( $\times 20$ ). Lower picture: vertical section of thallus, with rhizines protruding from the lower surface. ( $\times 140$ ).

**Specimen 2.**

Fig. 130. To the right: thallus with two apothecia and several small isidia. ( $\times 18$ ). To the left: portion of thallus, with three pycnidia. ( $\times 18$ ).

Fig. 131. Vertical section of the thallus, with isidia at the upper surface. ( $\times 607$ ).

Fig. 132. Upper surface of thallus. Note the rather dense tissues of the upper surface and the mode of branching of the hyphæ. ( $\times 602$ ).



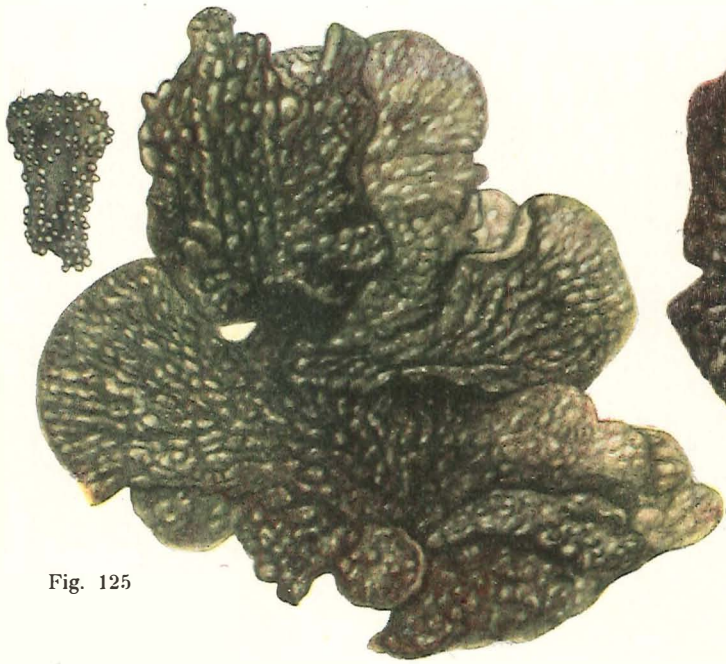


Fig. 125



Fig. 126

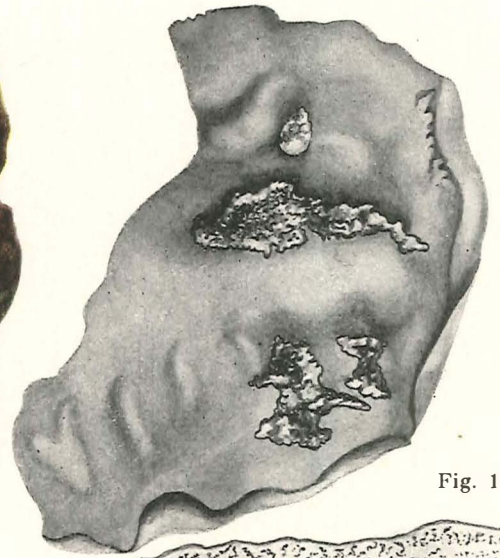


Fig. 129

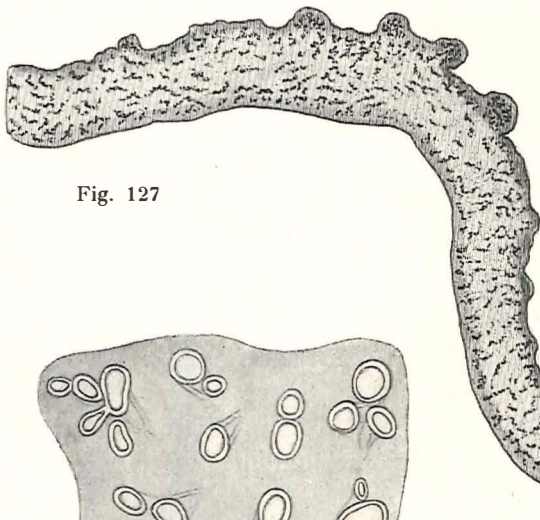


Fig. 127



Fig. 130

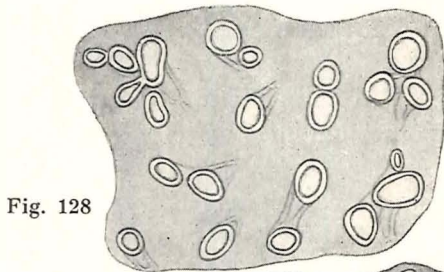


Fig. 128

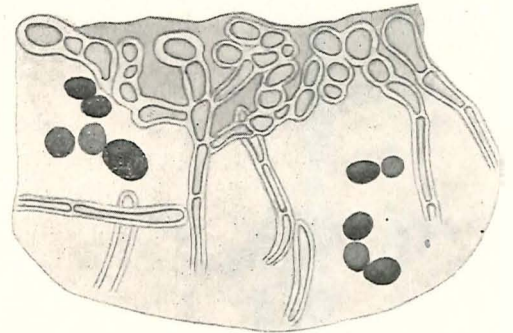
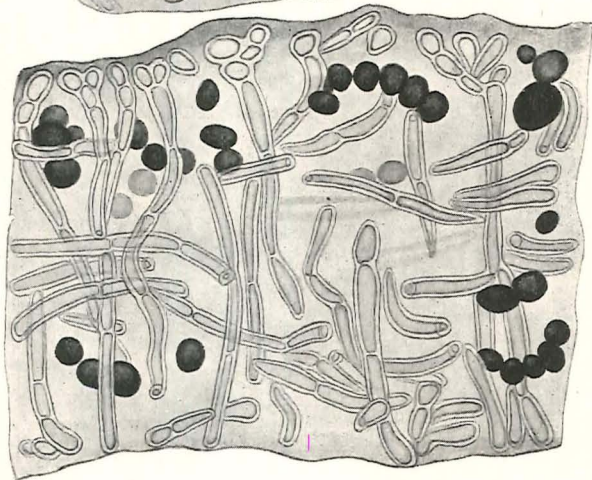


Fig. 132

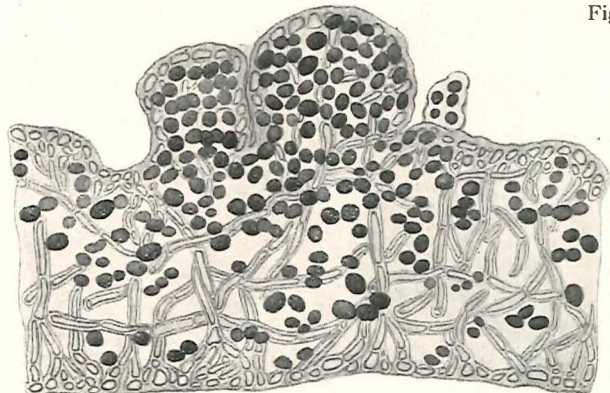


Fig. 131

PLATE 22.

COLLEMA RUPESTRE.

Sw.

**Specimen 2.**

Fig. 133. Apothecium. ( $\times 70$ ).

Fig. 134. Margin of apothecium. ( $\times 620$ ).

Fig. 135. Top picture: thallus with two pycnidia; the right one is open. ( $\times 140$ ). Bottom picture, to the right: upper part of a pycnide, with the ostiole filled with conidia. ( $\times 620$ ). Bottom picture, to the left: conidiiferous hypha. ( $\times 1053$ ).

Fig. 136. Paraphyses, ripe ascus, and isolated ripe spores. ( $\times 672$ ).

**Specimen 3.**

Fig. 137. Margin of a lobe of thallus, in dry condition, with two young unripe apothecia and numerous small squamules at the surface. ( $\times 24$ ).

Fig. 138. Central picture: a squamule, issuing from the upper surface; two isidia are seen close to its free edge and at its base. ( $\times 135$ ).

Above this picture is seen the edge of the same squamule, drawn under greater magnification and showing an isidium. ( $\times 602$ ).

Bottom picture: cells from the cortex-like tissue of the lower surface of thallus, from which rhizoidal hyphæ are protruding. ( $\times 1022$ ).

Fig. 139. Apothecium. The lower surface of thallus just beneath the apothecium is dense and cortex-like (*vide* Fig. 140). To the right of the apothecium the tips of some few paraphyses can be seen. ( $\times 620$ ).

Fig. 140. Above, to the right: cortex from the lower surface of the thallus just beneath the apothecium (*vide* Fig. 139). ( $\times 620$ ).

Below, to the left: at the top of this picture the bases of the paraphyses; beneath these the small-celled tissue of the calyx, which latter passes downwards into the ordinary thallus with normal gonidia. ( $\times 620$ ).

Below, to the right: portion of the lower surface of thallus. ( $\times 620$ ).





Fig. 134

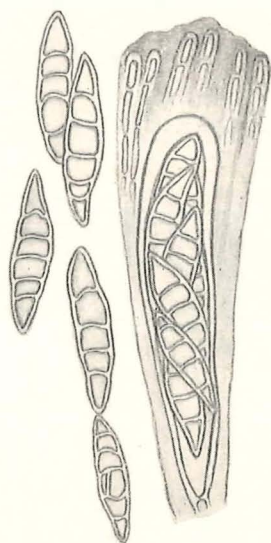


Fig. 136

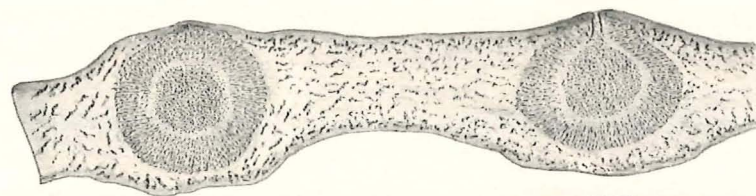


Fig. 135

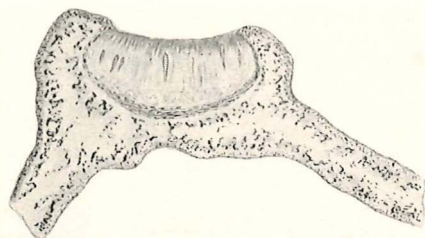
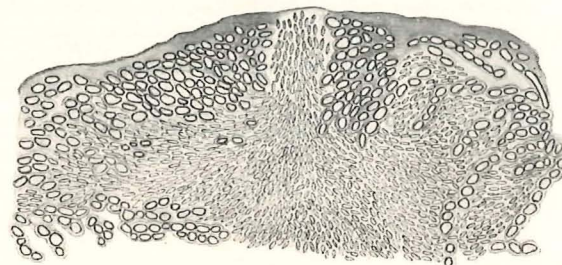


Fig. 133

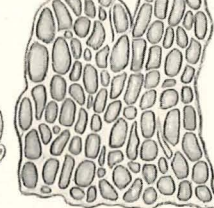


Fig. 140

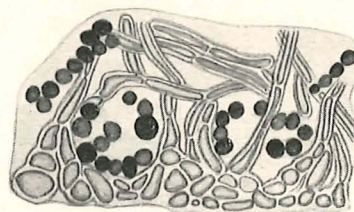


Fig. 138

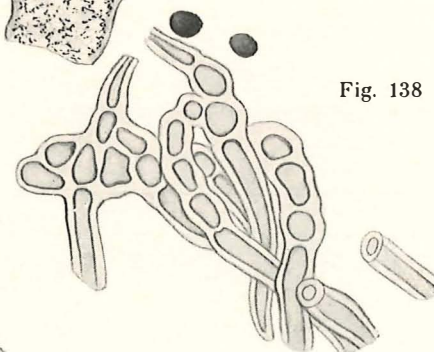


Fig. 139

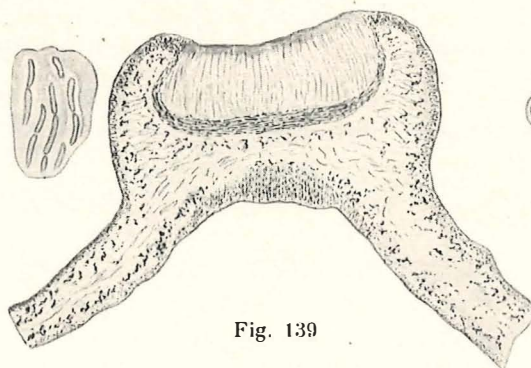


Fig. 137



PLATE 23.

LEPTOGIUM MICROPHYLLUM.

ACH.

Fig. 141. Entire specimen, painted in moistened and swollen condition. ( $\times 23$ ).

Fig. 142. Three apothecia, in dry condition. ( $\times 92$ ).

Fig. 143. Vertical section of thallus and apothecium. This section is in part stained artificially (e. g. the red-stained portions of the apothecium). ( $\times 92$ ).

Fig. 144. Longitudinal section of a lobe of thallus. Its surface is everywhere brownish from a non-granular pigment, deposited in the gelatinous cell-walls of the *Nostoc*. ( $\times 821$ ).

Fig. 145. Vertical section of thallus; from below issue rhizoidal hyphæ, piercing through the thallus of *Bacidia incompta*, which latter is gradually broken down by the hyphæ of *Collema*. The free hyphæ at the bottom of the section belong to *Collema*. ( $\times 861$ ).

Fig. 146. Margin of apothecium. ( $\times 746$ ).

Fig. 147. Two ripe spores. ( $\times 784$ ).





Fig. 143

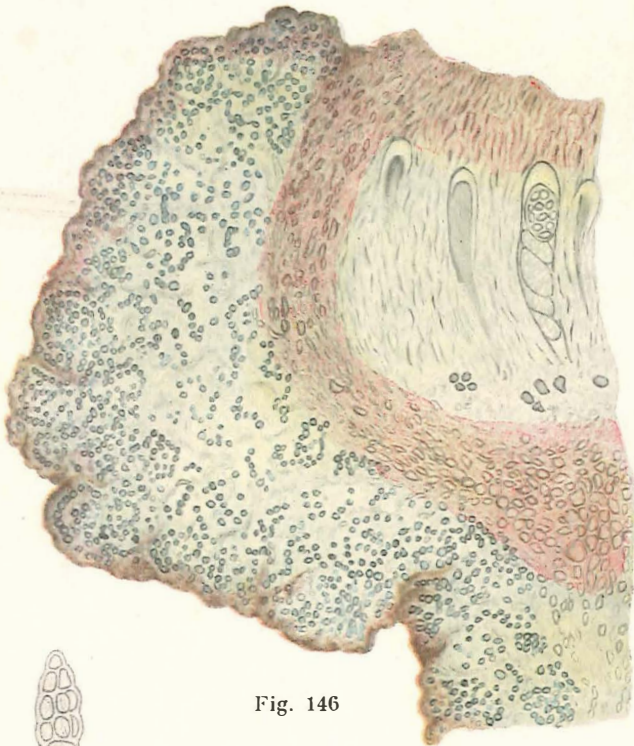


Fig. 146



Fig. 147

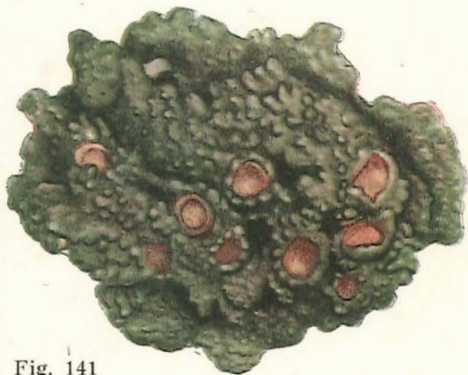


Fig. 141

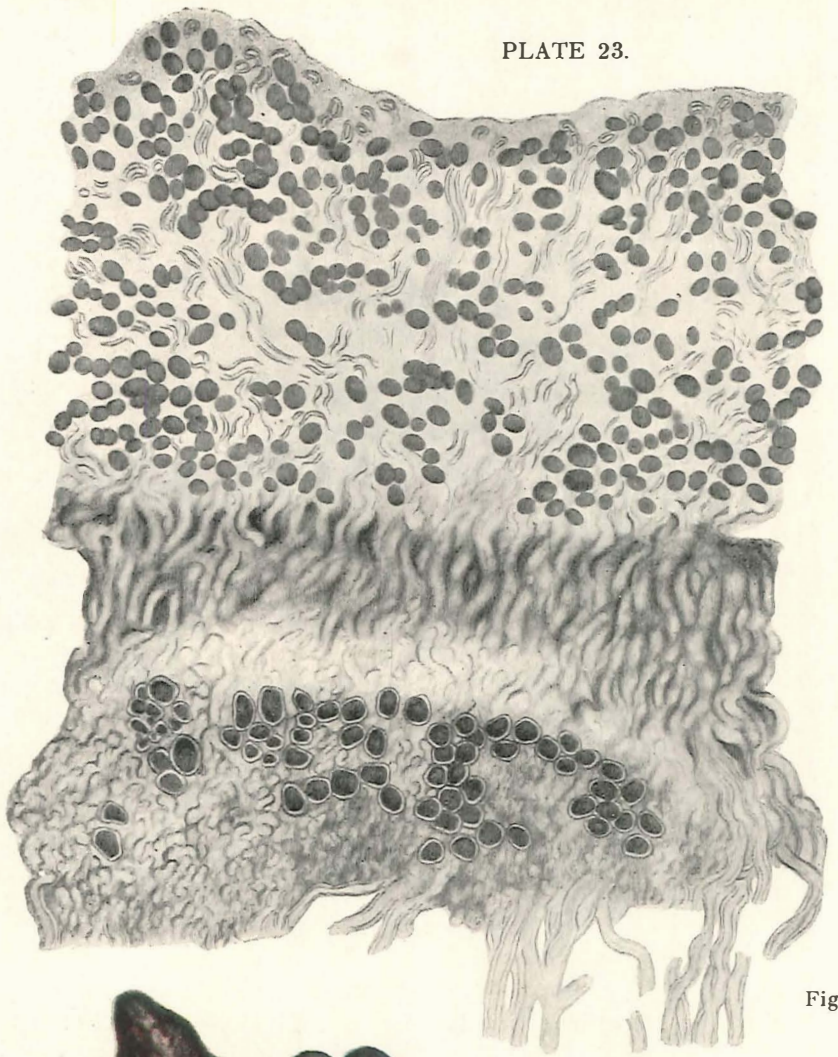


Fig. 145

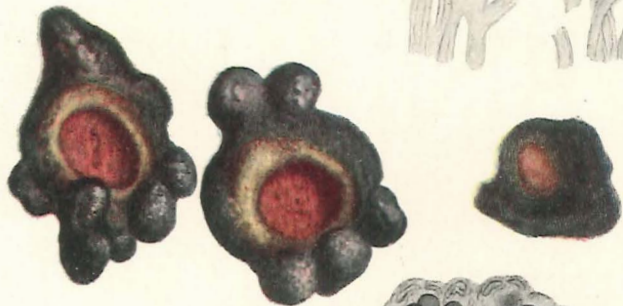


Fig. 142



Fig. 144



PLATE 24.

LEPTOGIUM MICROSCOPICUM.

NYL.

Fig. 148. Entire specimen, seen from above. ( $\times 90$ ).

Fig. 149. Portion of a procumbent branch of thallus with erect lateral branches. ( $\times 90$ ).

Fig. 150. Vertical section of a portion of thallus, showing the mode of branching. ( $\times 140$ ).

Fig. 151. Section of an erect branch of thallus, with lateral branches, which latter are shown only in part, the other parts having been cut off; at the base of the two upper branches a small colony of an alien *Cyanophyceae* is embedded in the thallus. ( $\times 697$ ).

Fig. 152. Transverse section of a branch of thallus. ( $\times 1053$ ).

Fig. 153. Tip of a young branch of thallus, showing the cortex of the surface of thallus. ( $\times 654$ ).

Fig. 154. Portion of the surface of the thallus, on the outside of which (above to the right) two free gonidia are situated. ( $\times 1053$ ).

Fig. 155. To the right: a small globular colony of a *Cyanophyceae*, which was found lying on the surface of the thallus; a similar one was found in the interior of thallus (*vide* Fig. 151). To the left, a chain of gonidia isolated from the interior of the thallus. ( $\times 1053$ ).

Fig. 156. A rhizine, issuing from the lower surface of a branch of thallus. Below it spreads over the decomposed cells of the periderm of the substratum plant. ( $\times 683$ ).



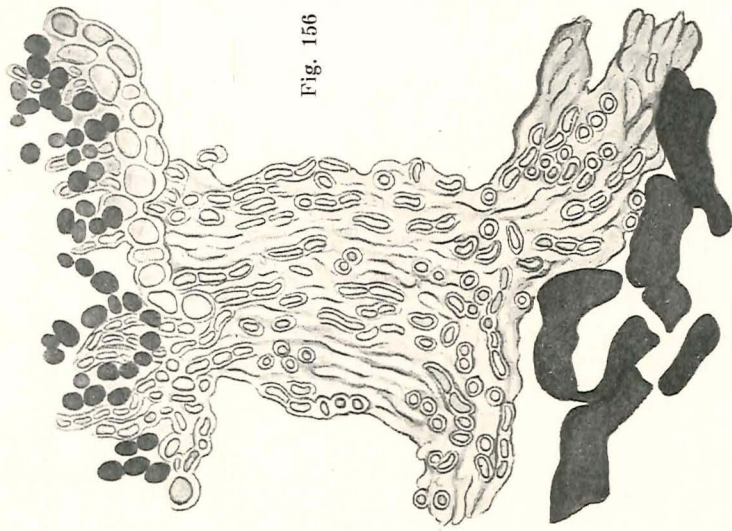


Fig. 156



Fig. 150

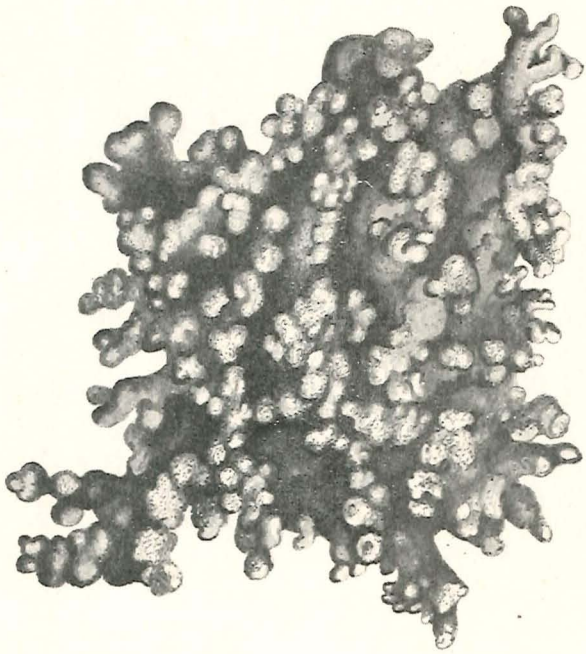


Fig. 148

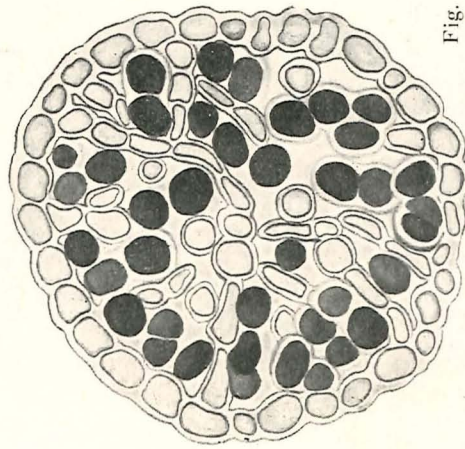


Fig. 152

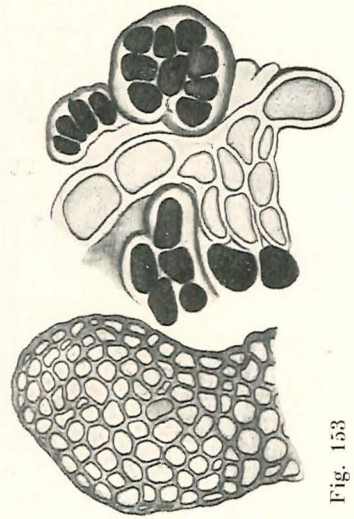


Fig. 154

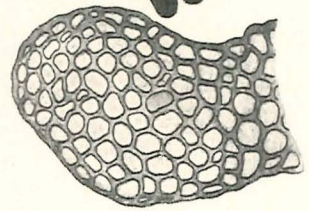


Fig. 153

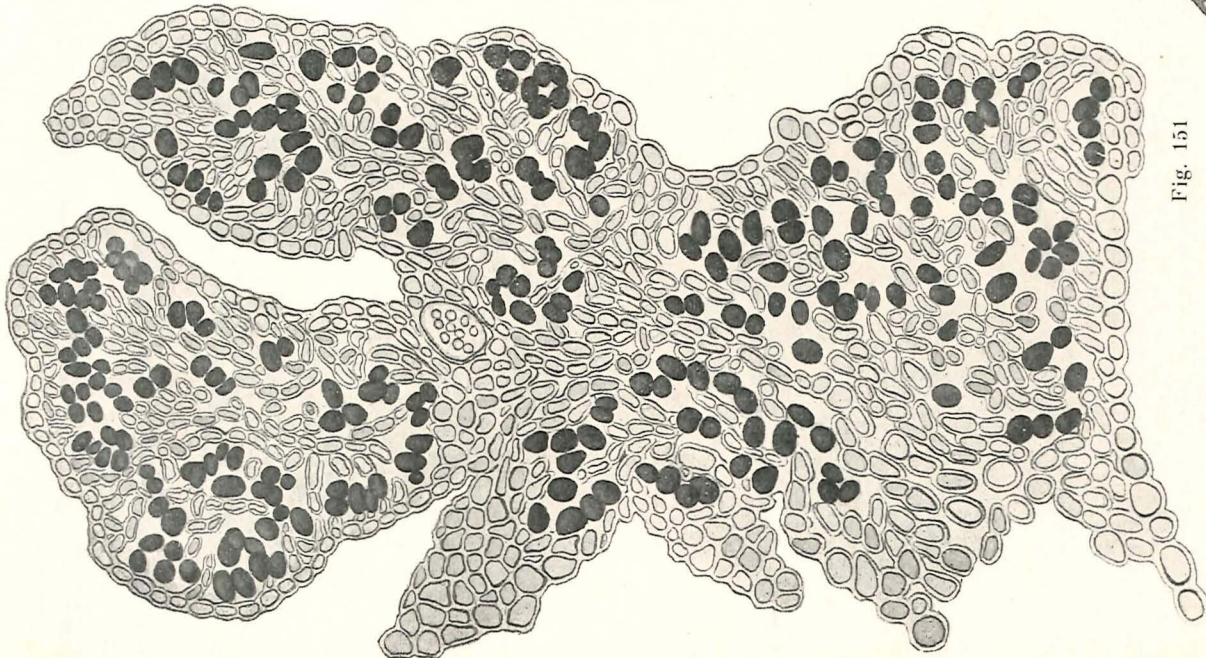


Fig. 151



Fig. 149



PLATE 25.

LEPTOGIUM SINUATUM.

Huds.

Fig. 157. Thallus, in dry condition, with numerous apothecia, among moss on the ground. ( $\times 6$ ).

Fig. 158. The foremost portions of a lobe of thallus (in moistened condition), with apothecia. ( $\times 22$ ).

Fig. 159. The foremost portions of a dry, wrinkled lobe of thallus, with apothecia. ( $\times 22$ ).

Fig. 160. Section of a lobe, with a rhizine, in which fragment of moss are enclosed. ( $\times 140$ ).

Fig. 161. Margin of thallus, longitudinal section, showing among other things the arrangement of the hyphæ. ( $\times 706$ ).

Fig. 162. Rhizoidal hyphæ, attached to a moss-leaf, the cell-walls and cell-contents of which are not (yet?) attacked by the hyphæ. ( $\times 620$ ).

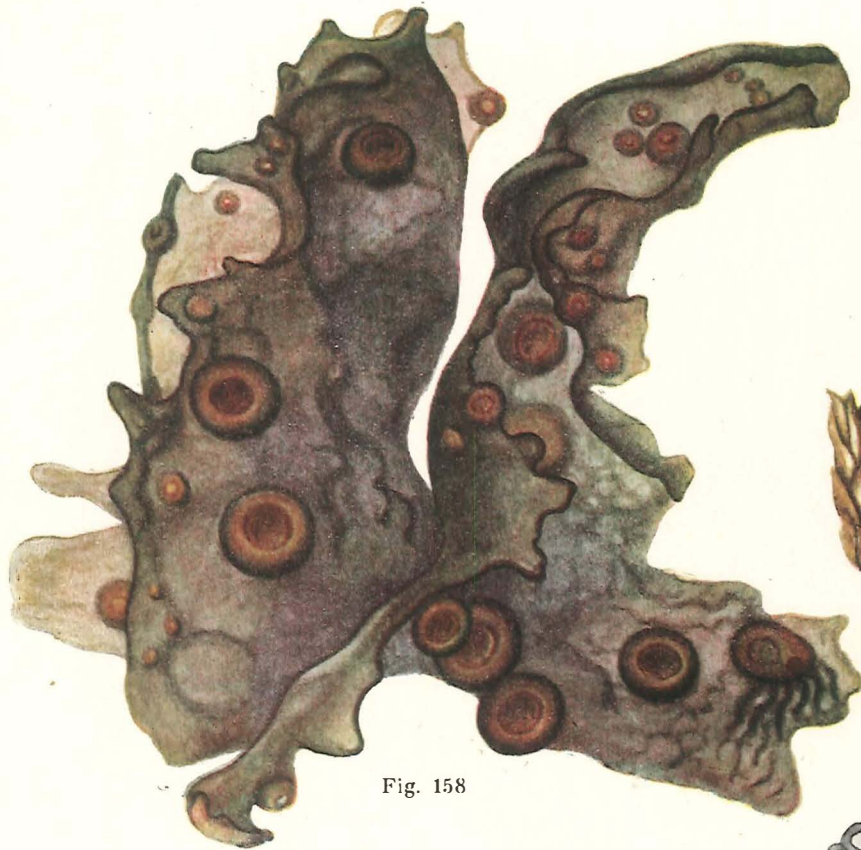


Fig. 158



Fig. 157

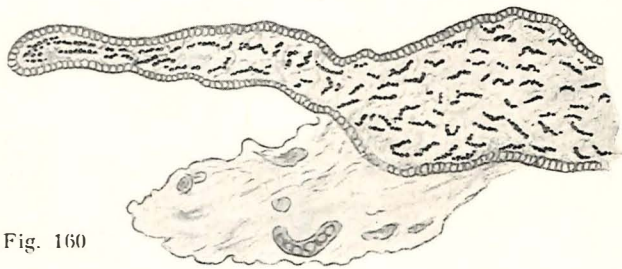


Fig. 160

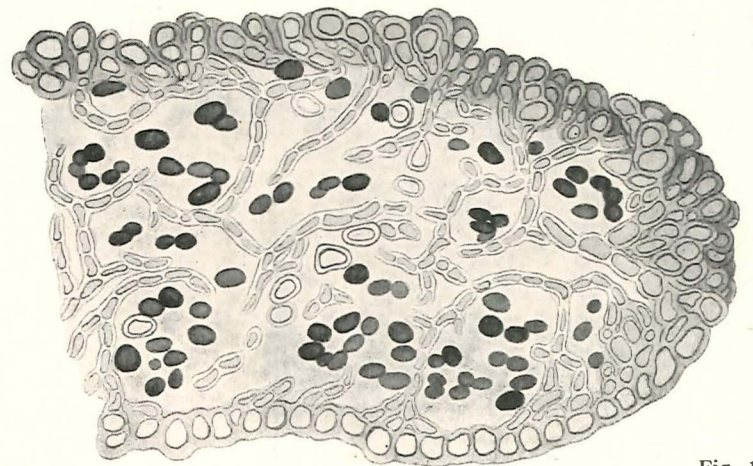


Fig. 161

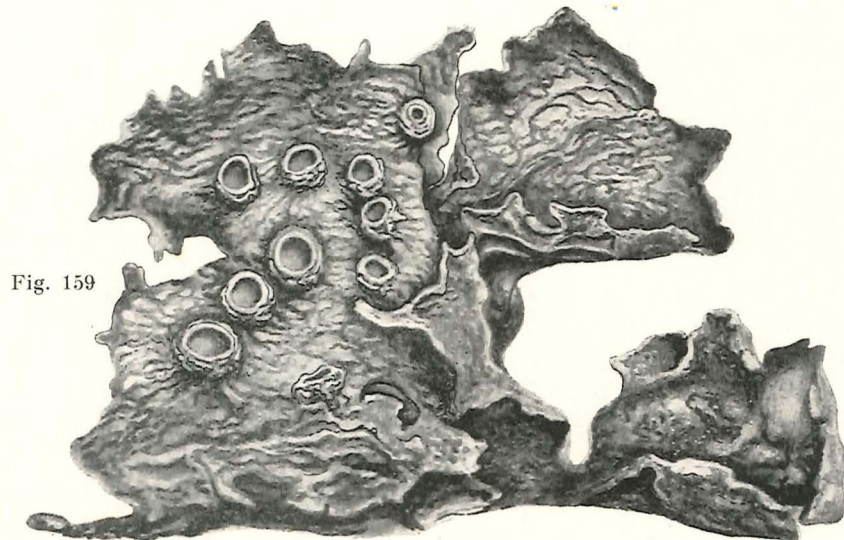


Fig. 159

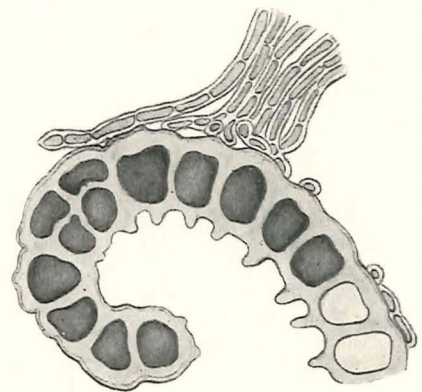


Fig. 162

O. Galloë del.

LEPTOGIUM SINUATUM HUDS.



PLATE 26.

LEPTOGIUM SINUATUM.

Huds.

Fig. 163. A *Nostoc*-chain, with a heterocyste and with portions of hyphæ. ( $\times 1053$ ).

Fig. 164. Young, unripe apothecium, still entirely embedded in the thallus. ( $\times 154$ ).

Fig. 165. Longitudinal section of thallus, with two ripe apothecia. ( $\times 162$ ).

Fig. 166. Margin of apothecium. Note the well-developed calyx, the upper margin of which widens considerably at the surface of the apothecium. ( $\times 600$ ).

Fig. 167. Calyx, formed of parallel hyphæ. Below, i above, into the sub-hymenial tissue (with distinct ascogonia) and into the paraphyses. ( $\times 692$ ).

Fig. 168. Ripe ascus and an isolated spore. ( $\times 746$ ).

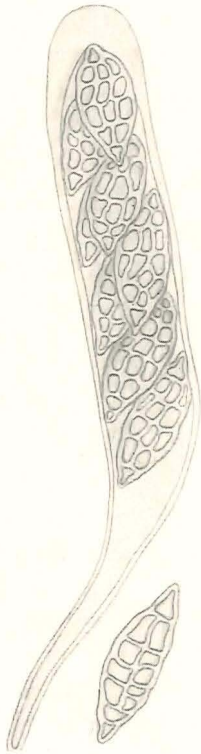


Fig. 168

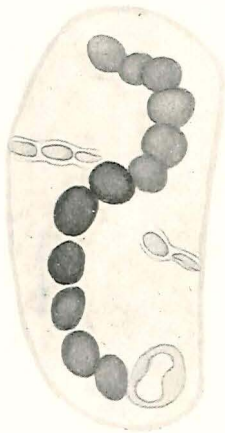


Fig. 163

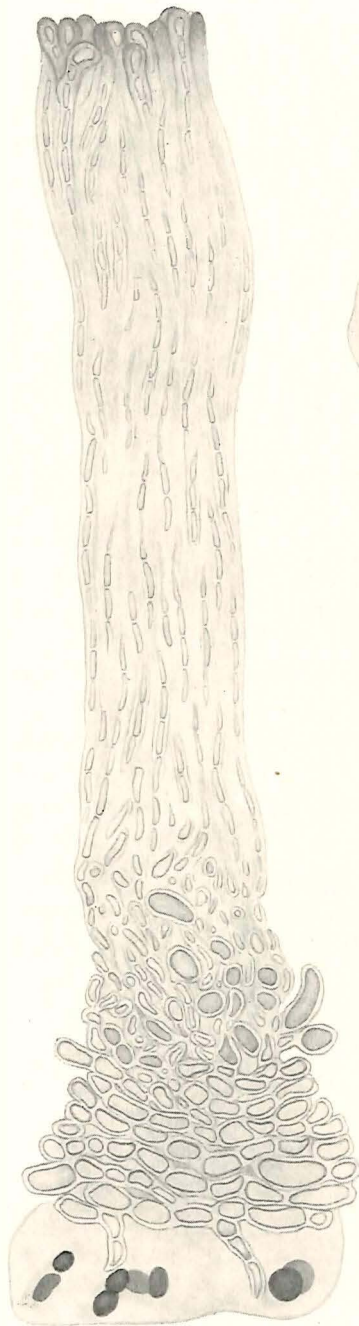


Fig. 167

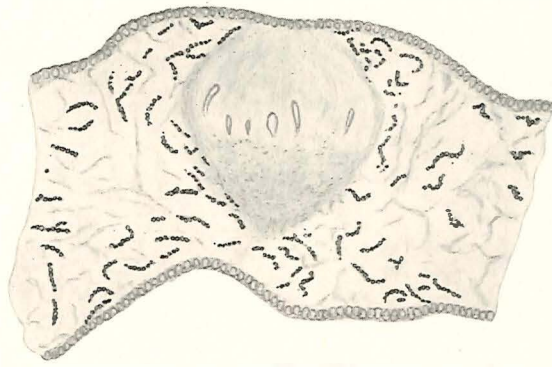


Fig. 164

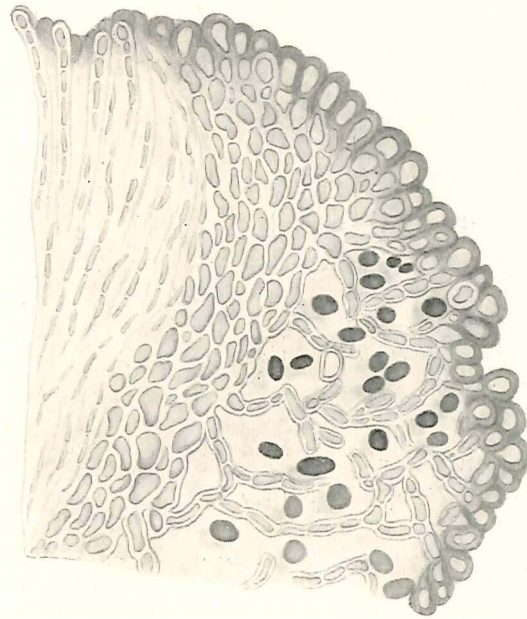


Fig. 166

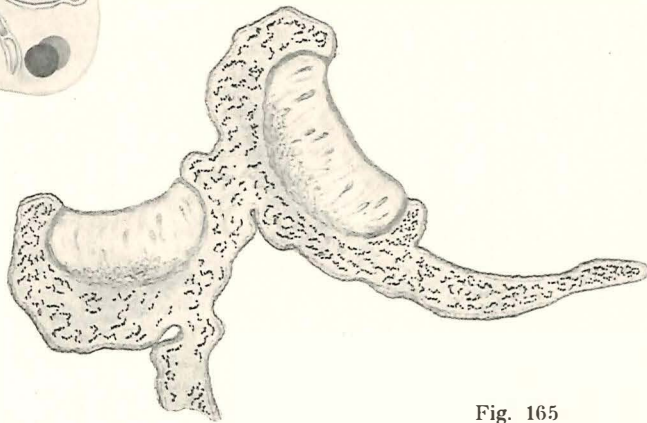


Fig. 165

O. Galløe del.

LEPTOGIUM SINUATUM HUDS.

PLATE 27.

LEPTOGIUM SUBTILE.

SCHRAD.

Fig. 169. Above, portion of thallus, with apothecia ( $\times 20$ ). Below, three apothecia at various ages. ( $\times 90$ ).

Fig. 170. Longitudinal section of the margin of thallus, with an apothecium. ( $\times 105$ ).

Fig. 171. Two lobules of thallus, the margins of which are connected by interlaced rhizoidal hyphæ. ( $\times 158$ ).

Fig. 172. Section of thallus, with rhizoidal hyphæ. ( $\times 620$ ).

Fig. 173. Margin of apothecium, showing the distinct calyx, above ending in a thick (yellowish) *margo proprius*, which externally is covered with a thin *margo thallinus*. ( $\times 650$ ).

Fig. 174. Hymenium and calyx, below passing into the ordinary thallus. ( $\times 747$ ).

Fig. 175. Pycnidia. ( $\times 747$ ).



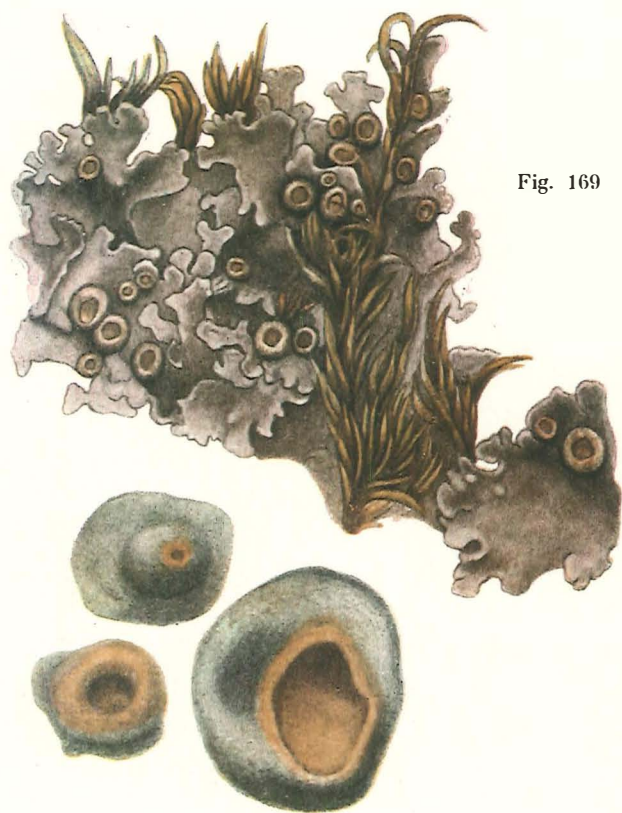


Fig. 169

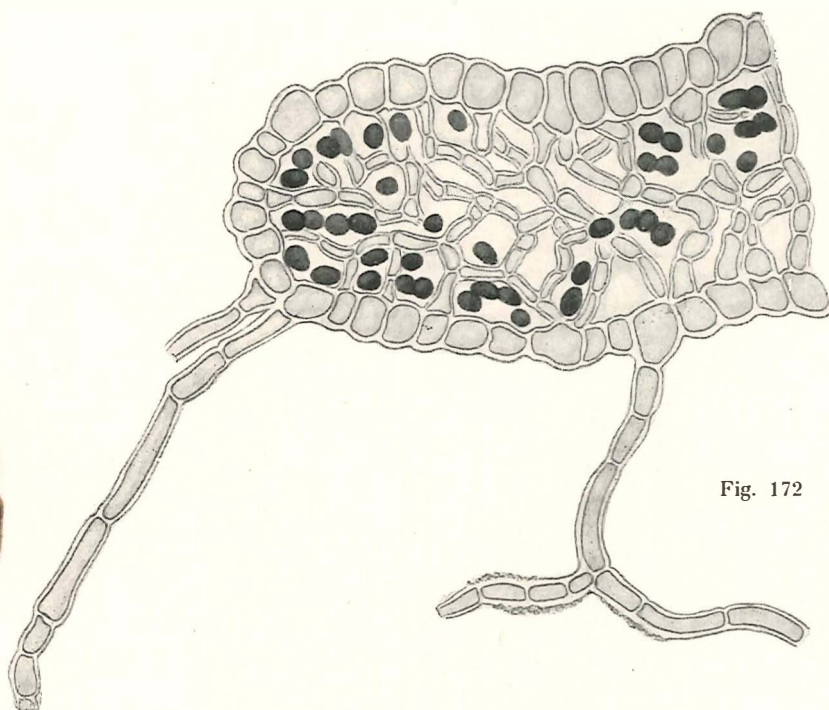


Fig. 172



Fig. 171

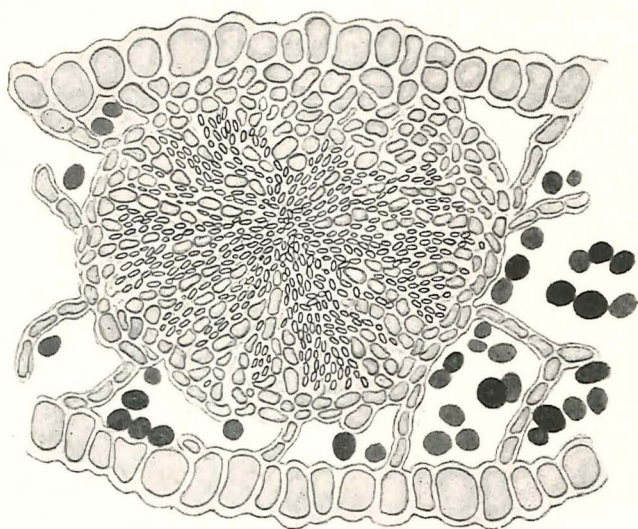


Fig. 175



Fig. 174

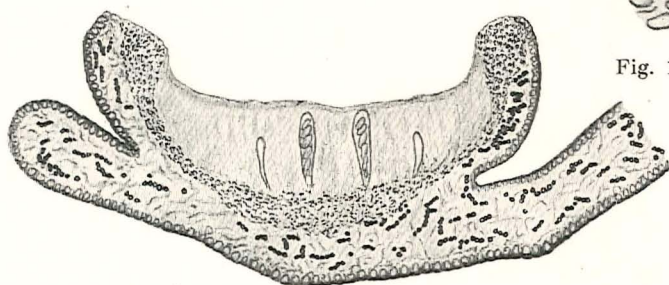


Fig. 170

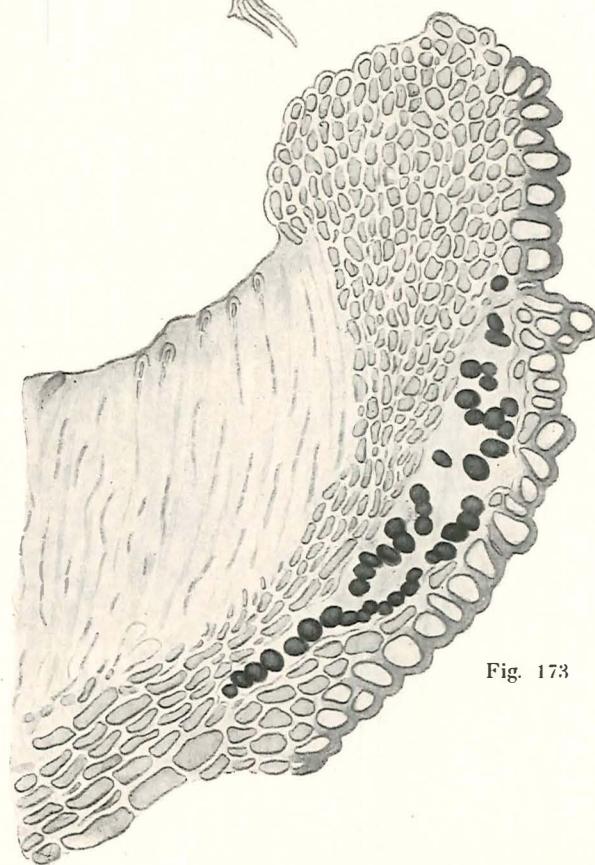


Fig. 173

PLATE 28.

LEPTOGIUM PALMATUM.

HUDS.

**Specimen 1.**

Fig. 176. Portion of a lobe of thallus, in dry condition. ( $\times 23$ ).

Fig. 177. Portion of a lobe of thallus, to which the tip of a moss-stem is attached; painted in moistened state. ( $\times 23$ ).

Fig. 178. Transverse section of a rolled-up lobe of thallus ( $\times 80$ ), within which, besides, the margin of the same lobe is drawn. ( $\times 620$ ).

Fig. 179. Longitudinal section of a lobe; the cortex of the upper surface is brownish. ( $\times 715$ ).

Fig. 180. Cortex from the upper surface of a lobe — seen from above. ( $\times 715$ ).

**Specimen 2.**

Fig. 181. Portion of a tuft, seen from above. ( $\times 4$ ).

Fig. 182. The foremost end of a lobe of thallus — seen from below. To the right, another smaller lobe coalesced with the bigger one. ( $\times 4$ ).



Fig. 178

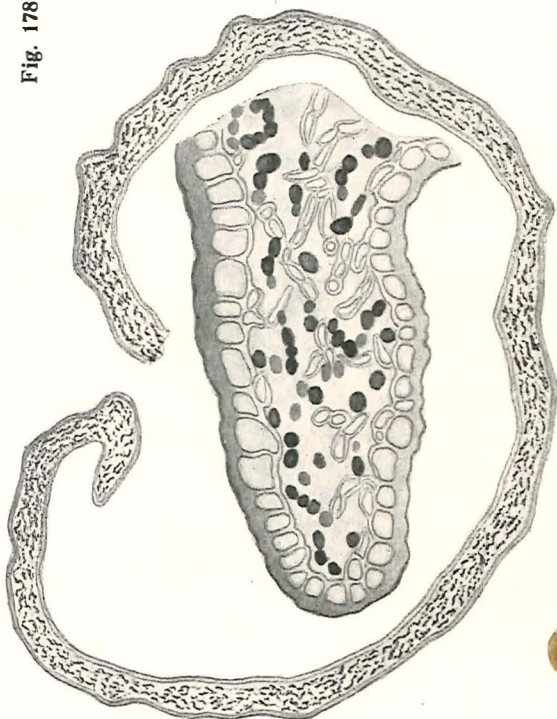


Fig. 177

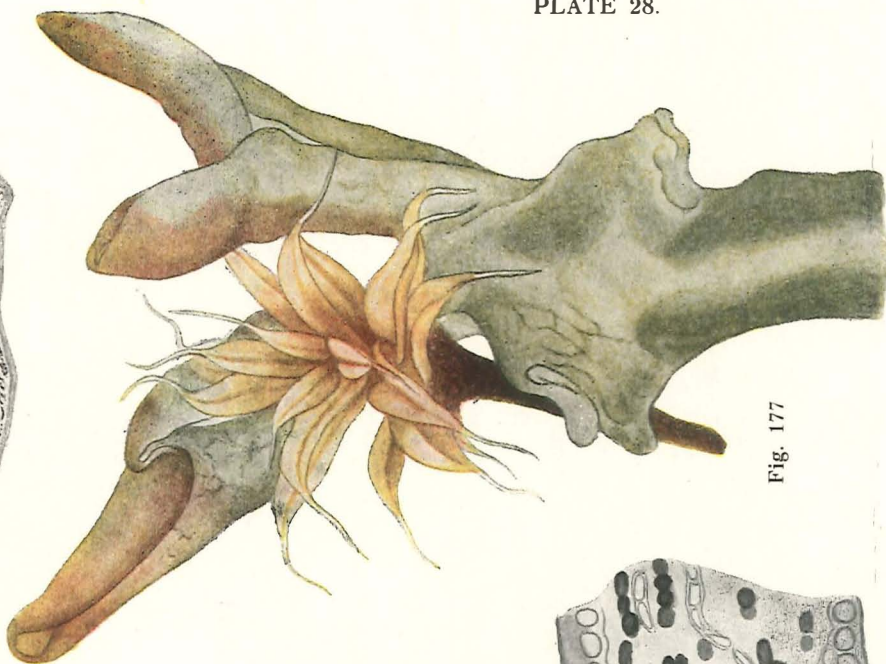


Fig. 182

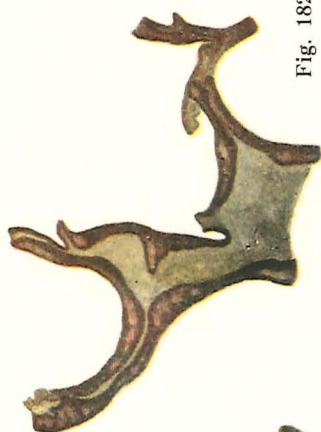


Fig. 181



Fig. 176



Fig. 179

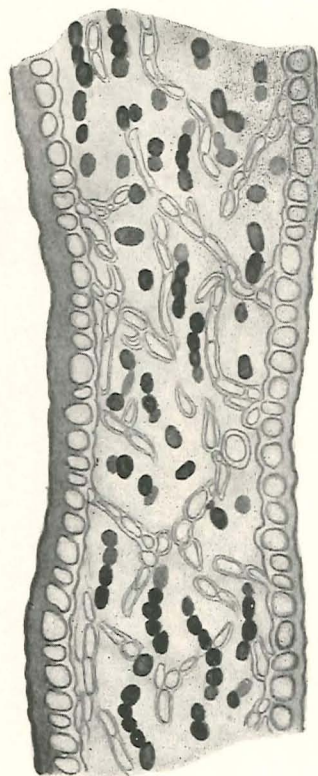
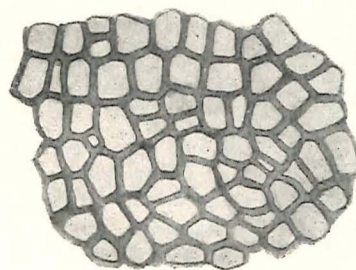


Fig. 180



O. Galløe del.

LEPTOGIUM PALMATUM HUDS.  
(Specimen 1, 2).



LEPTOGIUM LICHENOIDES.

(L.) ZAHLBR.

**Specimen 1.**

Fig. 183. A moss-tuft interspersed with the thallus of *Leptogium lichenoides*, painted in moistened state. ( $\times 2$ ).

Fig. 184. Lobe of thallus from the margin of the tuft, (moistened). ( $\times 3$ ).

Fig. 185. Foremost end of a moistened lobe of thallus, with distinct ribs. ( $\times 22$ ).

Fig. 186. Foremost end of a moistened lobe of thallus; this lobe is erect and isolateral. Isidia occur on both sides. ( $\times 22$ ).

Fig. 187. Erect lobe of moistened thallus, from the middle of the tuft. The edges, and partly the surfaces too, are laciniate. ( $\times 22$ ).

Fig. 188. Transverse section of a lobe of thallus; the gonidia are artificially stained red. The lobe is in contact with a moss-leaf (cut across), situated just at the base of a lacinia protruding from the thallus and here cut longitudinally. In two other places this lobe is connected with two other small lobes, which have coalesced with the bigger one. ( $\times 71$ ).

Fig. 189. Transverse section of thallus. ( $\times 90$ ).

Fig. 190. Plane-view of the upper surface of thallus. ( $\times 697$ ).

Fig. 191. Plane-view of the lower surface of thallus. ( $\times 697$ ).



Fig. 183



Fig. 187

Fig. 184



Fig. 185

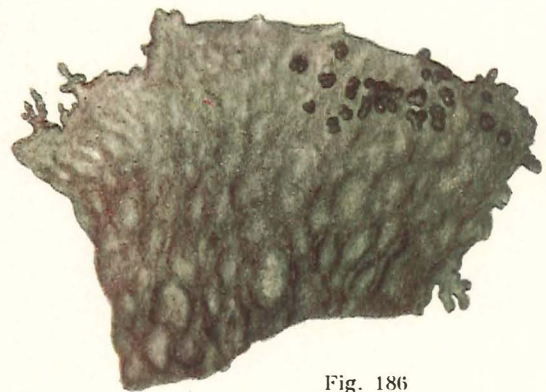
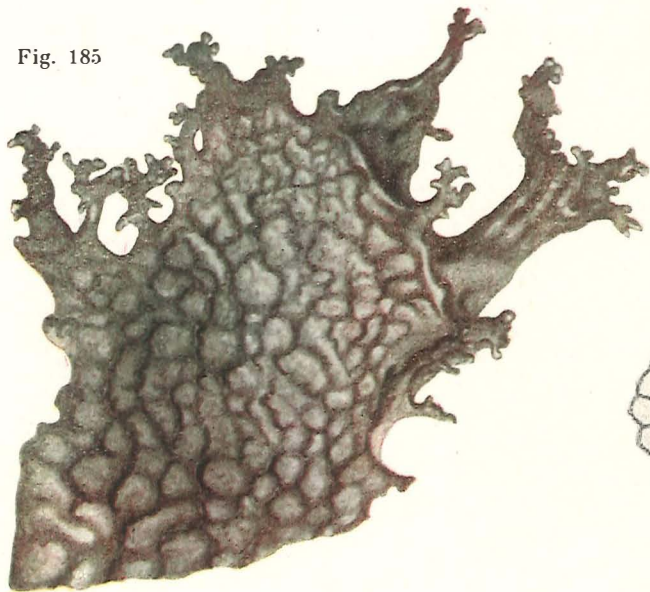


Fig. 186

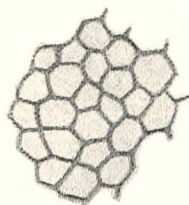


Fig. 191



Fig. 189



Fig. 188

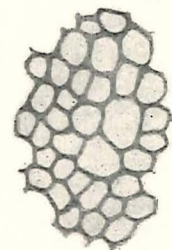


Fig. 190

*O. Galløe del.*

LEPTOGIUM LICHENOIDES (L.) ZAHLBR.  
(Specimen 1).

PLATE 30.

LEPTOGIUM LICHENOIDES.

(L.) ZAHLBR.

**Specimen 1.**

Fig. 192. Transverse section of thallus; the cortex of the upper surface is darker than that of the lower surface. ( $\times 620$ ).

Fig. 193. Two lobes of thallus, connected through rhizines. ( $\times 620$ ).

Fig. 194. Lobe of thallus, connected through rhizines to a living moss-leaf, which has not (yet?) suffered any damage by the attack. ( $\times 620$ ).

Fig. 195. Longitudinal section of lobe of thallus. ( $\times 620$ ).



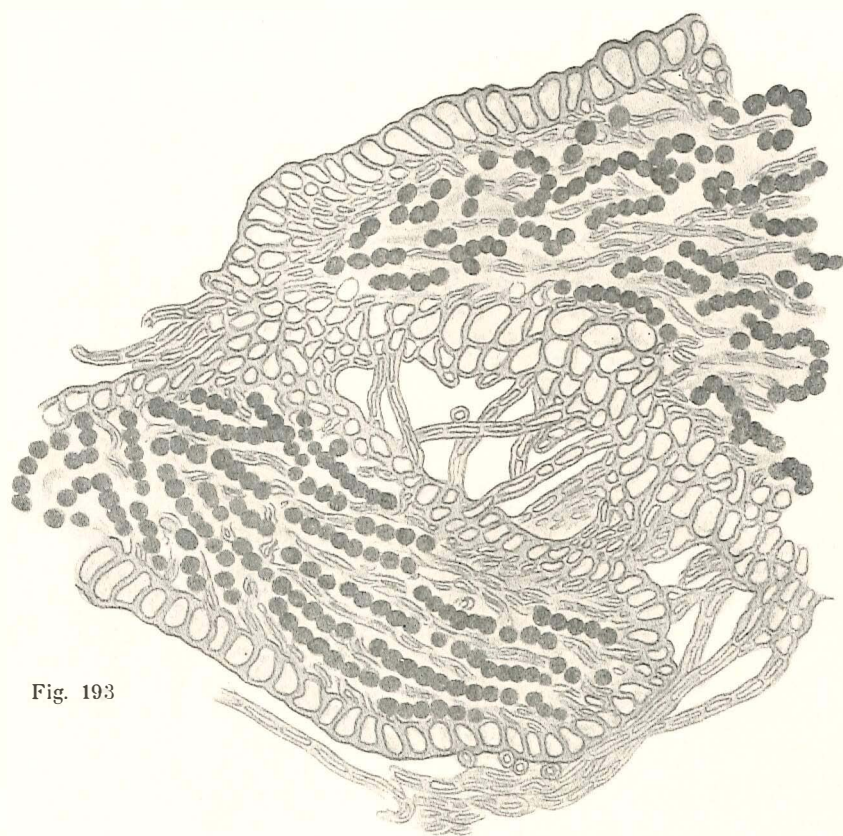


Fig. 193

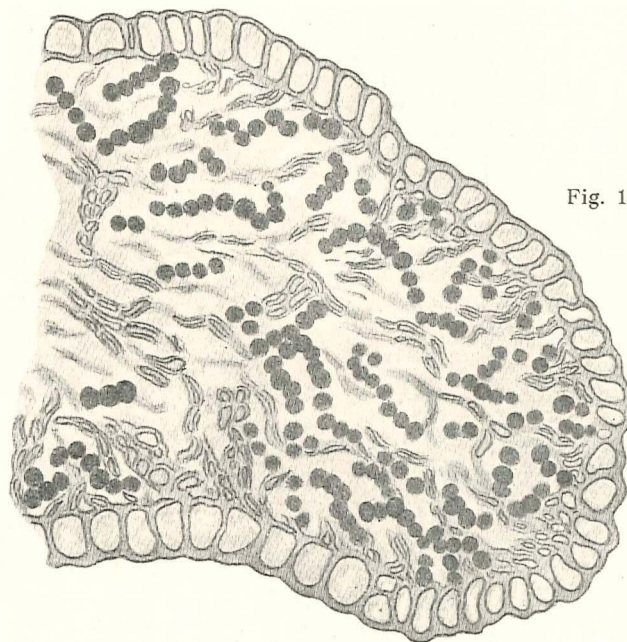


Fig. 195

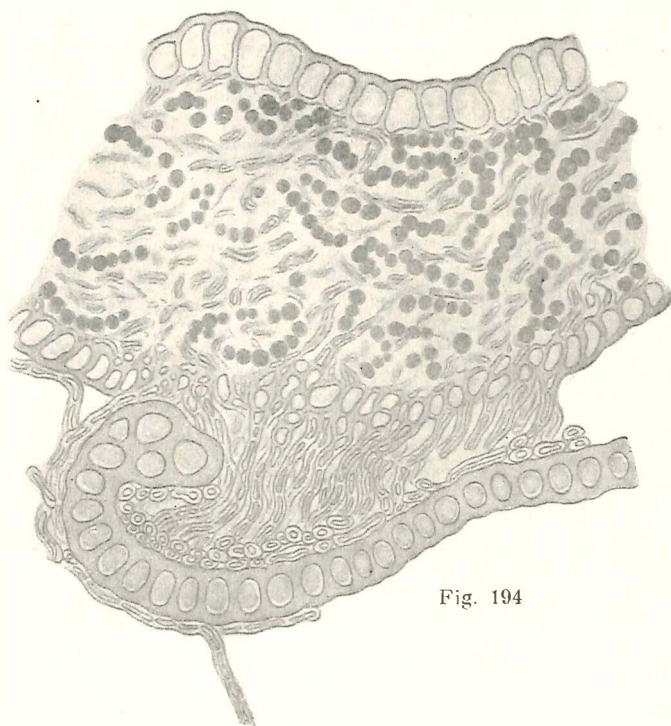


Fig. 194

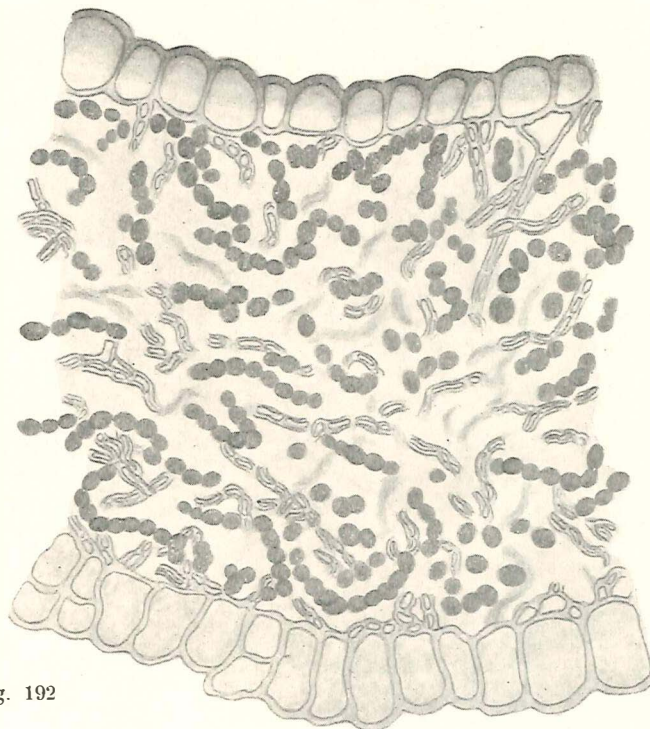


Fig. 192

*O. Galløe del.*

LEPTOGIUM LICHENOIDES (L.) ZAHLBR.  
(Specimen 1).

PLATE 31.

LEPTOGIUM LICHENOIDES.

(L.) ZAHLBR.

**Specimen 2.**

Fig. 196. Foremost end of a lobe of thallus, with four apothecia. The latter have a yellow disc, surrounded by a yellow *margo proprius* and, besides, with a *margo thallinus*. ( $\times 20$ ).

Fig. 197. Thallus with apothecium. ( $\times 157$ ).

Fig. 198. Margin of apothecium, with a very thin thalline margin and a well-developed calyx, the upper margin of which (*margo proprius*) is yellowish like disc (compare Fig. 196). ( $\times 856$ ).



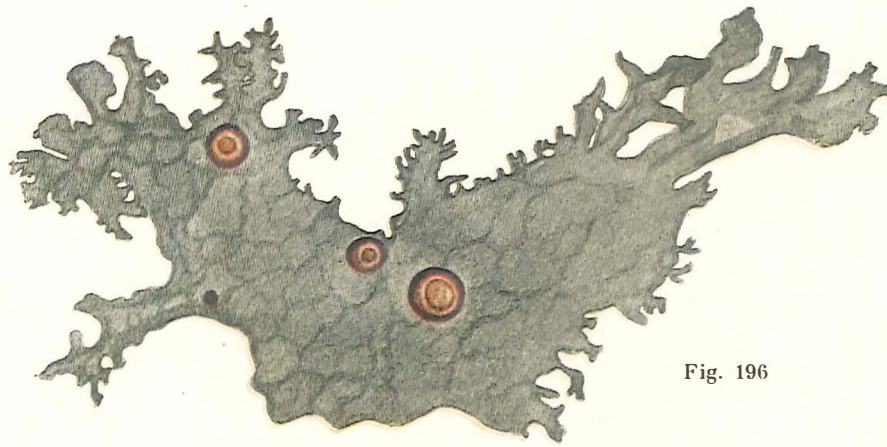


Fig. 196

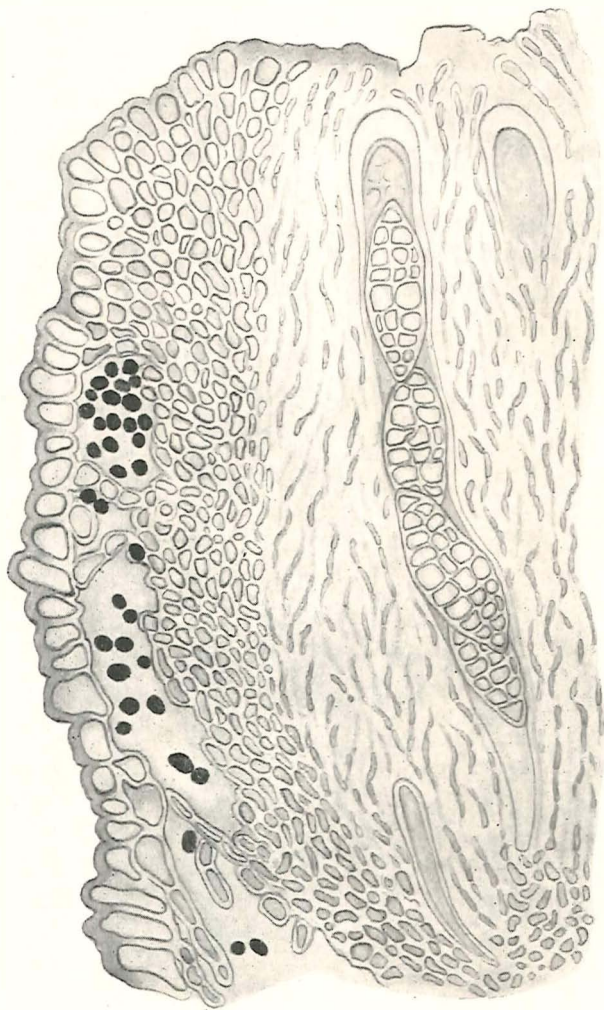


Fig. 198

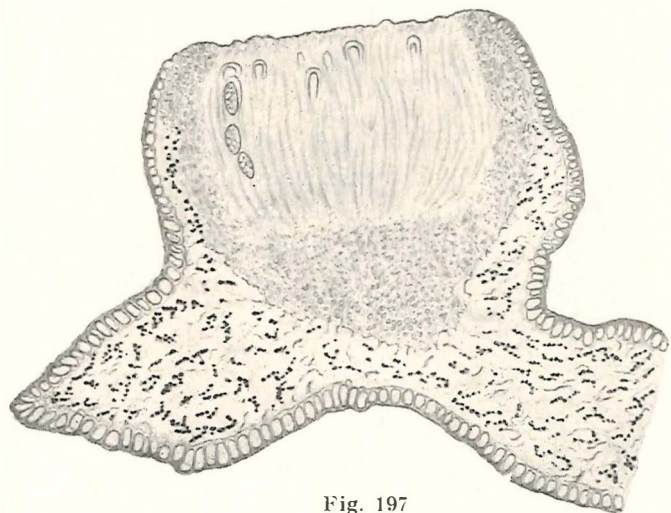


Fig. 197

*O. Gallæ del.*

LEPTOGIUM LICHENOIDES (L.) ZAHLBR.  
(Specimen 2).



PLATE 32.

PLACYNTHIUM NIGRUM.

Huds.

Fig. 199. Thallus with apothecia. ( $\times 27$ ).

Fig. 200. Margin of thallus with young areoles. ( $\times 90$ ).

Fig. 201. Portion of thallus with hypothallus-hyphæ and a young apothecium. ( $\times 90$ ).

Fig. 202. To the left a hormogonium of *Dichotrix* found lying free between the grains of thallus ( $\times 1053$ ); to the right of this a similar chain of alga, invested by hyphæ of the hypothallus. ( $\times 1053$ ). To the farthest right of the picture a young grain of thallus attached to a bluish hypothalloid hypha, above passing into a brown pseudo-parenchyma, which entirely invests a chain of alga (invisible in this figure). ( $\times 620$ ). The rest of the figure represents hypothallus-hyphæ of different aspect. ( $\times 620$ ).

Fig. 203. Vertical section of thallus, showing a ripe apothecium, formed in a grain of thallus connected with other grains of thallus through light, rhizoidal-like. The rest of the section shows young, light grains of thallus and some older ones, overgrown and brownish, all connected with each other through hyphæ. ( $\times 112$ ).

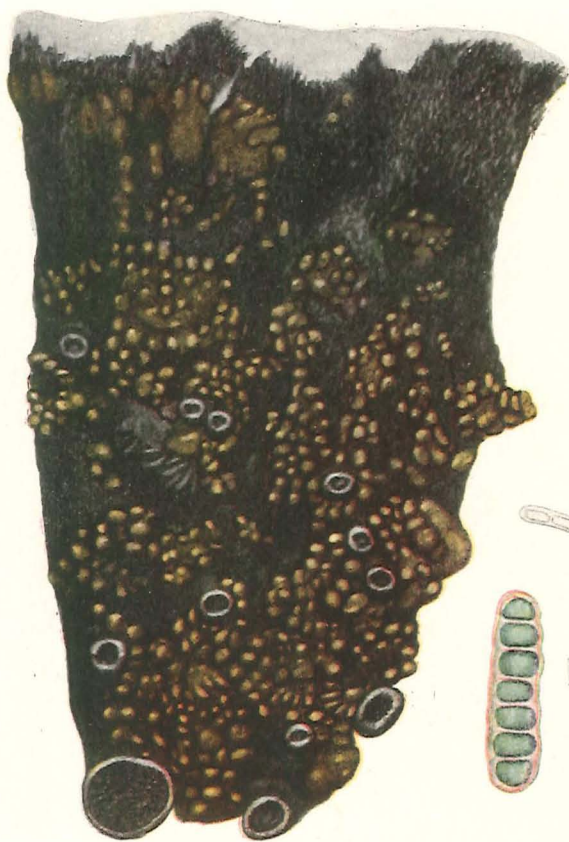


Fig. 199



Fig. 200

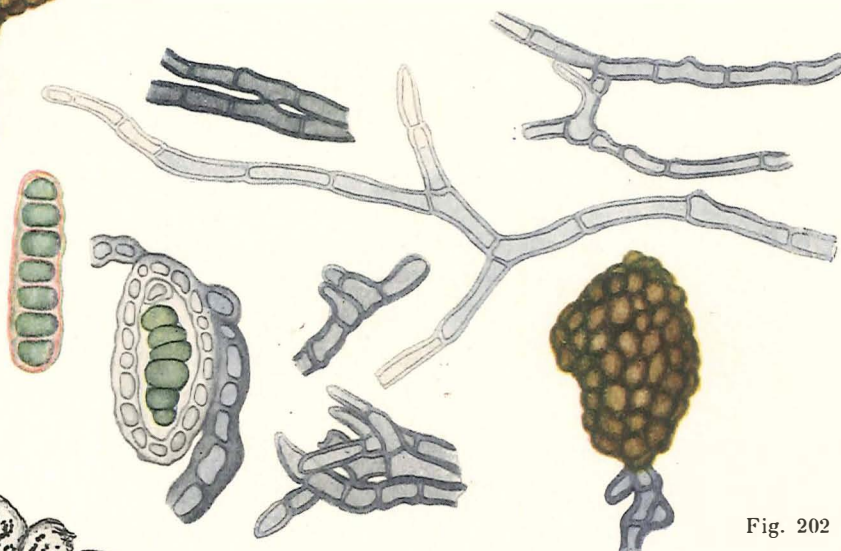


Fig. 202

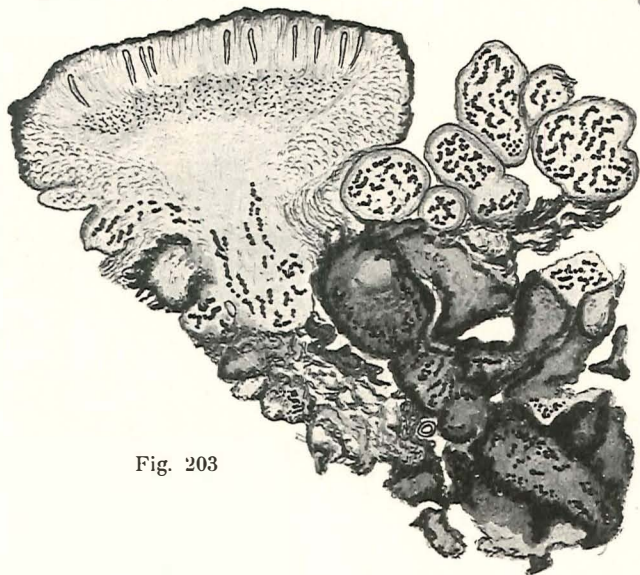


Fig. 203



Fig. 201

*O. Galløe del.*

PLACYNTHIUM NIGRUM HUDS.

PLATE 33.

PLACYNTHIUM NIGRUM.

HUDS.

Fig. 204. Grain of thallus; to the left light hyphæ issuing from the cortex; the blue hypothallus-hyphæ are visible below. ( $\times 750$ ).

Fig. 205. Margin of apothecium. ( $\times 715$ ).

Fig. 206. Boundary between the small-celled stipes and the big-celled hyphæ of the bottom-portions of a grain of thallus. ( $\times 1053$ ).

Fig. 207. Portion of a hymenium. ( $\times 720$ ). To the left a ripe ascus. ( $\times 720$ ).



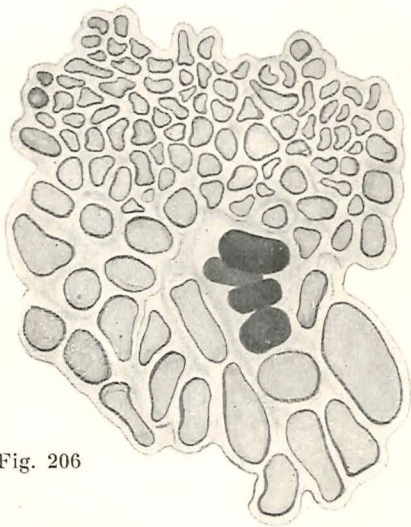


Fig. 206

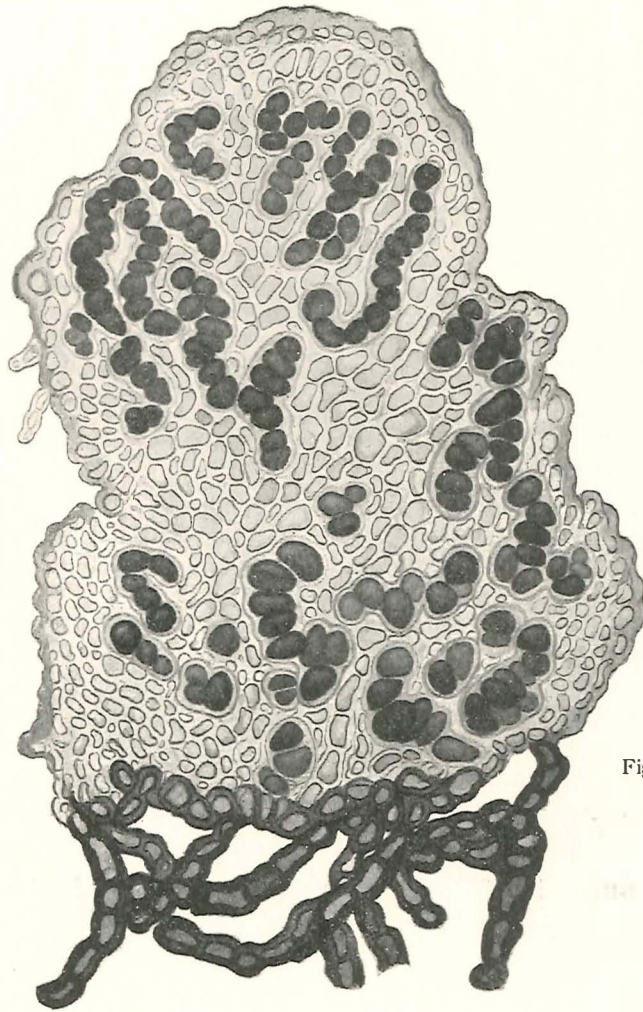


Fig. 204

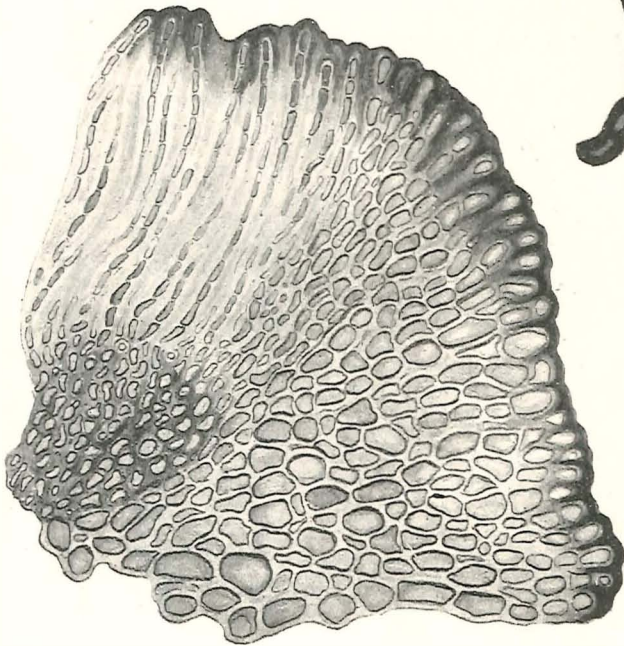


Fig. 205

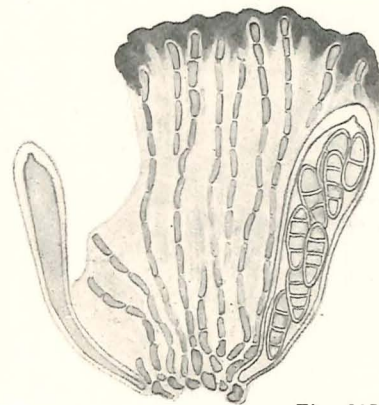


Fig. 207

*O. Galløe del.*

PLACYNTHIUM NIGRUM HUDS.

VI P 9a

PLATE 34.

CROCYNIA NEGLECTA.

(NYL.) HUE.

(A Swedish specimen).

Fig. 208. Sterile thallus growing over moss. ( $\times 20$ ).

Fig. 209. Margin of thallus, formed of grains growing over moss-leaves. ( $\times 90$ ).

Fig. 210. Vertical section of thallus, — four grains of thallus connected at the base through a colourless medulla, which downwards passes into a brown felt of rhizoidal hyphæ. ( $\times 157$ ).

Fig. 211. Two grains of thallus, below passing into a common, colourless medulla. ( $\times 625$ ). To the right, brown rhizoidal hyphæ. ( $\times 625$ ).



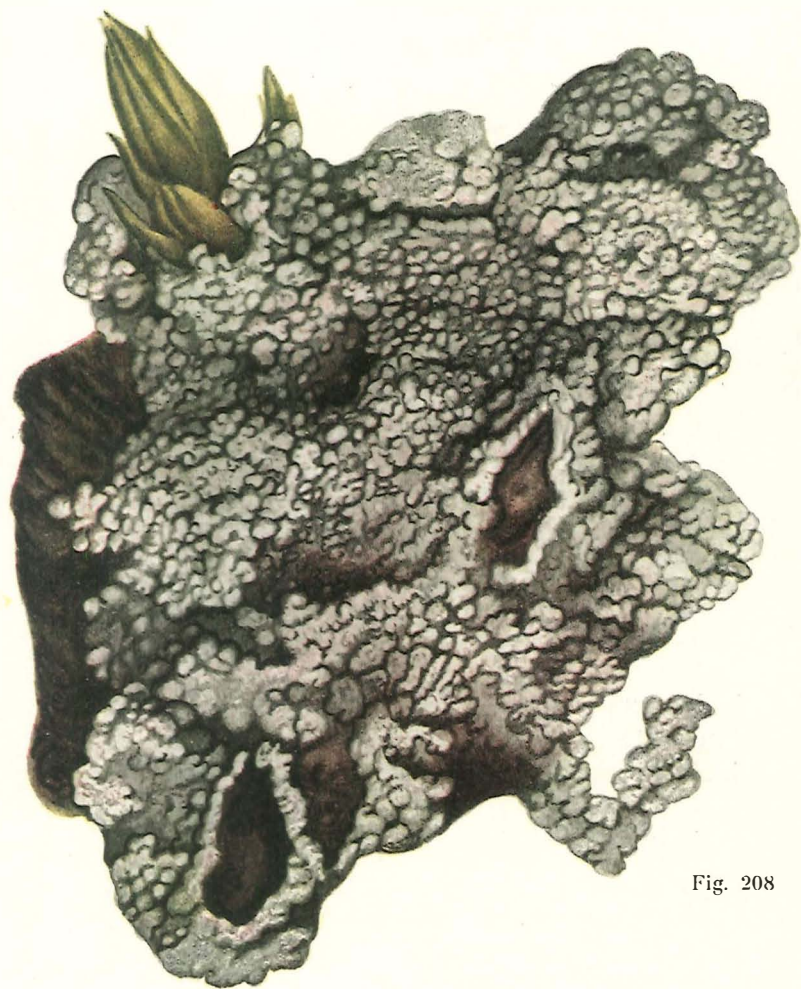


Fig. 208

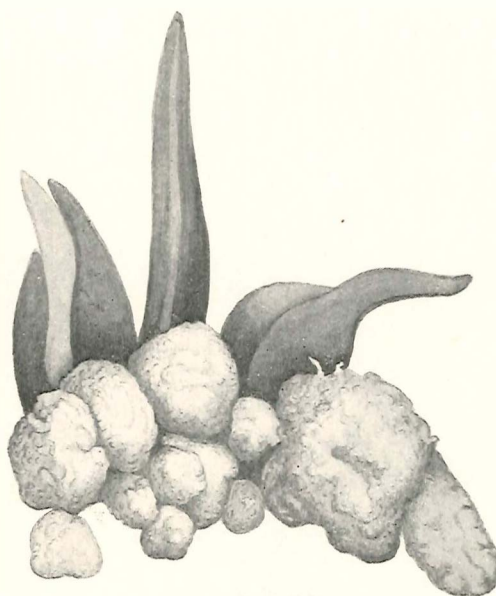


Fig. 209

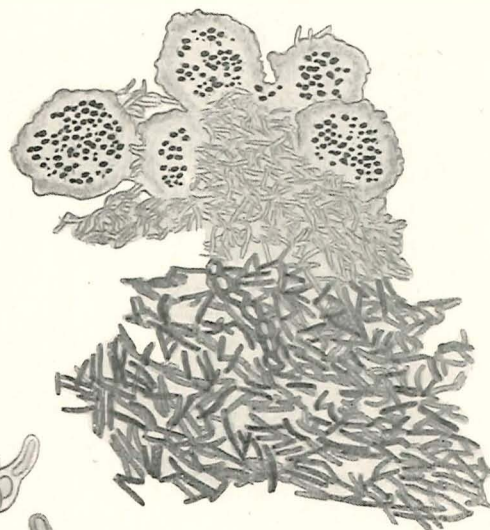


Fig. 210

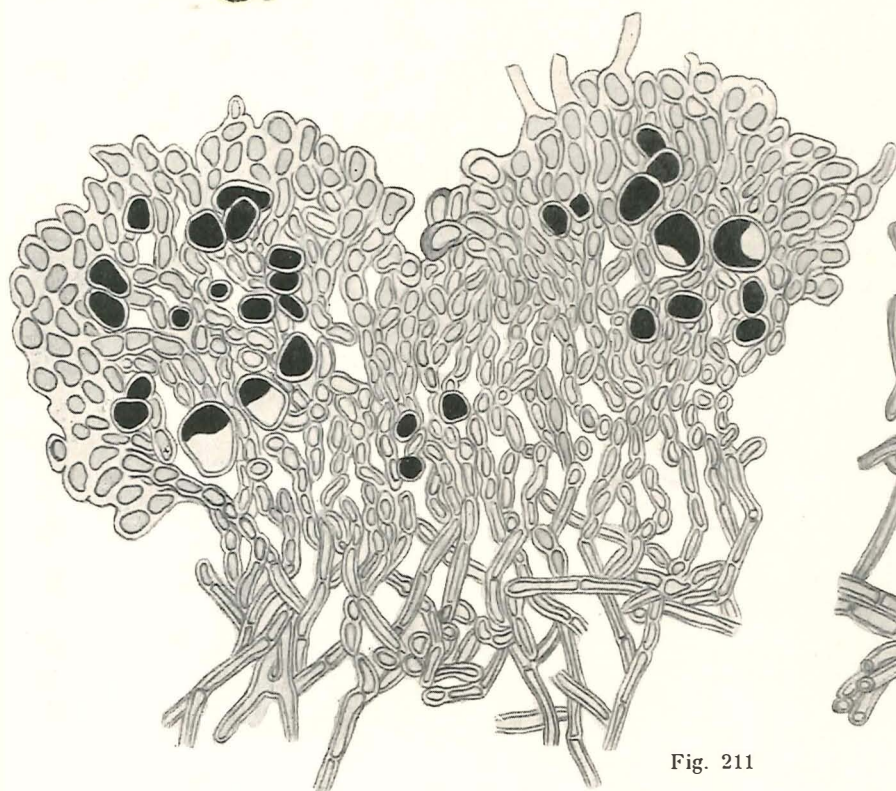
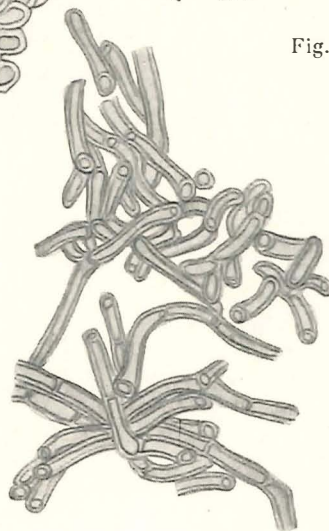


Fig. 211



*O. Galloë del.*

*CROCYNIA NEGLECTA* (NYL.) HUE.  
(A Swedish specimen).



PLATE 35.

CROCYNIA LANUGINOSA.

HUE.

Fig. 212. Thallus, the marginal lobes of which are above in the picture, spreading over moss. ( $\times 6$ ).

Fig. 213. Margin of a lobe of thallus, upper surface. The very edge is slightly recurved; the surface is faintly granular. ( $\times 18$ ).

Fig. 214. Margin of a lobe of thallus, lower surface, with attached dead moss. ( $\times 18$ ).

Fig. 215. Longitudinal section of the margin of thallus; note the granular surface. ( $\times 158$ ).

Fig. 216. Section through the thallus, below passing felt. ( $\times 610$ ).

Fig. 217. Colonies of *Gloeocapsa*, of which numerous specimens were found among the moss under the thallus of *Crocynia*. Some of these colonies were interlaced by, or enclosed among, the hyphæ from the lower surface of *Crocynia* — as the colonies pictured here. ( $\times 610$ ).



Fig. 215



Fig. 214

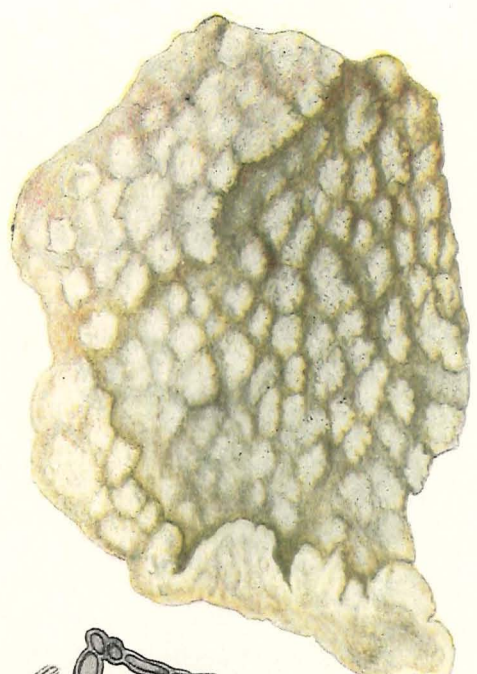


Fig. 213



Fig. 216

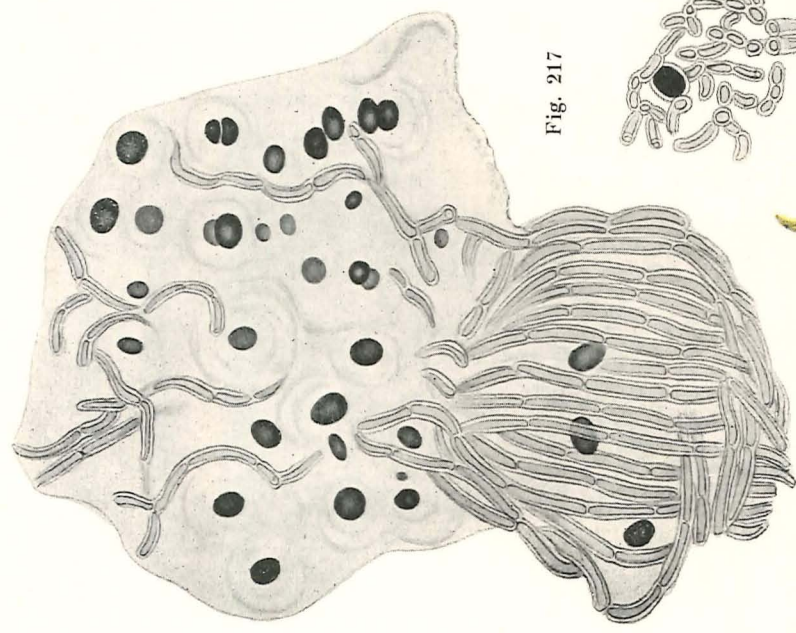


Fig. 217



Fig. 212



PARMELIELLA LEPIDIOTA.

SMRFT.

(A North-American specimen).

Fig. 218. Thallus. Resting on the dark rhizoidal felt near the margin of thallus there is among other squamules one independent squamule, incised and provided with small soredia-like protuberances. Two apothecia with a false thalline margin, which has not coalesced with the apothecium in the slightest degree (*compare* Fig. 222). ( $\times 13$ ).

Fig. 219. Longitudinal section of a squamule of thallus. To the right the embryonic margin of thallus, the thin cortex of which has not yet got the brown pigment and for that reason is rendered apparently soredia-like. Lengthwise arranged hyphæ can be seen at the bottom of the medulla directly above the dark rhizoidal felt. ( $\times 20$ ).

Fig. 220. Section of cortex, the deeper lying hyphæ of which are brown; next follows the gonidial layer with *Nostoc*-gonidia. ( $\times 620$ ).

Fig. 221. Above, the light-brownish medullary hyphæ, abruptly continuing into the bluish-brown rhizoidal felt. ( $\times 620$ ).

Fig. 222. Apothecium overgrowing the squamule, in which it has been formed, and several other squamules rendered brownish by being overgrown, and provided with gonidia. *Margo proprius* continues into a tissue rather similar to the rhizoidal felt, passing a little deeper down into brownish hyphæ like those in Fig. 223. ( $\times 33$ ).

Fig. 223. Hyphæ from the deeper parts of *margo proprius* (*vide* also the explanation of Fig. 222). ( $\times 620$ ).

Fig. 224. The light-brownish tissue of calyx situated just beneath the hymenium. Below it gradually passes into a more big-celled tissue. ( $\times 620$ ).

Fig. 225. Paraphyses and a ripe ascus. ( $\times 620$ ). To the left eight isolated spores. ( $\times 747$ ).





Fig. 218

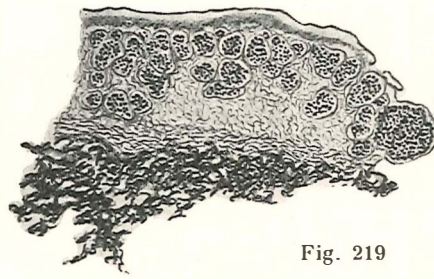


Fig. 219

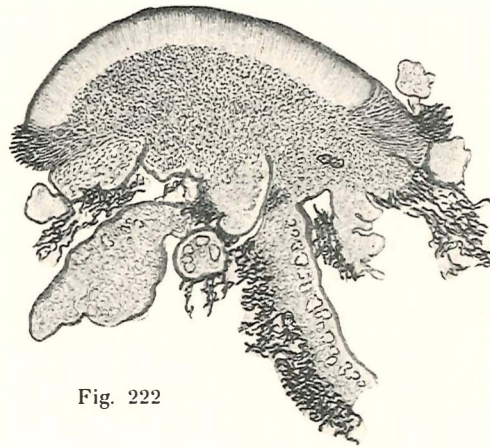


Fig. 222



Fig. 224

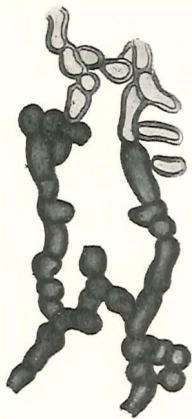


Fig. 221

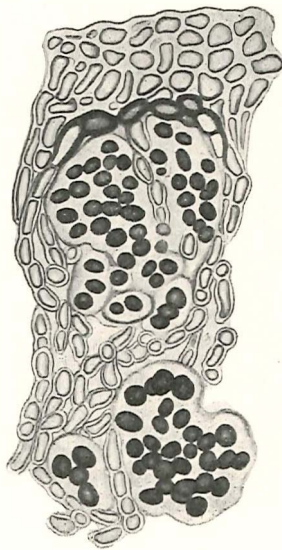


Fig. 220

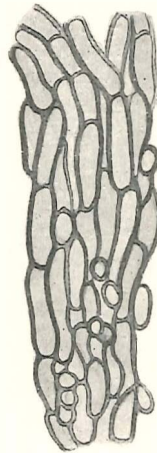


Fig. 223

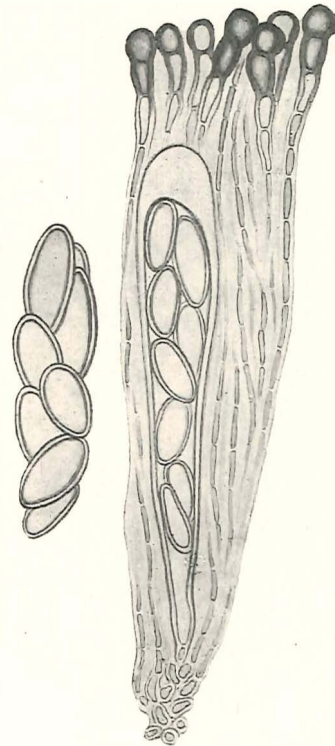


Fig. 225

*O. Galløe del.*

PARMELIELLA LEPIDIOTA SMRFT.  
(A North-American specimen).

PLATE 37.

PARMELIELLA PLUMBEA.

LIGHTF.

Fig. 226. Marginal and central parts of thallus, with numerous apothecia. ( $\times 7$ ).

Fig. 227. Rather old parts of thallus; with old, very high apothecia, the discs of which are subdivided into small secondary discs (*vide* the text); externally these apothecia are surrounded by squamules of thallus. A section of these apothecia is given in Fig. 234. ( $\times 40$ ).

Fig. 228. Squamules from the middle of thallus. They spread over other squamules, which were omitted in the picture. The light spots in the picture represent beginning squamules, which are chiefly formed along the margins of older squamules, but may, besides, be formed on their surfaces. ( $\times 16$ ).

Fig. 229. Longitudinal section of two lobes of thallus, underneath provided with blue felt. ( $\times 86$ ).

Fig. 230. Cortex and gonidial layer of the thallus ( $\times 620$ ); below, an isolated colony of *Nostoc*. ( $\times 1053$ ).



Fig. 227

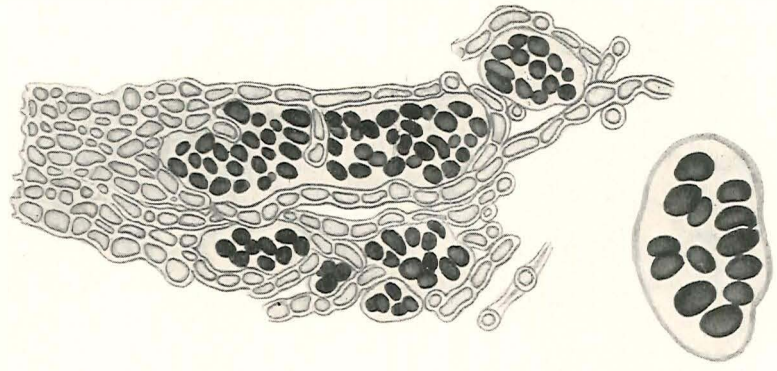
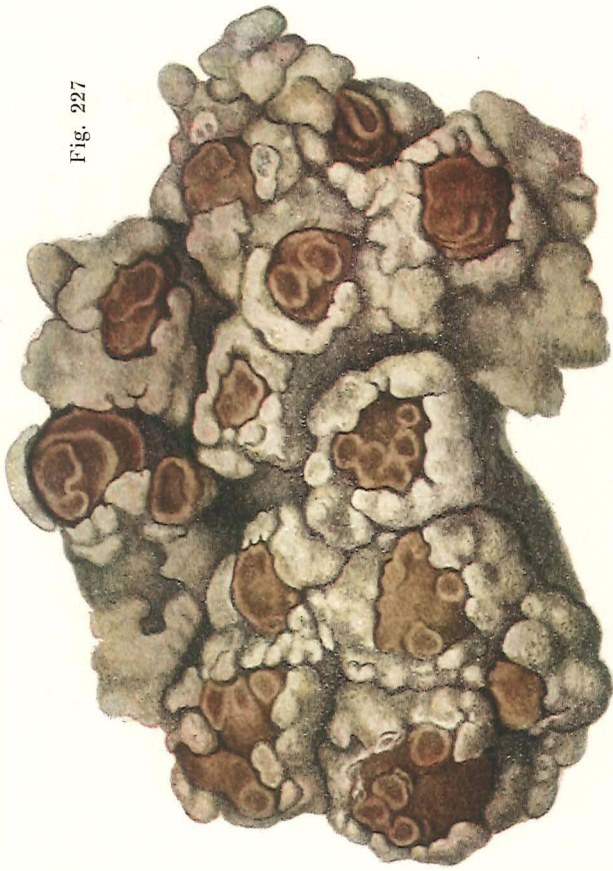


Fig. 230



Fig. 228



Fig. 226

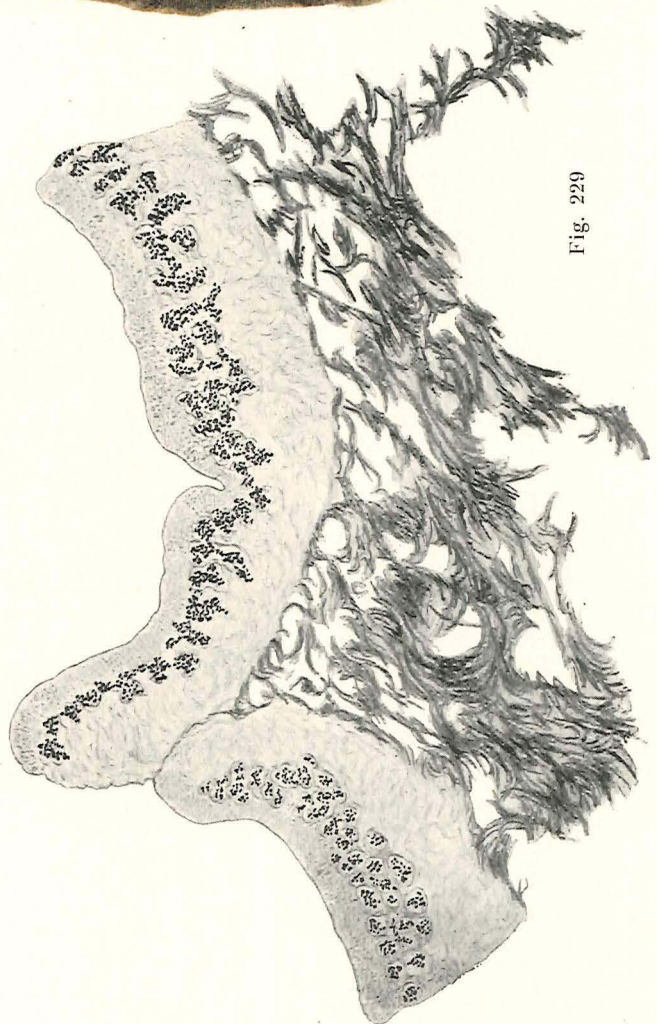


Fig. 229

O. Galløe del.

PARMELIELLA PLUMBEA LIGHTF.



PLATE 38.

PARMELIELLA PLUMBEA.

LIGHTF.

Fig. 231. Medulla. ( $\times 598$ ).

Fig. 232. Blue rhizoidal felt, issuing from the colourless medulla at the top of the figure. ( $\times 620$ ).

Fig. 233. Lecideine apothecium, formed in a squamule of thallus. Rhizoidal hyphæ issue from its lower surface. ( $\times 87$ ).

Fig. 234. Vertical section of an old and very high apothecium, as in Fig. 227, formed of a very high stipes-calyx of dense tissues, in which were found three inter-cellular spaces due to tensions of growth. At the top the hymenium is subdivided into two secondary hymenia. Externally the apothecium has four portions of squamules of thallus, which have no close connection with the apothecium, having been pressed upwards into this position while competing in growth with the apothecium. Compare this section with Fig. 227. The formation of similar old apothecia with several secondary hymenia has been described in several cases in this work (e. g. in *Lecanora subfusca*). ( $\times 36$ ).

Fig. 235. Four neighbouring apothecia with blue felt on their under-surfaces. ( $\times 28$ ).

Fig. 236. Margin of apothecium. To the left a young ascus. ( $\times 620$ ).

Fig. 237. Almost colourless felt-hyphæ from the underside of the cortex of an apothecium. ( $\times 620$ ).

Fig. 238. To the left a ripe ascus. To the right hyphæ from the calyx; above, they continue into paraphyses. ( $\times 620$ ).

Fig. 239. Three ripe spores. ( $\times 747$ ).

Fig. 240. Paraphyses. ( $\times 620$ ).

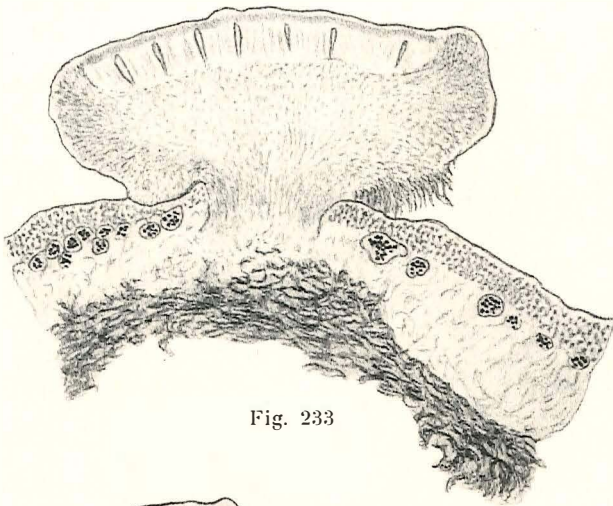


Fig. 233



Fig. 240

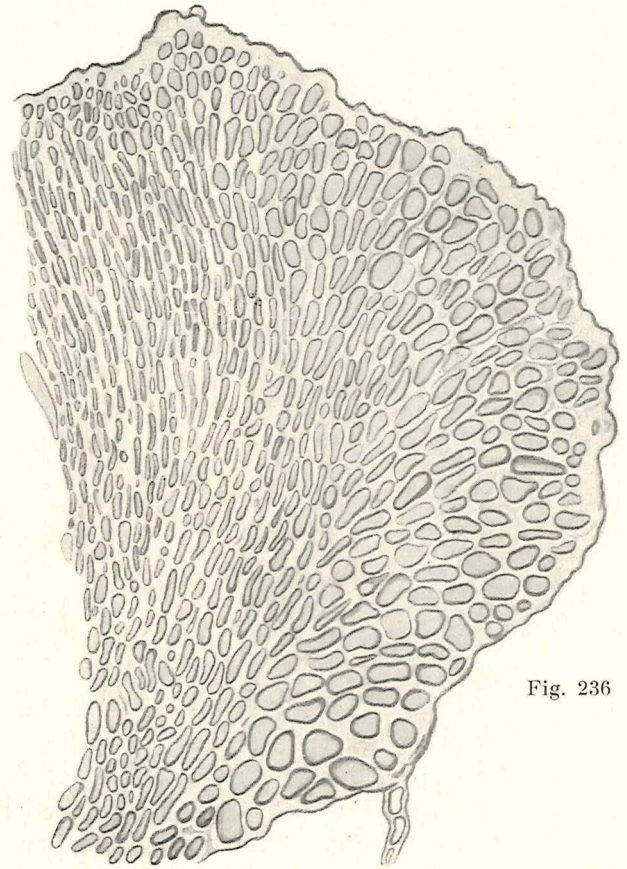


Fig. 236

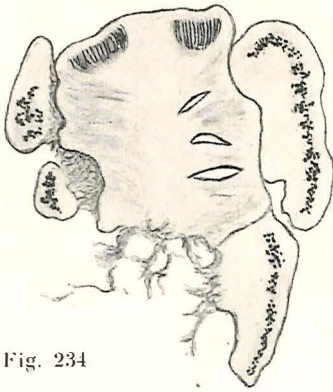


Fig. 234

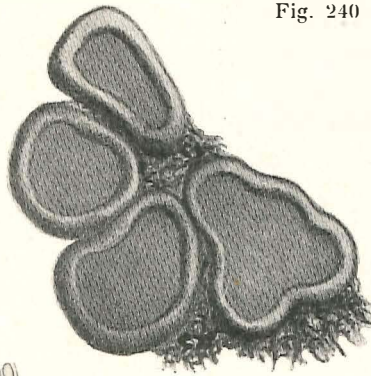


Fig. 235

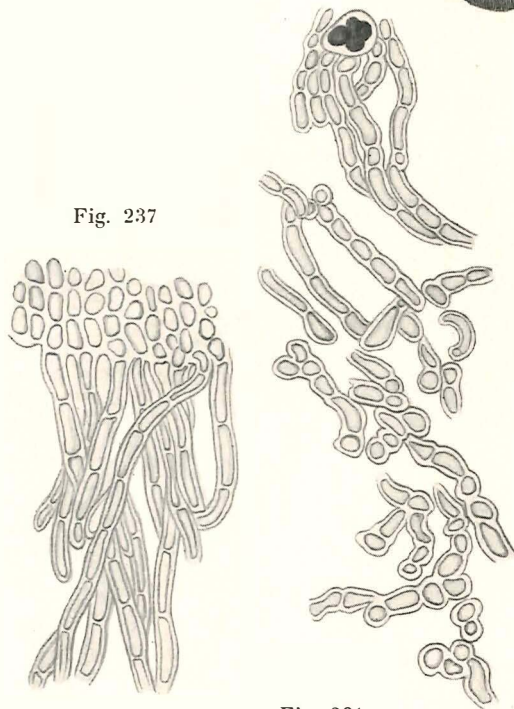


Fig. 231



Fig. 239

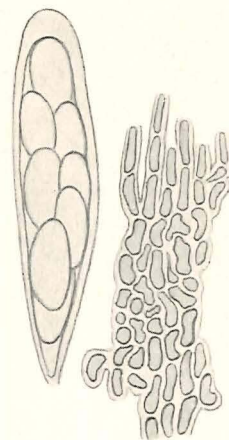


Fig. 238

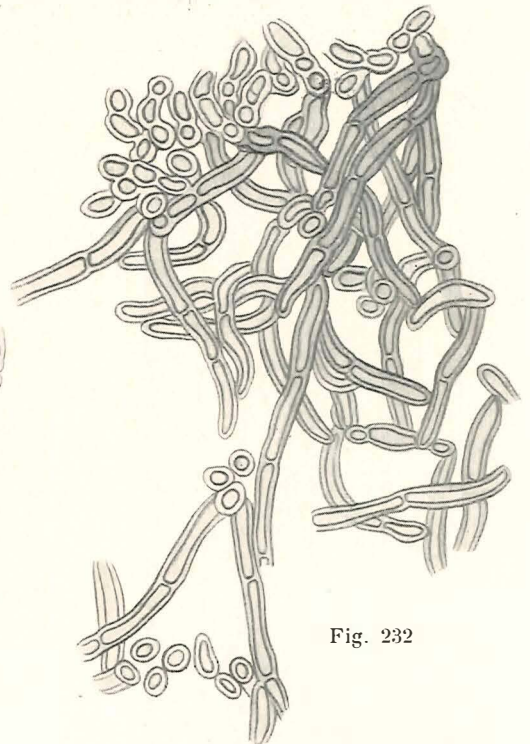


Fig. 232

*O. Galløe del.*

PARMELIELLA PLUMBEA LIGHTF.

PLATE 39.

PANNARIA NEBULOSA.

(HOFFM.) NYL.

Fig.      Portion of thallus, with two apothecia. ( $\times 80$ ).

Fig. 242. Vertical section of the granular thallus. Below, the rhizoids and particles of the soil adhering to them. ( $\times 80$ ).

Fig. 243. Thallus with apothecium. ( $\times 140$ ).

Fig. 244. Grain of thallus, vertical section; at the bottom of the picture the hyphæ are in contact with a moss-leaf. ( $\times 620$ ).

Fig. 245. Ripe ascus. ( $\times 747$ ).



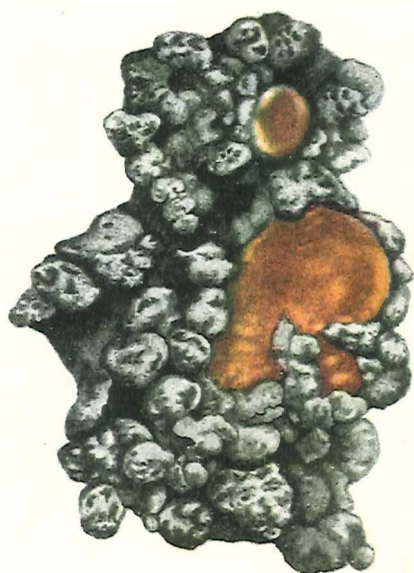


Fig. 241



Fig. 242

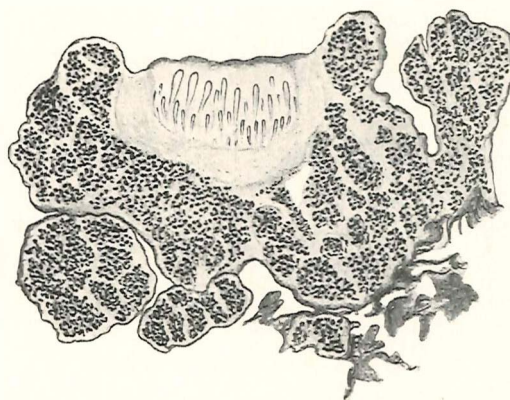


Fig. 243

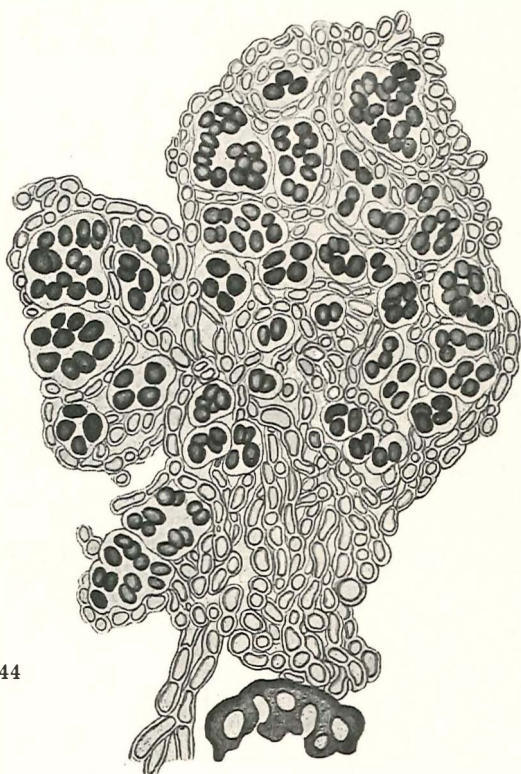


Fig. 244



Fig. 245

PLATE 40.

PANNARIA PEZIZOIDES.

WEB.

Fig. 246. Thallus with apothecia spreading over a *Polytrichum*. ( $\times 15$ ).

Fig. 247. The crenate margin of thallus, on a leaf of *Polytrichum*. ( $\times 67$ ).

Fig. 248. Apothecia at various ages. ( $\times 67$ ).

Fig. 249. Section of a squamule of thallus. In the basal portions of the squamules the gonidia are dying out, because these portions of thallus are overgrown by younger portions. ( $\times 67$ ).

Fig. 250. Margin of a squamule, longitudinal section. ( $\times 620$ ). Below to the left, *Nostoc* and hyphæ. ( $\times 1053$ ). Below to the right, medullary hyphæ. ( $\times 1053$ ).

Fig. 251. Cortex and gonidia. ( $\times 1053$ ).

Fig. 252. Bottom portions of a squamule, downwards continuing into brownish rhizoidal hyphæ. ( $\times 1005$ ).

Fig. 253. Margin of apothecium. ( $\times 175$ ).



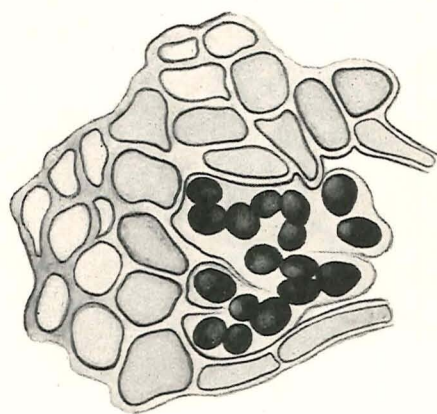


Fig. 251

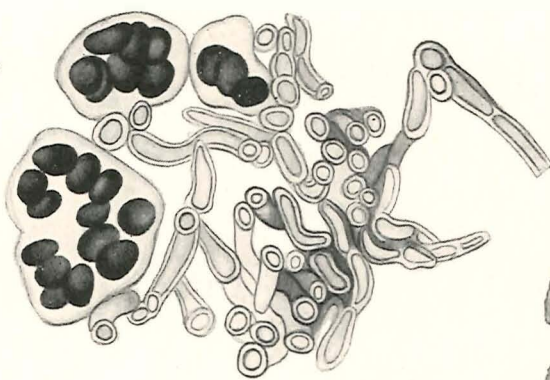


Fig. 252

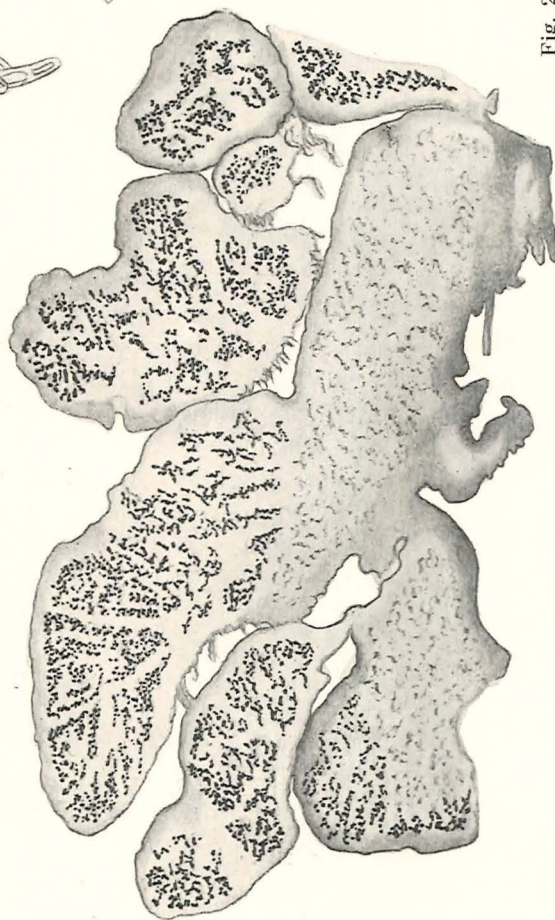


Fig. 249

Fig. 250

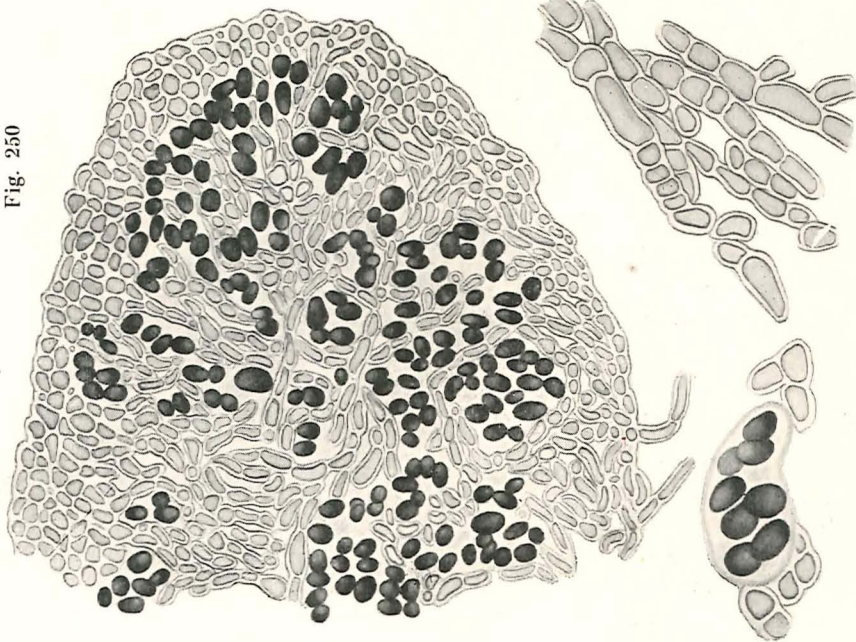


Fig. 247

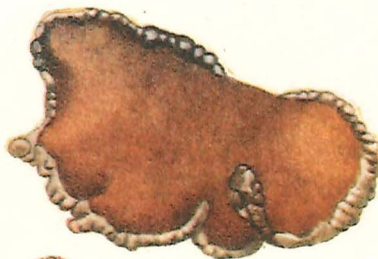


Fig. 248

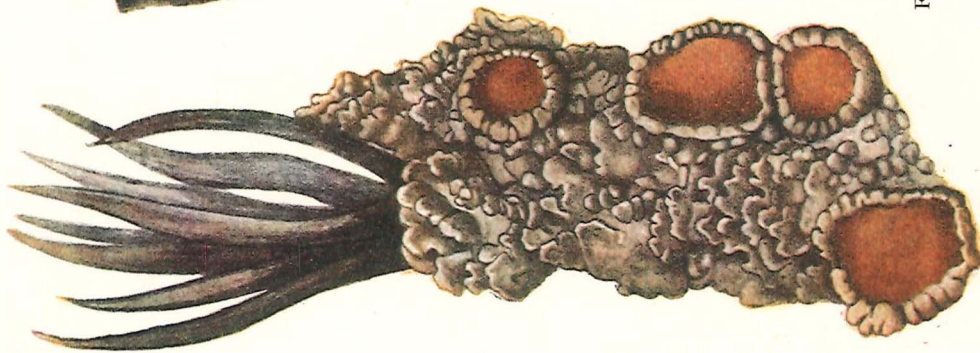


Fig. 246

Fig. 253

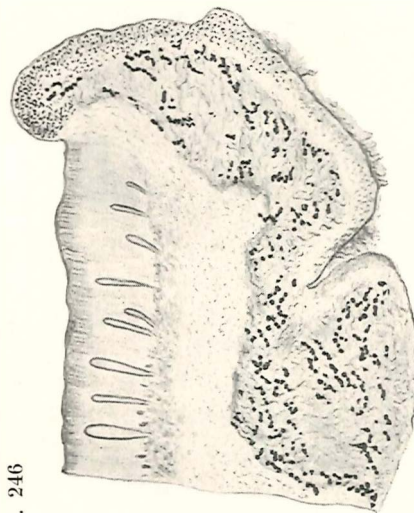




PLATE 41.

PANNARIA PEZIZOIDES.

WEB.

Fig. 254. A squamule of thallus. To the left in the picture the margin of a squamule bearing a ripe apothecium on its surface. ( $\times 38$ ).

Fig. 255. Dense tissues of the calyx, downwards continuing into the gonidial layer and upwards into the basal portions of paraphyses and into ascogenous tissues. ( $\times 620$ ).

Fig. 256. Boundary between calyx (to the left in the figure) and *margo thallinus*. The hymenium (omitted in the figure) would have its place to the left of the figure. ( $\times 620$ ).

Fig. 257. Ripe ascus and paraphyses, the tips of which are brownish. ( $\times 770$ ).

PANNARIA RUBIGINOSA.

THUNBG.

Fig. 258. Portion of thallus. ( $\times 3$ ).

Fig. 259. Some few squamules, with rhizoidal felt and with two young apothecia. ( $\times 12$ ).

Fig. 260. To the left, cortical hyphæ with yellow grains of pigment; to the right, yellow medullary hyphæ. ( $\times 1053$ ).

Fig. 261. Vertical section of squamule, with an apothecium. ( $\times 90$ ).

Fig. 256

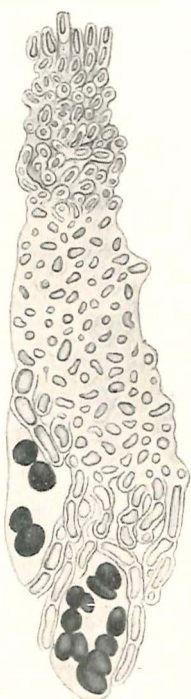


Fig. 257

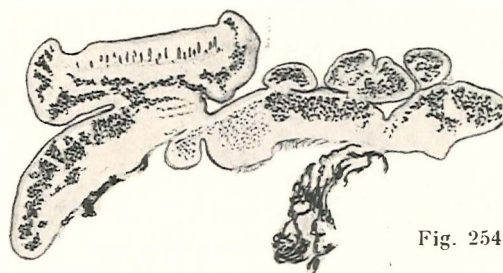
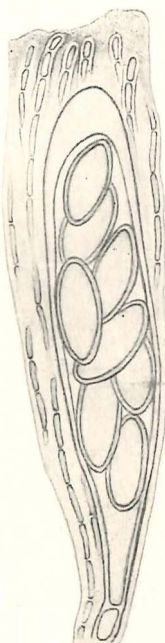


Fig. 254

Fig. 255

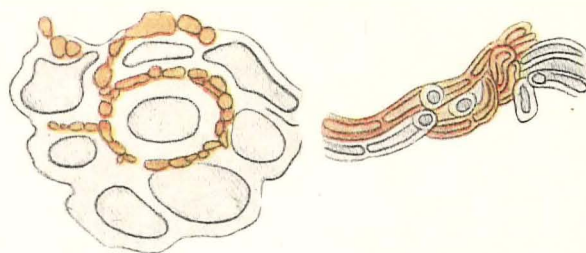


Fig. 260

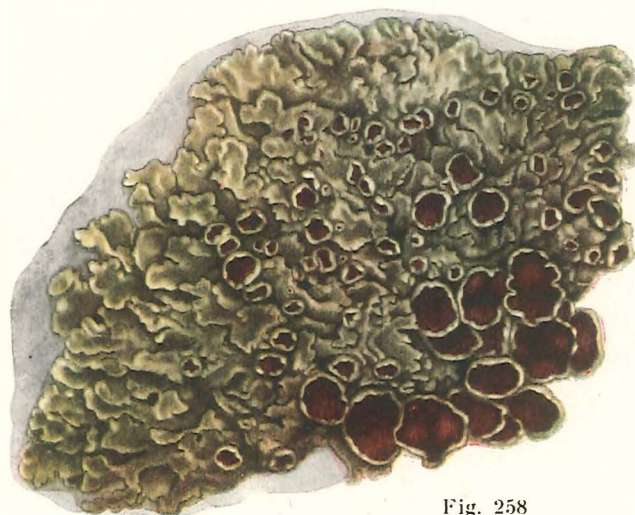


Fig. 258



Fig. 259

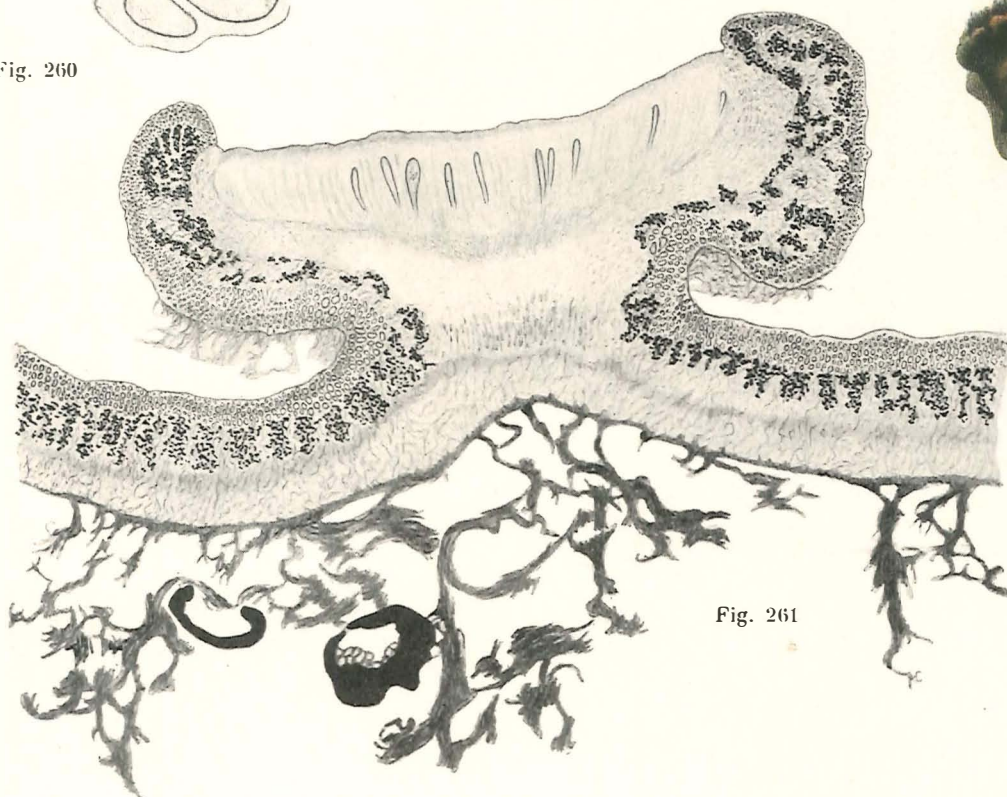


Fig. 261

O. Galløe del.

PANNARIA PEZIZOIDES WEB.  
PANNARIA RUBIGINOSA THUNBG.

PLATE 42.

PANNARIA RUBIGINOSA.

THUNBG.

- Fig. 262. Vertical section of lobes of thallus, connected by their common rhizoidal felt. ( $\times 22$ ).
- Fig. 263. Longitudinal section of the margin of a lobe. ( $\times 20$ ).
- Fig. 264. Vertical section of a lobe; below, some few hyphæ of the rhizoidal felt. ( $\times 620$ ).
- Fig. 265. Rhizoidal felt. ( $\times 435$ ).
- Fig. 266. Margin of hymenium with adjacent calyx; to the right, a small portion of the thalline margin. ( $\times 542$ ).
- Fig. 267. Hymenium, with a ripe ascus. ( $\times 747$ ).





Fig. 264

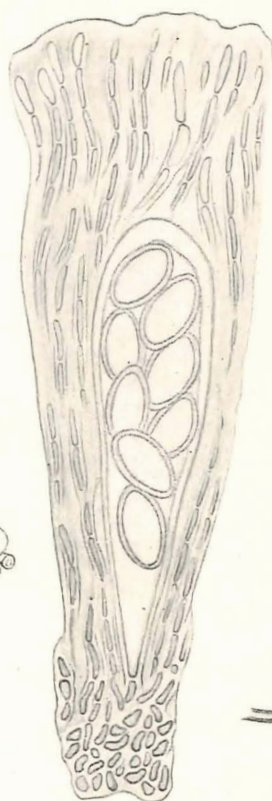


Fig. 267

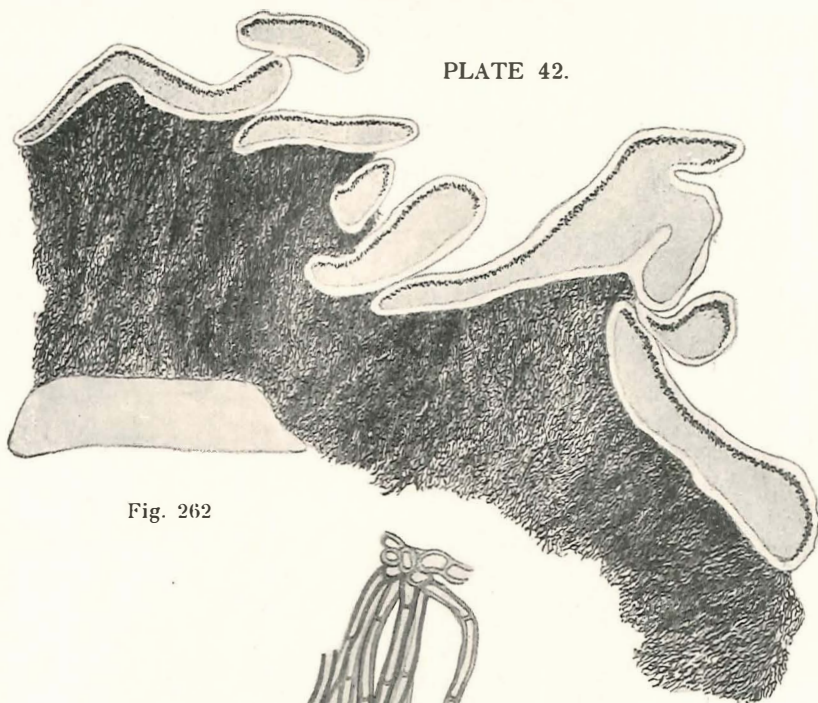


Fig. 262

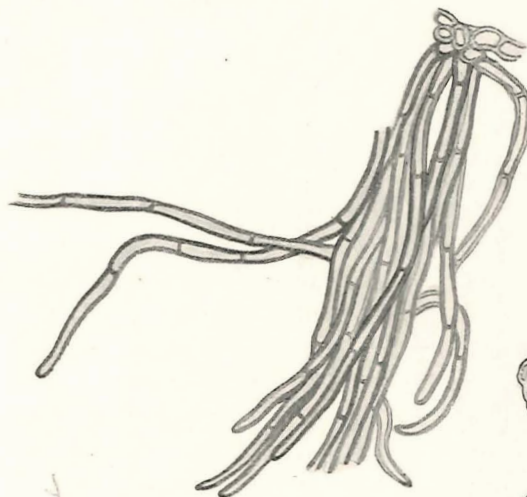


Fig. 265

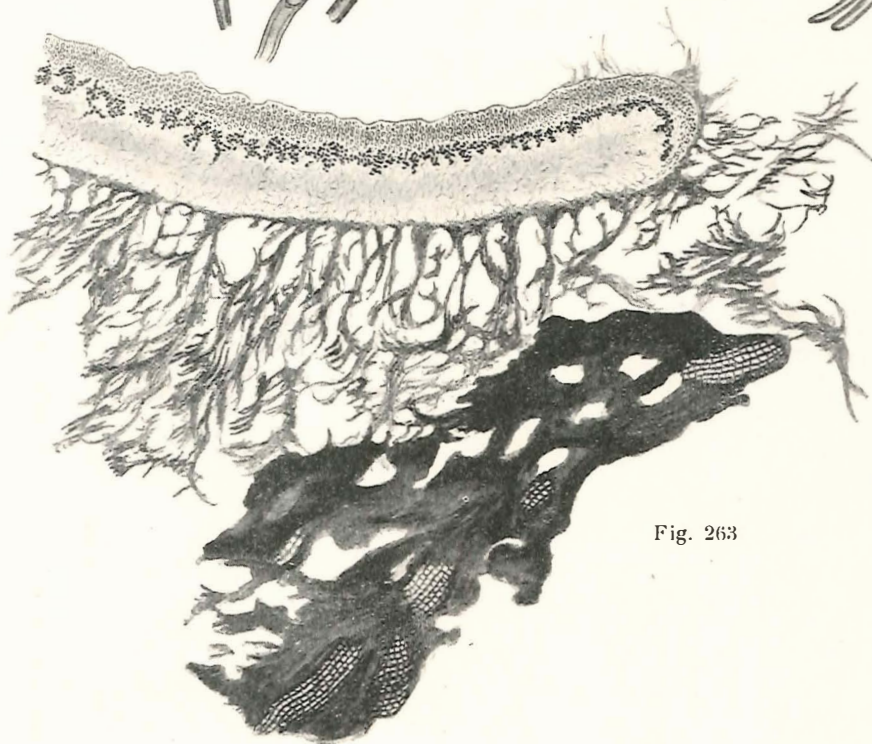


Fig. 263



Fig. 266

*O. Galløe del.*

PANNARIA RUBIGINOSA THUNBG.

PLATE 43.

PANNARIA COERULEOBADIA.

SCHLEICH.

Fig. 268. Portion of the margin of thallus. ( $\times 16$ ).

Fig. 269. Portion of the central parts of thallus. ( $\times 18$ ).

Fig. 270. Longitudinal s

Fig. 271. Vertical section of the central parts of thallus, showing the imbricate squamules, the edges of which are forming soredia

Fig. 272. Soredia on the point of loosening from the recurved edge of a squamule of thallus, the cortex of which is seen at the bottom of the section. ( $\times 620$ ).

Fig. 273. Section rhizoidal felt. ( $\times 620$ ).



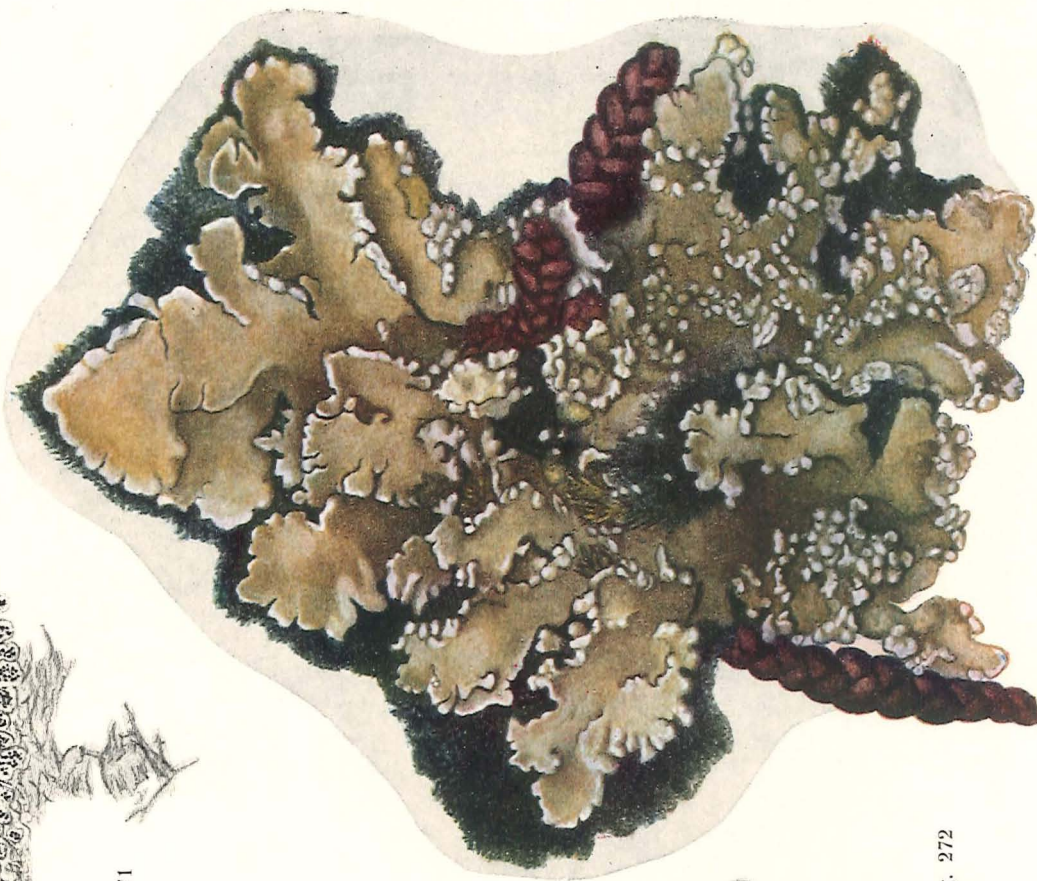


Fig. 268

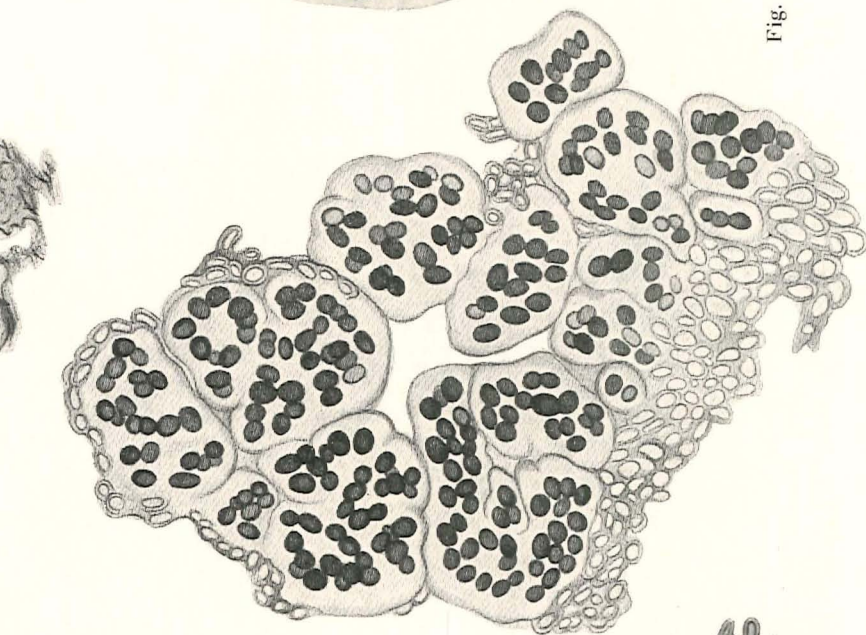


Fig. 272



Fig. 273

Fig. 270

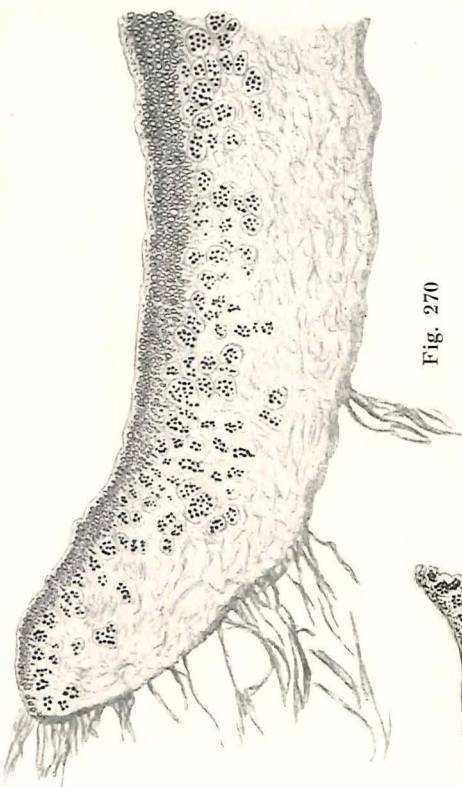


Fig. 271



Fig. 269

*O. Galløe del.*

PANNARIA COERULEOBADIA SCHLEICH.



PLATE 44.

MASSALONGIA CARNOSA.

DICKS.

Fig. 274. Thallus with apothecia spreading over moss. ( $\times 6$ ).

Fig. 275. Lobe of thallus, moistened, showing the mode of branching; with two apothecia. ( $\times 28$ ).

Fig. 276. Longitudinal section of margin of thallus, with a vertical section of an apothecium. ( $\times 86$ ).

Fig. 277. Cortex-like, big-celled tissue from the lower surface of thallus (*compare* Fig. 276), from which latter dark, rhizoidal hyphæ are protruding. A small filament of a *Scytonema* is entangled among the hyphæ. ( $\times 620$ ).

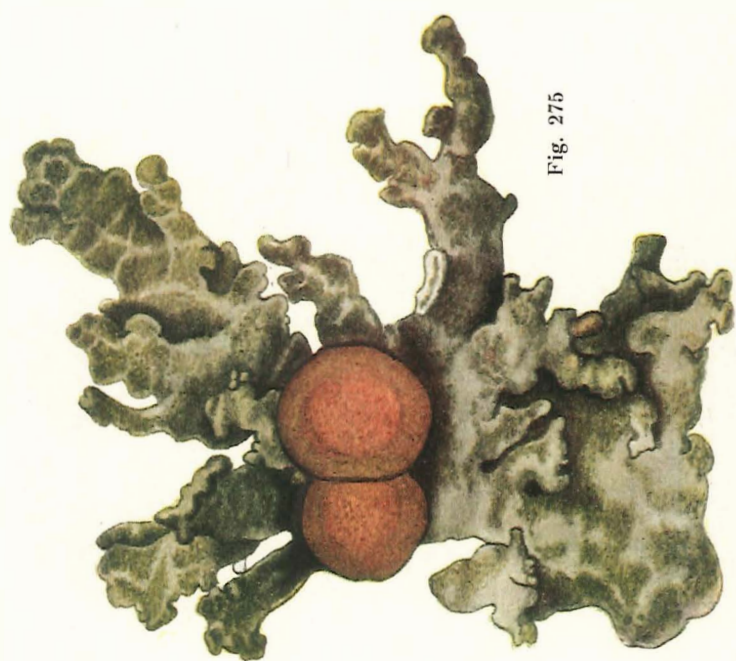


Fig. 275

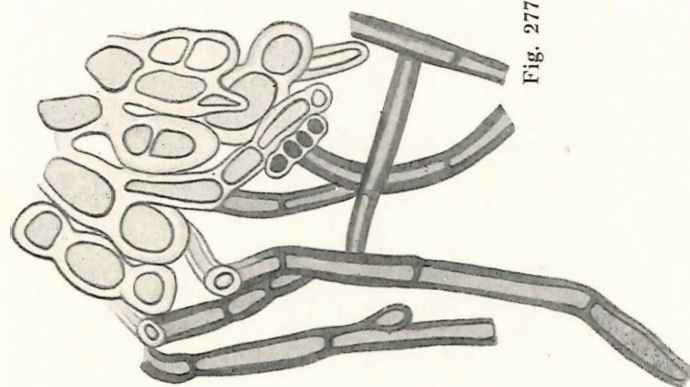


Fig. 277



Fig. 276



Fig. 274

O. Galloë del.

MASSALONGIA CARNOSA DICKS.

PLATE 45.

MASSALONGIA CARNOSA.

DICKS.

Fig. 278. Margin of apothecium. The epithecium and the surface of the margin of apothecium are brown; the inner tissues of the apothecium are colourless. ( $\times 620$ ).

Fig. 279. Paraphyses, with brown tips; a ripe ascus, and ascogenous hyphæ beneath the hymenium. ( $\times 720$ ).

Fig. 280. Longitudinal section of margin of thallus. ( $\times 670$ ).

Fig. 281. Entire pycnide, still covered by brown cortical hyphæ. ( $\times 620$ ).  
Below, to the left, portions of conidiiferous hyphæ. ( $\times 1053$ ).



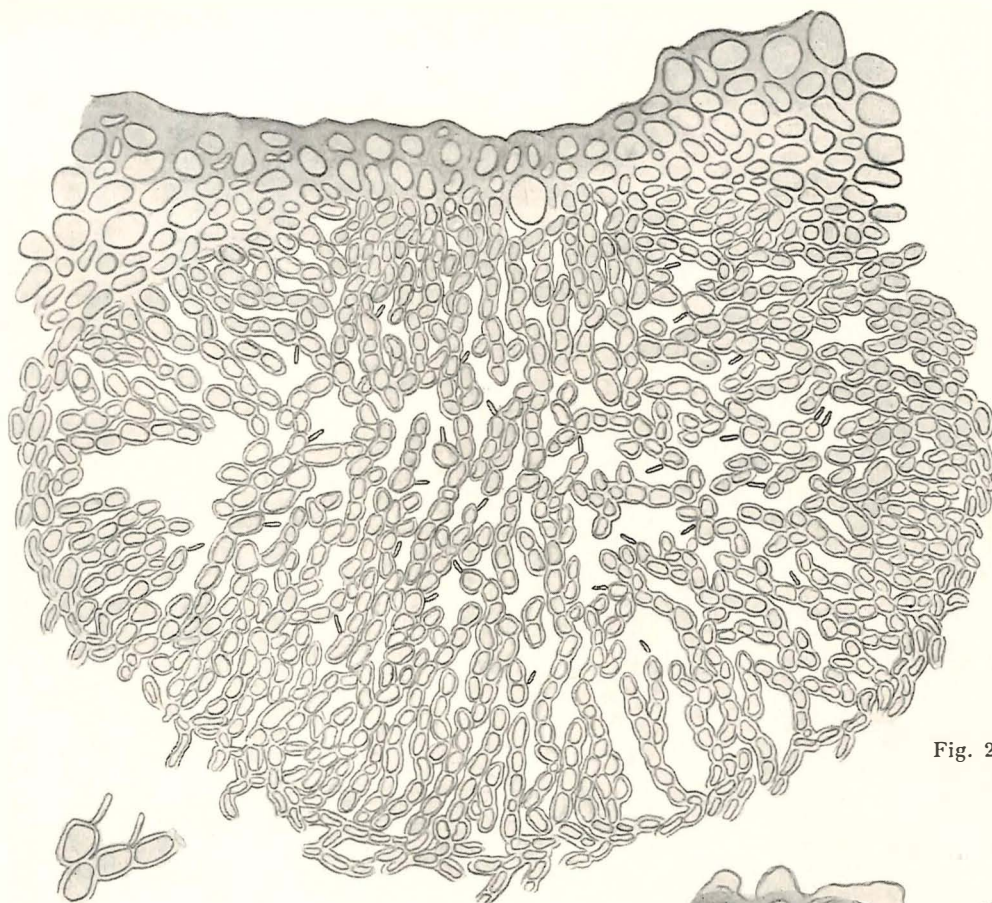


Fig. 281



Fig. 279

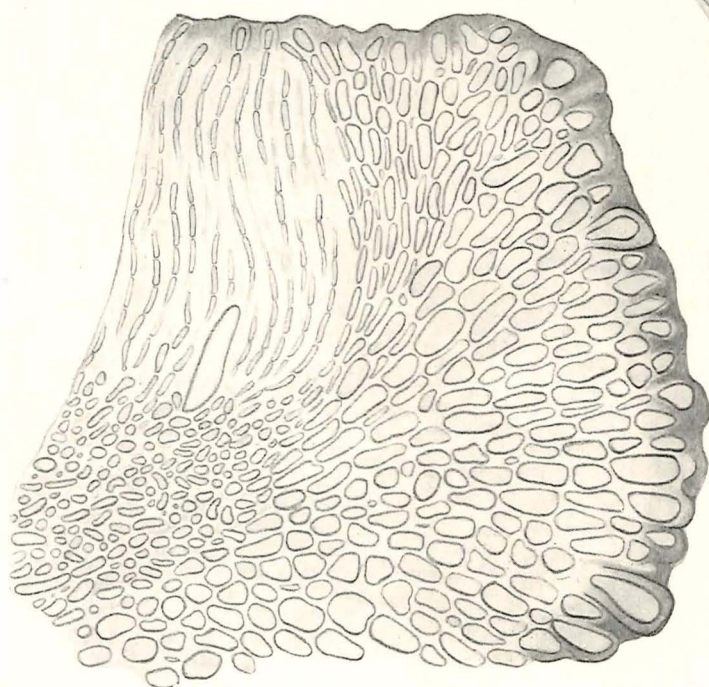


Fig. 278

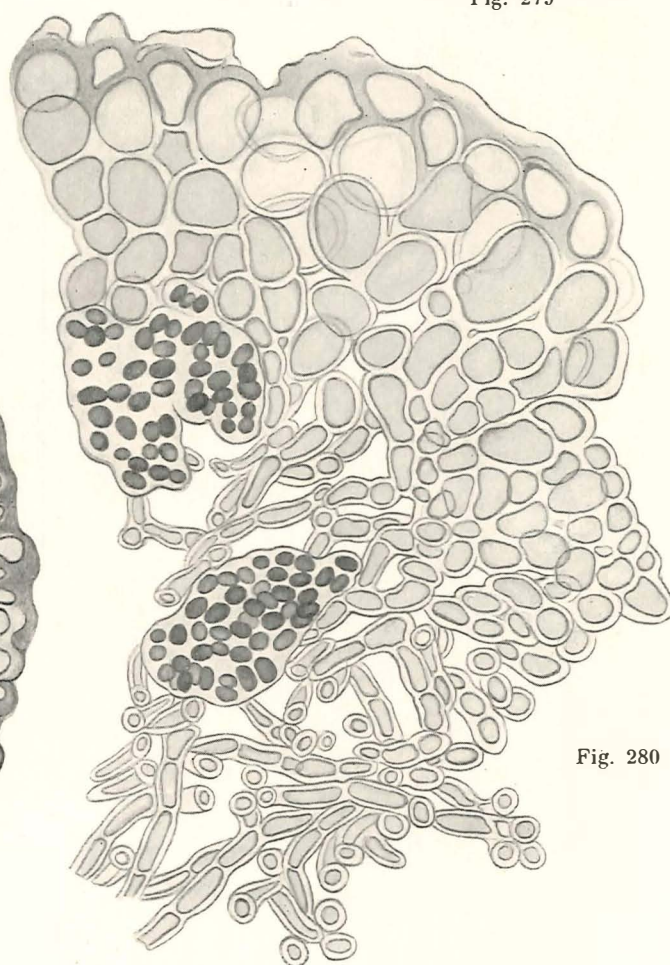


Fig. 280

PLATE 46.

PSOROMA HYPNORUM.

DICKS.

**Specimen 1.**

Fig. 282. Portion of thallus, with two apothecia. Between the grains of thallus particles of the soil itself can be seen, and among these ( $\times 15$ ).

Fig. 283. Young grains of thallus spreading over the substratum. ( $\times 15$ ).

Fig. 284. Grain of thallus, longitudinal section. ( $\times 90$ ).

Fig. 285. Margin of a grain of thallus, longitudinal section. ( $\times 620$ ).

Fig. 286. Two coalesced apothecia. Both of them have rhizoidal hyphæ issuing from the cortex at their lower surface. ( $\times 37$ ).

Fig. 287. Four squamules of thallus, with dark rhizoidal hyphæ, and with apothecia. ( $\times 22$ ).

Fig. 288. Margin of apothecium, with distinct calyx and thalline margin. ( $\times 161$ ).

Fig. 289. Paraphyses and ripe ascus. ( $\times 770$ ).



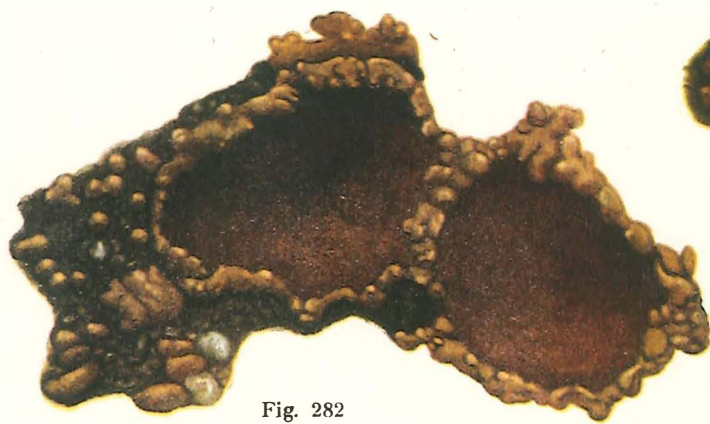


Fig. 282



Fig. 283

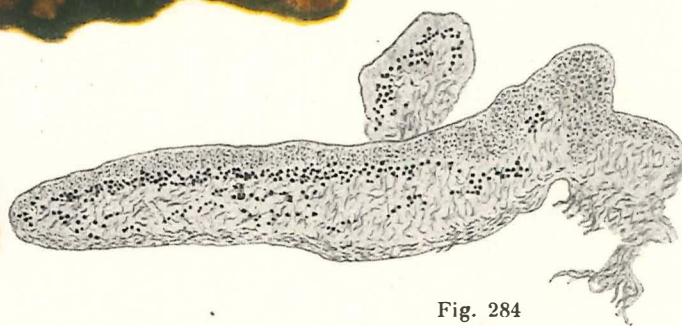


Fig. 284

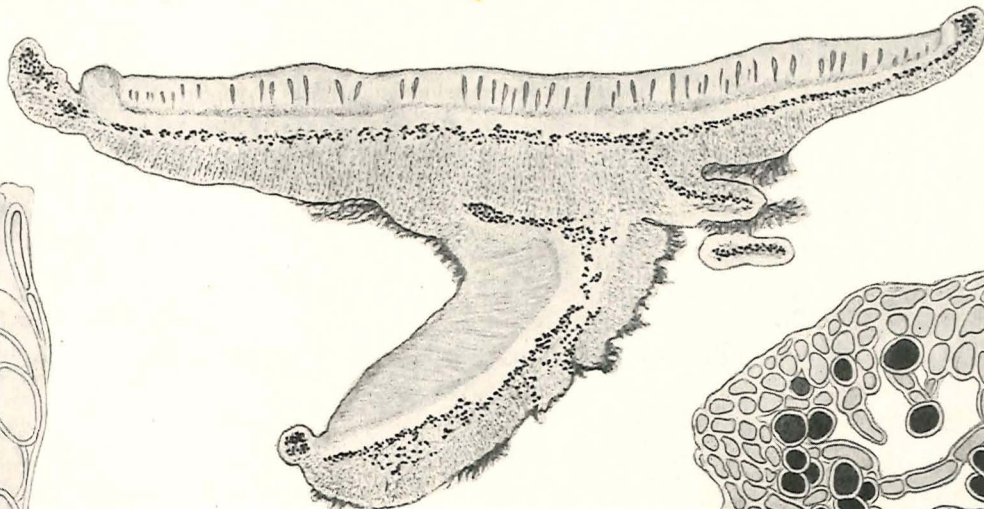


Fig. 286

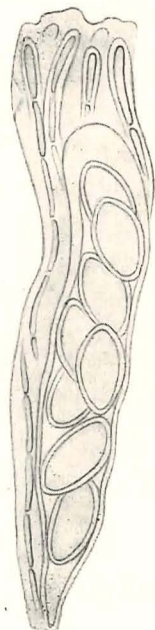


Fig. 289

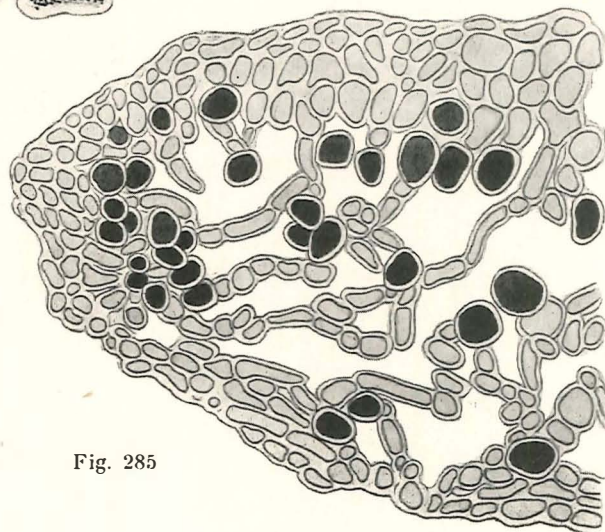


Fig. 285

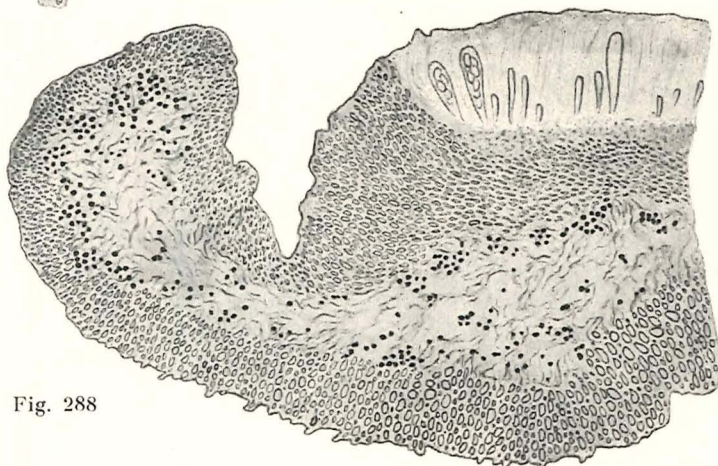


Fig. 288

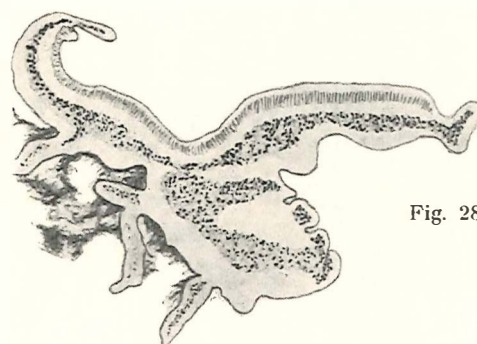


Fig. 287

*O. Gallæ del.*

PSOROMA HYPNORUM DICKS.  
(Specimen 1).

VI P 12b



PLATE 47

PSOROMA HYPNORUM.

DICKS.

**Specimen 1.**

Fig. 290. Tips of the hyphæ forming *margo proprius* inside the thalline margin. The walls of the top-cells are brown. ( $\times 620$ ).

Fig. 291. Cortex from the under surface of the thalline margin of the apothecium. Above in the picture there are some few hyphæ and an alga from the gonidial layer inside the cortex. ( $\times 642$ ).

Fig. 292. Rhizoidal hyphæ, issuing from the underside of the grain of thallus, the cortex-like tissue of which is at the top of the figure. The rhizoidal hyphæ are brown. ( $\times 685$ ).

Fig. 293. Hyphæ from the calyx; above they pass into the paraphyses, the basal cells of which are shown in the figure. Below, three algæ from the gonidial layer beneath the calyx. ( $\times 697$ ).

**Specimen 2.**

Fig. 294. Squamules of thallus at various ages, and young apothecia. Between the squamules the substratum is covered with *Cyanophyceæ*. ( $\times 16$ ).

Fig. 295. Grains of thallus and rather old apothecia. ( $\times 16$ ).

Fig. 296. Two apothecia, each formed in a separate squamule of thallus. ( $\times 38$ ).

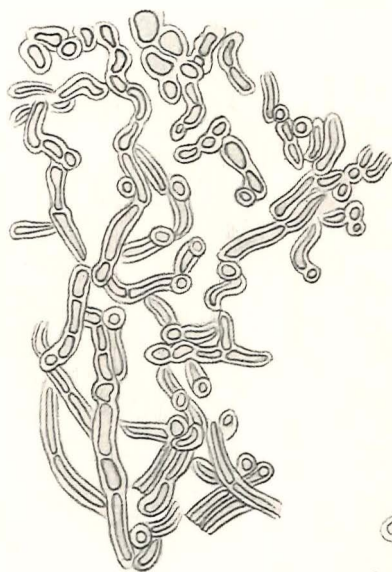


Fig. 292

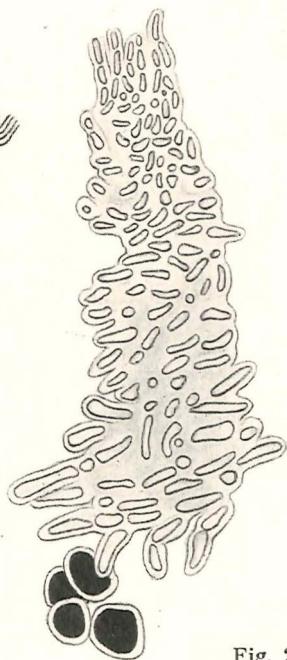


Fig. 293

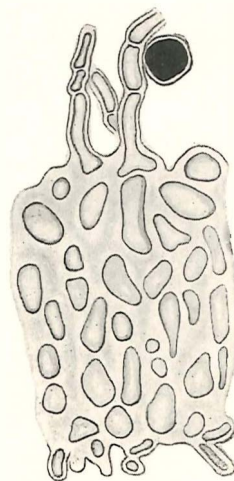


Fig. 291



Fig. 290



Fig. 294



Fig. 295

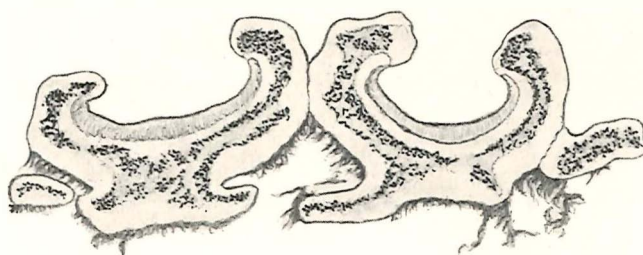


Fig. 296

*O. Galløe del.*

PSOROMA HYPNORUM DICKS.  
(Specimen 1, 2).

PLATE 48.

LOBARIA SCROBICULATA.

(SCOP.) DC.

**Specimen 1.**

Fig. 297. To the left a lobe with soralia and apothecia. ( $\times 2\frac{1}{4}$ ).

To the right: four stages of the development of the apothecium from the youngest apothecium, closed as yet, to the fully opened, ripe apothecium. In the nethermost picture but one there is a soral beside the apothecium. ( $\times 15$ ).

Fig. 298. Longitudinal section of a lobe of thallus, with a marginal soral, and an apothecium. ( $\times 38$ ). Above in the figure, an isolated soredium. ( $\times 704$ ).

Fig. 299. Cortex and gonidial layer. ( $\times 620$ ).

Fig. 300. Lower surface of thallus, with rhizoidal hyphæ. ( $\times 620$ ).

Fig. 301. Above: margin of apothecium; to the right of this, cortex from the surface of *margo thallinus*. ( $\times 620$ ). Below to the left: ripe spores ( $\times 750$ ), and an entire ascus. ( $\times 620$ ).

Fig. 302. To the left: the transition from a medullary hypha into a cortical hypha of the cortex of *margo thallinus* (compare Fig. 301). Central figure: hymenium, and beneath this, the calyx. To the right: transition from calyx (above in the figure) to medulla. ( $\times 620$ ).



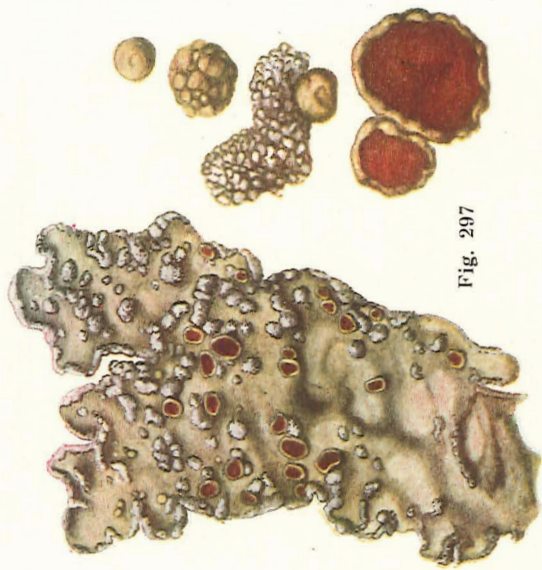


Fig. 297

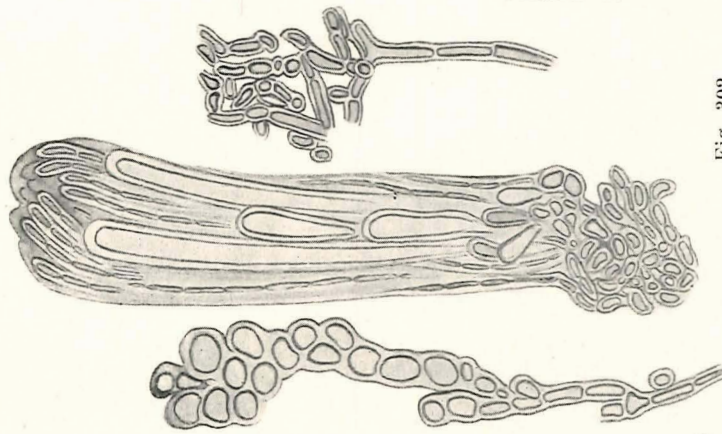


Fig. 302

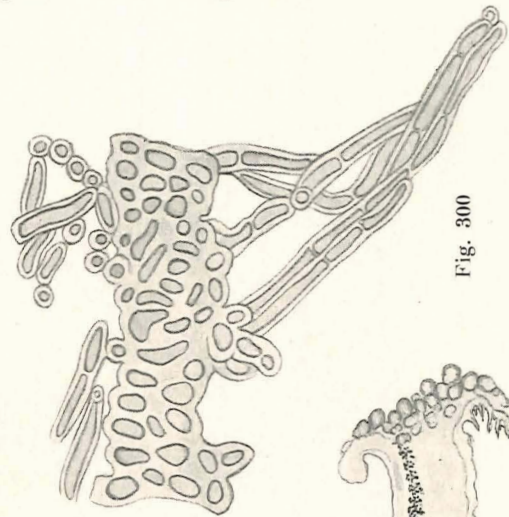


Fig. 300

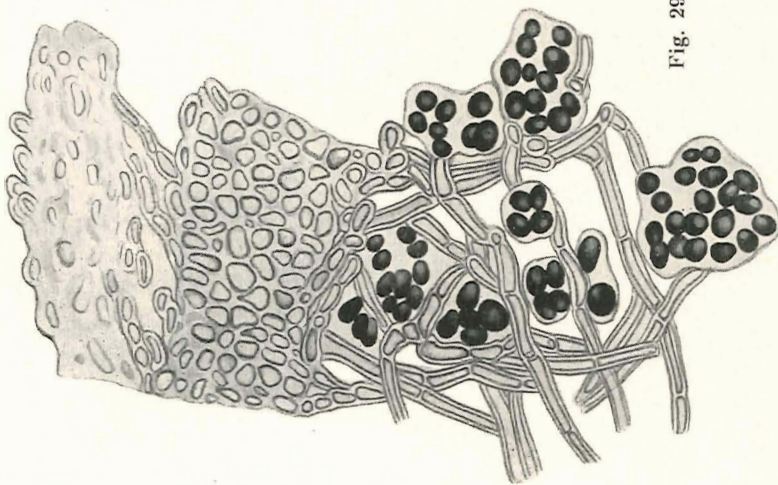


Fig. 299

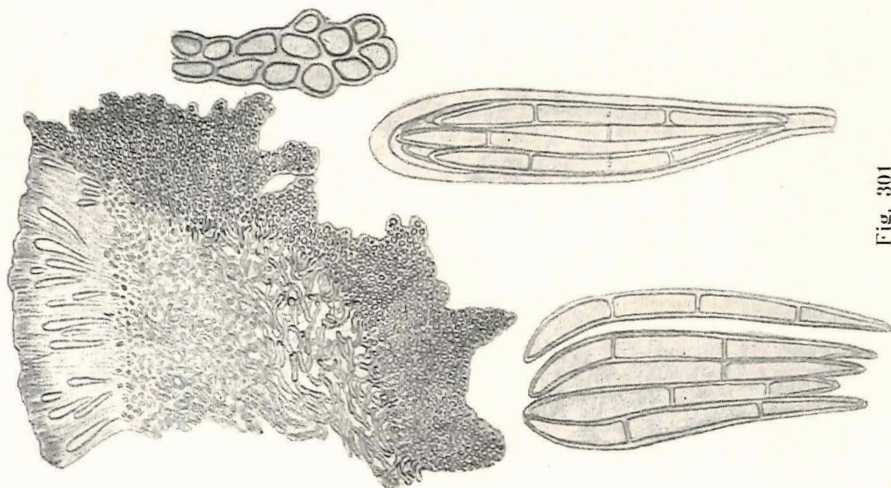


Fig. 301

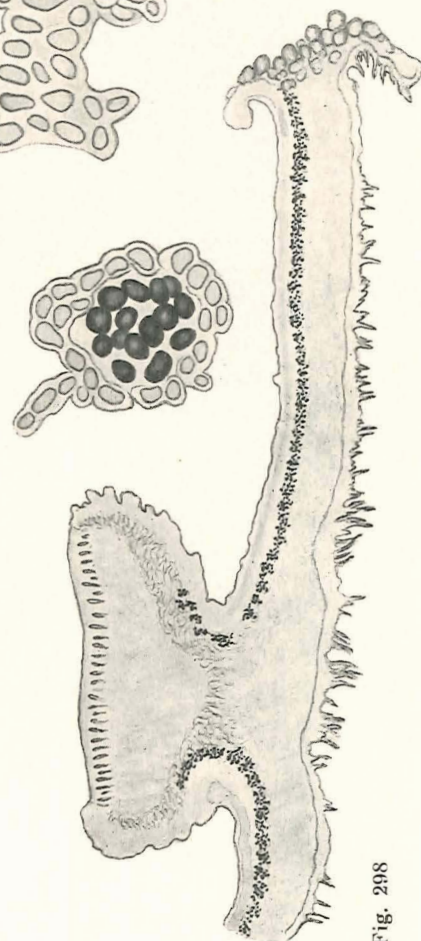


Fig. 298

O. Galløe del.

LOBARIA SCROBICULATA (Scop.) Dc.  
(Specimen 1).

PLATE 49.

LOBARIA SCROBICULATA.

(SCOP.) DC.

**Specimen 2.**

- Fig. 303. Thallus, among moss. ( $\times 1\frac{1}{2}$ ).  
Fig. 304. Margin of a lobe of thallus, with soralia. ( $\times 3$ ).  
Fig. 305. Margin of a lobe, seen from below, with cyphellæ. ( $\times 3$ ).

LOBARIA LAETEVIRENS.

LIGHTF.

- Fig. 306. Apothecium. ( $\times 22$ ).  
Fig. 307. Margin of apothecium. ( $\times 154$ ). Bottom picture: cortex from *margo thallinus*. ( $\times 620$ ).  
Fig. 308. Central figure: hymenium and sub-hymenial tissues. ( $\times 620$ ). Below to the right: hyphæ from calyx beneath the hymenium, and the sub-hymenial tissue. To the right and left in the picture: ripe spores and an ascus. ( $\times 746$ ).  
Fig. 309. Conidiiferous hyphæ, issuing from the perithecial wall of the pycnide: below the latter, medullary hyphæ. ( $\times 697$ ).



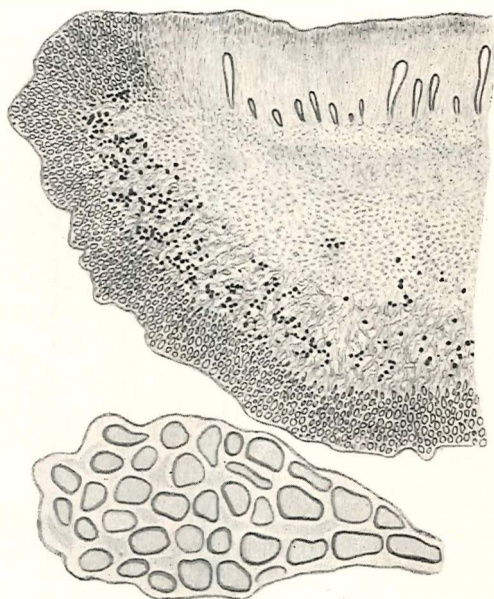


Fig. 307

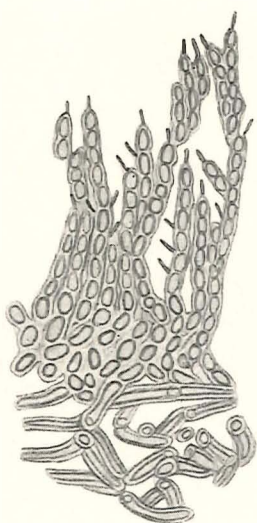


Fig. 309



Fig. 305

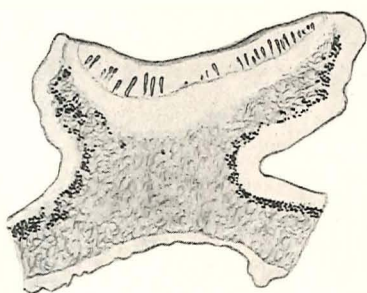


Fig. 306

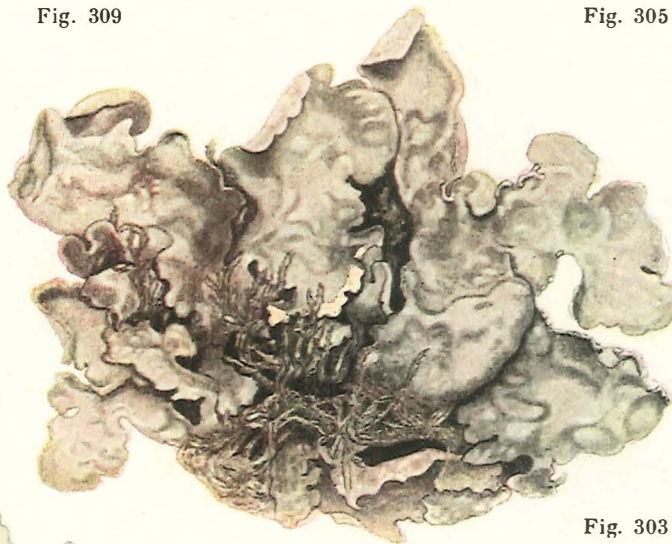


Fig. 303

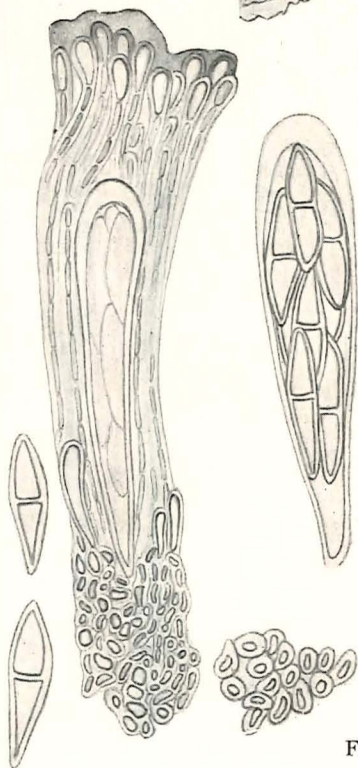


Fig. 308

*O. Galløe del.*

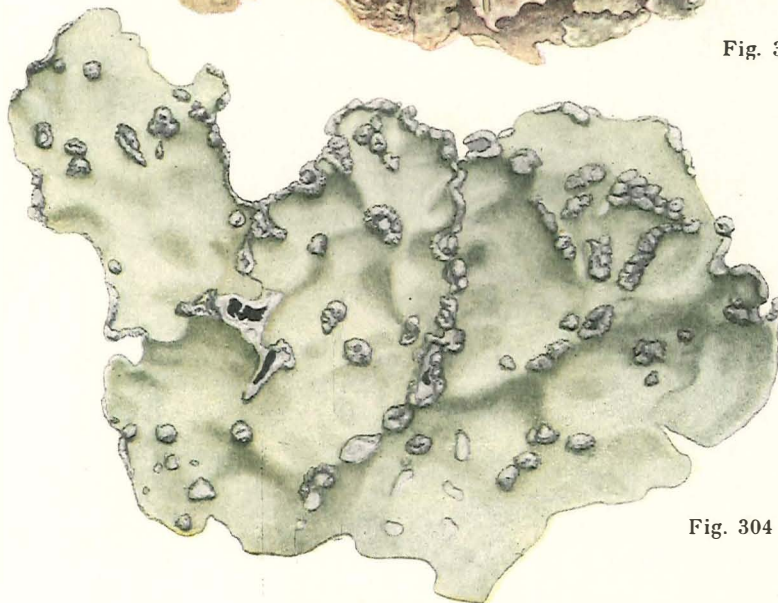


Fig. 304

LOBARIA SCROBICULATA (Scop.) DC.  
(Specimen 2.)  
LOBARIA LAETEVIRENS



PLATE 50.

LOBARIA LAETEVIRENS.

LIGHTF.

Fig. 310. Portion of thallus, with numerous pycnidia. Painted in moistened state. ( $\times 2$ ).

Fig. 311. Margin of a lobe, under-surface, with few rhizines and otherwise finely tomentose. ( $\times 4$ ).

Fig. 312. Two similar lobes as in Fig. 311. ( $\times 4$ ).

Fig. 313. Rather old portions of thallus, with apothecia. Moistened. ( $\times 3$ ).

Fig. 314. Two very young apothecia. ( $\times 21$ ).

Fig. 315. Pycnidia. ( $\times 21$ ).

Fig. 316. Longitudinal section of margin of thallus. ( $\times 152$ ).

Fig. 317. Portion of longitudinal section of thallus. ( $\times 650$ ).

Fig. 318. Vertical section of four pycnidia. ( $\times 152$ ).



Fig. 310

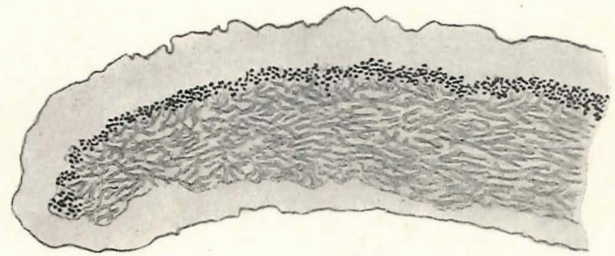


Fig. 316

Fig. 315



Fig. 313



Fig. 311



Fig. 312

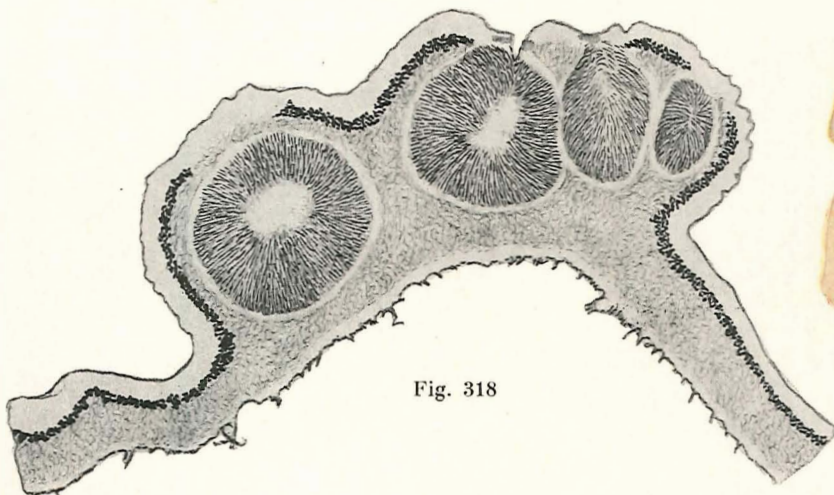


Fig. 318

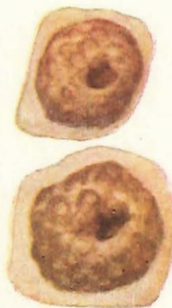


Fig. 314

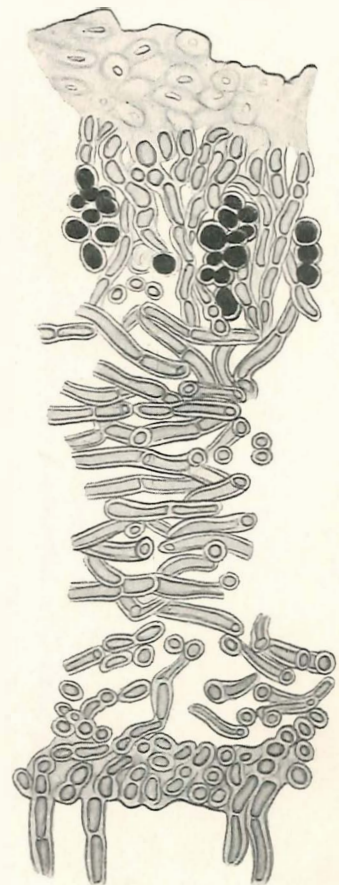


Fig. 317

*O. Galløe del.*

LOBARIA LAETEVIRENS LIGHTF.

PLATE 51.

LOBARIA AMPLISSIMA.

L.

**Specimen 1.**

Fig. 319. Portion of thallus. ( $\times 3\frac{1}{2}$ ). Below to the right, the lower surface of a lobe, covered with a fine tomentum and provided with scattered, short rhizines. ( $\times 3\frac{1}{2}$ ).

**Specimen 2.**

Fig. 320. Portion of the central parts of thallus, with apothecia, punctiform pycnidia, and several branched cephalodia. ( $\times 2$ ).

Fig. 321. A branched, shrub-like cephalodium. ( $\times 14$ ).

Fig. 322. Portion of a cephalodium as shown in Fig. 321, seen from below. ( $\times 85$ ).

Fig. 323. Two pycnidia. ( $\times 85$ ).

Fig. 324. Two young apothecia, both of them still closed and without any visible discs. ( $\times 90$ ).

Fig. 325. Three apothecia at more advanced stages of development. ( $\times 15$ ).

Fig. 326. To the right, section of apothecium; here there are some few groups of gonidia beneath calyx and hymenium. ( $\times 90$ ). To the left, hyphæ from the medulla beneath the calyx. ( $\times 697$ ).

Fig. 327. Young branch of cephalodium, cut longitudinally.





Fig. 319



Fig. 322

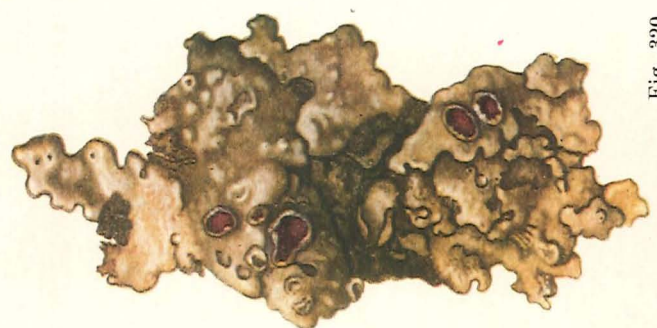


Fig. 320



Fig. 323



Fig. 324



Fig. 325

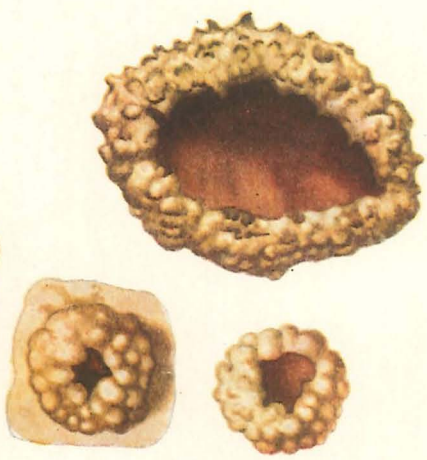


Fig. 326

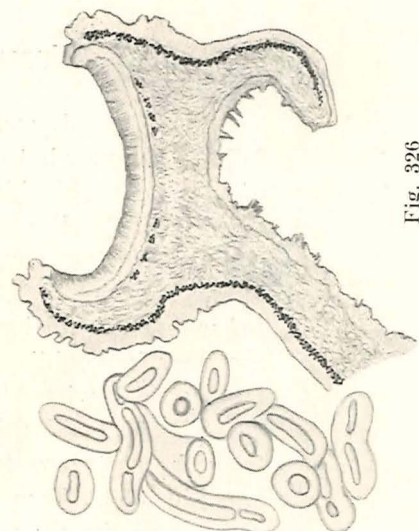
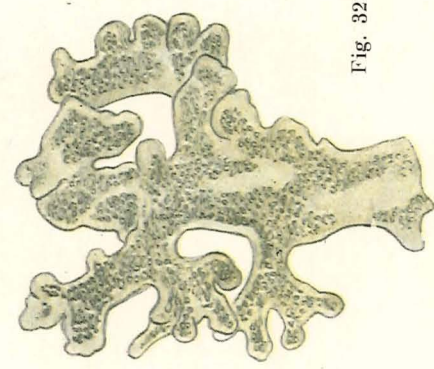


Fig. 327



Fig. 321



O. Gallæ del.

LOBARIA AMPLISSIMA L.  
(Specimen 1. 2).

PLATE 52.

LOBARIA AMPLISSIMA.

L.

**Specimen 2.**

Fig. 328. Upper surface of thallus; the upper layers of cortex are cuticle-like. ( $\times 620$ ).

Fig. 329. Lower surface of thallus. Above in the picture, the medulla; next follows a somewhat darker brownish cortex, from the lower surface of which bundles of brownish, rhizoidal hyphæ issue, constituting the tomentum. ( $\times 611$ ).

Fig. 330. Branch of cephalodium, cut lengthwise; at the top it has groups of gonidia (*Nostoc*) covered with some few layers of hyphæ. Deeper down, in the sides of the branch, there is a thick, brownish cortex and a tomentum of brownish hyphæ (of which a special picture is given to the right). The older portions of the branches are poor in gonidia. In the interior of the cephalodium there is a loose medulla of long-celled hyphæ. ( $\times 687$ ).

Fig. 331. Margin of a ripe apothecium ( $\times 90$ ); below this, some isolated hyphæ from the cortex covering *margo thallinus* of the apothecium. ( $\times 697$ ).

Fig. 332. Two ripe asci and part of the hymenium, with paraphyses, a young ascus, and the tissue just beneath the paraphyses. ( $\times 761$ ).



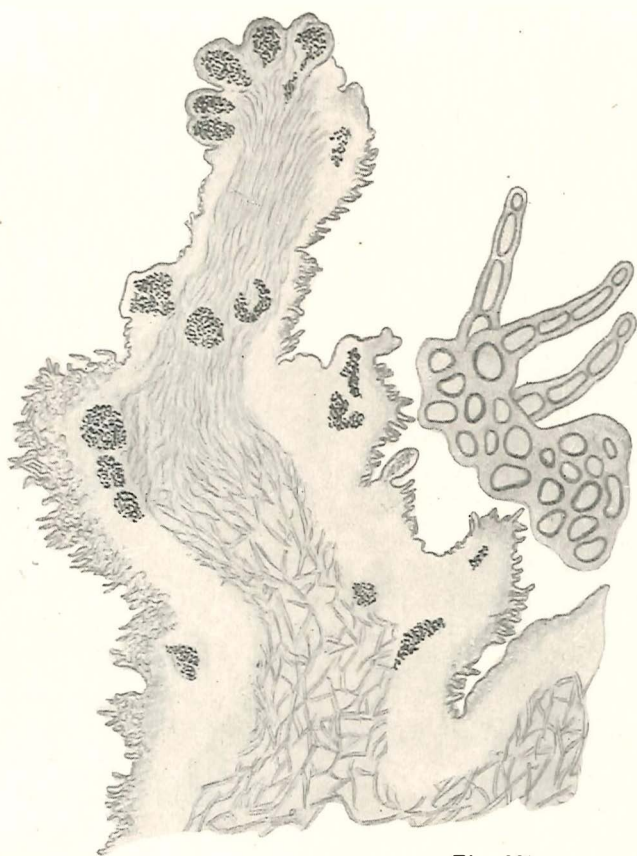


Fig. 330

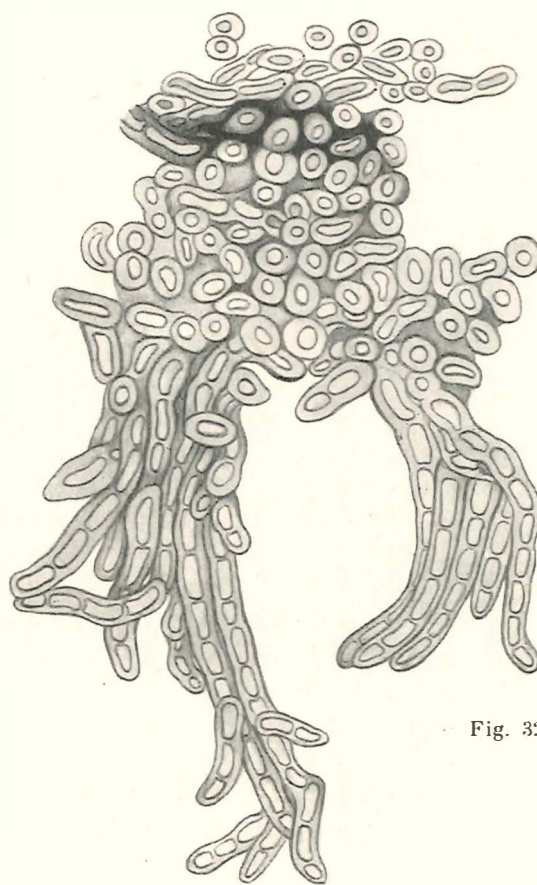


Fig. 329

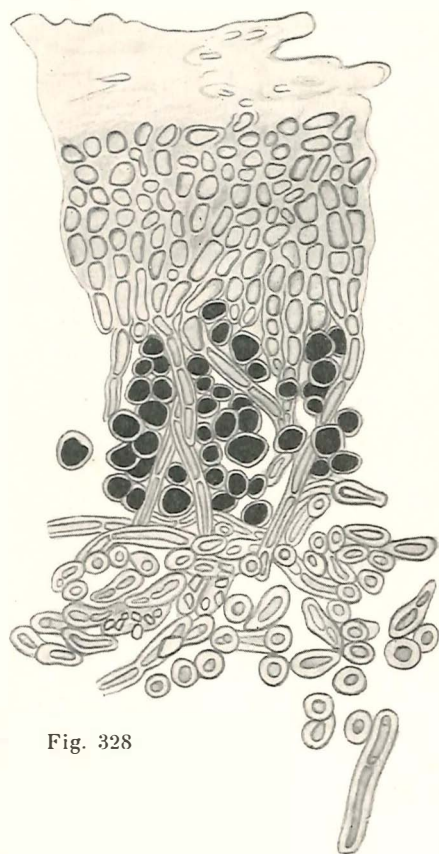


Fig. 328

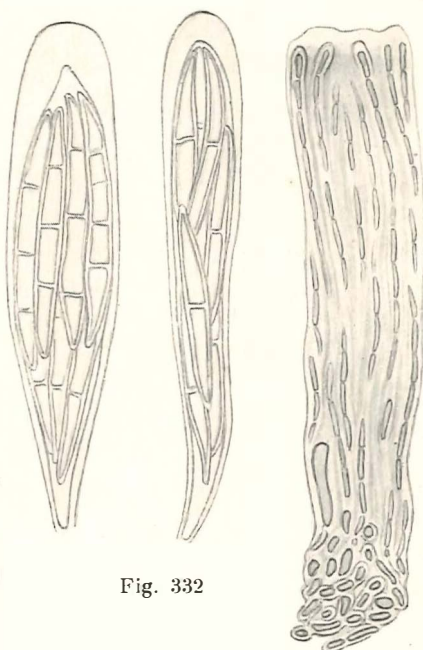


Fig. 332

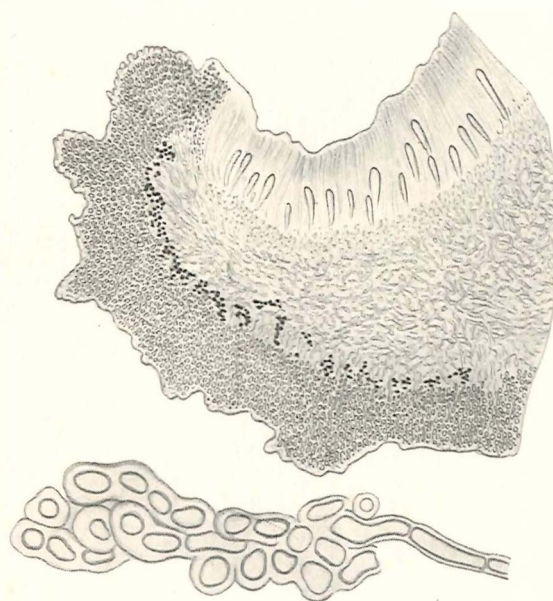


Fig. 331

*O. Galløe del.*

LOBARIA AMPLISSIMA L.  
(Specimen 2).



PLATE 53.

LOBARIA AMPLISSIMA.

L.

**Specimen 2.**

Fig. 333. Vertical section of a shrub-like cephalodium (*compare* Fig. 330). The plurality of the youngest branches have been removed by cutting the section. ( $\times 22$ ).

Fig. 334. At the top and at the bottom, young branches of a cephalodium cut across. ( $\times 620$ ). Central picture: longitudinal section of a similar branch. ( $\times 620$ ).

Fig. 335. Section of thallus, with two pycnidia. ( $\times 38$ ).

Fig. 336. Very long conidiiferous hyphæ, issuing from the perithecial wall of the pycnide shown below in the figure. ( $\times 711$ ).



Fig. 333

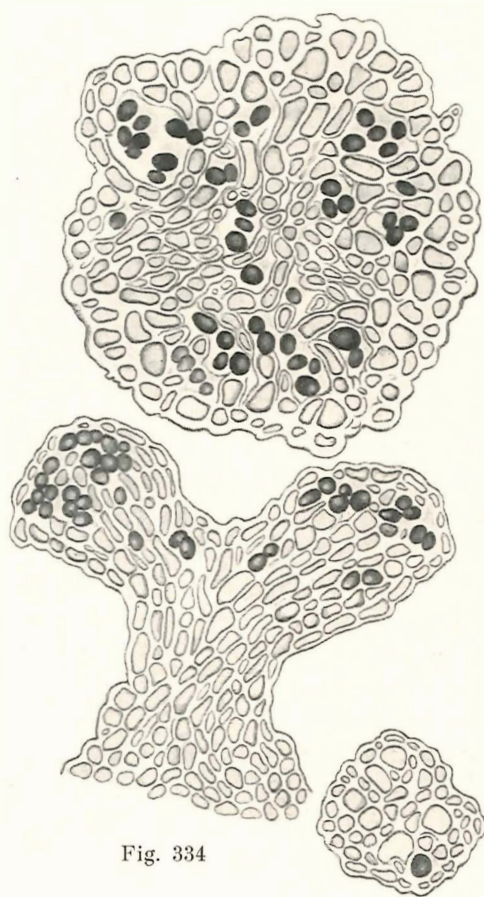


Fig. 334

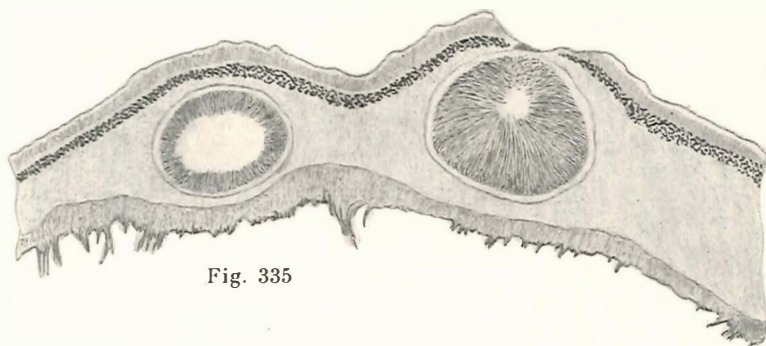


Fig. 335



Fig. 336

*O. Galløe del.*

LOBARIA AMPLISSIMA L.  
(Specimen 2).

VI P 14a

PLATE 54.

LOBARIA PULMONARIA.

(L.) HOFFM.

**Specimen 1.**

Fig. 337. Portion of thallus, with apothecia. (Natural size).

Fig. 338. Portion of the lower surface of thallus, showing the pustules, the top of which is devoid of rhizoidal hyphæ, while such occur between the pustules. ( $\times 15$ ).

Fig. 339. Longitudinal section of thallus. ( $\times 60$ ).

Fig. 340. Apothecium formed at the edge of a lobe of thallus; the upper surface of thallus is to the right. ( $\times 60$ ).

Fig. 341. Cortex and gonidial layer; the uppermost cells are light brown. ( $\times 724$ ).

Fig. 342. Cortex and medulla from the lower surface of thallus. The cell-walls are in part brown. ( $\times 620$ ).

Fig. 343. Very young apothecia, just recognizable as such, provided with ascogonia (the black dots beneath the hymenium), paraphyses and cortex, but without asci. ( $\times 87$ ).

Fig. 344. Conidiiferous hyphæ, issuing from concentric hyphæ constituting the perithecial wall of the pycnide. ( $\times 700$ ).



Fig. 340

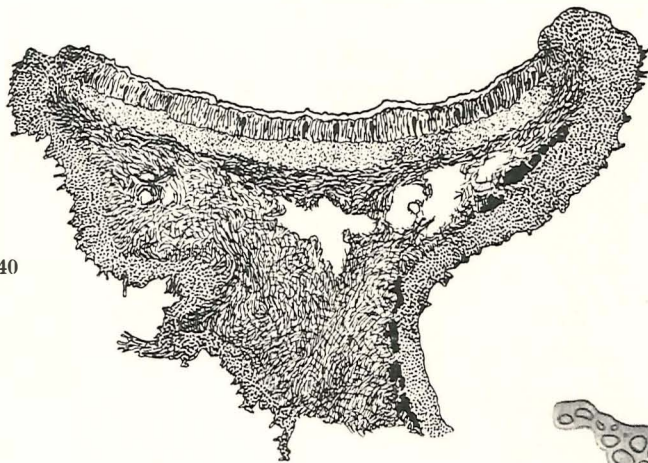


Fig. 341

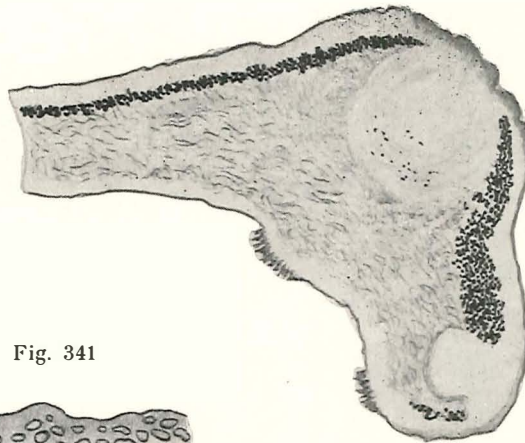


Fig. 343

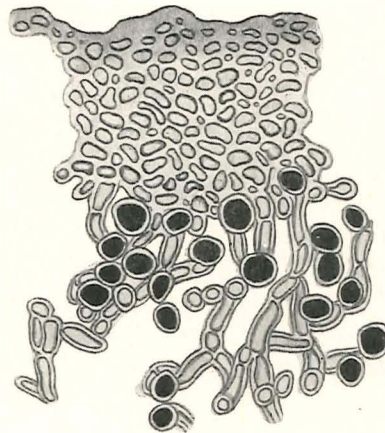


Fig. 339

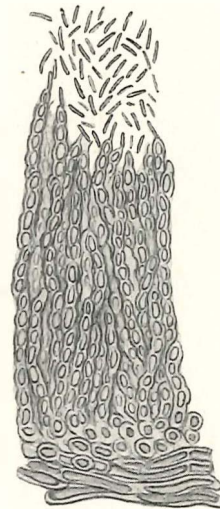
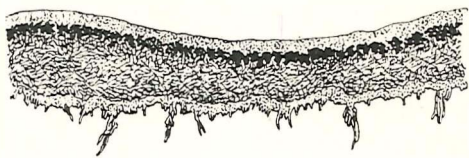


Fig. 344

Fig. 342



Fig. 338

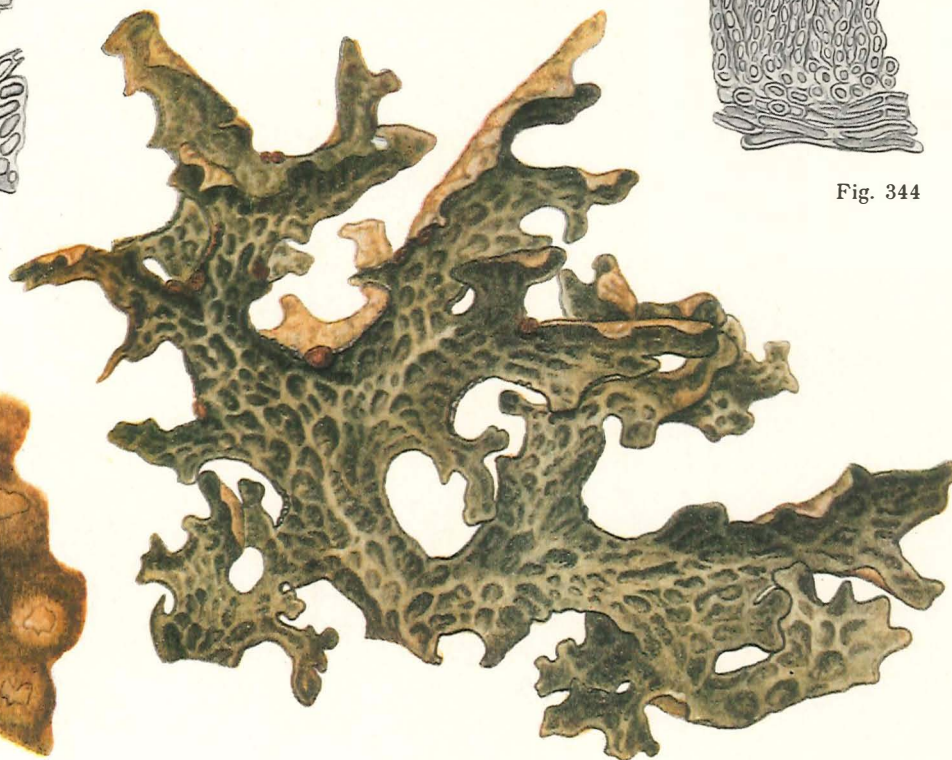


Fig. 337

*O. Galløe del.*

LOBARIA PULMONARIA (L.) HOFFM.  
(Specimen 1).

PLATE 55.

LOBARIA PULMONARIA.

(L.) HOFFM.

**Specimen 1.**

Fig. 345. Pycnide. ( $\times 156$ ). To the right, isolated conidia and a conidiiferous hypha. ( $\times 1053$ ).

Fig. 346. Paraphyses, beneath which there is a sub-hymenial tissue with ascogonia, and, still deeper down, the medulla of thallus. Drawn after a recently formed and very small apothecium. ( $\times 690$ ).

Fig. 347. Young asci and paraphyses from a ripe apothecium. ( $\times 631$ ).

Fig. 348. Two asci from an older apothecium. ( $\times 747$ ).

Fig. 349. Foremost end of a lobe of thallus, with isidia on its surface. ( $\times 14$ ).

**Specimen 2.**

Fig. 350. Portion of thallus, with apothecia. All the ribs of the thallus are broken up into soralia. ( $\times 2$ ).



Fig. 349

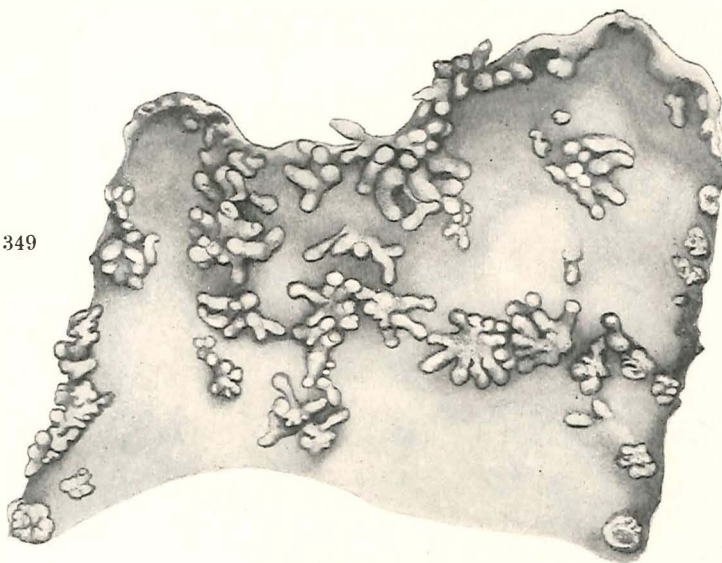


Fig. 350

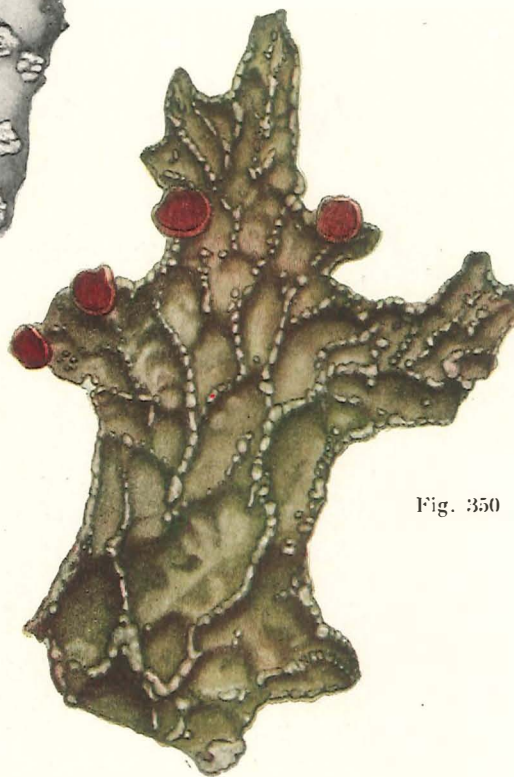


Fig. 348

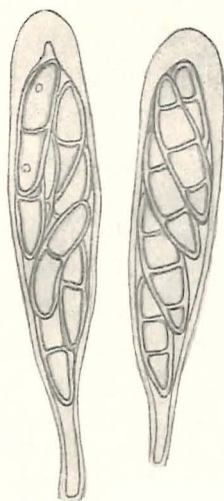


Fig. 347

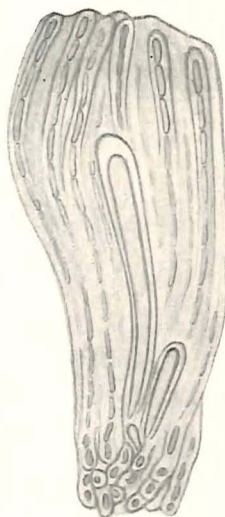
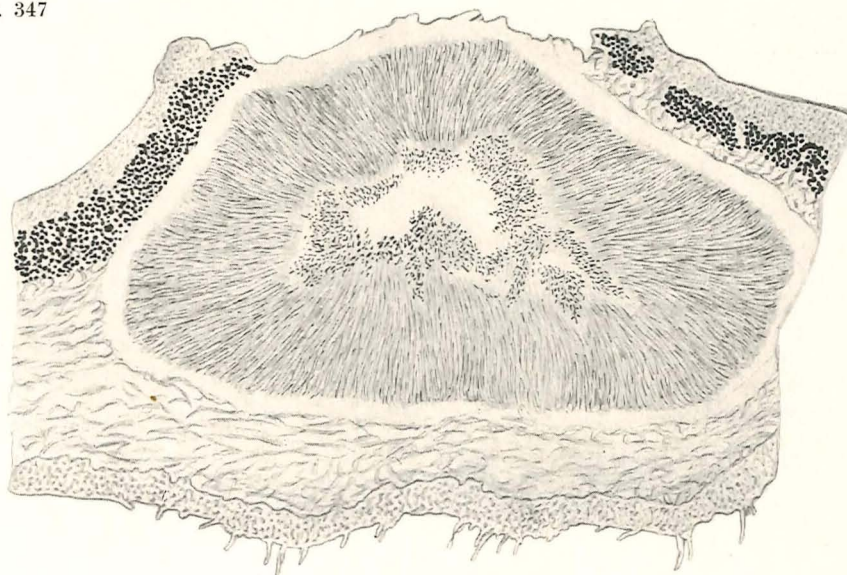


Fig. 345



Fig. 346



*O. Galløe del.*

LOBARIA PULMONARIA (L.) HOFFM.  
(Specimen 1, 2).



PLATE 56.

LOBARIA PULMONARIA.

(L.) HOFFM.

**Specimen 3.**

Fig. 351. Entire specimen, with numerous small *foliolæ* along the edge of the lobes. ( $\times \frac{3}{4}$ ).

Fig. 352. Portion of the thallus of this specimen, showing the *foliolæ* on the edge of a lobe. ( $\times 20$ ).

**Specimen 4.**

Fig. 353. Portion of thallus, with soredia and apothecia. Below to the left, three very young apothecia situated on the edge of a lobe.

**Specimen 5.**

Fig. 354. Portion of the lower surface of thallus, with one cephalodium. ( $\times 20$ ).

Fig. 355. To the left, portion of the upper surface of thallus, with two incrassate cephalodia, in which the bluish-green cephalodia can be discerned through the cortex. Below to the left, three cells of *Nostoc* isolated from these cephalodia. To the right, a portion of a similar cephalodium, cut vertically, with groups of gonidia visible in the interior (as three dark dots). ( $\times 20$ ).

Fig. 356. Vertical section of a double cephalodium. In the interior two big, lobed groups of *Nostoc* are visible. Above these the normal gonidia are seen as a narrow dark zone. At the top of the cephalodia the normal gonidia are absent. ( $\times 140$ ).

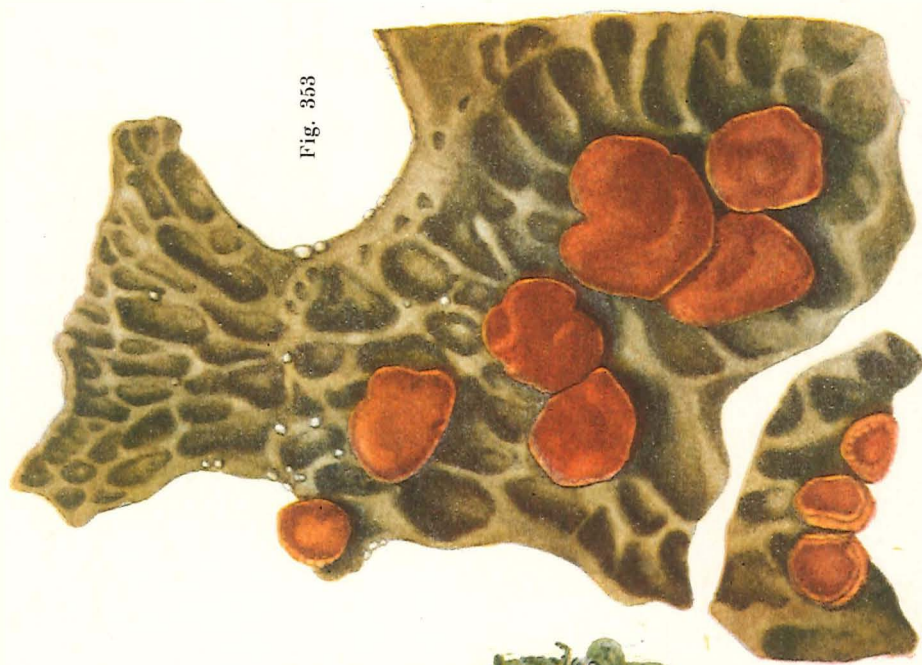


Fig. 353

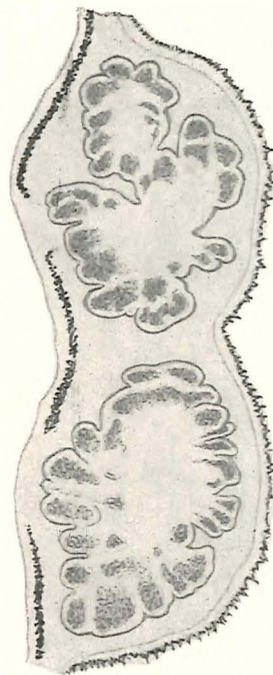


Fig. 356



Fig. 351

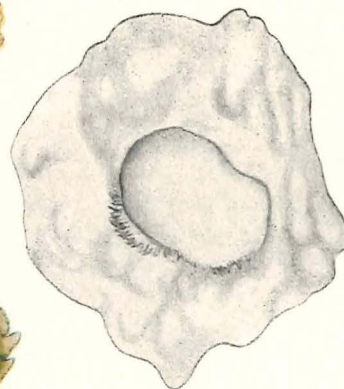


Fig. 354

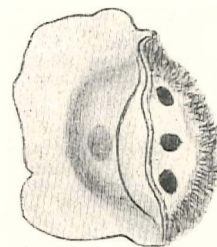


Fig. 355

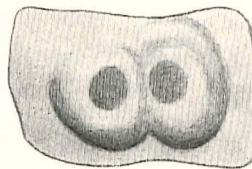


Fig. 352



PLATE 57.

LOBARIA PULMONARIA.

(L.) HOFFM.

**Specimen 6.**

Fig. 357. Foremost end of a lobe of thallus, bearing cecidia on its lower surface. ( $\times 3$ ). Below to the left, a similar cecidium under greater magnification; on its surface there are some dark dots, formed by groups of brown hyphæ. Below to the right, the upper surface of thallus with two apothecia, the discs of which are black from a parasitizing *Celidium*. ( $\times 20$ ).

Fig. 358. Vertical section of thallus; on its upper surface there is a dark crust of *Celidium*, while its lower surface has an apothecium-like protuberance with a dark crust of *Celidium*. ( $\times 20$ ).

Fig. 359. Apothecium, attacked by *Celidium*, which is spreading over the whole of the surface of the disc. ( $\times 20$ ).

Fig. 360. Apothecium-like cecidium of *Celidium* on the lower surface of thallus. ( $\times 20$ ).

Fig. 361. Cecidium placed on the lower surface of thallus, corresponding to the picture in Fig. 357 below to the left. ( $\times 23$ ).

Fig. 362. The cortical portions of the cecidium, pictured in Fig. 361, composed of dense tissues, which are chiefly light, but in places dark-brown as the portions seen above to the right in the picture. ( $\times 723$ ).

Fig. 363. Top picture: section of thallus with a young apothecium, attacked by *Celidium*. Bottom picture: hymenium and ripe asci of this *Celidium*. ( $\times 664$ ).



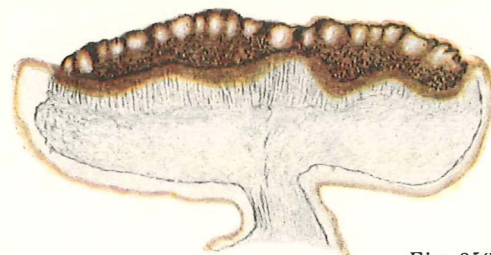


Fig. 359

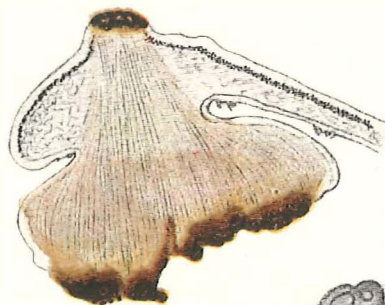


Fig. 358

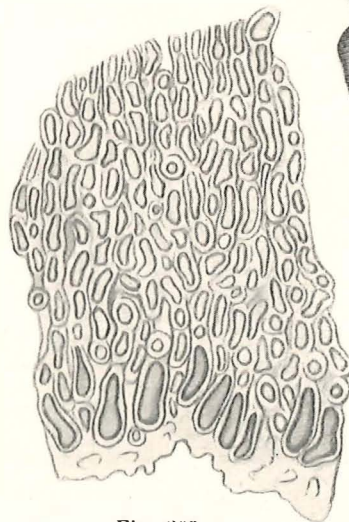
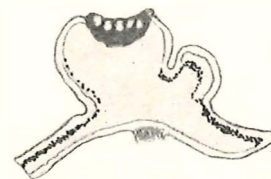
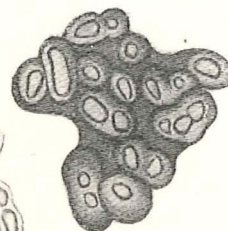


Fig. 362

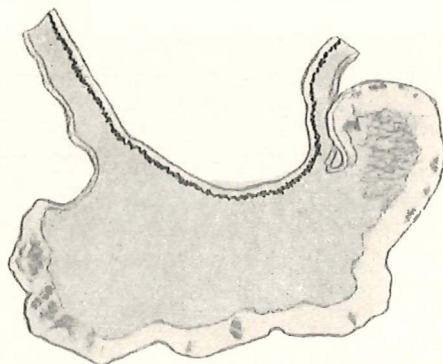


Fig. 361

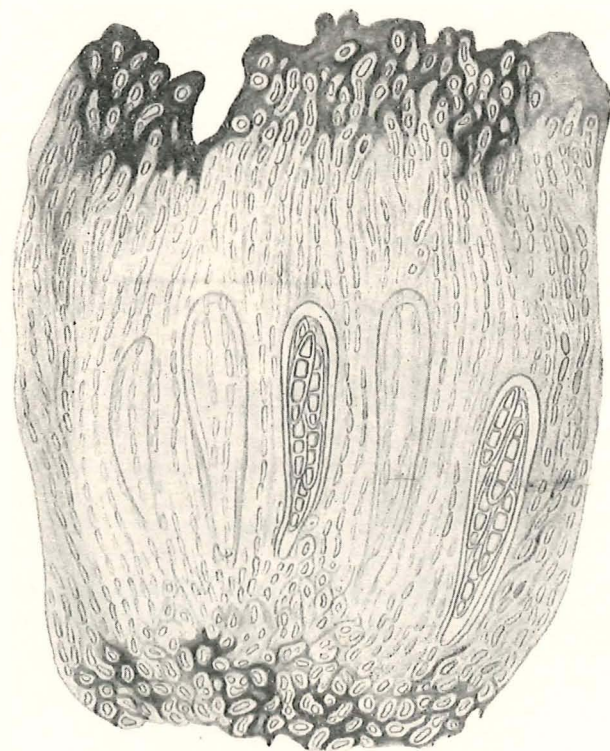


Fig. 363

Fig. 357

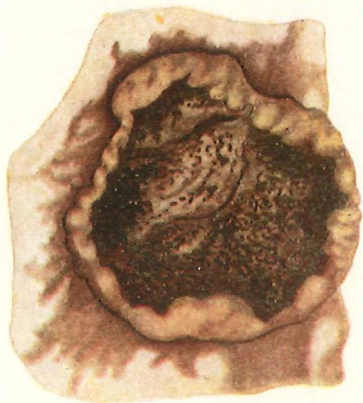
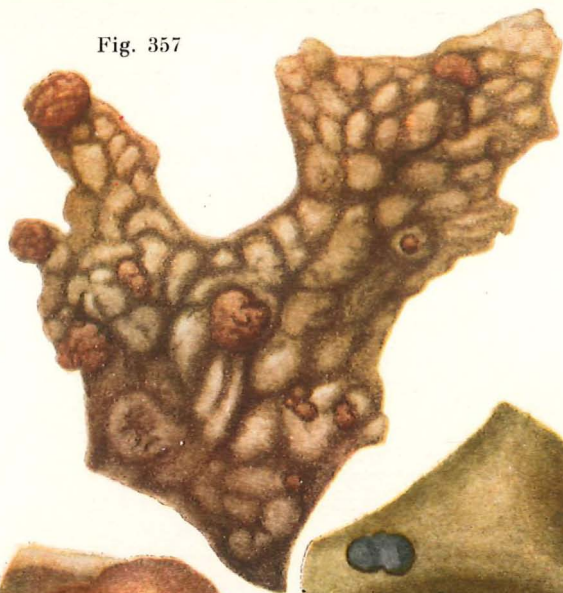


Fig. 360

O. Gallae del.

LOBARIA PULMONARIA (L.) HOFFM.  
(Specimen 6).

PLATE 58.

LOBARIA PULMONARIA.

(L.) HOFFM.

**Specimen 6.**

Fig. 364. Branched cecidium from the upper surface of thallus, provided with a very thick cortex, the outmost cells of which have brown cell-walls as shown above to the left in the figure. ( $\times 90$ ).

Fig. 365. Above: two young cecidia from the upper surface of thallus. ( $\times 24$ ). Below: vertical section of a young cecidium ( $\times 96$ ); to the right, three *Chlorogonidia* from a cecidium. ( $\times 708$ ).

Fig. 366. A big, gonidialess cecidium from the upper surface of thallus. ( $\times 22$ ).

Fig. 367. Dense, cortex-like tissue from the surface of a cecidium like the one shown in Fig. 364. ( $\times 752$ ).

Fig. 368. Medulla from a cecidium like the one shown in Fig. 364. ( $\times 697$ ).

Fig. 369. Cecidium from the lower surface of thallus, with cortex-like surface and a loose medulla in the interior. ( $\times 23$ ). (*Compare* Fig. 361).

Fig. 370. Brown-walled hyphæ from the surface of the cecidium in Fig. 369, cut lengthwise, and two cross-sections of similar hyphæ. ( $\times 697$ ).

Fig. 371. Cortex from the lower surface of thallus, with a patch of *Celidium*.



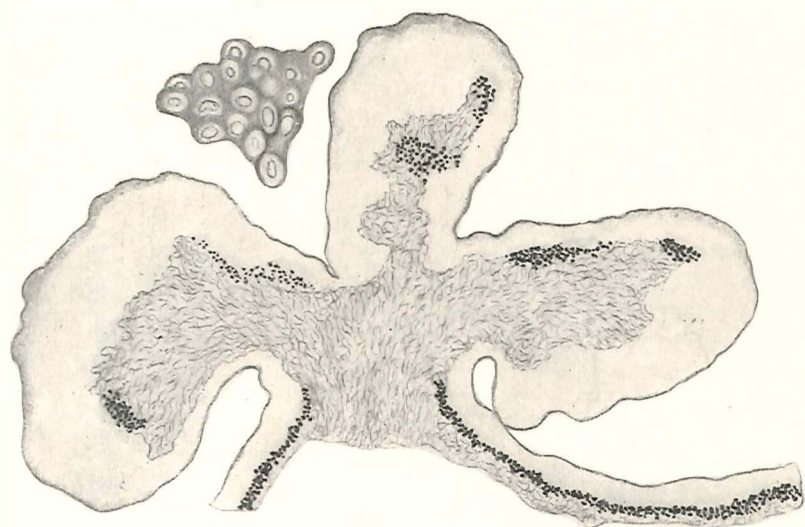


Fig. 364

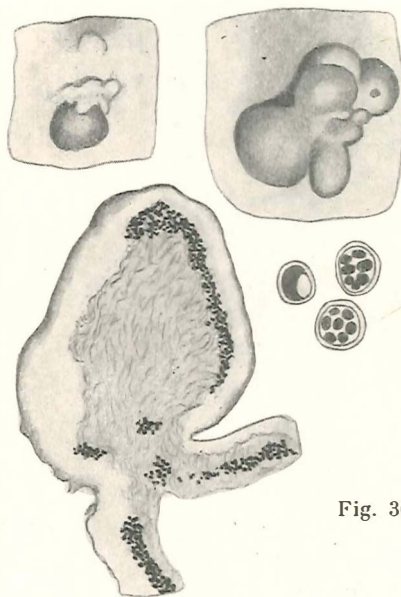


Fig. 365

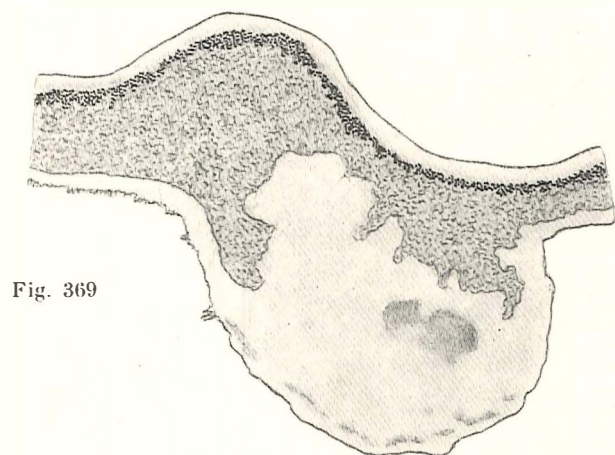


Fig. 369

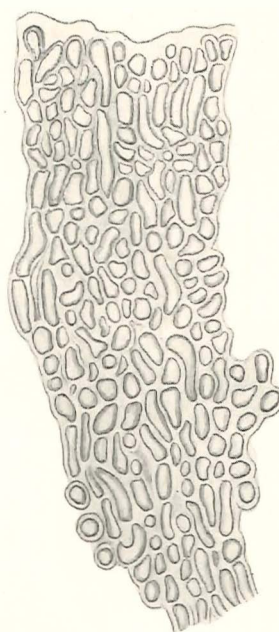


Fig. 367

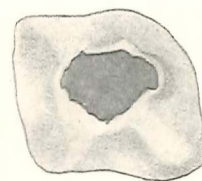


Fig. 371

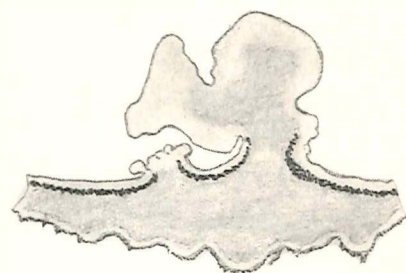


Fig. 366

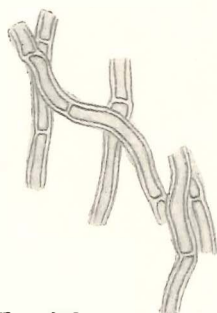
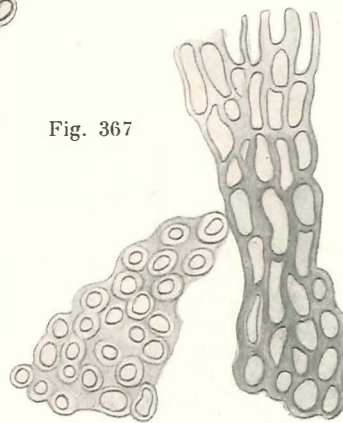


Fig. 368



Fig. 370



*O. Galløe del.*

LOBARIA PULMONARIA (L.) HOFFM.  
(Specimen 6).



PLATE 59.

SOLORINA SPONGIOSA.

SM.

Fig. 372. Portion of thallus with two ripe apothecia. ( $\times 4$ ).

Fig. 373. Portion of thallus, showing the granules of which it is composed. Small, isidia-like protuberances, containing *Nostoc*-gonidia, issue from the surface of thallus, and the same algæ likewise occur in all the other parts of the thallus. Two young, confluent apothecia, still without asci. A grain of sand lies on the surface of thallus. ( $\times 90$ ).

Fig. 374. Section of thallus, with a ripe apothecium. ( $\times 90$ ).

Fig. 375. The figure shows a portion of the hymenium at the stage of development attained in Fig. 373. The vertical, long-celled hyphæ are yellow and constitute young paraphyses. Beneath these a sub-hymenial tissue, among which some few bigger, ascogenous hyphæ. ( $\times 706$ ).



Fig. 372

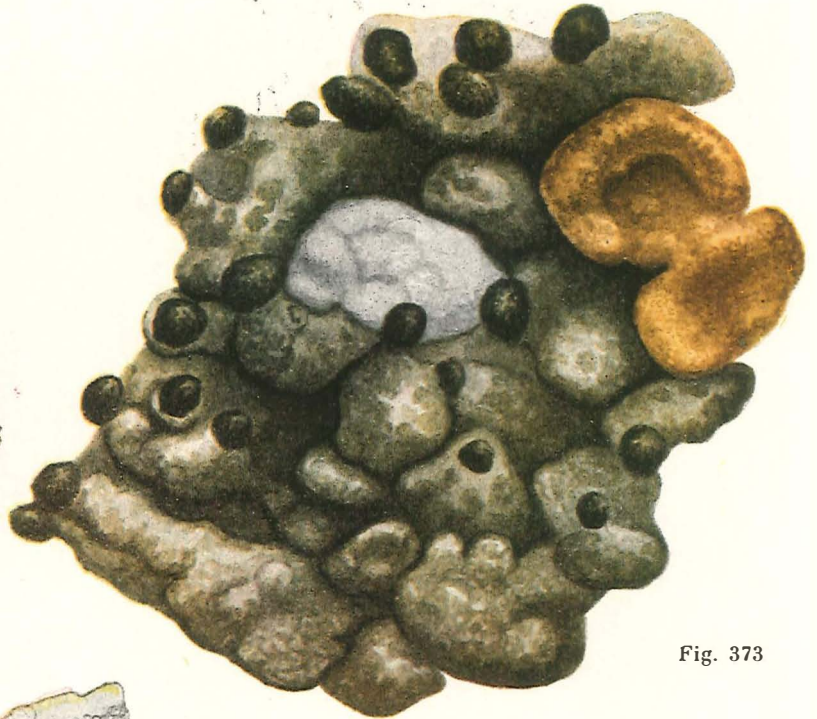


Fig. 373

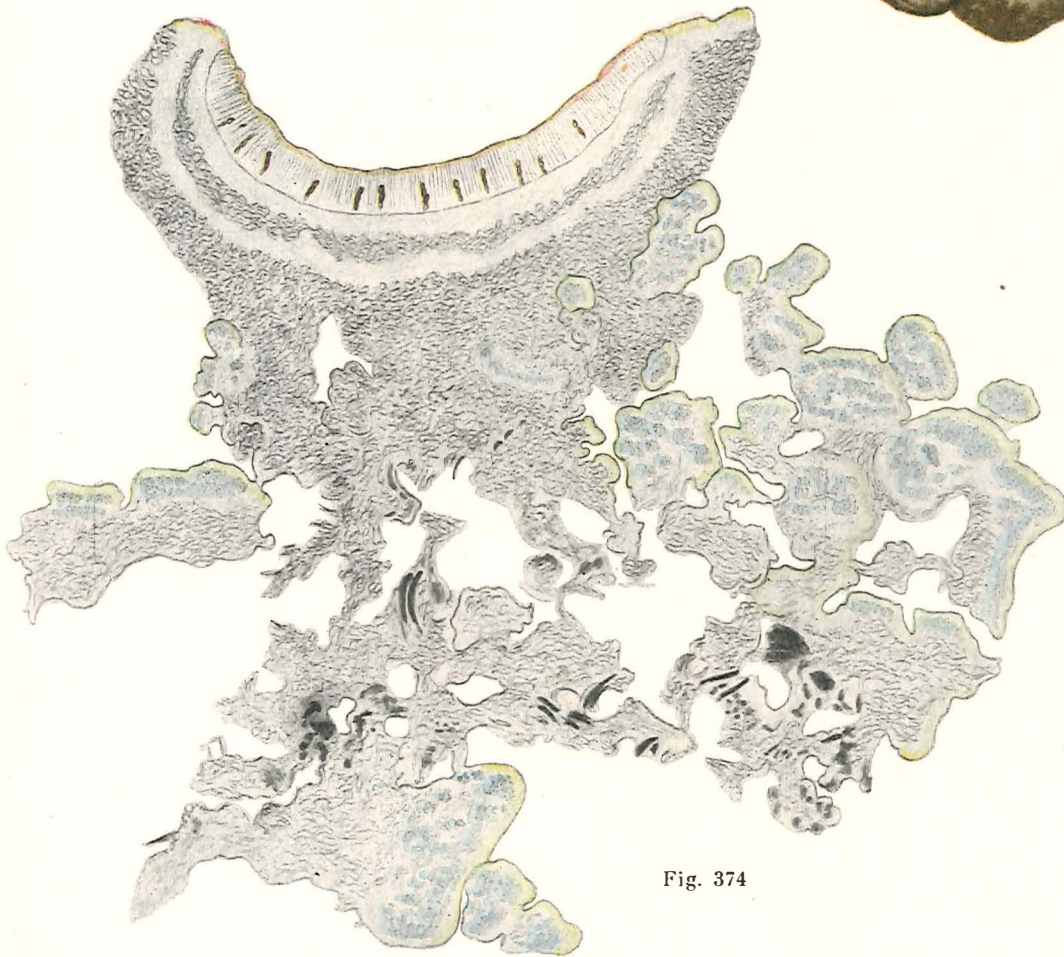


Fig. 374

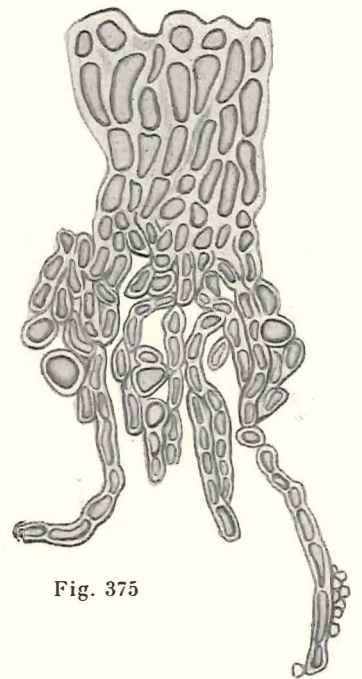


Fig. 375

PLATE 60.

SOLORINA SPONGIOSA.

SM.

Fig. 376. A very young apothecium on the thallus. Beneath the vertical paraphyses (built as those in Fig. 375) are the sub-hymenial tissues with ascogenous hyphæ; in this picture that tissue is represented by a light zone. Next follows the medulla (as in Fig. 378), which has not yet developed the lower cortex beneath the apothecium, occurring in ripe apothecia. ( $\times 180$ ). (*Compare* Fig. 374).

Fig. 377. Some few cortical hyphæ of the type which may sometimes occur in spots on the margins of ripe apothecia (such hyphæ are seen e. g. in Fig. 374, above to the right on the margin of the apothecium). ( $\times 697$ ).

Fig. 378. Above, cortex and gonidial layer from the surface of thallus. To the right, a medullary hypha and an isolated *Nostoc* from the thallus. Below, gonidial layer and medulla. ( $\times 697$ ).

Fig. 379. Hymenium, unripe spore, and, below to the left, hyphæ from the lower cortex of the apothecium of Fig. 374. ( $\times 740$ ).



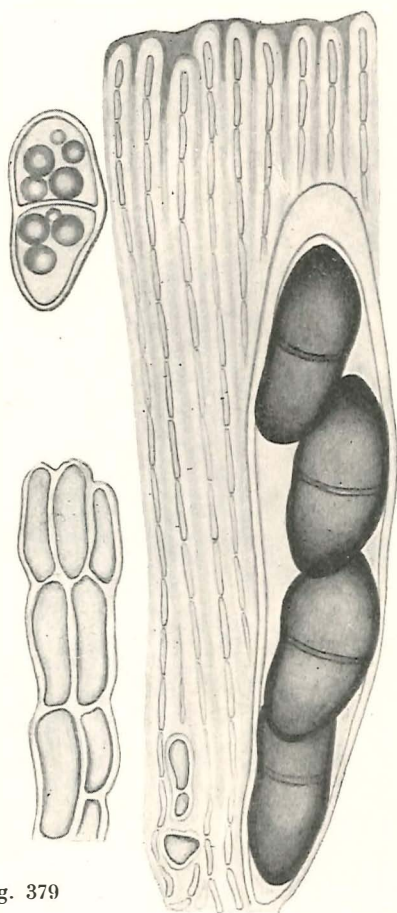


Fig. 379



Fig. 378



Fig. 376



Fig. 377

*O. Galløe del.*

SOLORINA SPONGIOSA SM.

PLATE 61.

SOLORINA SACCATA.

L.

Fig. 380. Entire thallus with apothecia. ( $\times 2\frac{1}{3}$ ).

Fig. 381. To the left, four apothecia at different stages of development. ( $\times 6$ ). To the right, the margin of thallus (seen from below), provided with rhizines; to the older ones of the latter grains of sand and other particles of the soil-substratum are attached. ( $\times 20$ ).

Fig. 382. Vertical section of apothecium with adjacent thallus. The cortex is pierced and has disappeared over the hymenium. The calyx continues upwards round the sides of the hymenium. The ascogenous hyphæ and short, slightly brown calyx-hyphæ (as in Fig. 390) are found beneath the hymenium, and deeper down a thin layer of gonidia, next followed by the common medulla, under which is the lower cortex (here visible as a light zone), completely built as the cortex occurring beneath the endogenous cephalodia (*vide* Fig. 389). Rhizoidal hyphæ of the same structure as that of the medullary hyphæ issue from this lower cortex. ( $\times 35$ ).

Fig. 383. Cortex and gonidial layer. ( $\times 633$ ).

Fig. 384. Below, endogenous cephalodium, seen from the surface of thallus. ( $\times 23$ ). Above, section of thallus with a rhizine. ( $\times 23$ ).

Fig. 385. Section of thallus, with a rhizine (in which dark particles of the substratum), and an endogenous cephalodium. ( $\times 90$ ).



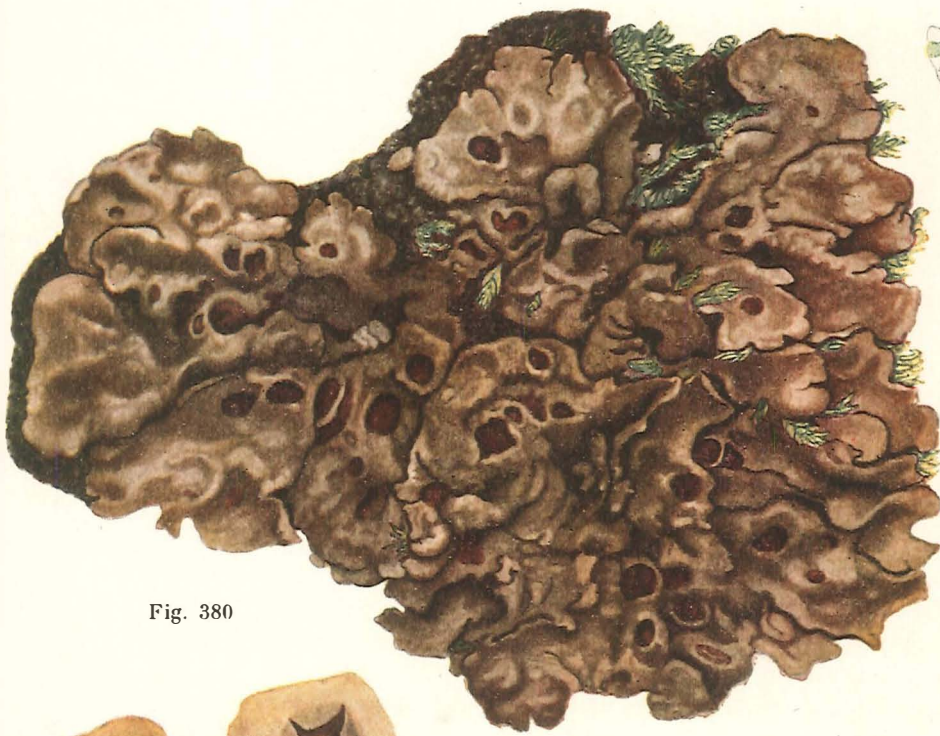


Fig. 380



Fig. 381

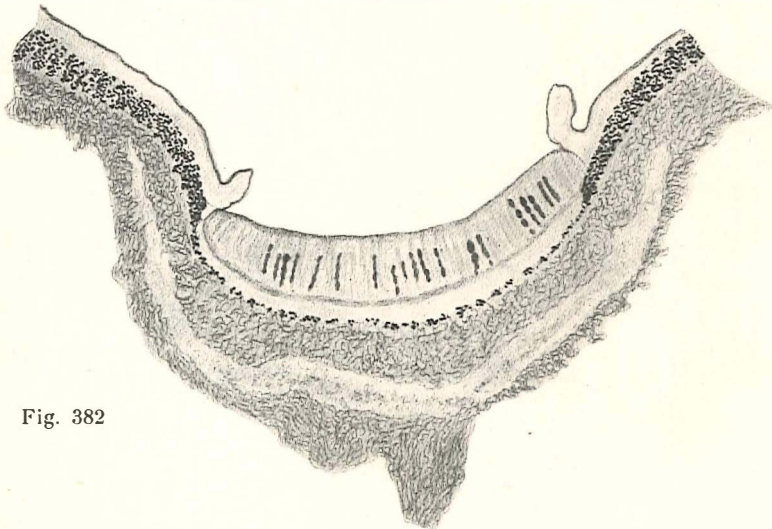


Fig. 382

*O. Galløe del.*



Fig. 385

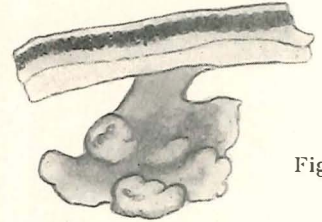


Fig. 384

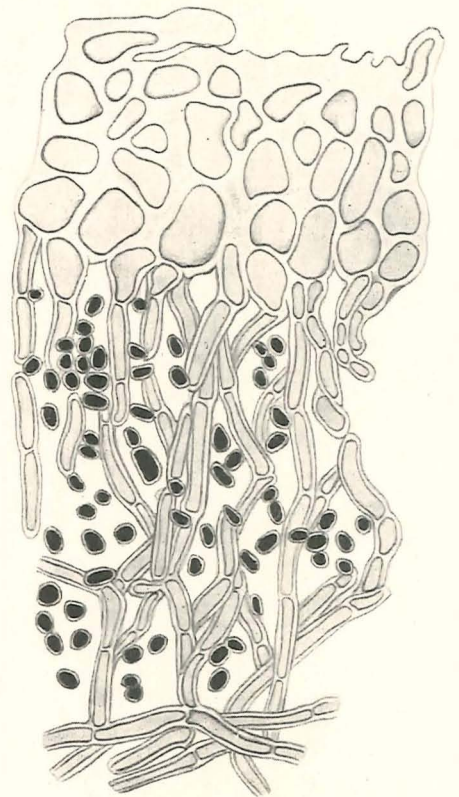
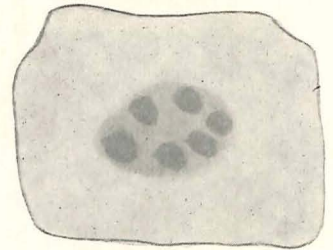


Fig. 383

SOLORINA SACCATA L.



PLATE 62.

SOLORINA SACCATA.

L.

Fig. 386. Endogenous cephalodium, embedded in the medulla and covered with *Chlorogonidia*. A lower cortex is found beneath the *Nostoc*-gonidia. ( $\times 158$ ).

Fig. 387. Rhizoidal hyphæ, isolated from a rhizine. ( $\times 697$ ).

Fig. 388. Medullary hyphæ, in part beset with small grains of a substance, not closer examined. ( $\times 620$ ).

Fig. 389. Bottom of an endogenous cephalodium (as in Fig. 386). Beneath the *Nostoc*-gonidia a cortex, from which medullary-rhizoidal hyphæ are protruding. ( $\times 620$ ).

Fig. 390. Above in the section, hyphæ from the calyx, among which a couple of bigger, ascogenous hyphæ; beneath the calyx some few gonidia, under which the medulla follows. ( $\times 620$ ). (*Compare* Fig. 382).

Fig. 391. Paraphyses, two unripe asci and one ripe ascus. ( $\times 740$ ).

Fig. 392. Plane view of tips of paraphyses, seen from the surface of the hymenium. ( $\times 682$ ).

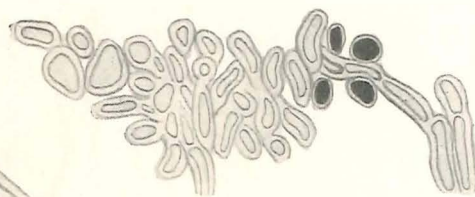


Fig. 390

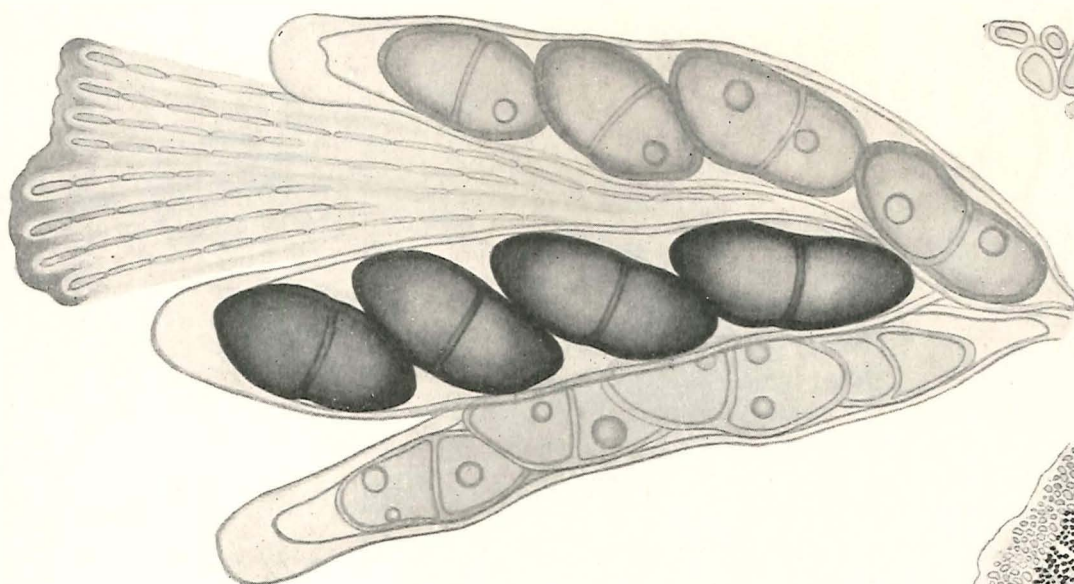


Fig. 391

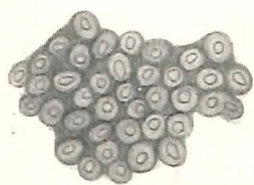


Fig. 392

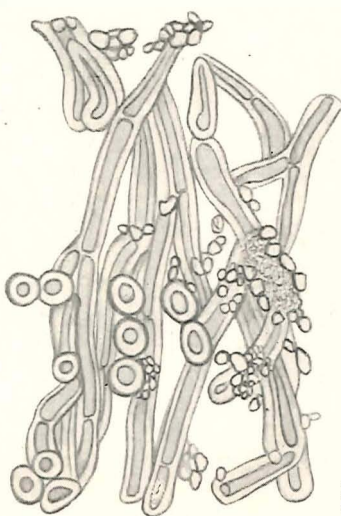


Fig. 388



Fig. 389

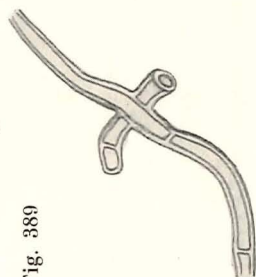


Fig. 387

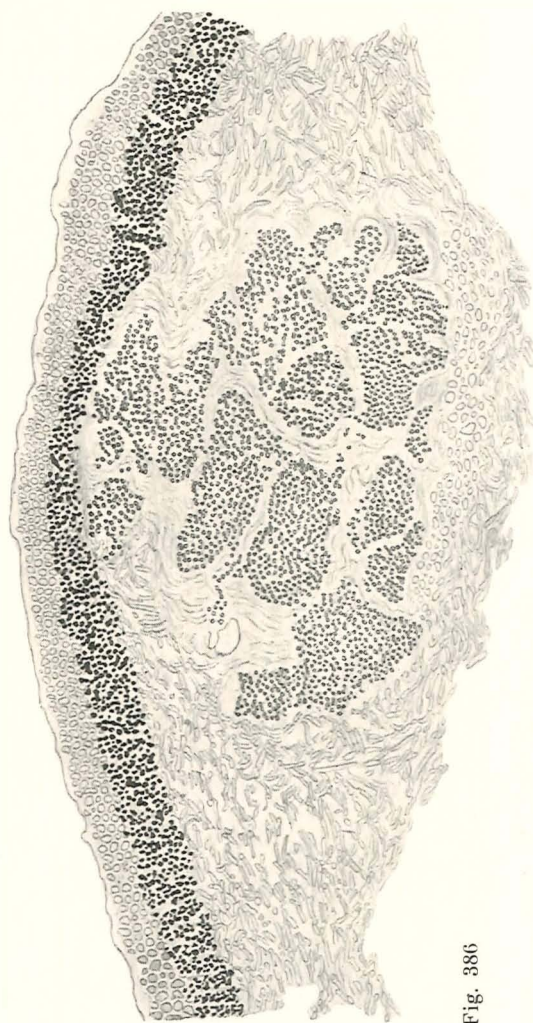


Fig. 386

*O. Galløe del.*

*SOLORINA SACCATA L.*

PLATE 63.

NEPHROMA PARILE.

ACH.

Fig. 393. Entire thallus. Note the retiform ribs on the recurved margin of one of the lobes. ( $\times 3\frac{1}{2}$ ).

Fig. 394. Portion of the margin of a lobe of thallus, with several soredia. ( $\times 20$ ).

Fig. 395. Two coalesced lobes of thallus, resting on the substratum-bark (of *Quercus*). ( $\times 90$ ).

Fig. 396. Longitudinal section of a lobe of thallus. ( $\times 135$ ).

Fig. 397. Cortex of the upper surface of thallus and its transition into gonidial and medullary layers. ( $\times 1038$ ).

Fig. 398. Longitudinal section of the margin of thallus. ( $\times 602$ ).

Fig. 399. Surface of thallus, showing cortex (in part brown and covered with a dead cuticle) and the gonidial layer. ( $\times 620$ ). Below, two anastomosed medullary hyphæ. ( $\times 1030$ ).

Fig. 400. The brown cortex of the lower surface of thallus, upwards continuing into medulla and downwards into rhizoidal hyphæ, of which one is attached to the periderm of the substratum. ( $\times 608$ ).



*O. Gallae del.*

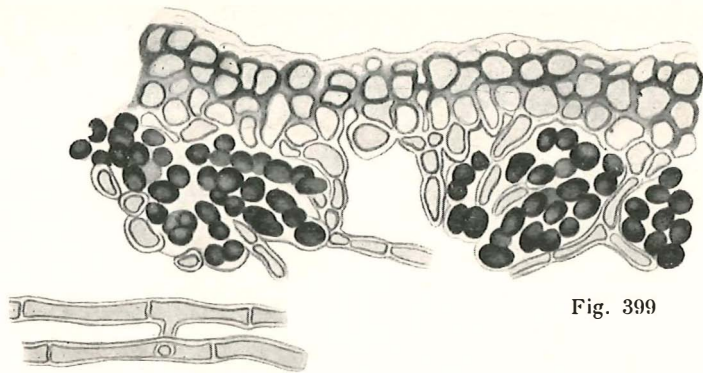


Fig. 399

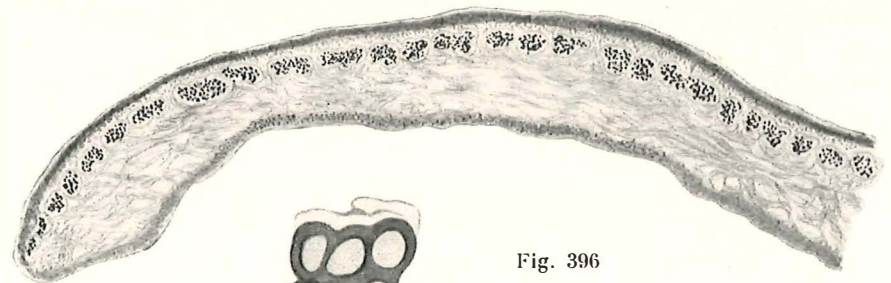


Fig. 396

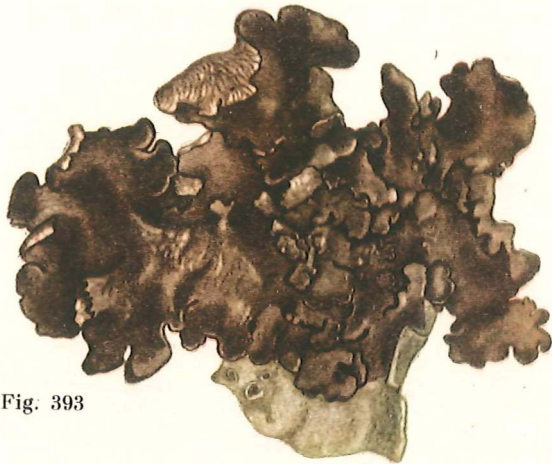


Fig. 393

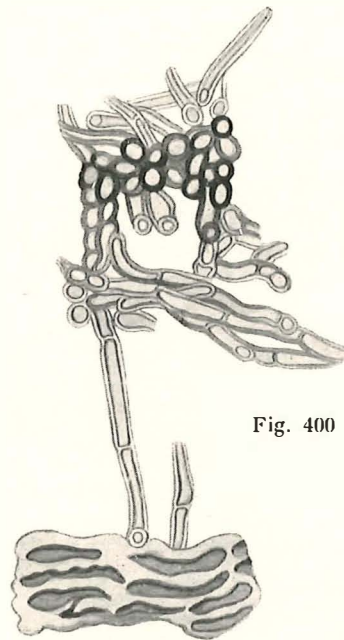


Fig. 400

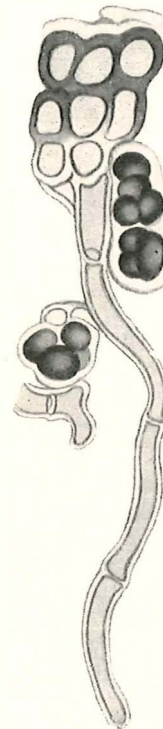


Fig. 397



Fig. 394

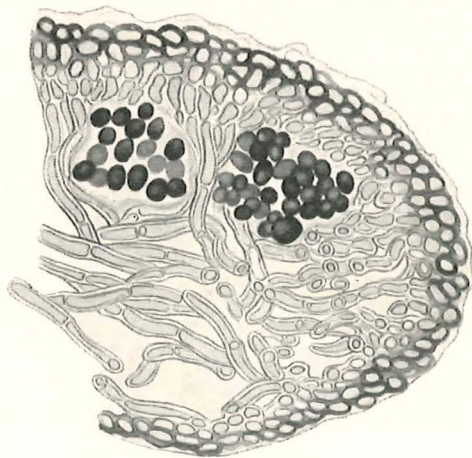


Fig. 398

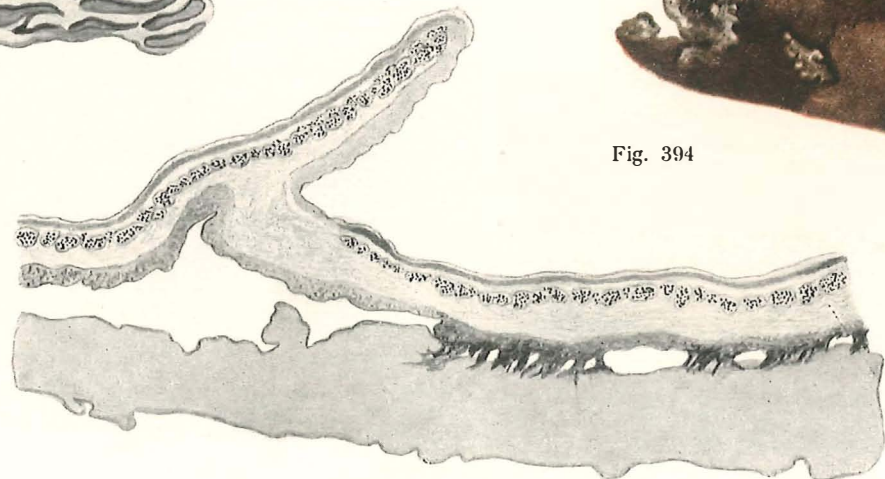


Fig. 395

NEPHROMA PARILE ACH.

PLATE 64.

NEPHROMA LAEVIGATUM.

ACH.

Fig. 401. Portion of thallus with numerous apothecia on the under-surfaces of the wrinkled ends of lobes. ( $\times 1\frac{1}{2}$ ).

Fig. 402. Lower surface of a lobe, with several apothecia. ( $\times 5$ ).

Fig. 403. Above, portion of a lobe, with a short isidium. Below, end of a lobe, bearing a lobe on its underside. ( $\times 15$ ).

Fig. 404. Longitudinal section of a lobe, with a young unripe apothecium. ( $\times 22$ ).





Fig. 401

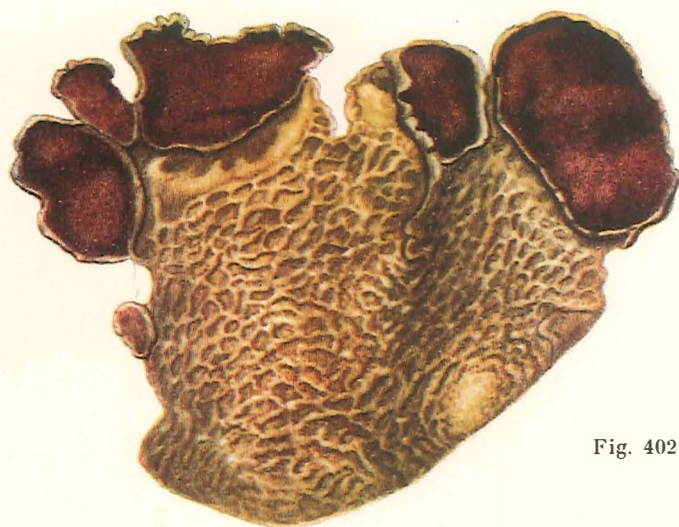


Fig. 402

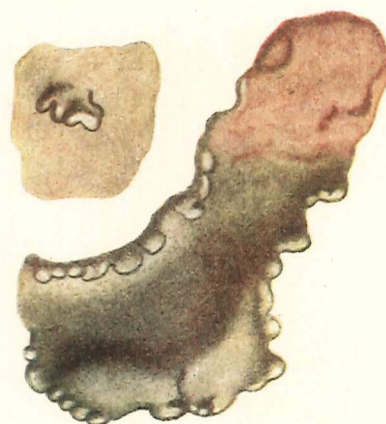


Fig. 403

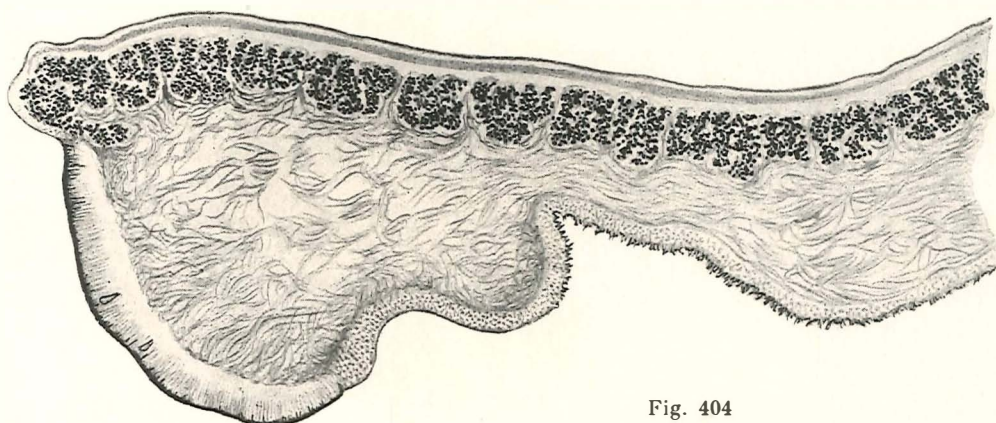


Fig. 404

*O. Galløe del.*

NEPHROMA LAEVIGATUM Ach.



PLATE 65.

NEPHROMA LAEVIGATUM.

ACH.

Fig. 405. Longitudinal section of a lobe, with a ripe apothecium on its underside. ( $\times 22$ ).

Fig. 406. Cortex and gonidial layer from the upper surface of thallus. ( $\times 640$ ).

Fig. 407. Cortex from the lower surface of thallus. ( $\times 620$ ).

Fig. 408. Longitudinal section of the foremost distal portion of the margin of apothecium. ( $\times 143$ ).

Fig. 409. Proximal portion of apothecium, with hymenium, which latter is abruptly followed by the cortex of the thallus. ( $\times 697$ ).

Fig. 410. Hymenium and sub-hymenial tissues (calyx), below followed by the medulla. ( $\times 697$ ).

Fig. 411. To the left, ripe spores and one ripe ascus. To the right, an isolated medullary hypha. ( $\times 747$ ).

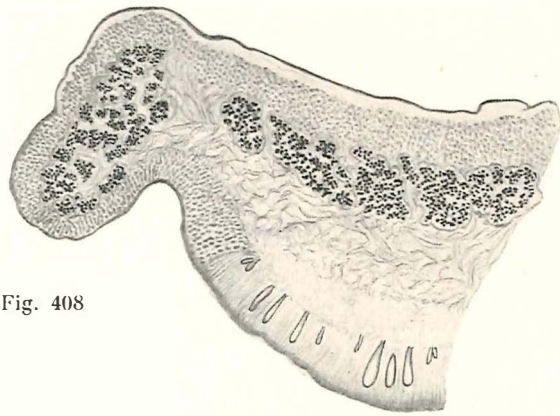


Fig. 408

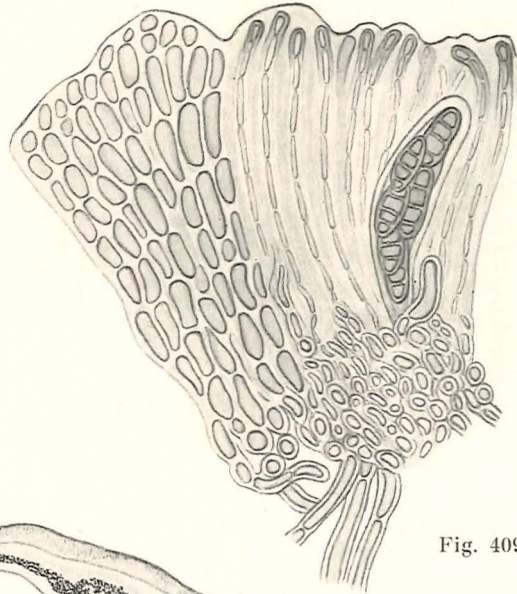


Fig. 409



Fig. 406

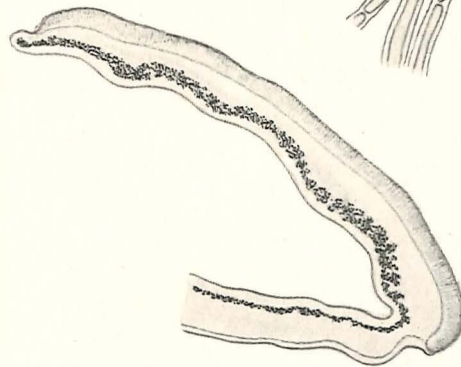


Fig. 405

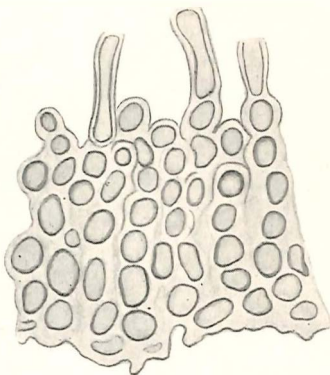


Fig. 407

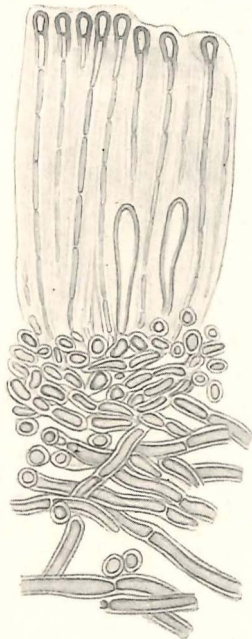


Fig. 410

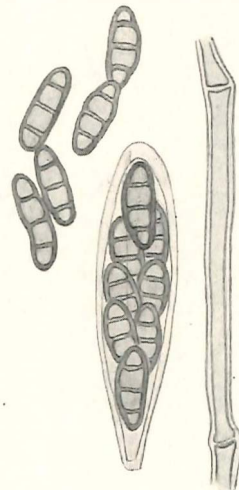


Fig. 411

PLATE 66.

NEPHROMA RESUPINATUM.

L.

Fig. 412. Thallus with apothecia, moistened. ( $\times 4$ ).

Fig. 413. Margin of lobe of thallus, lower surface with tomentum and several resupinate apothecia. ( $\times 13$ ).

Fig. 414. Finely incised edges of lobes of thallus. ( $\times 14$ ).

Fig. 415. Transverse section of thallus. The rhizines are composed of the same type of hyphæ as those constituting the tomentum; they penetrate into the surface of the substratum. ( $\times 90$ ).

Fig. 416. Distal margin of an apothecium. ( $\times 152$ ).

Fig. 417. Section of thallus, showing among other things the finely hairy upper surface and the tomentum beneath the thallus. ( $\times 46$ ).

Fig. 418. Ripe ascus and two isolated spores. ( $\times 90$ ).





Fig. 412

O. Galløe del.

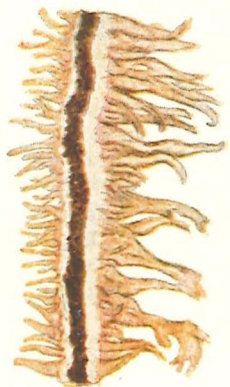


Fig. 417



Fig. 414



Fig. 413

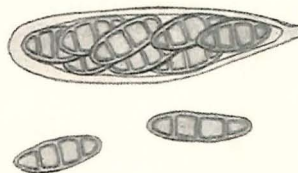


Fig. 418

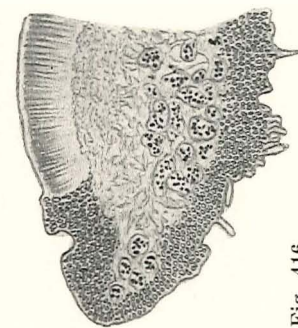


Fig. 416

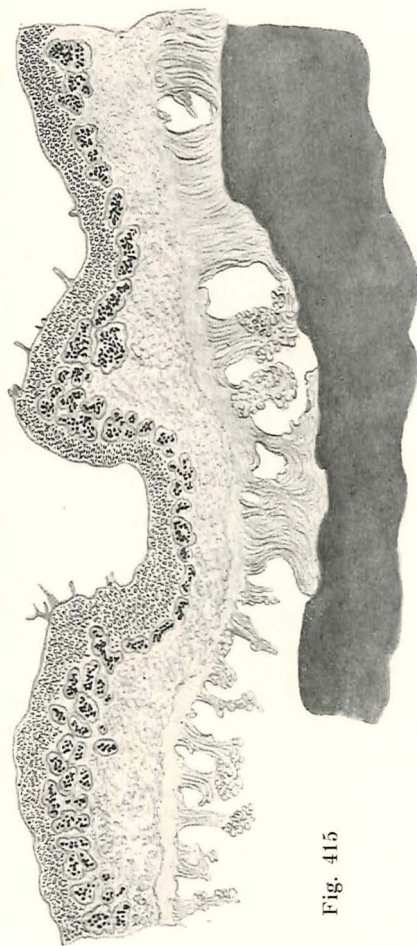


Fig. 415

NEPHROMA RESUPINATUM L.

PLATE 67.

NEPHROMA RESUPINATUM.

L.

Fig. 419. Longitudinal section of a lobe of thallus, with an apothecium on the morphological lower surface. ( $\times 33$ ).

Fig. 420. Upper cortex, issuing free hyphæ. ( $\times 637$ ).

Fig. 421. Lower cortex, medulla, and tomentum. ( $\times 620$ ).

Fig. 422. Rhizine, below somewhat brush-like and short-celled. ( $\times 620$ ).

Fig. 423. Proximal margin of apothecium, contiguous to the ordinary cortex of the thallus. ( $\times 620$ ).





Fig. 420

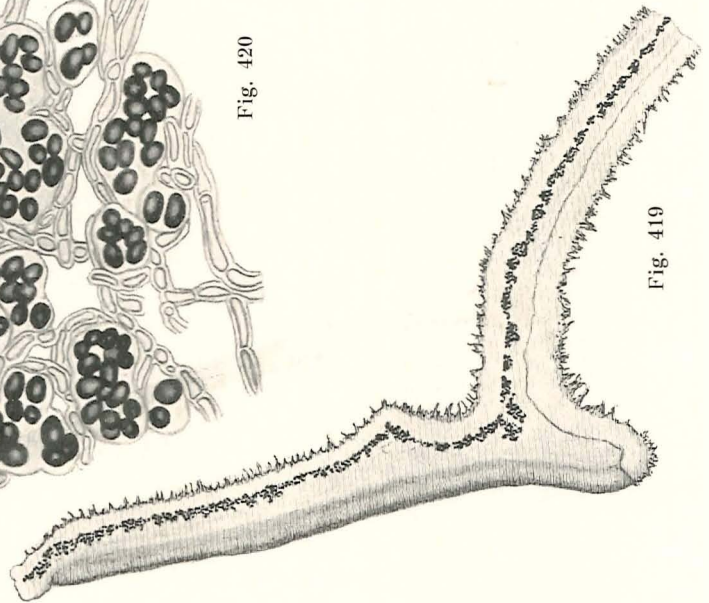


Fig. 419

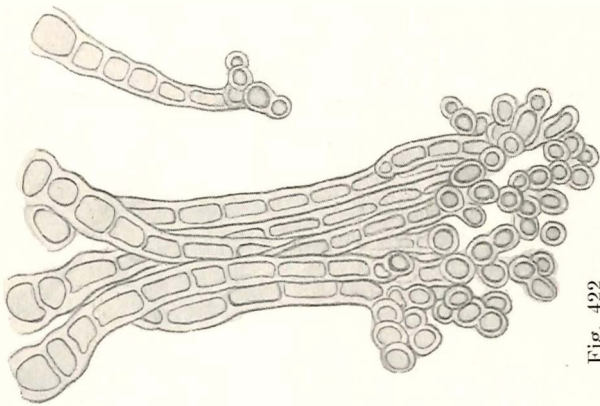


Fig. 422

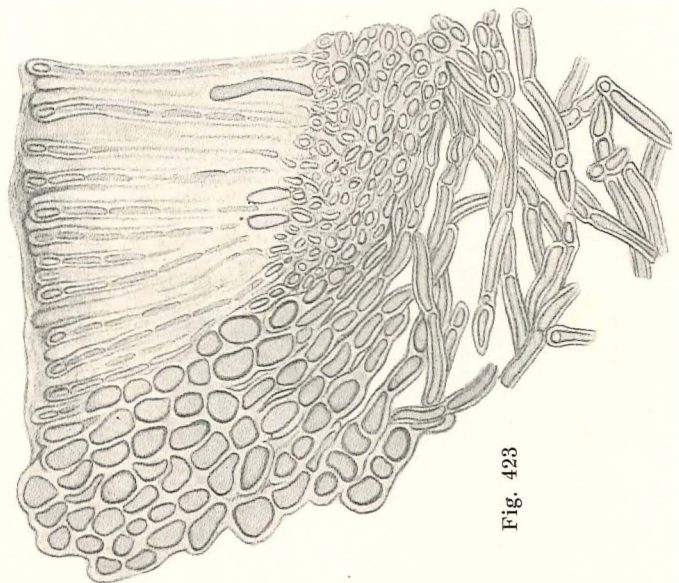


Fig. 423

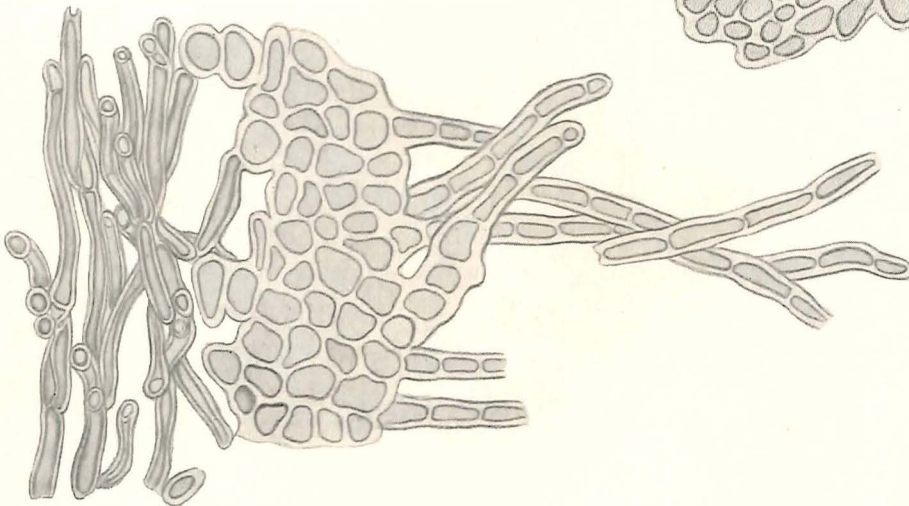


Fig. 421



PLATE 68.

PELTIGERA VENOSA.

L.

Fig. 424. A lobe of thallus with apothecium, seen from below. At the base, adhering particles of the soil-substratum and white grains of sand. ( $\times 14$ ).

Fig. 425. Apothecium. ( $\times 14$ ).

Fig. 426. Longitudinal section of a lobe of thallus with a primordium of apothecium. Ascogenous cells are visible in the hypothecial tissues. The apothecium has paraphyses but as yet no asci. ( $\times 140$ ).

Fig. 427. Ripe apothecium. ( $\times 140$ ).

Fig. 428. Young apothecium, still closed, provided with asci. ( $\times 41$ ).

Fig. 429. Upper surface of the thallus near the base of a lobe (*compare* Fig 432). ( $\times 620$ ).

Fig. 430. Hyphæ from the colourless medulla of the thallus. ( $\times 697$ ).

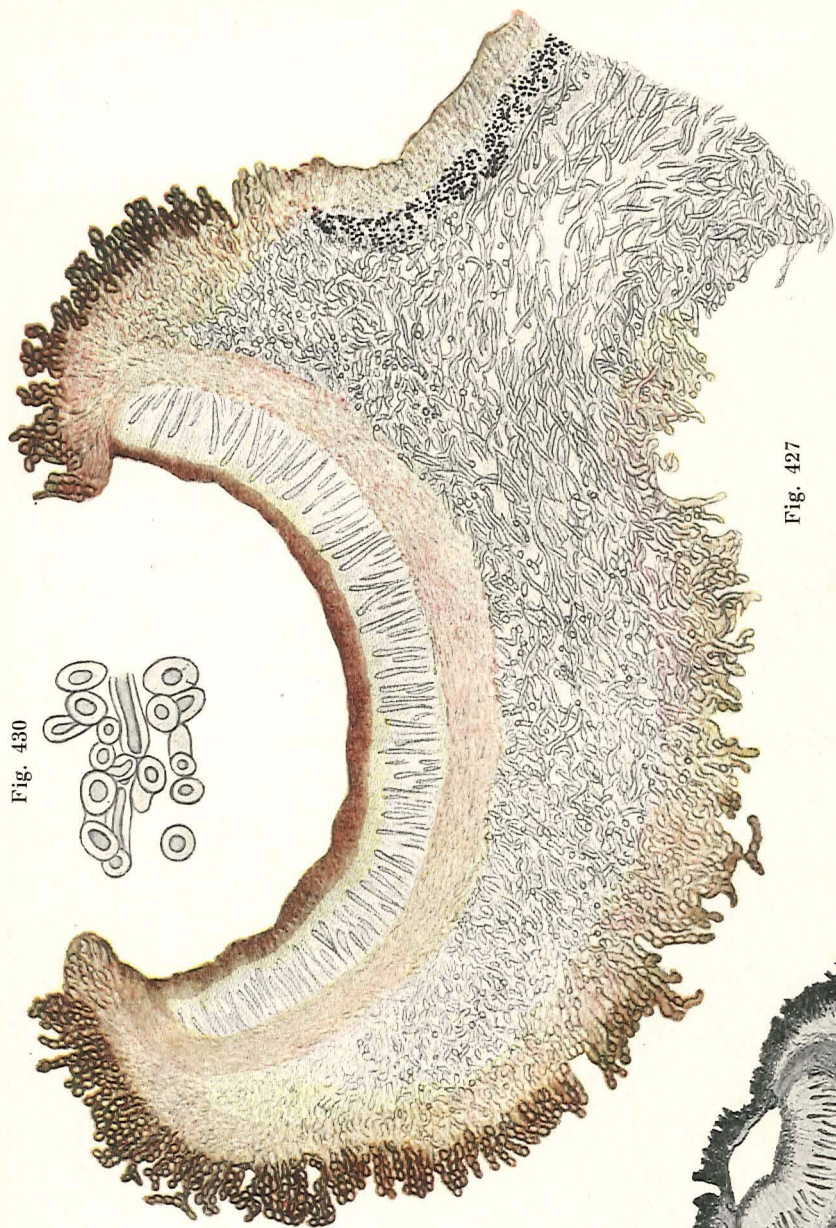


Fig. 430

Fig. 427

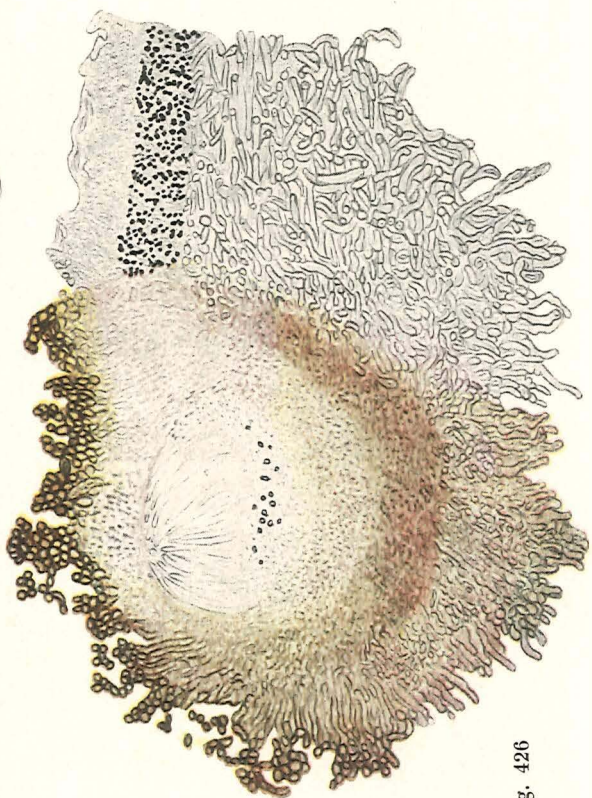


Fig. 426

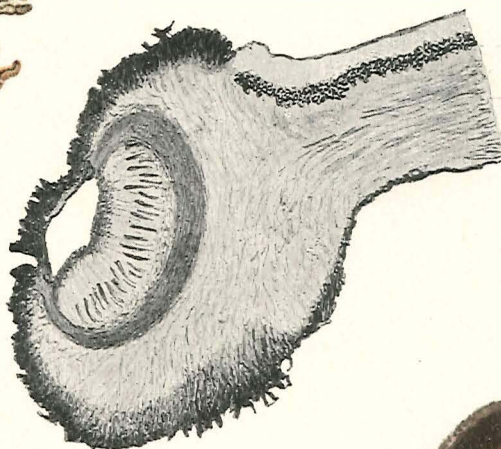


Fig. 428

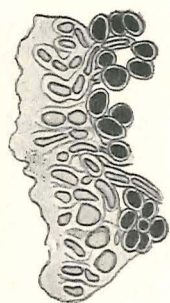


Fig. 429



Fig. 424



Fig. 425



PLATE 69.

PELTIGERA VENOSA.

L.

Fig. 431. Three lobes of thallus, all of them constricted at the base, protruding from the substratum. ( $\times 5$ ).

Fig. 432. Transverse section of the narrow, brown base of a lobe, above bearing three light, gonidiiferous portions of thallus, the surface of which is shown in Fig. 429, while their underside, turning towards the brown tissue, is shown beneath in Fig. 434; the coarse brown hyphæ, constituting the base of thallus and continuing into the dark ribs of thallus, are shown in Fig. 436.

Fig. 433. Transverse section of thallus; at the bottom of the latter a brown rib ( $\times 90$ ), the hyphæ of which are shown below to the right in the picture. ( $\times 711$ ).

Fig. 434. *Vide* the explanation of Fig. 432.

Fig. 435. Upper surface of thallus, with cortex, gonidial layer, and upper parts of medulla. ( $\times 786$ ).

Fig. 436. *Vide* the explanation of Fig. 432.

Fig. 437. Hymenium and calyx, one ripe ascus, and three isolated spores. ( $\times 724$ ).



Fig. 433

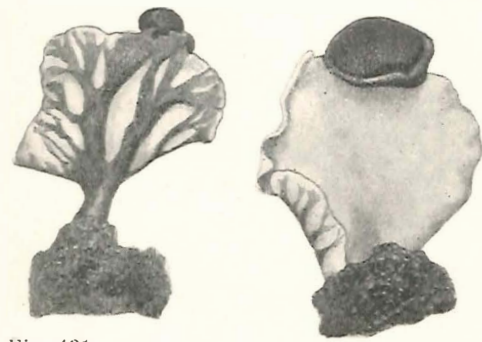
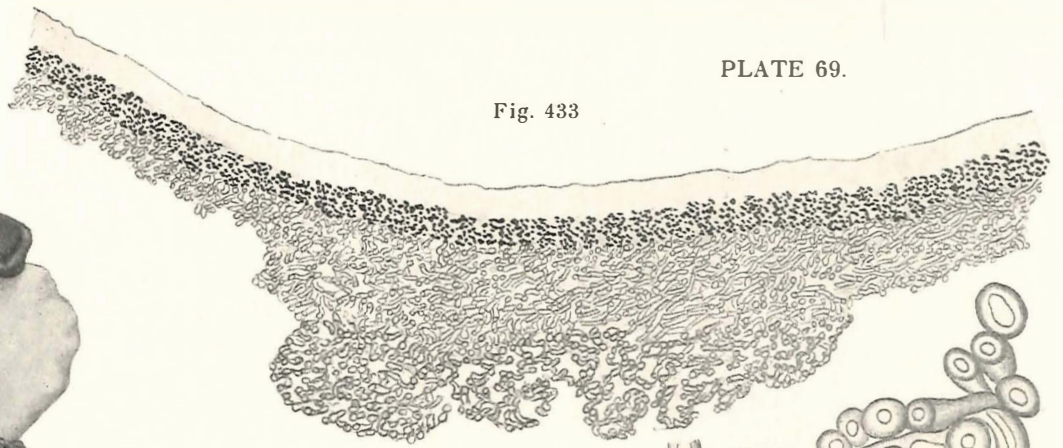


Fig. 431

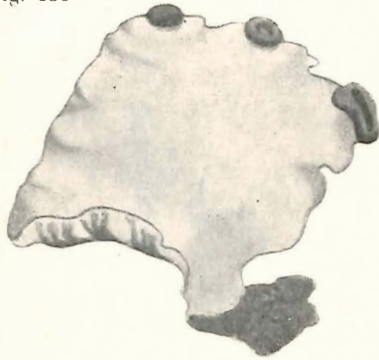


Fig. 434



Fig. 436

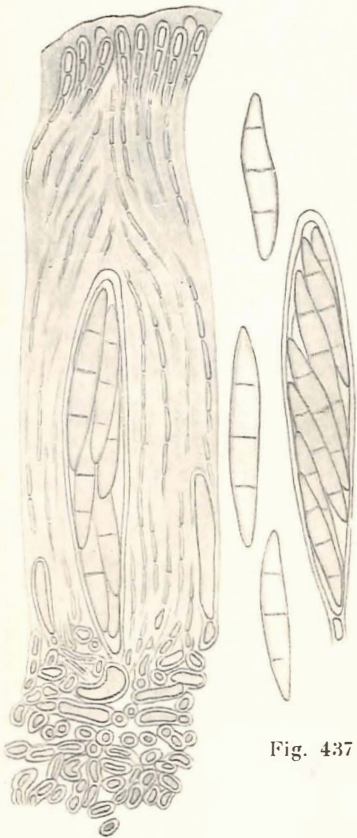


Fig. 437

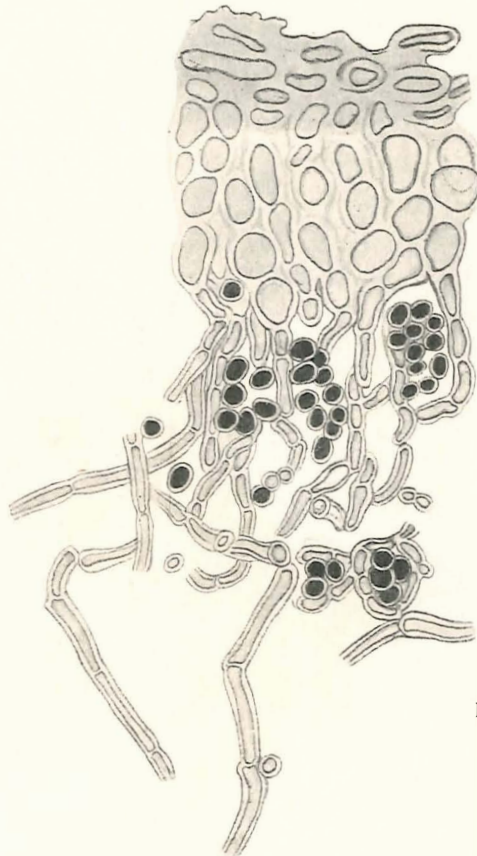
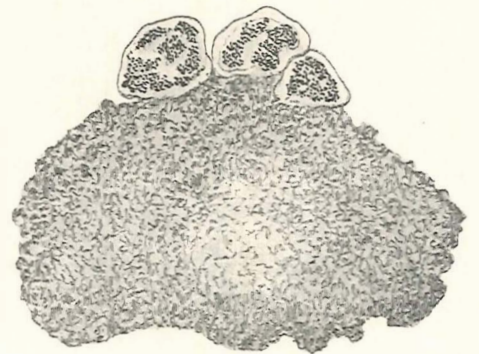


Fig. 438



*O. Galløe del.*

PELTIGERA VENOSA L.

PLATE 70

PELTIGERA HORIZONTALIS.

L.

- Fig. 438. Fertile lobe of thallus, dying out at the base. ( $\times 1\frac{1}{2}$ ).  
Fig. 439. Lobe of thallus with several apothecia. ( $\times 1\frac{1}{2}$ ).  
Fig. 440. Underside of a lobe, repeatedly divided in front. The lobe above to the right in the picture bears two apothecia (here seen from below). ( $\times 2$ ).  
Fig. 441. Distal end of a lobe, seen from below. ( $\times 4$ ).  
Fig. 442. Portion of longitudinal section of thallus; the walls of the upper cells are brown. ( $\times 620$ ).  
Fig. 443. Transverse section of thallus. At the bottom of the picture the dark portions of the ribs of the thallus are seen to be thinner than the medulla. ( $\times 38$ ).



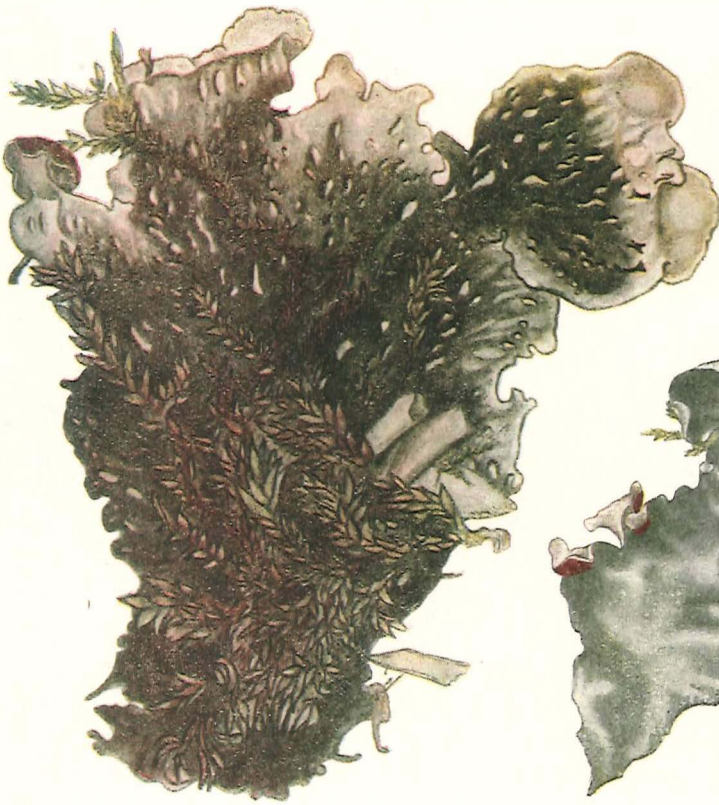


Fig. 440



Fig. 439



Fig. 438

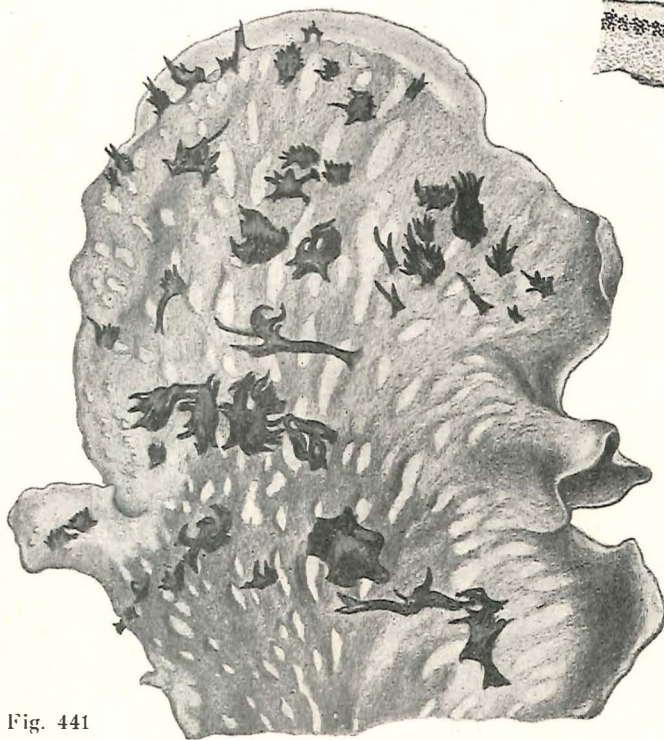


Fig. 441

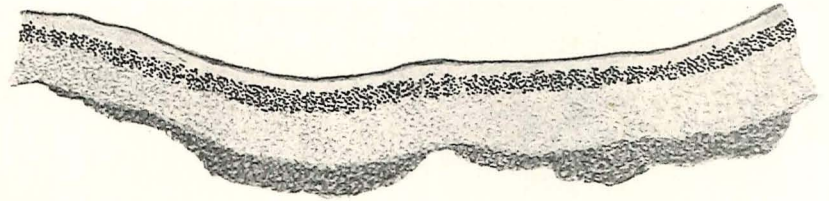


Fig. 443

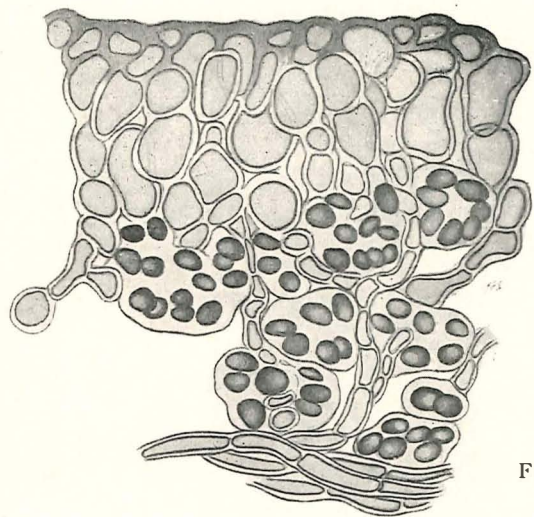


Fig. 442

*O. Galløe det.*

PELTIGERA HORIZONTALIS L.



PLATE 71.

PELTIGERA HORIZONTALIS.

L.

Fig. 444. Medullary hyphæ. ( $\times 620$ ).

Fig. 445. Hyphæ from a rhizine. ( $\times 602$ ).

Fig. 446. Proximal margin of an apothecium, contiguous to the gonidiiferous parts of thallus. ( $\times 96$ ).

Fig. 447. Distal margin of apothecium. ( $\times 100$ ).

Fig. 448. Calyx and sub-hymenial tissues, above continuing into the hymenium. ( $\times 90$ ). To the right, a ripe ascus with slightly brownish spores, and an isolated spore. ( $\times 747$ ).

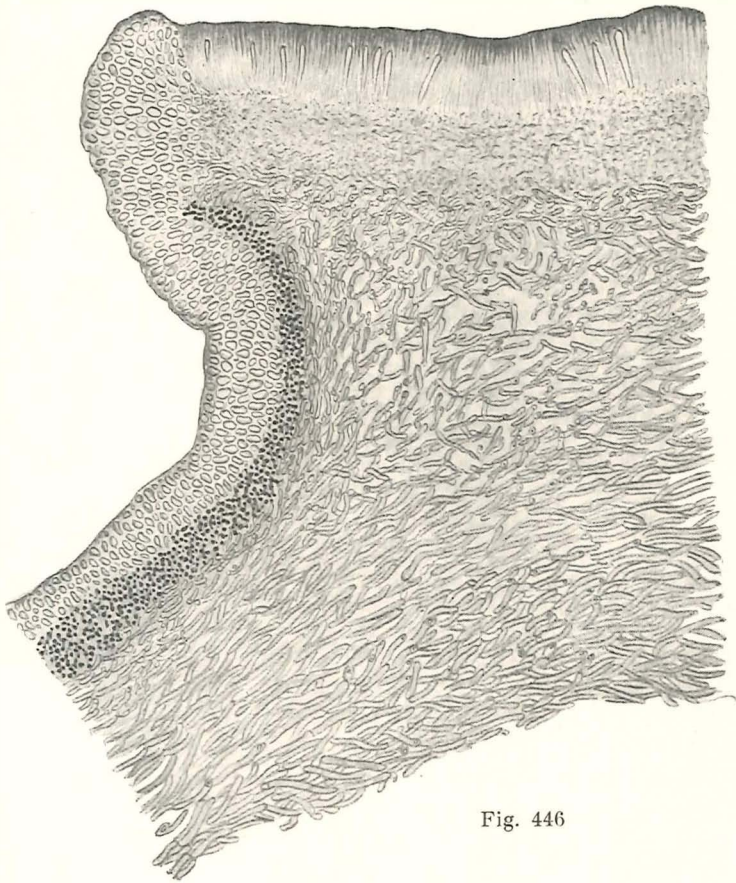


Fig. 446

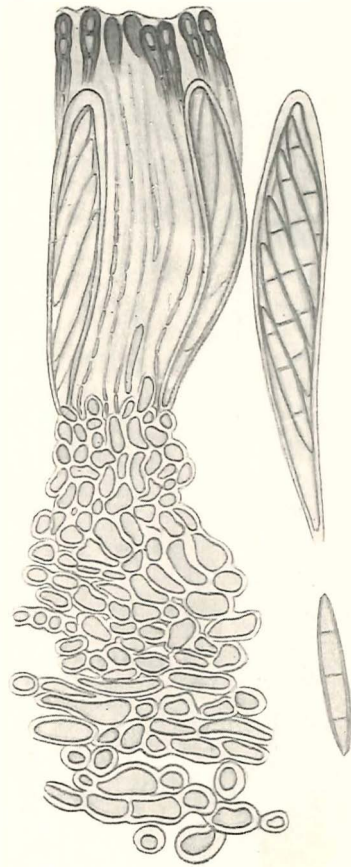


Fig. 448

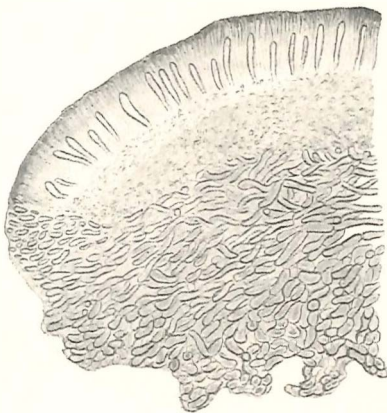


Fig. 447

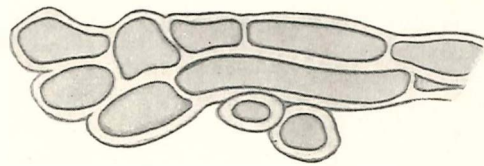


Fig. 444

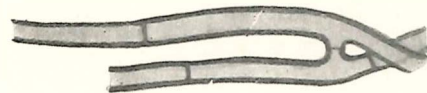


Fig. 445

PLATE 72.

PELTIGERA MALACEA.

ACH.

**Specimen 1.**

- Fig. 449. A lobe of thallus, moistened. ( $\times 3$ ).  
Fig. 450. Lower surface of a lobe of thallus. ( $\times 3$ ).  
Fig. 451. Apothecium. ( $\times 9$ ).





Fig. 449



Fig. 450

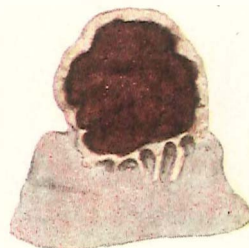


Fig. 451

*O. Galløe del.*

PELTIGERA MALACEA ACH.  
(Specimen 1).

PLATE 73.

PELTIGERA MALACEA.

ACH.

**Specimen 1.**

- Fig. 452. Longitudinal section of a lobe of thallus, with a young apothecium. ( $\times 90$ ).
- Fig. 453. Cortex and gonidial layer. To the right, brown rhizoidal hyphæ. ( $\times 604$ ).
- Fig. 454. Hypogenous cephalodium (*compare* Fig. 458). ( $\times 604$ ).
- Fig. 455. Hymenium and calyx. ( $\times 602$ ).
- Fig. 456. Hymenium and ripe ascus. ( $\times 747$ ).

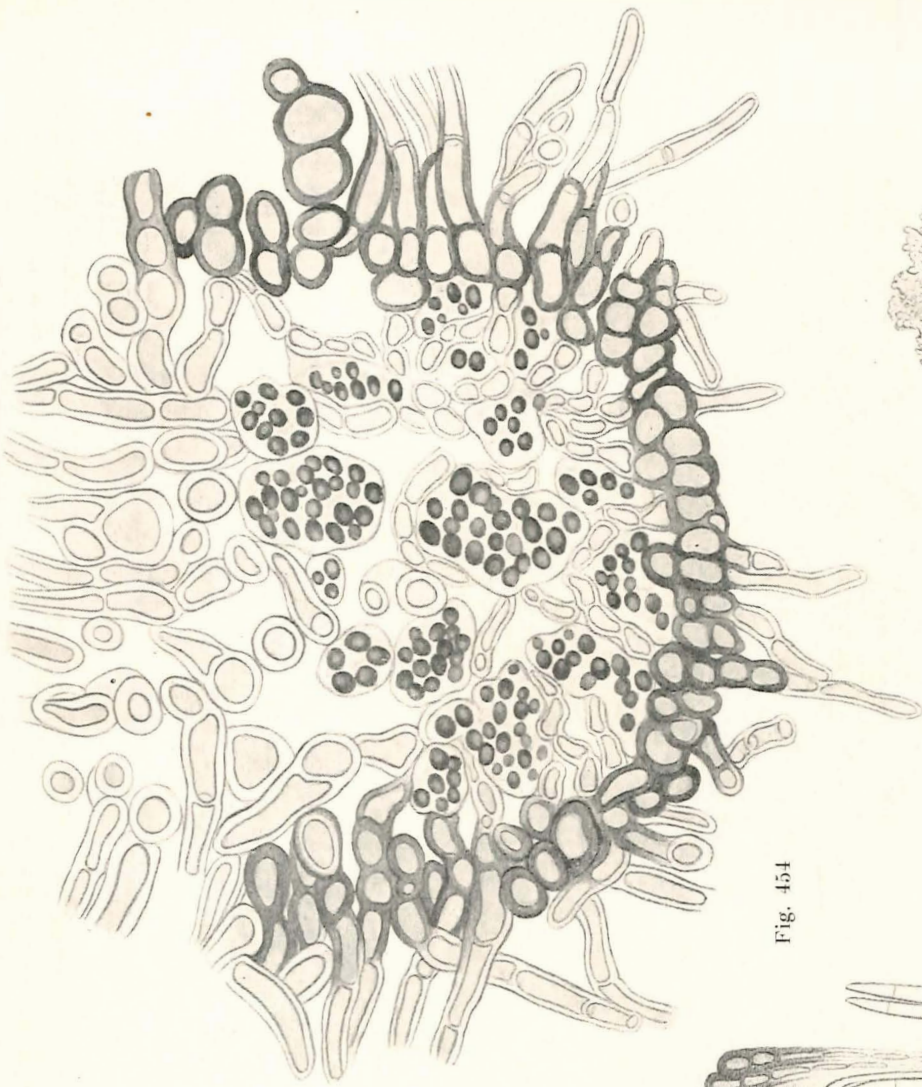


Fig. 454



Fig. 452

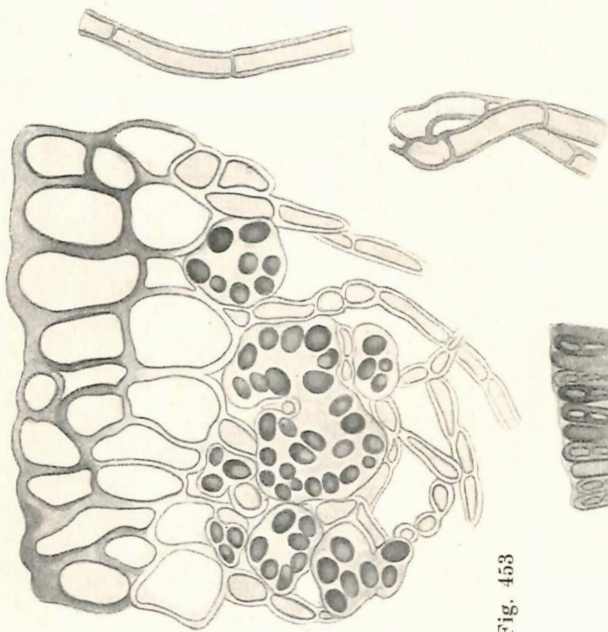


Fig. 453

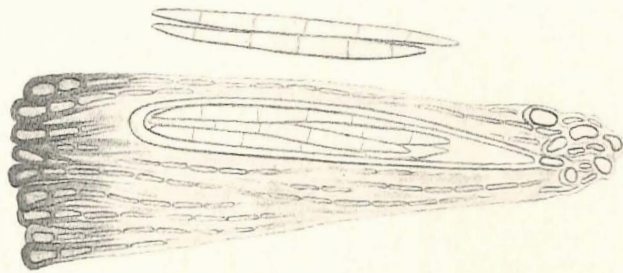


Fig. 456

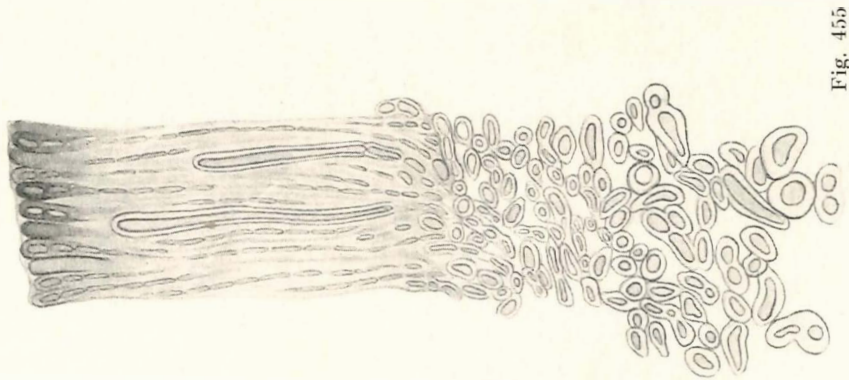


Fig. 455

*O. Galløe del.*

PELTIGERA MALACEA ACH.  
(Specimen 1).



PLATE 74.

PELTIGERA MALACEA.

ACH.

**Specimen 1.**

Fig. 457. Transverse section of an edge of a lobe of thallus. ( $\times 20$ ).

Fig. 458. Transverse section of a lobe of thallus. Below to the right, a hypogenous cephalodium (*vide* Fig. 454). ( $\times 90$ ).

Fig. 459. Longitudinal section of a ripe apothecium. ( $\times 20$ ).

**Specimen 2.**

Fig. 460. A lobe of thallus, seen from below. ( $\times 1\frac{1}{2}$ ).

Fig. 461. Apothecia-bearing lobes of thallus, seen from below. ( $\times 1\frac{1}{2}$ ).

Fig. 462. Apothecia. ( $\times 2$ ).

Fig. 463. A lobe of thallus, surface-view. ( $\times 1\frac{1}{2}$ ).

Fig. 464. Distal (foremost) end of a lobe of thallus, showing the ribs. ( $\times 13$ ).



Fig. 460

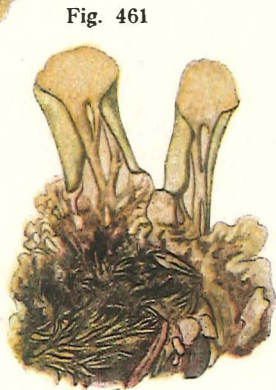


Fig. 461



Fig. 462



Fig. 463

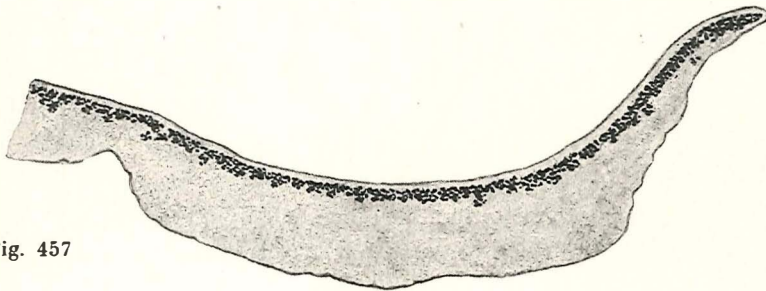


Fig. 457



Fig. 464



Fig. 458

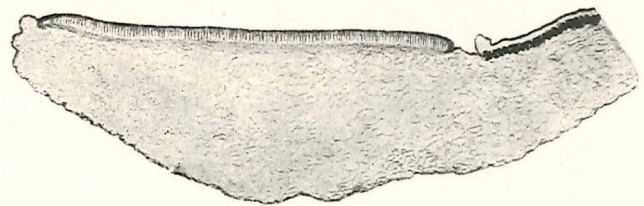


Fig. 459

*O. Galløe del.*

PELTIGERA MALACEA ACH.  
(Specimen 1, 2).

VI P 19b

PLATE 75.

PELTIGERA POLYDACTYLA.

NECK.

- Fig. 465. Distal end of a lobe of thallus. ( $\times 1\frac{1}{2}$ ).  
Fig. 466. Portion of a lobe of thallus, with two apothecia, seen from below. ( $\times 3$ ).  
Fig. 467. Portion of the lateral edge of a lobe of thallus (seen from below), provided with marginal small squamules. ( $\times 23$ ).  
Fig. 468. Portion of transverse section of thallus, with a dark rhizine. ( $\times 39$ ).  
Fig. 469. Longitudinal section of an apothecium. ( $\times 24$ ).  
Fig. 470. Proximal margin of an apothecium, to the right passing into the thallus. ( $\times 165$ ).  
Fig. 471. Medullary hyphæ, cut across. ( $\times 620$ ).  
Fig. 472. Portion of transverse section of thallus. The medullary hyphæ beneath the *Nostoc*-gonidia are in part cut across, as they run chiefly lengthwise in the lobes. ( $\times 620$ ). To the left, a ripe ascus. ( $\times 747$ ).  
Fig. 473. Below, the loose calyx, upwards continuing into the sub-hymenial tissue with ascogenous hyphæ, and into the hymenium. Besides the spores pictured here, other spores were seen, which were about  $60\mu$  long, with 6—8 cells each. ( $\times 600$ ).



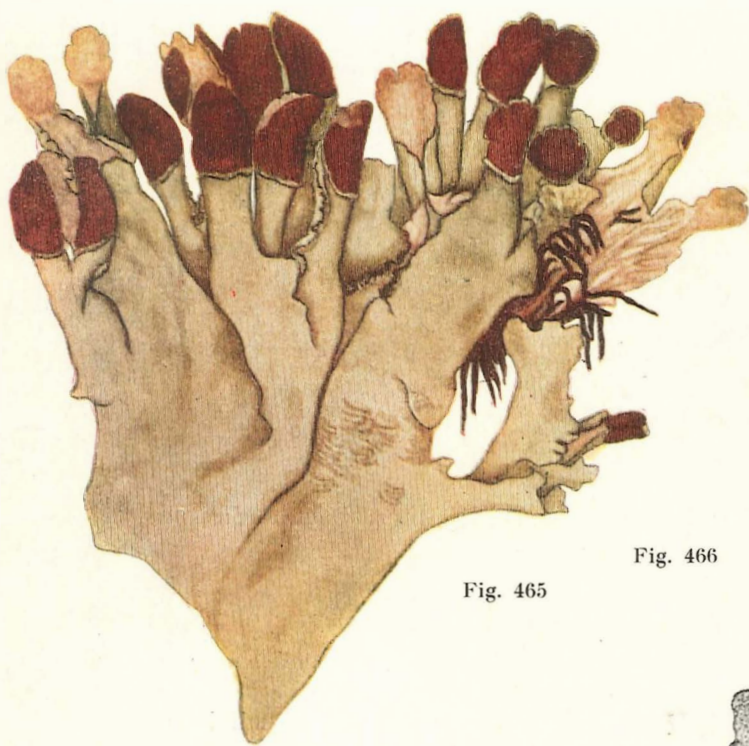


Fig. 465

Fig. 466

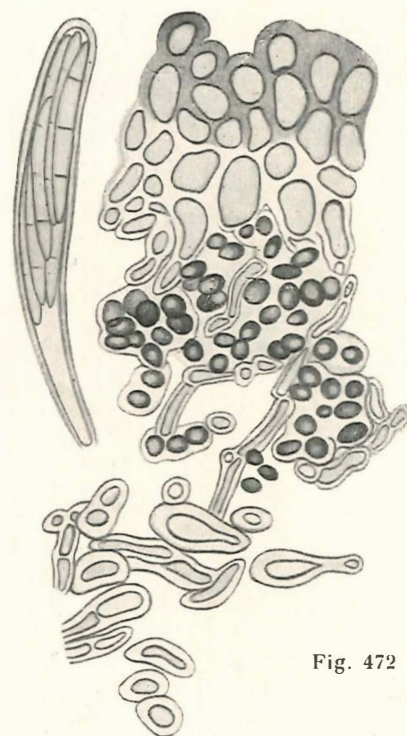


Fig. 472

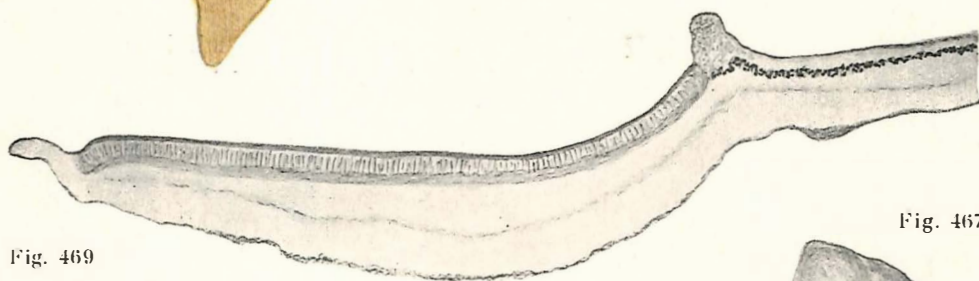


Fig. 469

Fig. 467

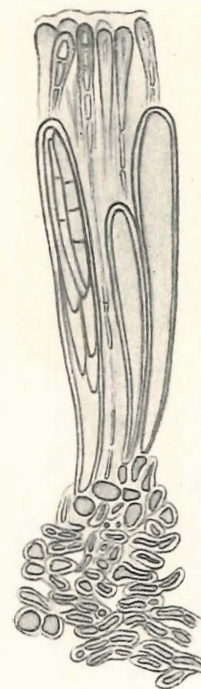


Fig. 473



Fig. 468

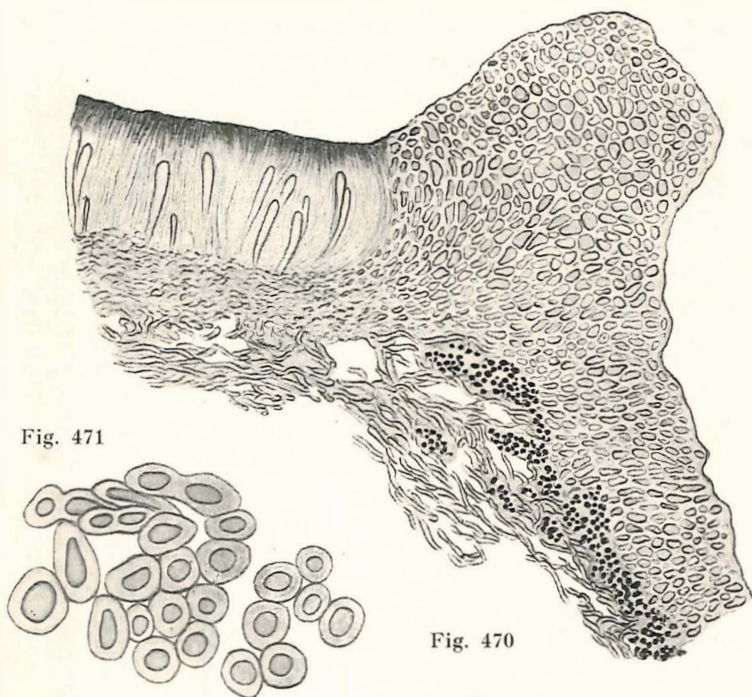
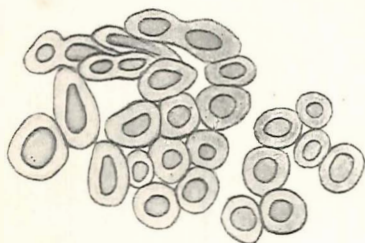


Fig. 470

Fig. 471



O. Galløe del.

PELTIGERA POLYDACTYLA NECK.

PLATE 76.

PELTIGERA SPURIA.

ACH.

Fig. 474. Above, a lobe of thallus with two soralia, seen from above and from below (at the right). ( $\times 4$ ). Below, a lobe of thallus with two apothecia, soralia, and fissures. ( $\times 4$ ).

Fig. 475. The same lobe as in Fig. 474, and (to the left in the picture) another entire lobe, hiding one half of the first specimen, which is identical with the specimen pictured anatomically in the following pictures. ( $\times 4$ ).

Fig. 476. Transverse section of a lobe of thallus, the free edge of which is to the left. Note the felt of the surface, and the thick ribs beneath. ( $\times 38$ ).

Fig. 477. Portion of the same section, showing brown cortex, felt, ribs, etc. ( $\times 152$ ).

Fig. 478. Cortex, partly with brown cell-walls; on the latter a single colourless tomentum-hypha cut across. Gonidial layer with *Nostoc*. ( $\times 634$ ).

Fig. 479. Cross section of the lowest, slender hyphæ of a rib of the lower surface of thallus. ( $\times 620$ ).

Fig. 480. Longitudinal section of a soral. ( $\times 90$ ).

Fig. 481. Margin of a soral. Above to the right, the intact cortex. ( $\times 620$ ).





Fig. 474

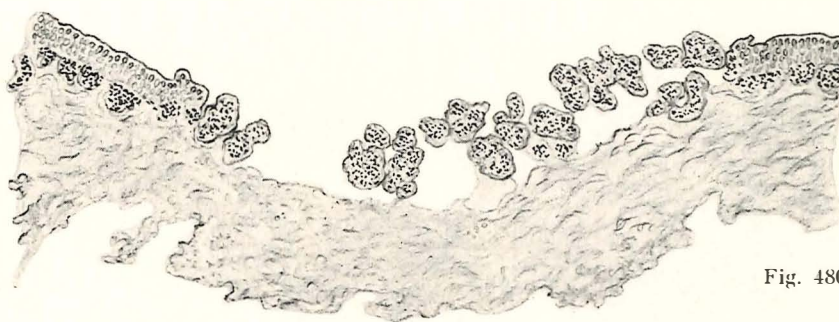


Fig. 480

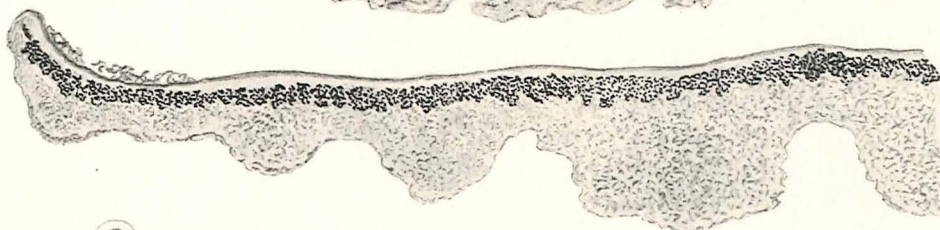


Fig. 476



Fig. 478



Fig. 477



Fig. 475

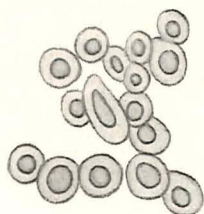


Fig. 479

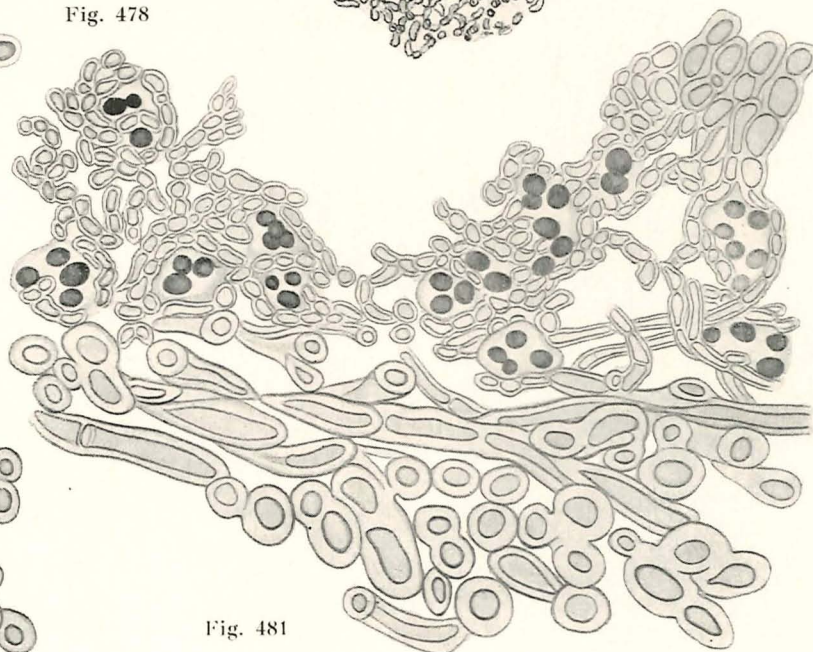


Fig. 481

*O. Gallæ del.*

PELTIGERA SPURIA ACH.



PLATE 77.

PELTIGERA SPURIA.

ACH.

- Fig. 482. Longitudinal section of an apothecium. ( $\times 22$ ).
- Fig. 483. Distal margin of an apothecium. ( $\times 140$ ).
- Fig. 484. Proximal margin of an apothecium. ( $\times 140$ ).
- Fig. 485. Sub-hymenial tissues (of a faintly brownish colour), and hymenium.  
( $\times 632$ ).
- Fig. 486. Ripe asci. The spores are slightly brown. ( $\times 747$ ).
- Fig. 487. Coarse hyphæ from a vein. ( $\times 667$ ).

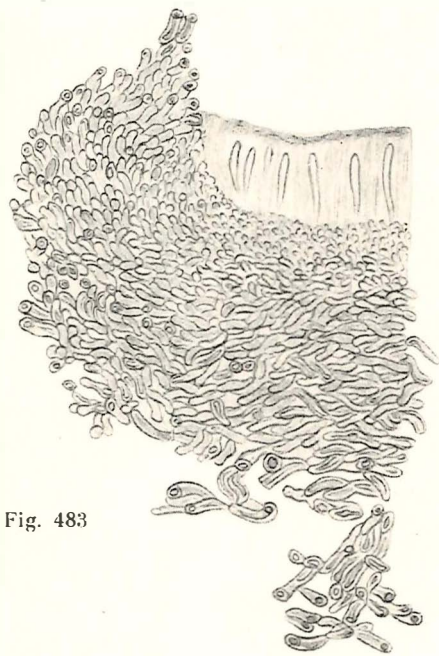


Fig. 483

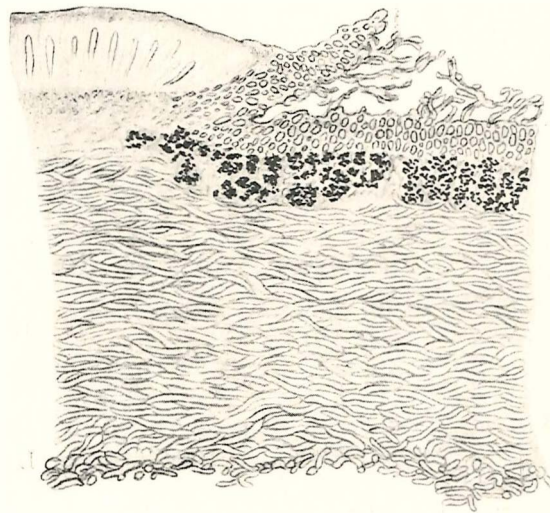


Fig. 484

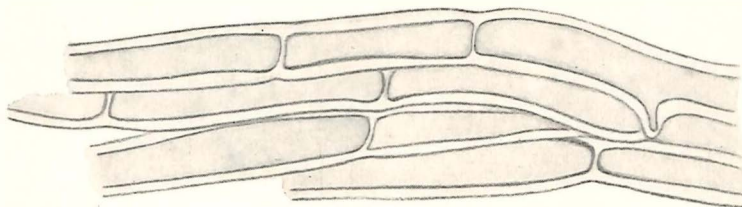


Fig. 487

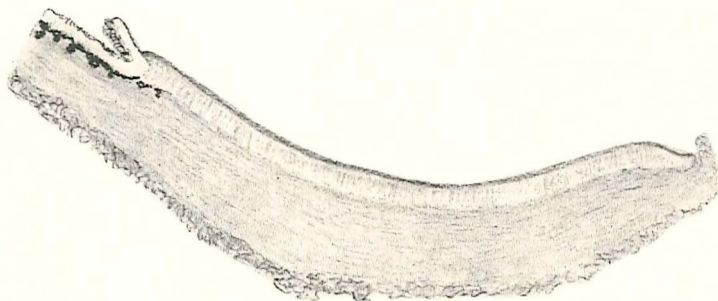


Fig. 482

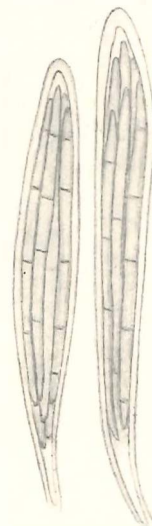


Fig. 486



Fig. 485

*O. Galløe del.*

PELTIGERA SPURIA ACH.

PLATE 78.

PELTIGERA APHTOSA.

L.

Fig. 488. The foremost parts of a lobe of thallus, with cephalodia. ( $\times 3$ ).

Fig. 489. Cephalodia at different stages of development; the four upper cephalodia magnified 33 times, the lowest one magnified 80 times.

Fig. 490. Longitudinal section of a lobe of thallus, with a young cephalodium. ( $\times 90$ ).

Fig. 491. Portion of a very thick section near the centre of the thallus. The thin, light zone above in the section represents cortex, gonidial layer, and the upper part of the colourless medulla; beneath this follows a mighty thick and dark medulla with rhizines. ( $\times 23$ ).

Fig. 492. Longitudinal section through the margin of thallus, showing among other things the transition from cortex to the medulla. ( $\times 608$ ).



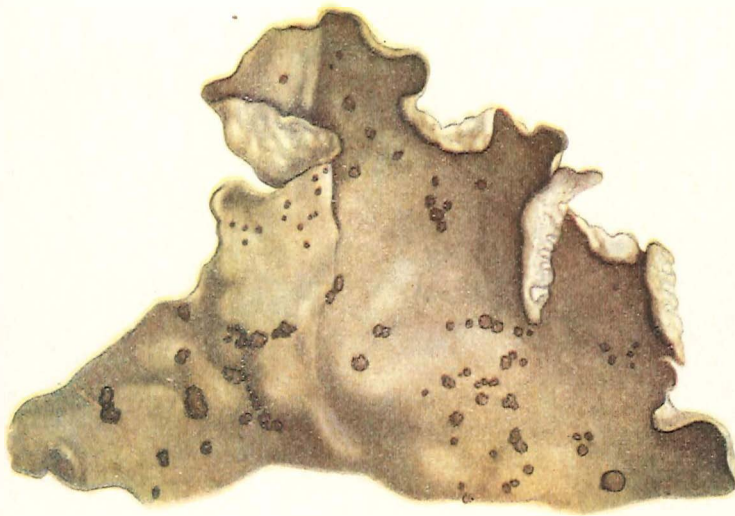


Fig. 488

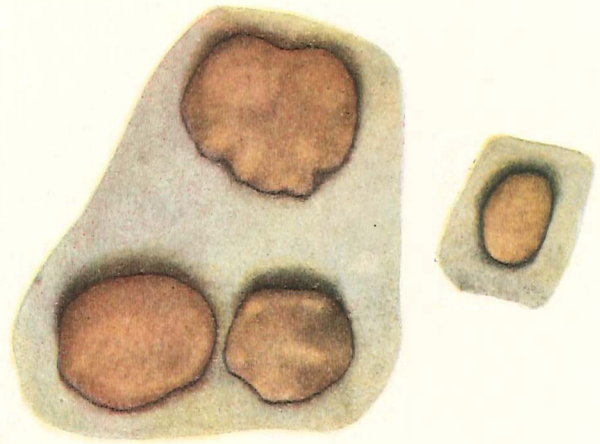


Fig. 489

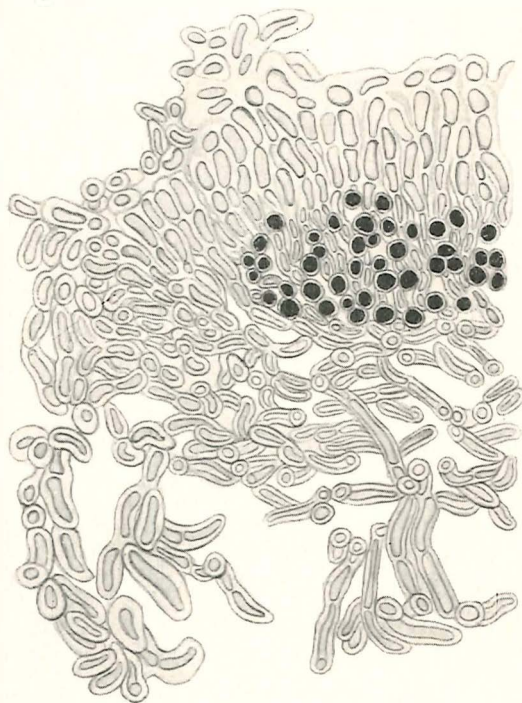
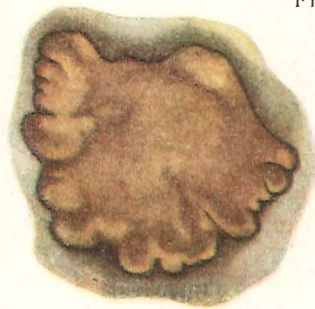


Fig. 492

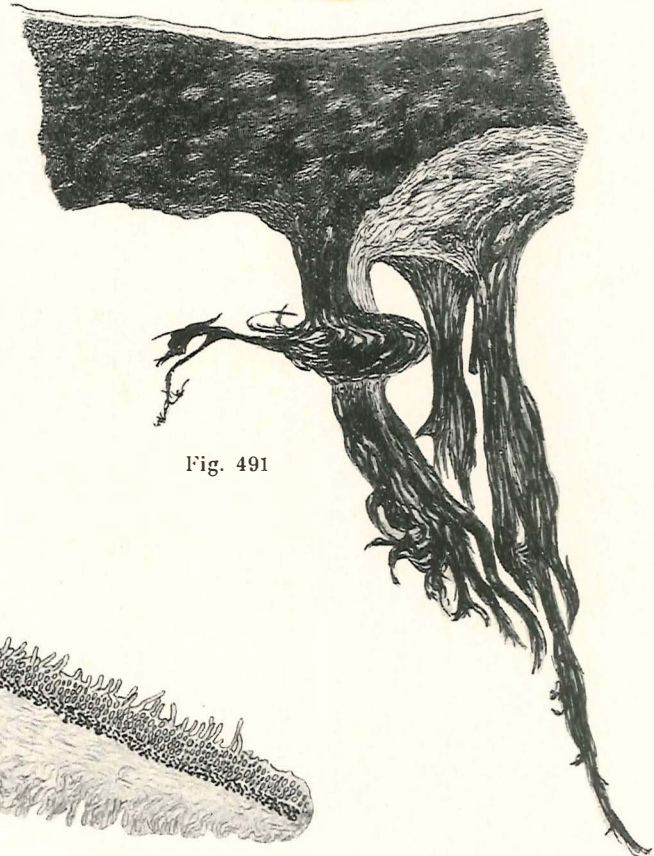


Fig. 491

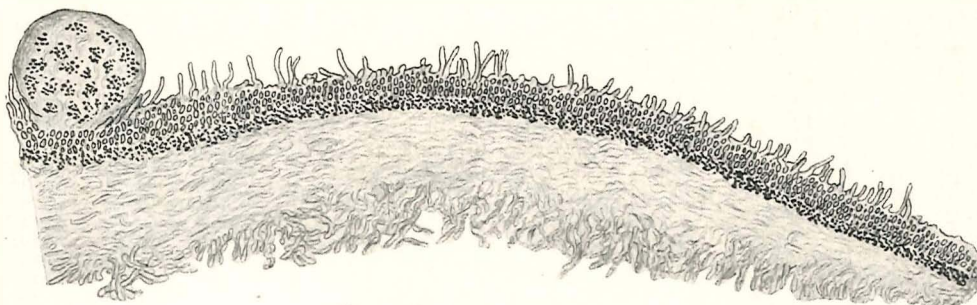


Fig. 490

*O. Galløe del.*

*PELTIGERA APHTOSA L.*

PLATE 79.

PELTIGERA APHTOSA.

L.

Fig. 493. Cortex, gonidial layer, and upper portion of medulla from an older portion of thallus; cut lengthwise. ( $\times 703$ ).

Fig. 494. Cephalodium, resting on the surface of the thallus among the tomentum-hyphæ. ( $\times 697$ ).

Fig. 495. Two confluent cephalodia on the cortex, which latter has gradually altered its structure and become less distinctly pseudo-parenchymatic. The gonidia of the sub-jacent thallus beneath the cephalodia are about to disappear — presumably owing to the over-shadowing caused by the presence of the cephalodia. ( $\times 156$ ).



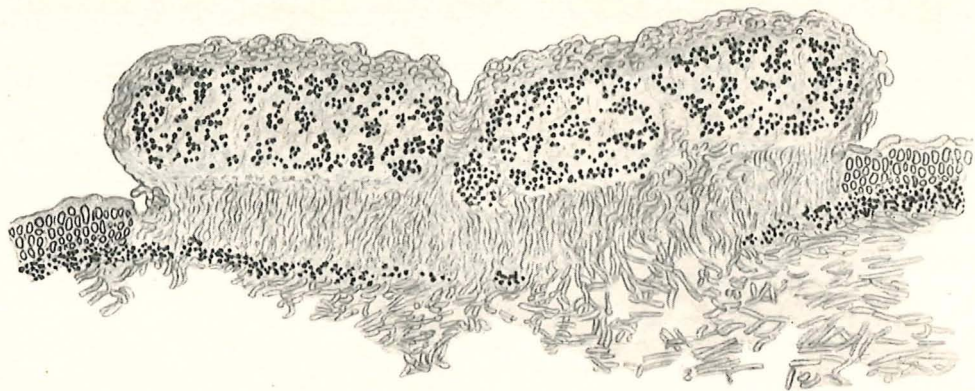


Fig. 495

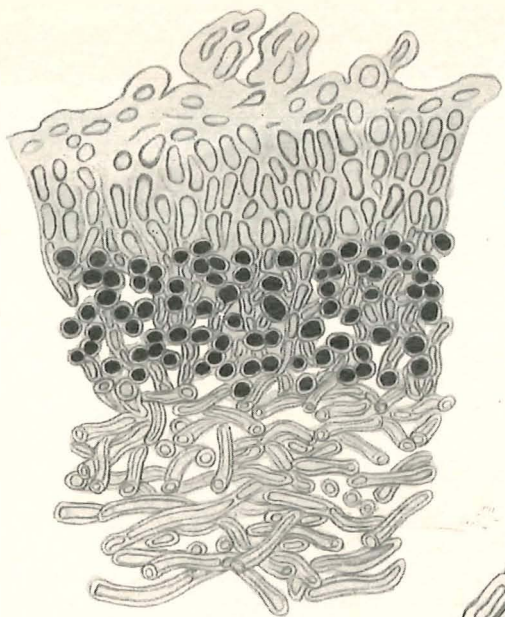


Fig. 493

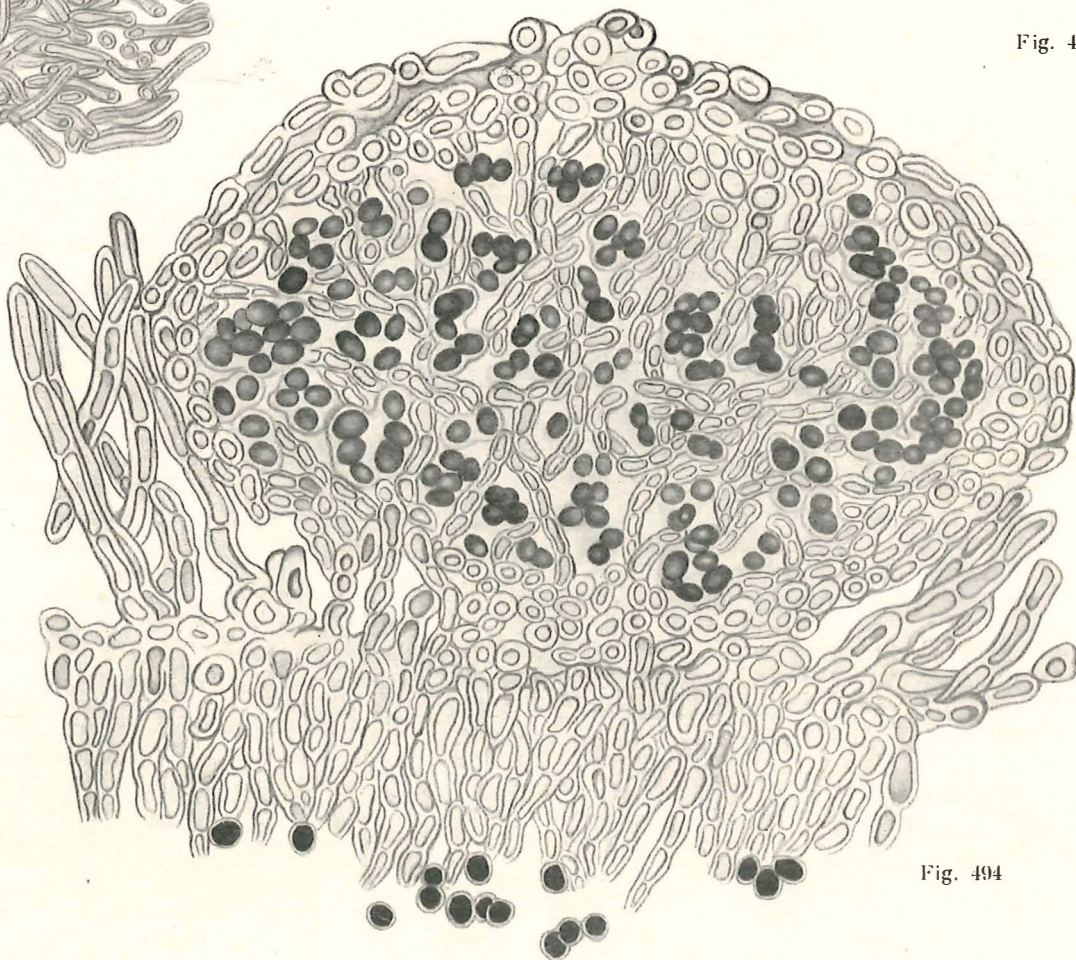


Fig. 494

*O. Gallæ del.*

PELTIGERA APHTOSA L.



PLATE 80.

PELTIGERA RUFESCENS.

WEIS.

**Specimen 1.**

Fig. 496. Top picture: Foremost margin of a lobe of thallus, showing the mode of branching. To the left, a lobe of thallus, turned in such a way that an adventive apothecium is to be seen, formed beneath a normal apothecium. Bottom picture: another lobe of thallus, with a normal apothecium, on the lower surface of which there are two adventive apothecia. ( $\times 3$ ).

Fig. 497. Normal apothecium. ( $\times 4$ ).

Fig. 498. A lobe of thallus, seen from below. ( $\times 4$ ).

Fig. 499. Apothecium, on the lower surface of which there is a very young adventive apothecium, being at the stage of development drawn in Fig. 501, top picture. ( $\times 4$ ).

Fig. 500. Longitudinal section of the margin of a normal apothecium. At the bottom of the section there is an extra-axial section of an adventive apothecium. ( $\times 20$ ).

Fig. 501. Top picture: portion of a normal apothecium; below in the section a young, still closed, adventive apothecium. ( $\times 33$ ). Bottom picture: margin of an adventive apothecium. ( $\times 611$ ). Beside this a ripe spore. ( $\times 672$ ).

Fig. 502. Fully developed adventive apothecium. Above in the section, the hymenium of a normal apothecium. ( $\times 33$ ).



Fig. 496



Fig. 497



Fig. 498



Fig. 499

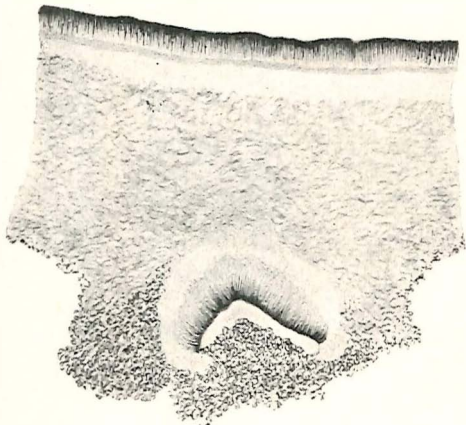
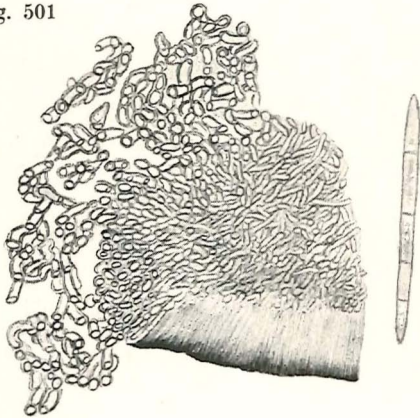


Fig. 501



O. Galløe del.

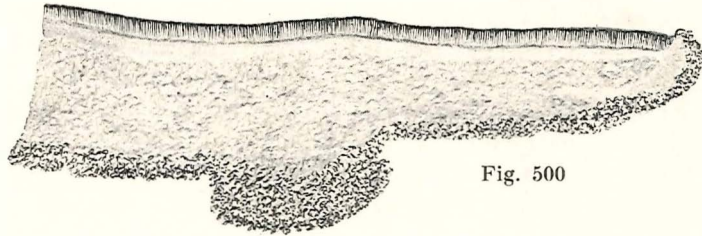


Fig. 500

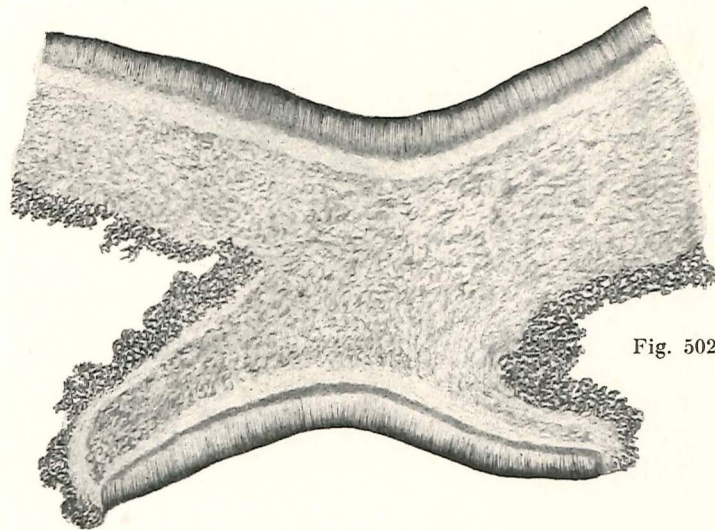


Fig. 502

PELTIGERA RUFESCENS WEIS.  
(Specimen 1).

PLATE 81.

PELTIGERA RUFESCENS.

WEIS.

**Specimen 2.**

Fig. 503. A lobe of thallus with several apothecia, and with isidia along the margin and on the surface. ( $\times 1\frac{1}{3}$ ).

Fig. 504. A lobe of thallus (seen from below), showing reticulate veins and rhizines. Particles of moss, partly dead, partly still living, adhere to some of the rhizines. ( $\times 1\frac{1}{2}$ ).

Fig. 505. Branched isidia on the surface of the thallus. ( $\times 17$ ).

Fig. 506. Apothecium. ( $\times 2$ ).

Fig. 507. Transverse section of thallus, with isidia on the surface and with dark ribs. ( $\times 20$ ).

Fig. 508. Surface of thallus; the upper cells are dead and light; the deeper ones are brown. ( $\times 620$ ).

Fig. 509. Transverse section of thallus with a rhizine, cut lengthwise. ( $\times 750$ ). To the right, two anastomosed rhizoidal hyphæ. ( $\times 750$ ).

Fig. 510. From a cross-section of a dark vein. The hyphæ have chiefly been cut across; their walls are light sordidly-brown. The bottom of the section is identical with the lower surface of the vein. ( $\times 606$ ).

Fig. 511. Cortex from the thallus near the proximal portion of the margin of the apothecium (as in Fig. 514). ( $\times 900$ ).

Fig. 512. Hyphæ from the upper parts of the medulla. ( $\times 620$ ).





Fig. 503



Fig. 504

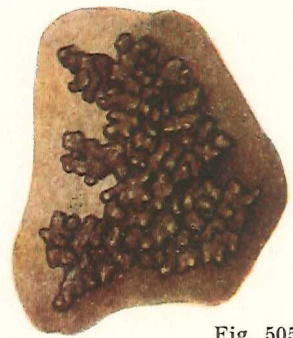


Fig. 505

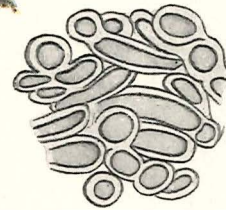


Fig. 512



Fig. 511



Fig. 506

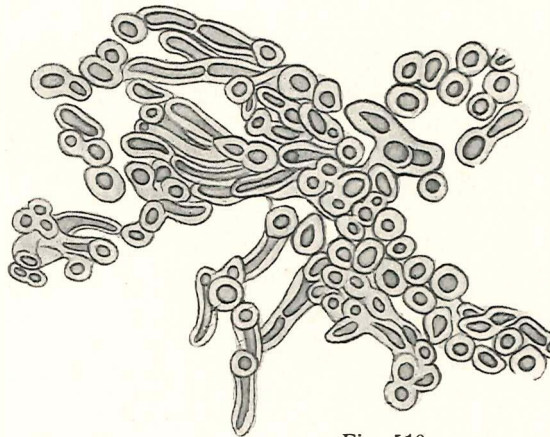


Fig. 510



Fig. 509

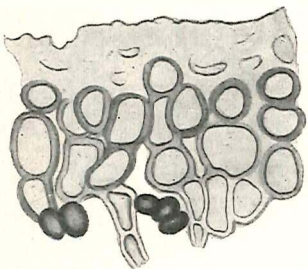


Fig. 508

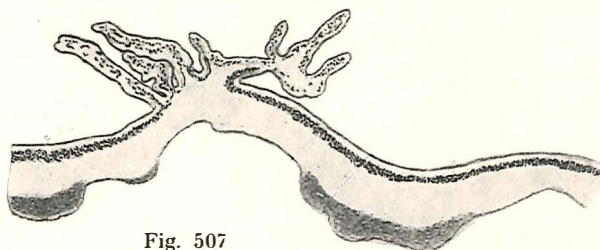


Fig. 507

*O. Galløe del.*

*PELTIGERA RUFESCENS* WEIS.  
(Specimen 2).

PLATE 82.

PELTIGERA RUFESCENS.

WEIS.

**Specimen 2.**

Fig. 513. Distal margin of an apothecium. ( $\times 140$ ). On the free, lower surface of the apothecium, embedded among the medullary hyphæ, there were several small colonies of *Nostoc*; they are dimly seen in the main picture, and one of them has been drawn separately ( $\times 600$ ) to the right.

Fig. 514. Proximal margin of an apothecium. ( $\times 140$ ).

Fig. 515. Longitudinal section of an isidium from the surface of the thallus (compare Fig. 507). ( $\times 620$ ).

Fig. 516. An ascus and an isolated spore. ( $\times 747$ ).



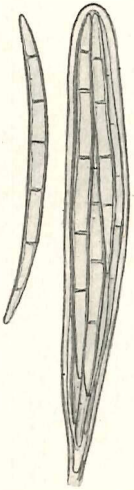


Fig. 516

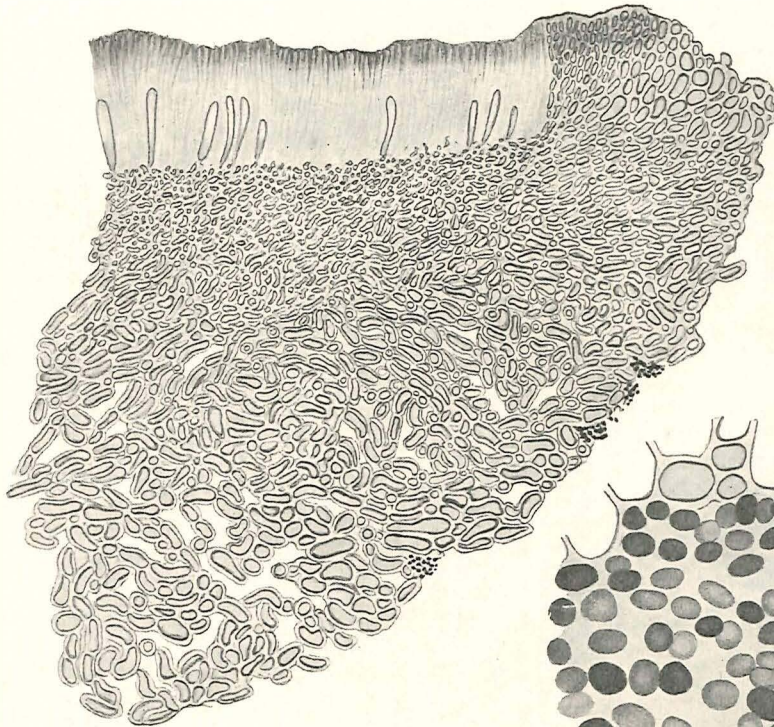


Fig. 513

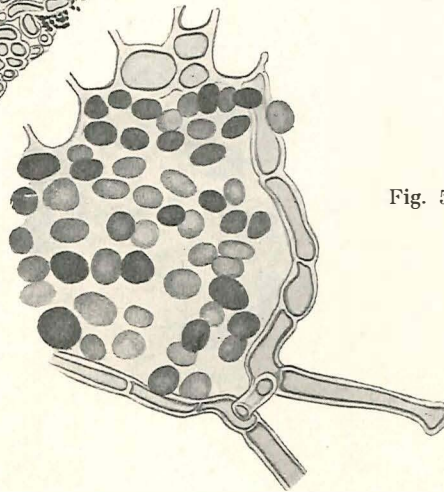


Fig. 515

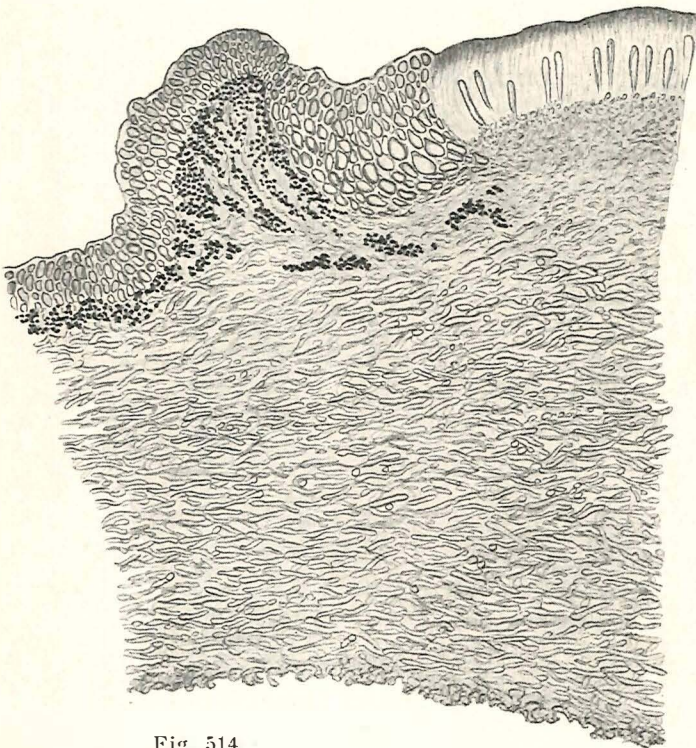


Fig. 514

*O. Galløe del.*

PELTIGERA RUFESCENS WEIS.  
(Specimen 2).

VI P 21b



PLATE 83.

PELTIGERA CANINA.

L.

**Specimen 1.**

Fig. 517. A very young specimen, at the base fixed to the substratum. ( $\times 5$ ).

**Specimen 2.**

Fig. 518. A young, entire, fertile specimen, painted in moistened state. ( $\times 3$ ).

**Specimen 3.**

Fig. 519. An entire, very big specimen (here strongly diminished). Some of the whitish, rhizine-bearing undersides of the lobes of thallus are seen at the bottom of the picture.

Fig. 520. Above, young apothecia, of which two are not yet opened, while the two others have remains of the broken cortex sitting like a veil along the reddish-brown disc of the apothecium. Below, three other apothecia, of which the two to the right are fully ripe.



Fig. 519



Fig. 517



Fig. 518

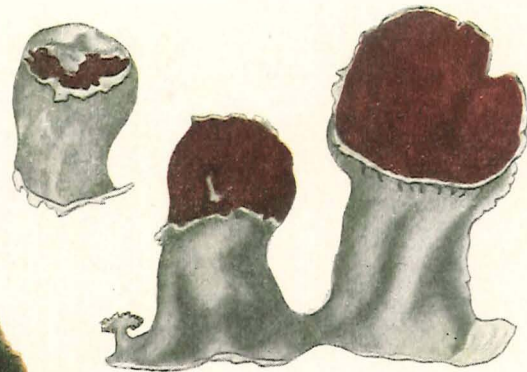
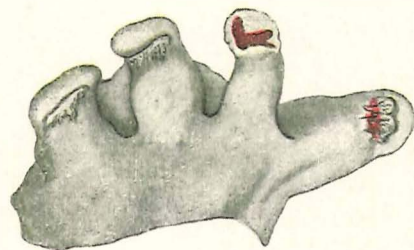


Fig. 520

*O. Galløe del.*

PELTIGERA CANINA L.  
(Specimen 1, 2, 3).

PLATE 84.

PELTIGERA CANINA.

L.

**Specimen 3.**

Fig. 521. Foremost end of a lobe of thallus, showing the mode of branching. Here and there along the edge there are numerous small isidia-like protuberances.

Fig. 522. Lower surface of a lobe of thallus, with veins and rhizines at various stages of development. ( $\times 4$ ).

Fig. 523. Portion of a transverse section of a lobe of thallus, with veins beneath. ( $\times 80$ ).

Fig. 524. Upper surface of thallus, with tomentum-hyphæ. ( $\times 684$ ). Below, an isolated colony of *Nostoc*. ( $\times 1076$ ).



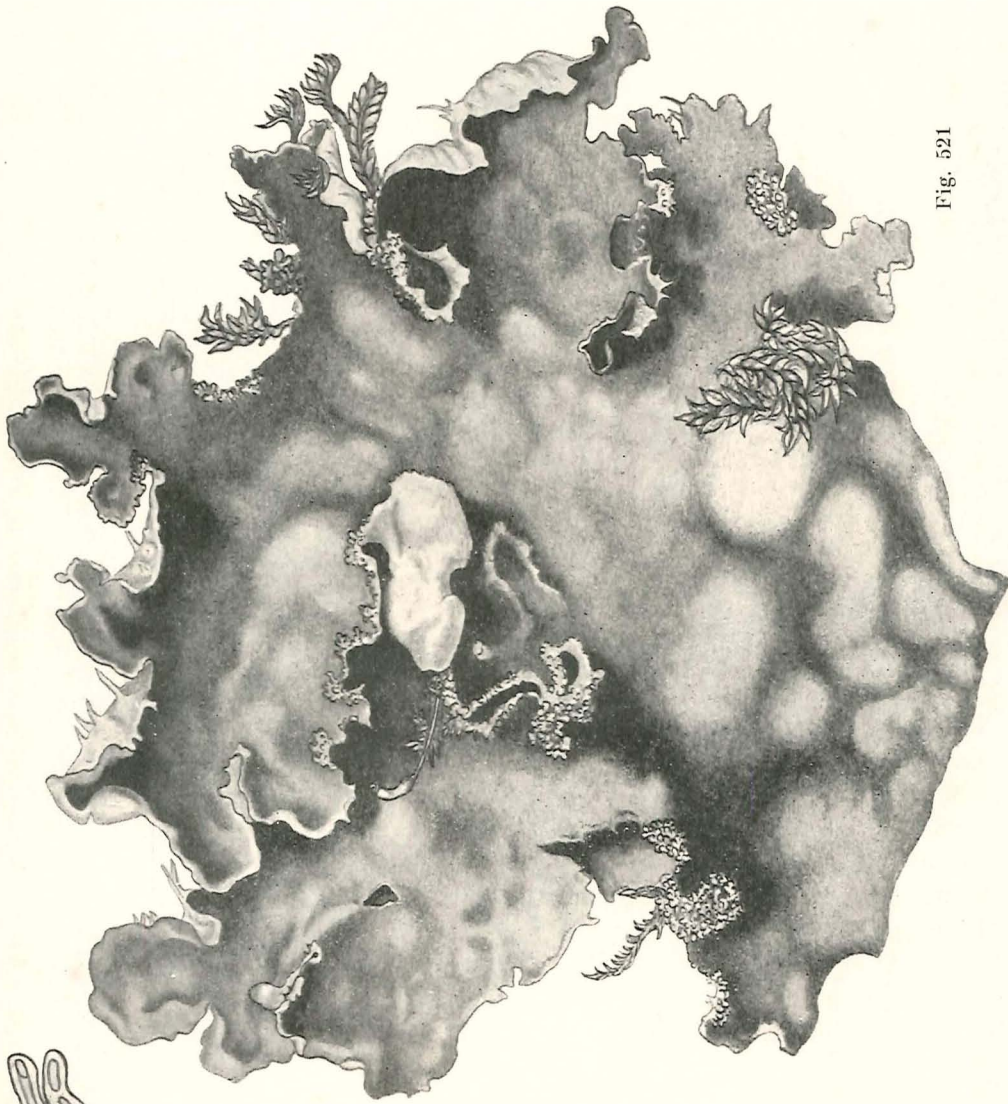


Fig. 521

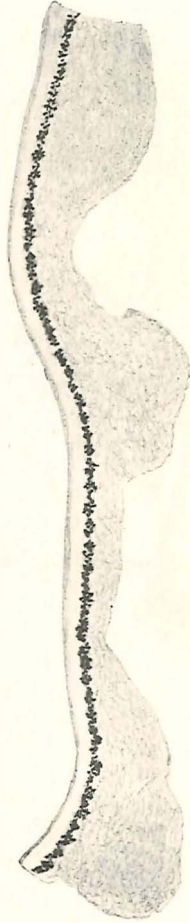


Fig. 523

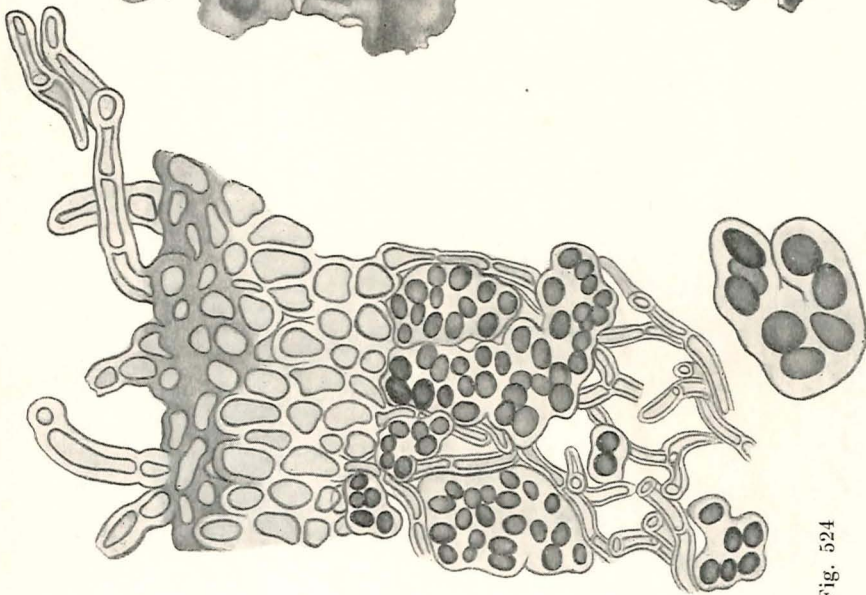


Fig. 524



Fig. 522

O. Galløe del.

PELTIGERA CANINA L.  
(Specimen 3).

PLATE 85.

PELTIGERA CANINA.

L.

**Specimen 3.**

- Fig. 525. Isolated hyphæ from a rhizine. ( $\times 1053$ ).
- Fig. 526. Cross-section of thallus, with a rhizine. ( $\times 80$ ).
- Fig. 527. Tomentum-hyphæ from the surface of the thallus. ( $\times 620$ ).
- Fig. 528. Hyphæ from the felt of the lower surface of the thallus. ( $\times 697$ ).
- Fig. 529. Young, still closed apothecium, cut longitudinally. ( $\times 38$ ).
- Fig. 530. Young, just opened apothecium. ( $\times 38$ ).
- Fig. 531. Ripe apothecium. ( $\times 21$ ).



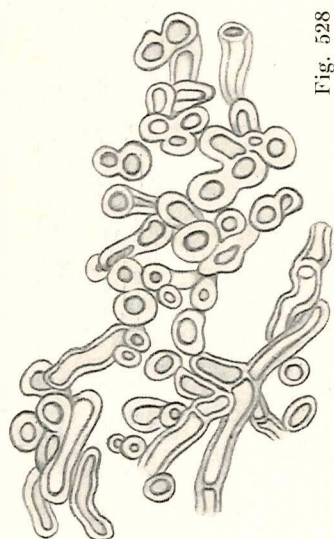


Fig. 528

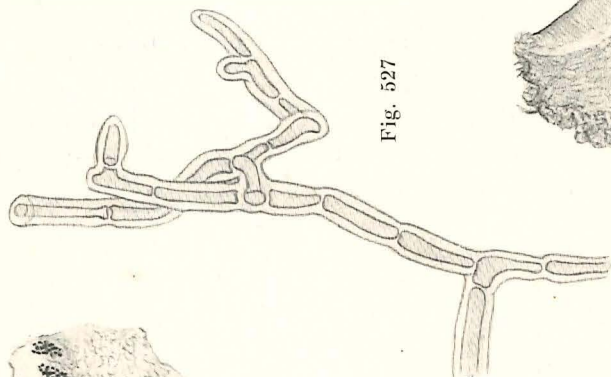


Fig. 527

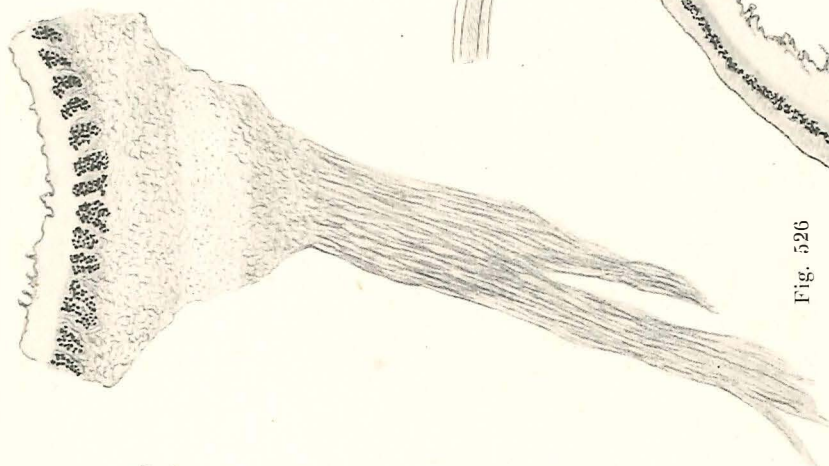


Fig. 526

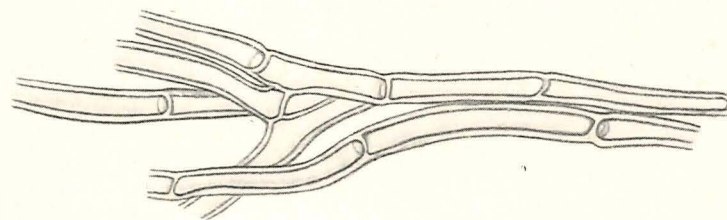


Fig. 525

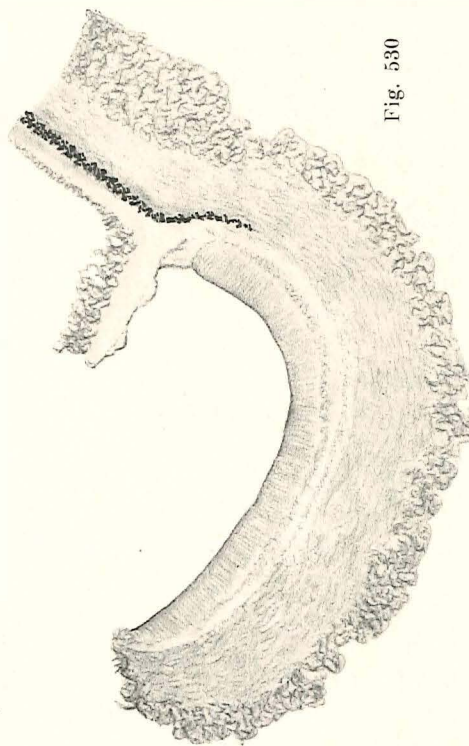


Fig. 530

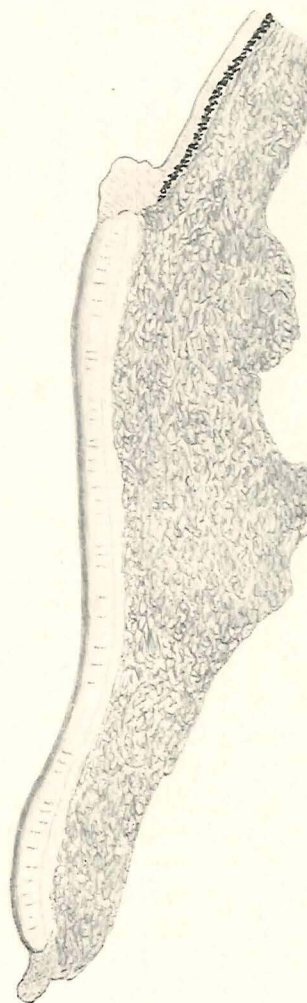


Fig. 531

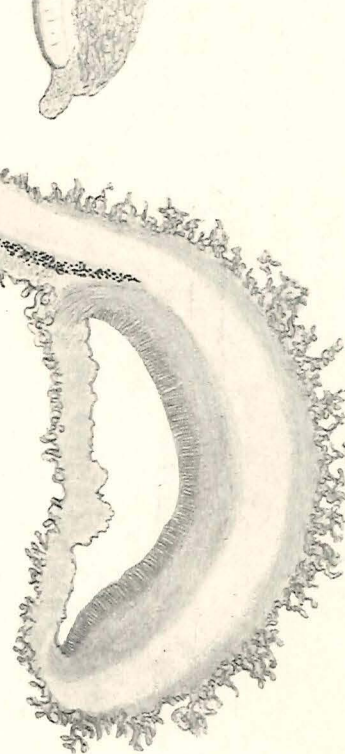


Fig. 529

O. Galløe del.

PELTIGERA CANINA L.  
(Specimen 3).



PLATE 86.

PELTIGERA CANINA.

L.

**Specimen 3.**

Fig. 532. Youngest, macroscopically recognizable, apothecium, with young paraphyses, below which ascogenous hyphæ (for details, *vide* the text). ( $\times 140$ ).

Fig. 533. Special picture of young paraphyses and big ascogenous hyphæ from a primordium of apothecium like the one shown in Fig. 532. Above the young paraphyses is seen the detached cortex with tomentum. ( $\times 697$ ).

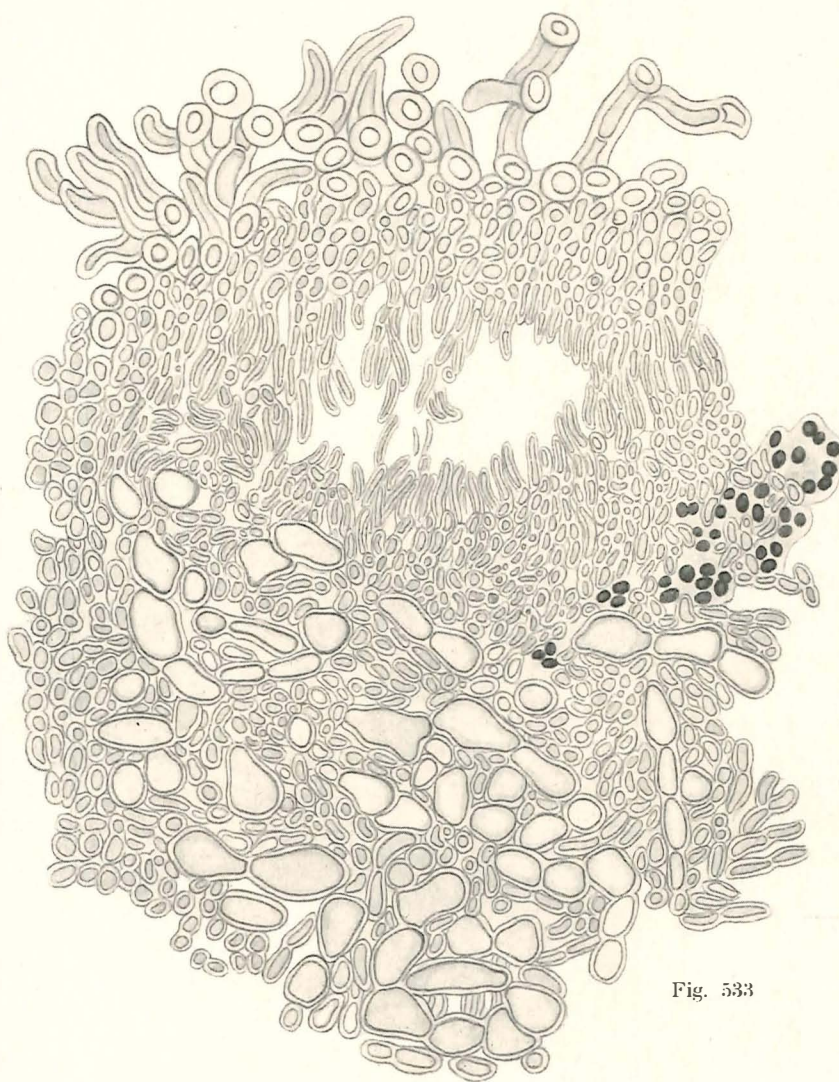


Fig. 533

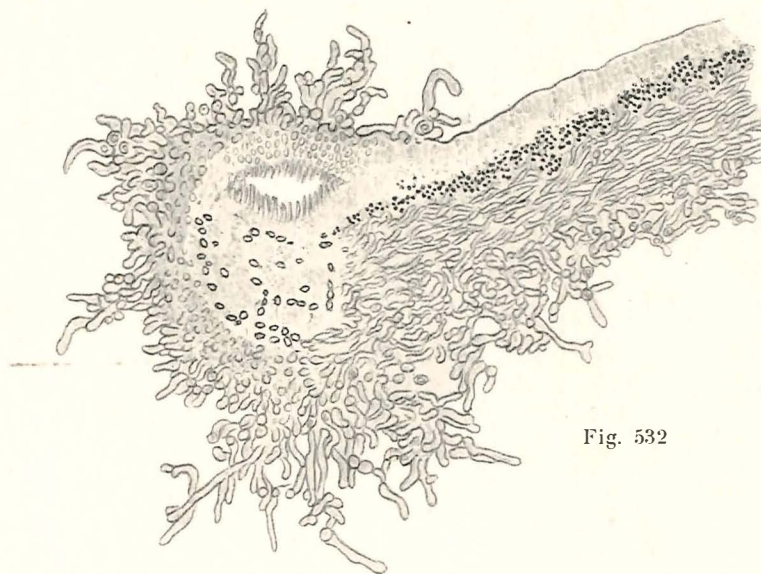


Fig. 532

*O. Galløe det.*

PELTIGERA CANINA L.  
(Specimen 3).

VI P 22b

PLATE 87.

PELTIGERA CANINA.

L.

**Specimen 3.**

- Fig. 534. Longitudinal section of distal margin of an apothecium. ( $\times 140$ ).  
Fig. 535. Proximal margin of the same apothecium as in Fig. 534. ( $\times 90$ ).  
Fig. 536. Hymenium and calyx. ( $\times 600$ ).  
Fig. 537. Asci and paraphyses. Above to the left, surface view of tips of paraphyses. ( $\times 775$ ).



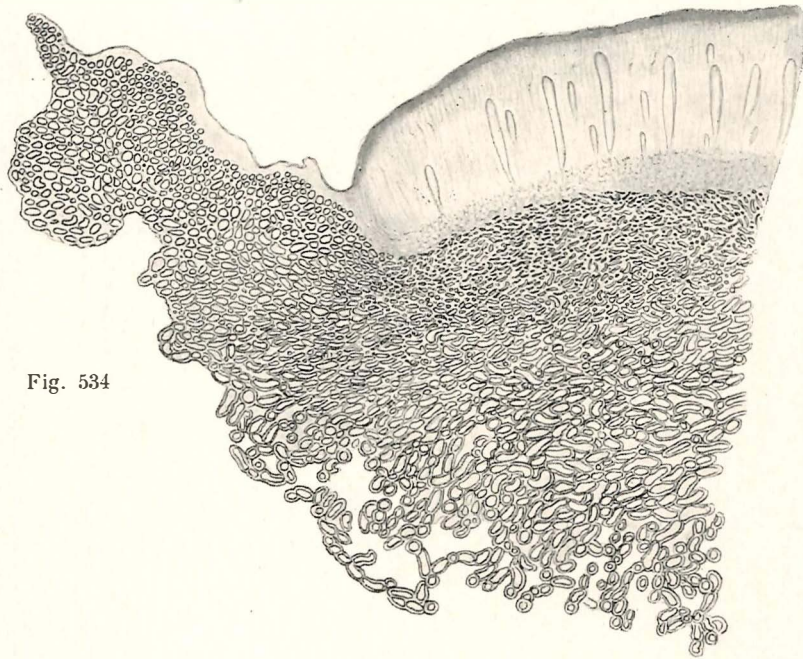


Fig. 534

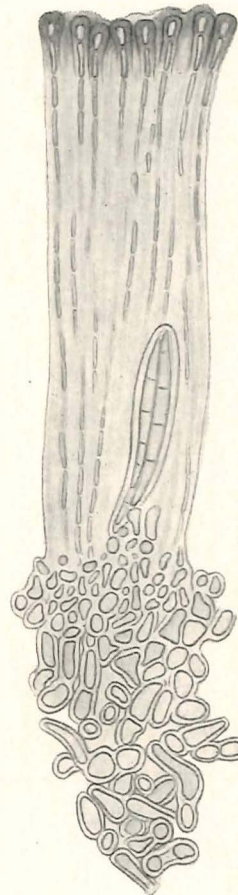


Fig. 536

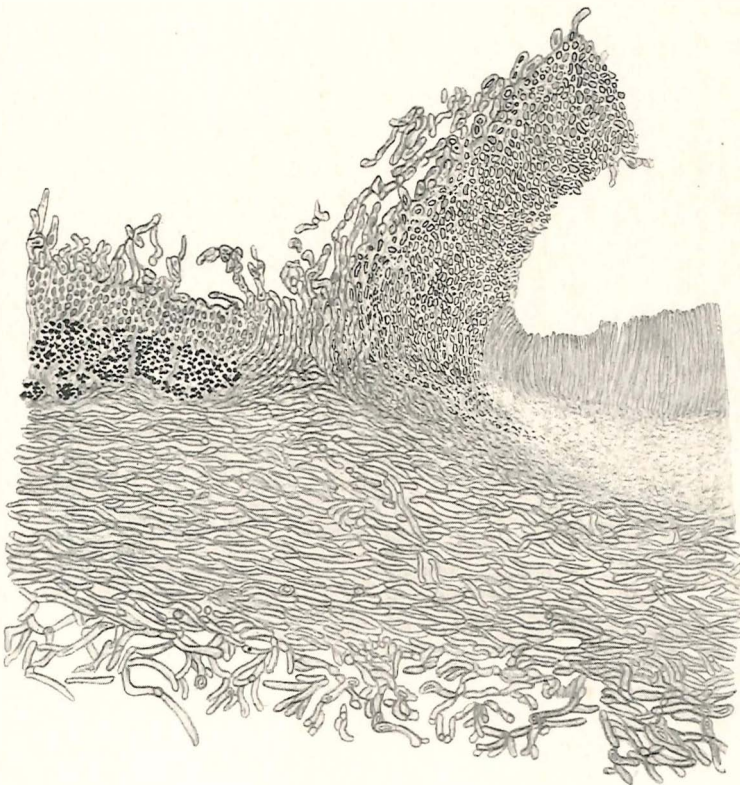


Fig. 535

*O. Galløe del.*

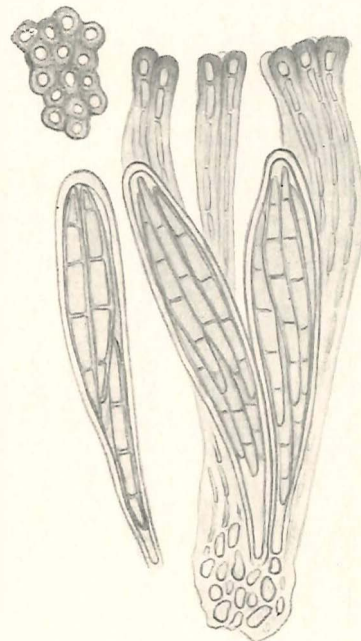


Fig. 537

*PELTIGERA CANINA* L.  
(Specimen 3).

PLATE 88.

PELTIGERA CANINA.

L.

**Specimen 4.**

Fig. 538. Entire thallus, among moss. ( $\times \frac{1}{2}$ ).

Fig. 539. Surface of thallus, to which is attached a rhizine from a lobe, which latter is omitted in the picture. ( $\times 90$ ).

Fig. 540. Two lobes of thallus, one growing over the other, to which it is attached through a rhizine (*vide* Fig. 539 and Fig. 541). ( $\times 5$ ).

Fig. 541. Upper surface of thallus, with cortex and gonidia. At the upper surface of the cortex there are dark, rhizoidal hyphæ coming from another, superposed lobe of thallus, which has been omitted in the picture: this picture corresponds to the conditions shown in Fig. 539 and Fig. 540. ( $\times 602$ ).



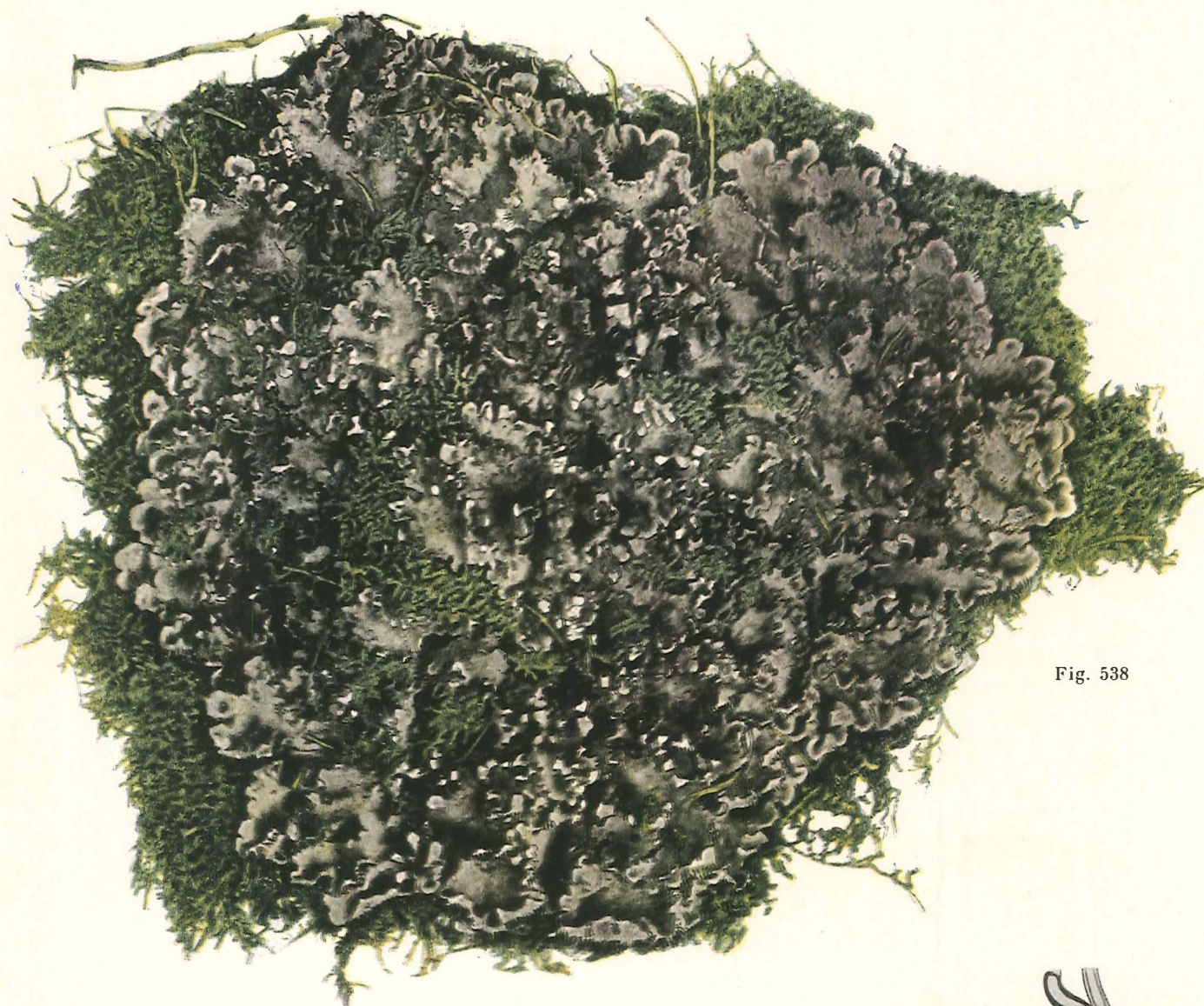


Fig. 538

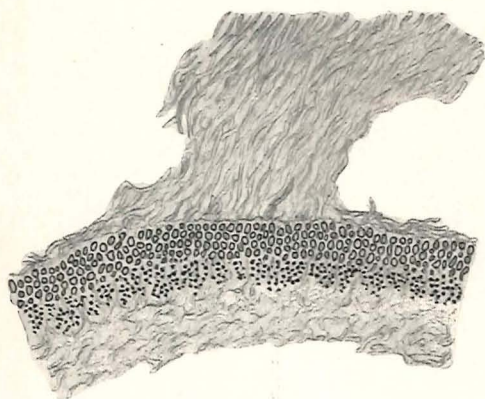


Fig. 539

*O. Galløe del.*

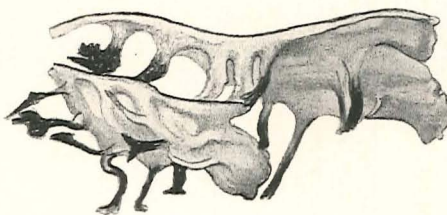


Fig. 540



Fig. 541

PELTIGERA CANINA L.  
(Specimen 4).







