NATURAL HISTORY OF THE DANISH LICHENS

ORIGINAL INVESTIGATIONS BASED UPON NEW PRINCIPLES

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EJNAR MUNKSGAARD
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Omnis vera cognitio speciei
e cognitione individui.

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ASPICILIA Mass.

Phylogeny. In all species belonging to this genus the spore is one-celled and colourless as in the genera *Lecidea* and *Lecanora*, their relationship to these genera being thus unmistakable.

Different hypotheses may be advanced about the origin of *Aspicilia:* 1) All the species may be considered to be descended monophyletically from one species — or 2) polyphyletically from several species — of *Lecidea* or *Lecanora* respectively, or 3) some of the species may be descended directly from *Lecidea*, others from *Lecanora*. Which of these alternatives has actually been realized, is quite unknown.

In this work the species have been arranged in the following way: we begin with the most *Lecanora*-like species, having their apothecia raised above the level of the thallus and being provided with a thalline margin; from these species we pass over to species with entirely immersed apothecia. I am inclined to consider this arrangement as giving a fairly true image of the real phylogeny of the species — beginning with purely lecanorine species and ending with purely aspicilioid species.

The **spore** is colourless and 1-celled in all the species.

The **thallus** is areolate in *Aspicilia cinerea, flavida, gibbosa,* and *contorta,* while it is considerably smoother and more coherent in *Aspicilia calcarea* and *Aspicilia lacustris*. In the greatly areolate species the c o r t e x is thick, with a distinct cuticle. The g o n i d i a are cystococcoid. H a u s t o r i a do not occur. The a p o t h e c i a are developed in the gonidial layer or a little deeper down under the gonidia. There is only a short stipes or no stipes at all; the apothecia are most often immersed.

Soredia were not found in any Danish species.

Pycnidia were observed in *Aspicilia calcarea,* in which species they were developed in the apothecia. For details the description of this species is referred to.

Ecology. All our species are saxicolous, and like many other lichens from rocky substrata they have an areolate thallus with a still thinner inter-areolar thallus. The areoles are usually provided with a thick cortex on their horizontal surfaces, while the sides of the areoles are more thinly corticate.

ASPICILIA CINEREA.

(L) SMRFLT.

(Plate 1—2).

Stone fence. *Halsskov by Korsør.* F. J. MATHIESEN.

The margin of the thallus is wanting in the present specimen. Metathallus is light greyish and areolate. The areoles differ greatly in size, some of them being thin and low, while others are thick and high; all of them have an irregular, angular outline and are connected with each other by a thin, inter-areolar thallus. The surface of the areoles is smooth or slightly uneven. Thallus stains red by addition of K O H.

Cortex has a colourless cuticle of dead, compressed cells; next follow the living hyphæ, the walls of which are brown from a non-granular pigment. The cells of the gonidial layer are colourless, without haustoria. The gonidia are cystococcoid. The cells of the medullary layer are somewhat stretched, often standing fairly perpendicularly on the substratum; they are colourless, or here and there brownish from small granules in the interior of the cells; such cells seem to be dead.

The apothecia are formed by ones or several together in the areoles. At first only the disc is to be seen as a small, concave, roundish, and black dot; later on they have an irregular outline and are provided with a thin, persistent thalline margin and frequently rise somewhat over the level of the thallus. In some of the apothecia the thalline margin is totally wanting, the proper margin thus being the only one existing. In other cases the apothecium is but incompletely surrounded by a thalline margin, whereas the proper margin is never wanting. The apothecia have an exciple, composed of a stipes of much the same structure as the medullary layer of the thallus. The stipes is, however, somewhat lighter and denser than the medullary layer; downwards it passes insensibly into the medulla while upwards it is continued by the calyx. Just below the hymenium the calyx has somewhat irregularly interwoven hyphæ, while its peripheral portions are composed of dense, erect hyphæ forming a rather distinct borderline against the thalline margin, where such a margin is present. Rather numerous ascogenous hyphæ occur in the hypothecium. The paraphyses are very slightly thickened at the tips. The walls of the ripe asci are greatly thickened at the top. They contain eight 1-celled spores, about 14 μ long. The proper margin and the tips of the paraphyses are sligthly brownish-olivaceous; all other parts of the hymenium and calyx-stipes are colourless.

Pycnidia were not observed.

ASPICILIA FLAVIDA.

HEPP.

(Plate 3—4).

Tile on the wall round *Frerslev* Church, *Seeland*.

The margin of the thallus is wanting in the present specimen. Metathallus is thin, sordidly-yellowish, and areolate; the areoles are densely crowded, angular by mutual pressure, and rather plane on their surfaces.

The cortex is thickest on the horizontal surfaces of the areoles and thinner on the perpendicular sides; it is composed of rather erect, living hyphæ, with short cells, the walls of which are stained brown by a non-granular pigment; moreover, on their surfaces they are covered with extremely small brownish granules and, in much smaller numbers, with some big colourless granules. The gonidial layer is looser in texture, with bigger intercellular spaces. The hyphæ are rather short-celled, colourless, without haustoria. The gonidia are cystococcoid. The hyphæ of the medullary layer are rather distinctly erect and somewhat small-celled. In some places the hyphæ are colourless and almost without granules, in other places they are colourless but densely crowded with big colourless granules on their surfaces; finally, they may in places be brown and of much the same structure as the cortical cells.

The apothecia are formed by ones or several together in each areole; in several cases they are contiguous. At first they appear as small black or bluish, pruinose, concave, immersed discs. Later on they rise somewhat over the thallus and are surrounded by a persistent, irregular, sometimes indistinct margin. In the fully ripe apothecia both disc and margin are on the whole of a bluish-white, farinose-pruinose appearance.

The exciple consists of a short, rather distinct stipes of densely interwoven, colourless hyphæ, insensibly passing downwards into the medullary layer; upwards the stipes is continued into a calyx, the bottom of which is of the same structure as the stipes; from there it is continued upwards round the hymenium, above ending as a distinct proper margin, the hyphæ of which are rather dark at the apices, being either brownish or more bluish-green, of the same colour as the paraphyses. When seen macroscopically this margin appears light bluish-white and not at all covered (or at any rate very incompletely covered) by a thalline margin. Such margins were only observed in apothecia situated near the margin of the areoles, where the margin of the areole functions as a margo thallinus. Distinct ascogenous hyphæ occur in the hypothecium. The paraphyses are slightly thickened and bluish-green at the tips; some of them are scantily branched. Asci are broadly clavate; they contain 6—8 colourless, 1-celled spores, about 12 μ long. The tips of the paraphyses are bluish-green, and this colour passes insensibly into the brownish colour of the superficial layers of the apothecial margin; all other parts of the apothecium are colourless.

DEICHMANN BRANTH determined this specimen as an '*Urceolaria calcarea f. farinosa* Nyl.' It differs, however, considerably in structure from *Aspicilia calcarea*.

ASPICILIA GIBBOSA.

ACH.

(Plate 5—6—7—8).

Specimen 1. On a pebble of flint. *Rønbjerg*. TH. JENSEN.

The margin of the thallus is thin and very dark-brownish; the youngest areoles are gradually developed in it, appearing as low, roundish protuberances, which later on expand into roundish, or somewhat angular, convex, smooth, faintly shining, brownish areoles, connected with each other by a thin inter-areolar thallus. Thallus stains very indistinctly red by addition of K O H.

In the examined sections no gonidia were found in the margin of the thallus; it is therefore unknown how the young areoles are provided with algæ. The margin of the thallus has an enormous, dead, colourless cuticle, downwards passing into horizontal hyphæ, the brown colour of which is due to a non-granular pigment mainly deposited in the peripheral layers of the cell-walls. The inter-areolar thallus is almost colourless and of a more delicate structure than the margin of the thallus. The ar have a thick colourless cuticle, gradually passing into a living brown cortex, the upper layers of which have brown cell-walls, stained brown by a non-granular pigment, whereas the deeper layers of the cortex are colourless. The gonidial layer is of much the same structure as the colourless parts of the cortex. There are no haustoria. The gonidia are cystococcoid. The hyphæ of the medullary layer are like those of the gonidial layer. Here and there they are brownish from minute granules deposited on the surface of the hyphæ. The thallus is tightly pressed to the flint substratum but does not send its hyphæ down into it.

The apothecia are formed by ones or in pairs in the areoles; they are small, almost punctiform, immersed, with a small blackish disc, surrounded by a faintly lighter margin.

The exciple consists of a calyx without a stipes. At the base the thin but dense calyx is suddenly displaced by the loosely interwoven hyphæ of the medullary layer. Round the hymenium the hyphæ of the calyx run upwards to the surface of the thallus, where they form a colourless proper margin. Scanty and rather indistinct ascogenous hyphæ occur in the hypothecium. The paraphyses are distinctly thickened at the tips and covered by a cuticle-like, dead, colourless layer. When ripe the asci contain eight big, roundish spores, about 20 μ across. The tips of the paraphyses are olivaceous below the cuticle. All other parts of the apothecium are colourless.

Pycnidia were not observed.

Specimen 2. On sandstone. *Ravnsholt* Plantation, March 1921. O. GALLØE.

The margin of the thallus is indistinct and of the same colour as the areoles and the inter-areolar thallus, a greenish grey. The areoles are very irregular in outline, confluent, here and there provided with a free, squamulous margin, free of the substratum (and corticate on its lower surface); they are rather plane or slightly uneven on the surface, greatly varying in size and thickness.

The upper part of the cortex is dead, cuticle-like; deeper down the cuticle

passes into living hyphæ with walls stained brown by a non-granular pigment; next follow colourless hyphæ. The vertical sides of the areoles are corticate too, but covered by a thinner cortex than the horizontal ones. The hyphæ of the g o n i d i a l layer are colourless, erect, without haustoria. The gonidia are cystococcoid and are wanting in the vertical sides of the areoles. The hyphæ of the m e d u l l a r y layer are colourless, erect, rather densely interwoven.

The a p o t h e c i a are formed without any visible order, by ones or several together in each areole; they are rarely confluent. At first they appear as small, black, concave, immersed discs, surrounded by a prominent light margin; later on they raise their margin somewhat above the level of the thallus, but as a whole the apothecia remain immersed or adnate.

The exciple consists of a short stipes of short-celled, irregularly interwoven, colourless hyphæ, and a calyx surrounding the hymenium and above forming a proper margin around it. A genuine margo thallinus, participating in the growth of the calyx and rising above the level of the thallus, may scarcely be pointed out. Only in cases where the apothecium is situated near the margin of the areole, the latter may assume the character of a margo thallinus. The hypothecium contains distinct ascogenous hyphæ. At their tips the p a r a p h y s e s develop a thick, cuticle-like, colourless epithecium, below which the apices of the paraphyses are greenish-olivaceous. The other tissues of the apothecium are colourless. A s c i are stretched. Unfortunately, no ripe spores were found in this specimen, for which reason it is very difficult to determine this specimen with full cerstainty. I refer it to *Aspicilia gibbosa*, because the thallus does not stain by addition of K O H. As to habit, morphology, and anatomical structure, however, it agrees to a higher degree with *Asp. cinerea*. On the whole, I do not feel sure that the two species are well separated from one another, or whether any natural line of demarcation may at all be established by means of the chemical reaction by K O H, or whether they do not differ more clearly in the shape and the size of the spore, as it appears in my figures of *Asp. gibbosa*, specimen 1, and *Asp. cinerea*.

ASPICILIA CONTORTA.

ACH.

(Plate 9—10).

On granite. *Ferslev* by *Aalborg*. J. BRANTH.

The t h a l l u s has a very thin and narrow margin, of much the same colour as the areoles and the thin inter-areolar thallus, a dark sordidly brownish-grey. The areoles are irregular in outline and rather high; several of them are stipitate and widen at the top into a squamule-like shape. Their surfaces are rather even or slightly uneven. C o r t e x covers the whole of the surface of the areole. Where the surface

is exposed to the light, its outer portions are dead but not markedly cuticle-like, the cell-lumina being visible. All other parts of the cortex are composed of living cells, the walls of which are coloured brownish by a non-granular pigment. The hyphæ of the gonidial layer are rather small-celled, without haustoria. The gonidia are cystoccoid and not present in the vertical sides of the areoles. The hyphæ of the medullary layer are similar to those of the gonidial layer but gradually become more long-celled and loosely interwoven at the vicinity of the surface of the substratum.

The apothecia arise by ones in each areole. At first they appear as small protuberances above the level of the thallus and are provided with radiating cracks. Later on these cracks widen, and the disc becomes visible. When fully developed they have a bluish pruinose disc, surrounded by a whitish, thick, sinuose or crenate margin, the gonidialess margin of the calyx, which downwards insensibly passes into the thallus.

The exciple consists of a calyx without a stipes; the calyx surrounds the hymenium, above forming a thick proper margin distinctly limited to the genuine thallus. The hypothecium contains distinct ascogenous hyphæ. The paraphyses are but slightly broadened at their tips and pass insensibly into an epithecium of dead cells mixed with numerous white crystals, presumably of oxalate of calcium. Asci are big; their walls are considerably thickened at the top; they contain 4—8 roundish colourless spores, which occasionally become irregular by mutual pressure; they measure about 18 μ across. The upper ends of the hyphæ of the calyx (in the proper margin) are brownish-olivaceous; their apical parts, however, may be dead and colourless. All other parts of the apothecium are colourless.

DEICHMANN BRANTH determined the present specimen as a '*Lecanora calcarea L. var. contorta*'.

ASPICILIA CALCAREA
L.

(Plate 11—12—13—14).

On mortar. *Hammershus, Bornholm.* P. HELLBORN 1884.

The thallus is effuse, thin, whitish, with a white margin, coherent; in places, however, faintly cracked or indistinctly areolate, with a rather even surface.

The cortex is thick, composed of rather short-celled, densely interwoven hyphæ; the upper cell-layers are usually dead, with cell-walls slightly coloured brown by a non-granular pigment. In places, however, living hyphæ may occur mixed with the dead hyphæ; numerous white, irregular granules are deposited between the hyphæ. The deeper layers of the cortex are living. The hyphæ of the gonidial layer are somewhat looser in texture, without haustoria. The gonidia are cystococcoid. In the medullary layer the hyphæ are of a loose texture, with

numerous intercellular spaces. Considerable portions of the medulla are almost opaque from granules deposited in abundance between the hyphæ, while other parts of the medulla are much more transparent, without granules.

The apothecia are scanty, very small, somewhat immersed, irregular in outline, with a disc either purely black or covered with a white pruina, surrounded by a low, comparatively thick margin. The exciple has no distinct stipes but a distinct calyx, the bottom of which is composed of dense, short-celled hyphæ, whereas the sides surrounding the hymenium are composed of erect, more long-celled hyphæ, above forming a proper margin. When seen macroscopically the latter passes insensibly into the surrounding thallus; in the anatomical sections, however, the margin is clearly seperated from the thallus. Conspicuous ascogenous hyphæ occur in the hypothecium. The paraphyses are but slightly thickened at the tips and are in places covered with a pruina of remnants of dead cells, mixed with white granules of much the same appearance as those occurring in the cortex. In the ripe asci the cell-walls are greatly thickened at the top. The asci contain 2, 3, or 4 big spores, which are roundish or irregular by mutual pressure, about 20—30 μ across. The upper ends of the paraphyses immediately beneath the pruina and the apical parts of the hyphæ of margo proprius are greenish-olivaceous; all other parts of the apothecium are colourless.

In the anatomical sections three pycnidia were observed. One of these was embedded in the thallus just beside an apothecium; the second one was situated beneath the calyx of the very same apothecium, and the third one in the interior of an apothecium, between the calyx and the hypothecium, continuing from the latter upwards between the hymenium and the proper margin. The three pycnidia were composed of dense, short-celled hyphæ, jointly forming a kind of wall, from the sides af which short-celled conidiiferous hyphæ radiate towards the centre of the pycnide. A thin, rod-like conidium (about 12 μ long) is cut off at the top of each hypha.

ASPICILIA LACUSTRIS

WITH.

(Plate 15—16).

On flint. *Skræm* Heath in *Hanherred, Jutland*. C. FEILBERG.

The thallus is effuse, very thin, light brownish-white, coherent, in places cracked or differentiated into thin areoles, in which the apothecia are formed.

The cortex consists of short-celled hyphæ, which are alive almost to the very surface of the thallus; the upper cell-layers are brownish from a non-granular pigment deposited in the walls of the hyphæ; in addition, numerous granules, small and big, occur between the hyphæ. The deeper layers of the cortex are colourless, somewhat looser in texture, and provided with some few big, colourless granules between

the hyphæ. The gonidial layer is somewhat looser in texture than the cortex. Haustoria do not occur. The gonidia are cystococcoid. The medulla is very thin and narrowly appressed to the substratum, but does not send hyphæ down into it.

The apothecia are formed by ones or some few together in areole-like, thickened portions of the thallus. They have a rather irregular, sinuose, often somewhat oblong, reddish disc, surrounded by a thick, persistent margin, being partly a proper margin, partly a thalline margin.

The exiple has no stipes, but a calyx formed of densely interwoven hyphæ lying beneath the hypothecium and continuing from there upwards round the hymenium, which is thus surrounded by a proper margin. The hyphæ of the latter are brownish at the apices from a non-granular pigment and covered by numerous minute granules. Distinct ascogenous hyphæ occur in the hypothecium. The paraphyses are embedded in a thick hymenial gelatine; they are but slightly thickened at the tips, and their apices are covered by minute, brown granules and are in addition coloured by a brownish, non-granular pigment. The asci are rather slender; they contain 6—8 colourless spores, about 16 μ long. Apart from the mentioned pigments of the paraphyses and the proper margin all the other tissues of the apothecium are colourless.

Pycnidia were not observed.

PLACODIUM

PLACODIUM HILL.

Phylogeny: In our three species the spore is like the spores in *Aspicilia* and *Lecanora*. The genus *Placodium* is no doubt descended from species of *Lecanora*, with which it fully agrees in the structure of the apothecia. The characteristic feature of *Placodium* is, first and foremost, the effigurate, laciniate or even imbricate thallus, which forms a clear transition to the genuine, foliaceous thallus. In this work the species are arranged in a series beginning with the most primitive species, *Placodium circinatum*, which has an appressed thallus; next follow the higher developed *Placodium saxicola* and finally the most differentiated *Placodium cartilagineum*, which in several respects reminds of purely foliaceous lichens.

PLACODIUM CIRCINATUM

PERS.

(Plate 17—18).

On sandstone. In *Funen* (definite locality not recorded). Ex herbario LIEBMANN.

The thallus is orbicular, the central parts somewhat granulose-areolate, the marginal parts radiate and lobulate. The colour of the thallus is cinereous or in places slightly brownish. The marginal lobules spread centrifugally over the substratum and are irregularly dichotomous. Instead of growing equally in thickness the older parts of these lobules gradually become areolate by producing small, low protrusions, which by degrees assume a more marked shape of roundish, low areoles, analogues (or even homologous) to the areoles of *Placodium saxicola;* the only difference is that the inter-areolar thallus in *Pl. circinatum* is of the same colour as the areoles, whereas it is greenish-black in *Pl. saxicola*. The hyphæ of the medulla run, in a large part, horizontally and radially; gonidial and cortical hyphæ issue from these hyphæ; they are partly erect hyphæ and partly downwards turned hyphæ fixing the thallus to the substratum.

The cortex is thick and dense, composed of erect hyphæ, at their top forming an uneven, structureless, brownish or colourless cuticle of dead, compressed hyphæ. The upper parts of the cortex are coloured brown by a non-granular pigment; the deeper parts are colourless and pass insensibly into the gonidial layer, the hyphæ of which are a little less distinctly erect. Haustoria were not observed. The gonidia are cystococcoid. Beneath the gonidial layer follows the medulla, the hyphæ of which are rather irregularly interwoven and densely covered with an almost colourless granular substance. In the deeper layers of the medulla the hyphæ run more markedly horizontally and are free from granules. From these hyphæ a rather dense, colourless tissue of downwards turned hyphæ issues, which certainly do not form a distinct cortex in *Pl. saxicola*. As regards the special structural features of the thalline margin the figures may be referred to.

The apothecia are in part formed distinctly centrifugally, the young ones being situated near the margin of the thallus, the older ones in the central parts of the thallus. Moreover, intercalary young apothecia are apparently formed between the older ones. At first the apothecia have a small, punctiform, brown, plane disc, surrounded by a comparatively thick thalline margin; later on the disc becomes broad, plane, dark brown, surrounded by a well developed thalline margin. The stipes is rather short, dense, and passes insensibly into the calyx, the sides of which are composed of erect, parallel hyphæ, and, moreover, surrounded by a thalline margin. Numerous ascogenous hyphæ occur in the hypothecium. The paraphyses are but slightly thickened at the tips and develop a structureless, cuticle-like epithecium. The asci are clavate; their walls are greatly thickened at the top. They contain 8 colourless spores, about 12 μ long. The tips of the paraphyses are coloured brown from a non-granular pigment. The sides of the calyx are of the same brown colour as the hyphæ of the cortex, whereas the other parts of the apothecium are colourless.

Pycnidia were not observed.

PLACODIUM SAXICOLA.

POLL.

(Plate 19—20—21).

Specimen 1. On a sand-blown stone (porphyry) at *'Engelskmile'* near *Skagen* (the *Skaw)*. O. GALLØE. June 1904.

The thallus is very minute and young; it consists of two small, orbicular, yellow areoles surrounded by a black margin. A pycnide has been developed in the biggest of the areoles. Anatomically this specimen entirely agrees with specimens 2 and 3, for which reason the anatomical details of specimen 3 are referred to.

Specimen 2. Growing in the same locality as specimen 1. O. GALLØE.

The present specimen is somewhat bigger and older than specimen 1. It consists of four areoles surrounded by a black margin. The areoles have begun to develop

into small squamules branching somewhat irregularly dichotomously. Anatomically specimen 2 entirely agrees with specimen 3, to which is referred.

Specimen 3. Growing in the same locality side by side with the two preceding specimens.

The thallus is considerably bigger than in specimens 1 and 2. It consists of a black 'hypothallus', i. e. a very thin thallus, which surrounds all the areoles and squamules like a narrow brim, connecting them with each other in much the same way as does the inter-areolar thallus in numerous, more markedly crustaceous, lichens.

The areoles, which at first are roundish in outline, gradually assume the shape of distinct, appressed lobules, spreading centrifugally over the substratum and branching somewhat irregularly. Longitudinal sections of the lobules show that the hyphæ of the medullary layer and of the margin of the thallus preferably grow horizontally and radially over the substratum. A lower cortex of vertical hyphæ issues downwards, and a gonidial layer and an upper cortex, both formed of mainly ascendent or erect hyphæ, issue upwards from the hyphæ mentioned above.

The cortex consists of erect, living hyphæ with oblong cell-lumina. Above, the cortex passes into a rather homogenous cuticle of dead, compressed cells. The cortex is yellowish from a non-granular pigment deposited in the walls of the hyphæ. The hyphæ of the gonidial layer branch irregularly between the gonidia, but in the (often very broad) interstices between the groups of gonidia the hyphæ are erect and regular in much the same way as in the cortex. No haustoria were found. The gonidia are cystococcoid. The hyphæ of the medullary layer run mainly horizontally: the cell-lumina are oblong. Big intercellular spaces are found between the hyphæ. To begin with the cortex of the lower surface of the thallus are composed of densely interwoven, downwards turned hyphæ, coloured black in the peripheral parts of the cell-walls. Later on, this cortex may develop usually colourless hyphæ, turning downwards towards the substratum, to which they fix themselves like a secondary, dense, colourless cortex; in places, moreover, colourless or dark rhizoids are developed. Along the margin of the thallus the upper cortex gradually passes into the black, gonidialess margin of the thallus, which again is continued into the lower cortex and the rhizoids.

The apothecia are formed partly in centrifugal order, the older ones occurring in the central parts of the thallus, partly developed without any visible order between the previously existing apothecia. They are always formed in the yellow, gonidia-provided portions of the thallus, never in the dark, interareolar portions. At first they are somewhat irregular in outline, rather flat, with a distinct thalline margin, and a somewhat darker ochraceous disc; later on they become greatly convex, and the thalline margin apparently disappears, i. e. it is not to be detected, hidden as it is under the convex disc, although it may always be pointed out in anatomical sections. The thalline margin has chiefly the same anatomical structure as the thallus. Inside it there exists an exciple consisting of a well-developed stipes of thick-walled hyphæ without intercellular spaces: the stipes gradually passes

into a calyx, which is continued into a proper margin of erect hyphæ and also into a hypothecium provided with numerous ascogenous hyphæ. The paraphyses are not at all, or only scantily, branched and slightly thickened at the tips; they form, moreover, a rather structureless, cuticle-like epithecium of dead cells. The asci are clavate, with 8 colourless, 1-celled spores, about 10 μ long.

The tips of the paraphyses and the apical cells of the hyphæ of margo proprius and margo thallinus are faintly yellowish. All the other parts of the apothecium are colourless.

The pycnidia are composed of radial hyphæ, which branch at the apices, each cutting off an oblong conidium (about 10 μ long).

Specimen 4. On a sandblown stone, *Melby Overdrev*. F. MATHIESEN.

On the rocky substratum sit several specimens, the limits of which cannot be made out with certainty. The specimen examined is seen above to the right in the figure. It agrees entirely with specimen 3 in all anatomical details and is pictured here only to demonstrate the morphological habit of fully developed individuals of this species, namely as follows:

The thallus is everywhere adpressed to the substratum; its central portions are crustaceous and areolate, with plane areoles having a very irregular circumference. Each areole is yellow, with a blackish-green margin. The margin of the thallus is composed of radiating, irregularly dichotomous lobules.

The mode of formation and the structure of the apothecia are quite as in specimen 3. The same applies to the pycnidia, which in the present specimen were placed in the lobules near the margin of the thallus.

Specimens 1, 2, 3, and 4, together with other specimens growing side by side with specimen 4, form a series illustrating the processes by which the thallus gradually acquires its characteristic habit. We witness how the lobules at first arise as yellow, irregular areoles on the common, connecting, inter-areolar, blackish-green thallus — how they gradually assume the shape of irregular lobules, among which the central lobules by degrees develop into areoles checking the growth of one another, while the marginal lobules spread centrifugally over the substratum. Owing to the existing irregular incisions the older portions of the lobules by degrees assume the character of areoles, whereas the marginal portions retain the character of lobules.

The inter-areolar, dark thallus is at first very dominant, the areoles being placed at considerable distances from one another. By degrees this state of things is altered simply by the fact that the dark portions of the thallus are transformed into light portions. But remains of the original dark surface are almost constantly preserved as dark margins along the areoles and the lobules. Occasionally the lobules may, even to a considerable extent, remain very dark.

PLACODIUM CARTILAGINEUM.

ACH.

(Plate 22 - 23).

Growing on a thin layer of earth over the stones of a fence facing south. *Ravnsholt* Plantation. March 1921. O. GALLØE.

The thallus is small, pulvinate, composed of numerous small, imbricate squamules, which spread centrifugally over the substratum in the margin of the cushion, whereas they compete for space, overlap and suppress each other and grow in all directions, even centripetally, in the central parts of the thallus. All the lobules of the thallus may be supposed to have arisen as branches of the original young thallus, the shape of which cannot be recognized any longer. The lobules existing at present on the surface of the knoll only represent the comparatively youngest portions of the squamules, the older portions of which are buried, overgrown, and mixed with both dark and light rhizoidal hyphæ issuing from the lower surface of many of the squamules. The outline of the squamules is greatly varying and irregular, as seen in the figures. Apparently, their form and mode of branching are highly dependent on local conditions: they branch in directions where at any time given there is still room to develop another small squamule on an empty spot between those previously existing. The colour of the surface of the squamules is a sordid, rather light greenish-grey with a faint ochraceous shade. On the lower surface they are either rather light or darker brownish in accordance with the anatomical structure of the cortex (vide below).

The cortex of the upper surface of the squamules varies much in thickness and is composed of hyphæ standing tolerably erect; its uppermost layer is dead, cuticle-like, and colourless; deeper down the cells are alive, densely interwoven, with faintly ochraceous walls, apparently coloured partly by a non-granular pigment, partly by a finely granular brownish pigment deposited between the hyphæ. From the cortex dense bundles of long-celled, colourless hyphæ continue downwards between the groups of gonidia towards the medulla, gradually passing into the tissue of the medullary layer. The gonidial layer is loose in texture, composed of rather short-celled hyphæ. No haustoria were observed.. The gonidia are cystococcoid. The medulla is loose in texture, with big intercellular spaces; the cells vary considerably in length and are colourless at the vicinity of the gonidial layer, whereas they become brownish deeper down near the cortex of the lower surface. The latter is composed of brown, short-celled hyphæ; in places, too, by lighter, almost colourless hyphæ forming a rather even cortex in the younger portions of the squamules, whereas the older portions of the squamules issue single hyphæ or bundles of hyphæ from their lower surfaces. These hyphæ function as rhizoids and penetrate into the substratum, hooking on to it, no matter whether it consists of old, dead or dying, portions of squamules or of particles of earth crowded together in the interior of the knoll.

The apothecia are developed in the interior of the squamules, apparently in the gonidial layer. At first they are rather regular in outline, provided with a thick thalline margin and a concave ochraceous disc. Later on, the outline becomes very

sinuose and irregular; the margin becomes crenate; the disc becomes plane and sordidly brownish-olivaceous. The youngest apothecia have a distinct stipes, embedded in the squamule and composed of colourless, thick-walled, very hard, chondroid hyphæ; above, the stipes passes into a thin calyx of erect, long-celled hyphæ surrounding the hymenium and the hypothecium. The outside of the calyx is surrounded by a thalline margin. By degrees the stipes widens enormously in breadth but rather slightly in height, and the greater part of the squamule in which the apothecium is situated is forced to partake in the horizontal increase of the stipes, so that the underside of the whole apothecium simply is identical with the whole of the original squamule; the gonidia thus form a coherent layer beneath the whole of the stipes. The hypothecium consists of short-celled paraphysogenous cells and of somewhat bigger ascogenous cells. The p a r a p h y s e s are unbranched and scarcely thickened at the tips; they are covered with a thin epithecium formed of the dying top-cells of the paraphyses. The a s c i are clavate; they contain 8 colourless spores, about 14—16 μ long. The tips of the paraphyses and the upper parts of the calyx (margo proprius) are faintly brownish-yellowish from a non-granular pigment. The other tissues of the apothecium are colourless; the thalline margin, however, is pigmented like the genuine thallus.

LECANIA

LECANIA MASS.

Phylogeny. The genus *Lecania* is evidently descended from the genus *Bilimbia* and — accordingly — from the more distantly related genus *Lecidea*. If we compare f. inst. *Lecania syringea* with *Bilimbia Naegelii* (*vide* Part II, Plates 56 and 57), the conformity in anatomical details is very obvious. The two species seem unmistakably to be closely related, *Lecania syringea* representing a lecanorine descendant of *Bilimbia Naegelii*. Our three Danish species of *Lecania* are no doubt closely allied, too. I did not, indeed, in any case find 2-celled spores in *Lecania syringea,* and the species thus differs in this point from our two other species, but I dare not maintain that 2 celled spores cannot at all occur in that species. Both 4-celled, 2-celled, and 1-celled spores are found in the closely allied *Bilimbia Naegelii*.

In this work our three species are arranged in a series beginning with *Lecania syringea,* which probably is our most primitive species, while *Lecania erysibe* is placed as the last of the three, being the most differentiated species.

LECANIA SYRINGEA.

ACH.

(Plate 24).

On bark. The present specimen belongs to Museum Botanicum Hauniense and is collected in Denmark; unfortunately no records as to substratum, locality, and collector is given on the label.

The thallus is extremely thin, greyish, without any distinct borderline.

The cortex is composed of living cells without any particular direction of growth. The gonidial layer is loose in texture, short-celled, with plenty of intercellular spaces. Haustoria were not observed. The gonidia are cystococcoid. The medullary and rhizoidal layers are loose in texture, short-celled, and do not show distinct signs of chemically attacking the cell-walls.

The apothecia are scattered over the thallus without any visible order. At first they are rather regularly orbicular with a somewhat flat, ochraceous disc, surrounded by a thick thalline margin. By degrees the disc may become convex, dark-brown; the thalline margin may persist or in part disappear, because it is recurved so much that it becomes invisible when the apothecium is seen from above. Anatomically the margin can always be pointed out. The exciple of the apothecium consists of a well developed stipes of rather dense tissues composed of thin-walled cells. The stipes is continued into a distinct calyx, the sides of which are composed of erect, thin-walled hyphæ, above forming a proper margin. Numerous distinct, ascogenous cells occur in the hypothecium. The paraphyses are either unbranched or somewhat branched at the top, with slightly thickened tips. The asci are rather broadly clavate; their walls are somewhat thickened at the top. They contain 16 colourless, 4-celled spores, about 12—14 μ long. The apothecium has a thalline margin of much the same structure as the thallus; the hyphæ of the cortex, however, are considerably thicker than those of the other parts of the thallus.

The tips of the paraphyses are ochraceous or slightly darker; all other parts of the apothecium are colourless.

Pycnidia were not observed.

According to the label the present specimen was determined by TH. FRIES as a *Lecania fuscella* MASS., and by NYLANDER as a *Bilimbia cyrtella* f. *alniaria*.

LECANIA CYRTELLA.

ACH.

(Plate 25—26—27).

On the bark of *Sambucus nigra, Rosenfeld* Forest, *Seeland.* $^{31}/_{3}$ 1887. FAUSSING.

The thallus is very thin, light greyish, in some places filmy, in others finely granular.

The cortex is chiefly composed of living cells without a distinct direction of growth. The hyphæ of the gonidial layer are irregularly interwoven, rather thin-walled and short-celled. Haustoria were not observed. The gonidia are cystococcoid. The medullary-rhizoidal layer is loose in textxure, with numerous intercellular spaces. The hyphæ do not show any distinct signs of chemically attacking the cell-walls of the substratum.

The apothecia are scattered over the thallus without any visible order, young and old mixed together. They have a rather regular outline and at first a plane, ochraceous disc, surrounded by a thin thalline margin. By degrees the disc increases considerably in size, and becomes highly convex, brown or even dark-brown, and the thalline margin may disappear, i. e. it may be invisible when the apothecium is seen from above. Anatomically the margin can always be pointed out.

The stipes is high, dense, almost without intercellular spaces. At the base it

passes into a loose medullary layer. Upwards it is continued into a calyx with a thick bottom and somewhat thinner sides, above forming a proper margin. Externally the calyx is surrounded by a thalline margin of the same structure as the other thallus. Numerous ascogenous cells occur in the hypothecium. The paraphyses are unbranched or scantily branched, slightly thickened at the tips. The asci are broadly clavate; frequently they contain about 16 colourless 1-celled spores, or far more frequently, 2-celled spores, about 10—12 μ long. The upper parts of the paraphyses and of the hyphæ of margo proprius are light-brownish. All other parts of the apothecium are colourless.

Pycnidia were not observed.

LECANIA ERYSIBE.

Ach.

(Plate 28—29).

On mortar. *Elling* School, *Jutland*. 1876.

The thallus has no distinct margin; it is thin, cracky-areolate. The areoles are irregular in outline, connected with each other at the base, finely granular on their surfaces, and almost sorediose.

There is no distinct cortex as the gonidia may occur to the very surface of the whole thallus or even be lying free on the surface. The hyphæ of the gonidial layer are irregularly interwoven, without any distinct direction of growth; frequently the hyphæ cling to each single alga as an almost dense tissue. Haustoria were not observed. The gonidia are cystococcoid. The medullary-rhizoidal layer is loose in texture, with numerous intercellular spaces; the hyphæ are chiefly erect.

The apothecia are spread over the thallus without any visible order. At first they have a light ochraceous, somewhat flat disc, surrounded by a thin, granular thalline margin; most frequently the disc gradually becomes convex and darker brown, with a thin thalline margin, which apparently may disappear though it can always be made out anatomically.

The stipes is composed of rather densely interwoven hyphæ and is upwards continued into a calyx, the sides of which are rather thin and surround the hymenium with a thin proper margin.

The hypothecium is rich in ascogenous hyphæ. The paraphyses are unbranched, slightly thickened at the tips. The asci are rather narrowly clavate, their walls are thickened at the top; they contain 8 light, 2-celled spores, about 10—12 μ long.

The tips of the paraphyses and of the hyphæ of the proper margin are light ochraceous. All other parts of the apothecium are colourless.

Pycnidia were not observed.

CANDELARIELLA

CANDELARIELLA MÜLL. ARG.

Phylogeny. In the structure of the spores this genus shows some resemblance to the genus *Gyalolechia*, to which it was formerly referred. Otherwise the two genera differ rather much in anatomical details and in pigmentation, as *Gyalolechia* contains parietine, which does not occur in *Candelariella*. It seems probable that *Candelariella* may descend directly from the genus *Lecidea-Psora* or perhaps from a *Biatorina-Bilimbia*. I do not, however, find any unmistakable transition to any of the species examined in the present work. The question of the origin of *Candelariella* must, therefore, remain unanswered till anatomical researches and pictures of foreign species of *Biatorina* and *Bilimbia* living in other countries may be published.

CANDELARIELLA VITELLINA.

EHRH.

(Plate 30—31).

On stone. *Ravnsholt* Plantation, *Seeland*. O. GALLØE 1921.

The thallus is minute, crustaceous, somewhat pulvinate, cracky-areolate. The areoles are finely granular on their surfaces. The margin of the thallus consists of sordidly yellowish, small, roundish and originally distant granules; by degrees these granules develop into extremely small microphylline squamules, which during their further growth gradually unite into an areolate crust. In the latter the microphylline granules compete individually for space, overgrow and suppress each other in several layers.

The uppermost granules, with a free access to light, have a dense cortex of erect hyphæ forming an almost parenchymatic tissue. A thin layer of minute yellow granules of a pigment is deposited on the surface of the cortex. Otherwise the cortex is colourless. The gonidial layer is likewise very dense, almost pseudo-parenchymatic, provided, however, with several intercellular spaces. No haustoria were ob-

served. The gonidia are cystococcoid. In the lower surface of the granules of the thallus the hyphæ are densely interwoven and frequently arranged longitudinally in the granule, when the latter has a distinct, longitudinal axis. In the suppressed and overgrown granules of the thallus the cortex is thinner and less dense, and the yellow granules of pigment lying on the surface is scantier. The g o n i d i a l layer, too, is looser in texture, and the same holds good of the medulla. The gonidia are less numerous and frequently in part discoloured and dying.

The a p o t h e c i a are formed in part in centrifugal order, the young ones being found near the margin of the thallus and the old ones near the centre; besides, the young apothecia are formed, too, intercalarily between the old ones. At first they are rather regularly orbicular, with a dark, yellow disc surrounded by a lighter yellowish, slightly crenate thalline margin; by degrees they frequently become very irregular in outline, with a brown, convex disc and a crenate, lighter thalline margin.

The s t i p e s is very well developed, composed of dense, thick-walled, somewhat irregularly interwoven hyphæ. Above, the stipes passes into a calyx, the bottom of which is of much the same structure as the stipes, while the sides are composed of erect, parallel hyphæ, above forming a distinct proper margin. On the outside the apothecium is covered with a thalline margin of the same structure as the rest of the thallus.

The hypothecium contains numerous ascogenous hyphæ. The p a r a p h y s e s are slightly branched and thickened at the tips. A s c i are rather broadly clavate; their walls are somewhat thickened at the top; they contain a rather considerable number of spores (e. g. 18). The spores are colourless, either 1-celled, and if so, they contain two rather highly refringent granules, or they may be distinctly 2-celled. Yellow granules of pigment are present at the tips of the paraphyses, in the proper margin, and on the surface of margo thallinus. All other parts of the apothecium are colourless.

P y c n i d i a were not observed.

CANDELARIA

CANDELARIA. MASS.

Phylogeny. *Candelaria concolor* resembles *Candelariella vitellina* so much that the two species must be considered as closely allied. The pictures of the two species show their mutual relation so clearly that it is scarcely to be doubted that *Candelaria* simply represents a microphylline and imbricate *Candelariella*. The apothecia of *Candelaria concolor* have not been found in this country, but from pictures of specimens growing in other countries it is evident that the apothecia in all essentials agree with those of *Candelariella*.

CANDELARIA CONCOLOR.

DICKS.

(Plate 32—33).

On bark. *Lyngby* in *Seeland*. December 1932, O. GALLØE.

The thallus consists of minute squamules, which are comparatively distant in some places, whereas in other places they are so densely crowded that they appear as a coherent crust. Any hyphæ connecting the squamules could not be made out with any certainty; thus it is possible that a thallus consisting of many squamules in reality may be an aggregate of several independent individuals. The mode of development of each squamule is as follows: At first the squamule is extremely small, regularly roundish and pulvinate, almost semiglobate. By degrees it develops into a dorsiventral, microphylline squamule, which may either be fixed to the substratum at one side or grow equally in all directions, thus developing into an umbilicate, microphylline squamule. When fully developed the squamule is brightly greenish-yellow on the upper surface and a little paler yellowish on the underside. The margin is variously incised, here and there disintegrated into yellow, globular soredia, presumably serving as means of propagation.

The hyphæ of the squamule form an almost pseudo-parenchymatic, but thin cortex on the upper and lower surface. Numerous yellow granules of a pigment

are deposited on the upper surface. The gonidial layer is likewise almost pseudoparenchymatic. Haustoria were not observed. The gonidia are cystococcoid. In the older, thicker portions of the squamule the gonidial and medullary layers are considerably looser in structure.

A p o t h e c i a have not been found in the present specimen, nor in any other Danish specimen examined by me.

S o r e d i a are globular and yellow.

The p y c n i d i a consist of radial, short-celled hyphæ, each cutting off a short, bean-shaped, or straight conidium.

HAEMATOMMA

HAEMATOMMA. MASS.

Phylogeny. In the structure of the spore *Haematomma* resembles the genus *Bacidia* so much that *Bacidia* may be considered as the probable prototype of *Haematomma*. If we compare *Haematomma coccineum* with e. g. *Bacidea rosella* (Part II, Plates 81—84) and the closely related *Bacidia rubella,* we will find so great anatomical resemblances that it seems very likely that *Haematomma* may have issued from one of these species. A characteristic of *Haematomma* is the occurrence of a markedly red pigment in the hymenium, reminding of the red pigment in some species of *Cladonia*. It would be very interesting to ascertain whether any chemical resemblance exists between the red apothecial pigment in *Bacidia rosella, Haematomma coccineum,* and *Cladonia (cornucopioides, etc.)*. If such a resemblance exists, it would greatly support the supposition of a genetical connection between the said species and genera, which then may have issued from each other in the sequence: *Bacidia-Haematomma-Cladonia.*

A phylogenetic connection of this nature seems also indicated in the structure of pycnidia and conidia, the latter being long, slender, and in part incurvate in the three genera — as shown in my pictures of them. Another rather characteristic feature suggesting a relation between *Haematomma* and the red-fruited *Cladoniæ* is the occurrence in each of them of red-coloured pycnidia — a very rare feature in lichens.

However, this is not the right place to discuss in details the course of the phylogeny of the genus *Cladonia;* many intricate, structural details of great importance to the right solution of the problem cannot be ascertained until explicit, anatomical pictures of *Cladonia, Baeomyces,* and some other genera have been published.

HAEMATOMMA COCCINEUM.

DICKS.

(Plate 34—35—36).

Specimen 1. On the periderm of *Fagus silvatica. Funen. Herbarium* LIEBMANN.

The thallus is crustaceous, pale, yellowish-green, even, with a sorediose surface.

There is no distinct cortex, the whole of the surface being dissolved into

soredia of irregular form, each consisting of some cystococcoid gonidia surrounded by short-celled, irregularly interwoven hyphæ. A medulla of loosely interwoven, short-celled hyphæ is found under the soredial-gonidial layer.

The apothecia are scattered over the thallus without any distinct, visible order. At first they are immersed and only appear as a small, reddish disc on a level with the surface of the thallus. By degrees it rises above the surface of the thallus and then consists of a plane or somewhat convex disc, surrounded by a sorediose thalline margin.

The base of the stipes consists of irregularly interwoven hyphæ, above continuing into a denser calyx with a proper margin, the sides of which are thick and composed of parallel, dense hyphæ. The hypothecium is rich in rather small, ascogenous hyphæ. The paraphyses are long and slender, unbranched and scarcely thickened at the tips. The asci are long, narrowly clavate; their walls are somewhat thickened at the top. They contain 8 oblong, colourless, 4-celled or 5-celled spores.

The tips of the paraphyses and of the hyphæ of margo proprius are faintly reddish-yellow. All other parts of the apothecium are colourless. Calyx-stipes is surrounded by a thalline margin of the same structure as the other parts of the thallus; it is clearly separated from the calyx by a deep furrow.

Pycnidia were not observed.

Specimen 2. Growing on a liverwort *(Frullania),* on the periderm of *Fagus silvatica; Sneptrup.* I. DEICHMANN BRANTH 1884.

The thallus is lighter greyish and even looser and more sorediose in structure than in specimen 1, but is nevertheless of the same structure.

Apothecia were absent.

Pycnidia occur in great numbers. They are of much the same red colour as the apothecia and immersed in the thallus. When fully ripe and opened they are shaped as deep or shallow cups, with a wall of radiating, short-celled hyphæ, each cutting off a long, narrow, rod-like conidium from the top-cell.

On the label DEICHMANN BRANTH determined the present specimen as a *Haematomma coccineum* (DICKS.) cum spermogoniis *('Lepraria latebrarum')'*. Whether this determination was meant to indicate that BRANTH considered every '*Lepraria latebrarum*' to be a form of *Hæmatomma,* is uncertain.

ICMADOPHILA

ICMADOPHILA. TREVIS.

Phylogeny. The spore of *Icmadophila ericetorum* has a great resemblance to the spores in some species of the genera *Catillaria* and *Bilimbia*. If we search for the prototypes of *Icmadophila* among the species of these two genera, we shall have to stop especially at one species, viz. *Bilimbia sphæroides*, which rather often has two-celled spores (*vide* Part II, Plates 60—63). This species resembles *Icmadophila ericetorum* in several anatomical details of thallus and apothecia. There are, in fact, weighty reasons for considering *Bilimbia sphæroides* as the probable lecideïne ancestor of the lecanorine *Icmadophila ericetorum*. The greatly developed chondroid stipes in *Bilimbia sphæroides* is analogous (or even homologous) to that of *Icmadophila ericetorum*, in which, however, the stipes has an extra thalline cover.

ICMADOPHILA ERICETORUM.
L.

(Plate 37—38).

On sandy soil mixed with raw humus. *Borris* Heath, *Jutland*, June 1903. O. GALLØE.

The thallus is crustaceous, pale, yellowish-grey, somewhat cracked, without a distinct mycelial margin. The surface is finely granular; the granules are connected at the base by a common medulla.

The cortex consists of living cells, without a cuticle. The hyphæ of the gonidial layer are irregularly interwoven, small-celled. Haustoria were not observed. The gonidia are rather thin-walled, oblong (the 'Leptogonidia' of TH. FRIES in *Lich. scand.*). Moreover, some considerably bigger *Cyanophycæ* with very thick cell-walls occured here and there. The hyphæ of the medullary layer are likewise short-celled. Long-celled rhizoidal hyphæ issue from the base of the medulla and penetrate into the soil, branching in the substratum.

The apothecia are rather scanty and formed by ones in the granules of the

thallus. At first these apothecia-developing granules only betray themselves by being a little bigger than the common vegetative granules. By degrees, however, the surface becomes deeper reddish-yellow and is transformed into a disc (hymenium), on the surface of which remains of the original cortex may still be found. The disc is surrounded by a crenate or smooth thalline margin. When growing older the apothecia become broad, with a plane or undulate carneolous disc, surrounded by a granular, sometimes incomplete margin.

I have not had the opportunity of meeting with the very youngest, primordial stages of development of the apothecia when they are still an ascogenium embedded in the thallus. At a still very young stage of development, however, they have already, as mentioned above, a very well developed calyx-stipes, composed of dense, thick-walled hyphæ, greatly reminding of the structure of the analogous (or better: homologous) tissue in *Bilimbia sphæroides*. This tissue constitutes the main part of the tissue of the apothecial granule and is upwards continued into a hymenium, exclusively formed of paraphyses without any asci. I did not succeed in pointing out with certainty ascogenous hyphæ (nor young asci) in the hypothecium under the paraphyses. Possibly this fact only signifies that at this stage the ascogonia do not differ clearly from the other hyphæ of the apothecium, for it is scarcely to be believed that the apothecial arrangement described here would have been established unless previously existing ascogonia had set the formation of calyx-stipes and paraphyses at work. The whole of the apothecial granule described here (except the paraphyses) is externally covered with a gonidial layer and a cortex, through which the paraphyses make their way to the surface of the granule.

At more advanced stages distinct, though always very small, ascogonia can be made out in the hypothecium; moreover, asci and a calyx occur. The latter forms a distinct exciple with a proper margin round the hymenium. But remains of the gonidial and cortical tissues of the original granule of thallus persistently surround the mighty stipes-calyx as a thalline margin, highly overreached by the proper margin of the calyx.

The hyphæ of the proper margin are thick-walled and erect. The p a r a p h y s e s are long, slender, and long-celled, slightly thickened at the tips. The a s c i are long; their walls are scarcely thickened at the top. They usually (but not always) contain 8 colourless, 2-celled spores. 4-celled spores are recorded in the literature but did not occur in my preparations.

The tips of the paraphyses and of the hyphæ of margo proprius are faintly reddish-yellow. All other parts of the apothecium are colourless.

P y c n i d i a were not observed.

SCHISMATOMMA

SCHISMATOMMA. FLOT.

Phylogeny. The genus *Schismatomma* is evidently so closely related to the genus *Lecanactis* that it is undoubtedly descended from the latter. In Schismatomma we meet with the structural feature, frequently found in other lichens, that margo proprius gets thinner and more slender when acquiring a thalline margin. This detail is very clearly seen if we compare the structure of the apothecia of the two genera pictured in Part III Plates 1—7 and in Part V Plates 39—43.

SCHISMATOMMA ABIETINUM. EHRH.

(Plate 39—40—41).

On the periderm of *Fagus silvatica*. *Skanderborg Deerpark* 1884.

The margin of the thallus passes insensibly into the substratum without any distinct radiating, mycelial hyphæ. Otherwise the thallus is thin, light greenish-grey, somewhat uneven and cracky.

Here and there the thallus retains traces of a cortex, composed of irregularly interwoven, short-celled, living hyphæ. In other places the gonidial layer reaches the very surface of the thallus. The gonidia may even occasionally penetrate the surface and constitute the uppermost layer. The gonidial and medullary layers pass insensibly into each other; the thallus thus becomes almost homoeomerous, composed as it is of loosely interwoven hyphæ with big intercellular spaces and short cells. Haustoria were not observed. The gonidia are normally *Trentepohlia*, together with which *Cyanophyceæ* of three different types were found embedded in the thallus. Concerning these gonidia, *vide* the figures.

The apothecia are scattered over the thallus without any visible order, young and old mixed together. Usually they have an irregular outline, being sinuose or angular with a black disc and a thin thalline margin; thus they have a lecanorine aspect.

The base of the stipes is formed of irregular and loosely interwoven hyphæ, of which some are distinctly brown while others are colourless. Upwards, this tissue is continued into a more regular tissue of parallel, brown, short-celled hyphæ combined to a well developed calyx, the sides of which are thin and surround the hymenium as a poorly developed proper margin of light-brownish hyphæ. The ascogenous hyphæ of the hypothecium are indistinct. There are two types of paraphyses, brown and colourless, mixed together in the hymenium; both types are branched and brown at the tips. The asci are clavate, slightly thickened at the top; they contain eight colourless, narrow, 4-celled spores, about 30 μ long.

Pycnidia are numerous, embedded in the thallus; they have a dark perithecium of rather concentric, co-axial, erect, brown hyphæ issuing colourless conidiiferous hyphæ, each cutting off at the apex an oblong, thin, colourless conidium, about 5—6 μ long.

SCHISMATOMMA RIMATUM.

Flot.

(Plate 42—43).

On bark. *Vordingborg.*

The thallus is very small, reddish-grey, thin, granular-cracky, surrounded by various other lichens, from which it is separated by a dark borderline. The anatomical structure is almost homoeomerous, composed as it is of very loosely interwoven hyphæ with big intercellular spaces. On the surface of the thallus there are, however, in several places traces of a cortical layer of dense hyphæ. In all parts of the thallus there may occasionally occur very numerous granules of oxalate of calcium between the hyphæ. The gonidia are *Trentepohlia.* Haustoria were not observed.

The apothecia are numerous and scattered over the thallus without any visible order. They are very irregular, with a black, narrow or broad, branched or unbranched, sinuose disc, the form of which greatly reminds of the apothecia in the *Graphideæ.* As each apothecium is placed in a thalline granule, it appears to be surrounded by a thalline margin.

The apothecium has an exciple composed of brown hyphæ. At the base the stipes is insensibly continued into the colourless basal tissue of the thallus; upwards it passes into a brown stipes, composed of short-celled, erect, somewhat winding hyphæ. At the top the stipes gradually passes into a brown calyx, the sides of which are composed of erect, brownish hyphæ surrounding the hymenium. The hyphæ of the hypothecium are very faintly coloured, and the ascogenous cells are but little conspicuous. There are two types of paraphyses, brown and colourless. Both types may be branched at the tips, and all the paraphyses are brown at the top. Asci are rather narrowly clavate; their walls are slightly thickened at the top. They contain eight colourless, 4-celled, often somewhat curved spores, about 35 μ long.

Pycnidia were not observed.

ACAROSPORA

ACAROSPORA. MASS.

Phylogeny. In *Acarospora* the spore-sacs contain numerous, extremely small spores—exactly as in the asci of *Biatorella*. This common feature suggests a relationship between the two genera. *Acarospora* may be considered a descendant of *Biatorella*. This supposition is also supported by the fact that the apothecia of the Danish species of *Acarospora* have a well developed calyx, in part raised above the level of the thallus and imperfectly covered by a thalline margin. *Acarospora* stands in the same relation to *Biatorella* as *Aspicilia* to *Lecidea*.

In our Danish species the thallus consists of minute, irregular areoles, which in *Acarospora smaragdula* have radiating, marginal hyphæ. The areoles coalesce into a common thallus, which undoubtedly in some cases is formed of several, originally independent, individuals. In *Acarospora fuscata* the anatomical arrangement of the hyphæ carries unmistakable evidences indicating that when growing free and unchecked the peripheral areoles have a marginal growth reminding of the growth of foliaceous lichens.

The apothecia arise in the upper part of the gonidial layer, from where they break out through the surface of the thallus. Their structure, when they are fully ripe, is shown in the pictures.

Pycnidia were only found in *Acarospora fuscata*. In some cases they arise near the margin of the areole.

Soredia do not occur in any Danish species.

All our species grow on rocky substrata and are areolate like many other saxicolous lichens. Like other crustaceous lichens they are potentially immortal.

ACAROSPORA FUSCATA.

SCHRAD.

(Plate 44—45—46).

On a stone-fence facing south. *Ravnsholt* Plantation. March 1921. O. GALLØE.

The thallus consists of dark-brown areoles, together forming an areolate crust, the marginal areoles of which spread centrifugally over the substratum and have

a microphylline appearance. The possibility cannot be dismissed that an apparently single thallus may have arisen by coalescence of several, originally independent, individuals. In fact, among the areoles some occur which seem entirely independent of the surrounding areoles, and which are not connected with them by basal, interareolar hyphæ. A real coalescense, or 'grafting,' of originally independent areoles does not take place. They check the growth of each other and compete for space, thus forming an only apparent unity.

The areoles of the marginal parts of the thallus have a microphylline structure. They are incised, branched, appressed to the substratum or in part free of it. As long as there are open spaces for them to grow unhindered, they will chiefly branch horizontally, but being by degrees cramped for room they may be forced to develop imbricate lobules. The older, central areoles have a very irregular outline and an uneven surface. They may have been developed from the marginal areoles, the older parts of which may grow so unequally as to acquire an areolate appearance. But — as mentioned above — they may have been originally independent areoles.

The hyphæ of the deeper layers of the m e d u l l a of the marginal areoles run chiefly horizontally and centrifugally towards the free edge of the areole. Partly ascendent hyphæ forming the gonidial layer and the cortex, partly downwards running hyphæ issue from these horizontal, colourless, loosely interwoven hyphæ. The downwards running hyphæ form a kind of primitive cortex on the underside of the areole, and, moreover, the rhizoidal hyphæ issuing from the lower cortex.

The c o r t e x of the upper surface has a colourless cuticle of dead, compressed cells; it is continued downwards into a thick, living cortex, the upper layers of which are coloured brown from a non-granular pigment, while the deeper layers are colourless. The hyphæ of the g o n i d i a l layer are of a looser texture and are chiefly erect. Haustoria were not observed. The gonidia are cystococcoid. Medulla is thick; its upper layers are composed of ascendent hyphæ, while the deeper layers are composed of horizontal hyphæ; finally, the deepest layers are built of downwards-turned hyphæ continuing into a brown cortex on the underside of the areole. Rhizoidal hyphæ penetrating into the substratum issue from the underside.

The a p o t h e c i a are immersed in the thallus or raised but slightly over its surface. Their margin, however, is more elevated and tumid. At first the apothecia are rather regular in outline; later on they become more irregular. To begin with, the disc is even, later on it is uneven and persistently dark-brown. It is surrounded by a thick margin of the same colour as the thallus and is either of distinctly thalline or frequently of lecideine structure. The e x c i p l e of the epithecium has a well developed s t i p e s of erect, colourless, dense hyphæ; above, it passes into a calyx with a thick bottom and thick sides surrounding the hymenium and forming the thick macroscopically visible margin. To a great extent, consequently, the latter is a proper margin because the thallus only slightly partakes in the growth of the calyx. The tips of the hyphæ of the calyx are brown; otherwise the hyphæ are colourless. Numerous ascogonia occur in the colourless hypothecium. The p a r a p h y s e s are chiefly

unbranched, slightly thickened, and brown at the tips. The asci are long, cylindric-clavate; their walls are slightly thickened at the top. They contain numerous colourless, minute spores, about 4 μ long.

The pycnidia consist of colourless, radial hyphæ with acrogenous, short, colourless conidia of much the same shape as the ascospores.

ACAROSPORA SMARAGDULA.

WNBG.

(Plate 47—48).

On a fragment of a red tile. *Skagen.* E. WARMING 1896.

The thallus consists of numerous minute areoles, which in some places are densely crowded, while in other places they are dispersed, with broad interstices. The specimen described here is undoubtedly composed of numerous originally independent individuals. On the other hand, it cannot be refuted that an individual originally consisting of one areole is able by degrees to form several fresh areoles: the radiating, marginal hyphæ of the areole take in fresh algæ, thus founding new areoles side by side with the previously existing ones.

Young areoles have a roundish outline and are lowly pulvinate with even or somewhat warty surfaces, sometimes with traces of concentric, shallow furrows. The areole has radiating, black marginal hyphæ, from which fresh areoles may originate, presumably in places where the hyphæ take in fresh algæ. Older areoles may gradually become more irregular, incised at the margin. The colour is dark olivaceous.

The hyphæ of the areoles stand everywhere rather erect when seen in relation to the actual surface of the thallus, whether this surface is that of the morphological upper or lower surface, or of the margin of the areole. The hyphæ are rather short-celled, and on the upper surface of the thallus they form a cortex, covered with a thin, colourless cuticle of dead, compressed cells. Below the cuticle the upper layers of the cortex are coloured brown by a non-granular pigment, while the deeper layers are colourless. The hyphæ of the gonidial layer have no haustoria. The gonidia are cystococcoid. The medulla is thick, colourless, and downwards it is continued into a somewhat denser tissue near the surface of the substratum. Rhizoidal hyphæ and radiating marginal hyphæ issue from this very primitive lower cortex round the margin of the areole.

The apothecia are formed by ones or several together in each areole. They are immersed in the areole — the disc on a level with the surface of the areole — and surrounded by a thick, prominent margin, which is chiefly a proper margin as most often no gonidia are found.

The apothecia have an exciple consisting of a calyx with a thick bottom of colourless, short-celled hyphæ, and with thick sides of erect, colourless, short-celled hyphæ surrounding the hymenium and above forming a thick, prominent proper margin. The apical cells of the hyphæ of the calyx are brown. A distinct elongated stipes does not occur. The ascogenous hyphæ of the hypothecium are not markedly conspicuous. The paraphyses are unbranched, slightly thickened, and brown at the tips; they are covered with a cuticle-like, colourless epithecium. The asci are long and narrow; their walls are somewhat thickened at the top. They contain numerous, minute, colourless spores, about 2 μ long.

Pycnidia were not observed.

ACAROSPORA VERONENSIS.

MASS.

(Plate 49).

On sandstone. *Ranum, Jutland.* TH. JENSEN.

The thallus is very small, dark-brown, composed of areoles. At first the areoles are roundish or somewhat incised and plane. Later on they become more irregular and confluent. Some few radiating, dark hyphæ connecting the areoles issue from their lower surface. The possibility cannot, however, be dismissed that a single specimen may have arisen by aggregation of several, originally independent individuals.

The cortex is big-celled, above coloured brown by a non-granular pigment. No cuticle was found. The hyphæ of the gonidial layer are loosely interwoven, rather short-celled. Haustoria were not observed. The gonidia are cystococcoid. Medulla is looser in texture with copious intercellular spaces; below, it passes into a very primitive lower cortex of erect, short-celled hyphæ, almost without intercellular spaces.

The apothecia are immersed in the thallus; their disc is on a level with the surface of the thallus and surrounded by a comparatively thick proper margin.

The apothecium has an exciple, consisting of a calyx almost without stipes. The bottom of the calyx consists of colourless, short-celled hyphæ; the sides of the calyx consist of erect, colourless, short-celled hyphæ surrounding the hymenium and above forming a thick proper margin, the top-cells of which are dark-brown. A genuine margo thallinus does not occur, because the apothecium is immersed. The hypothecium contains distinct ascogonia. As a rare exception the paraphyses are poorly branched and slightly thickened at the brown tips. The asci are long and slender; their walls are faintly thickened at the top. They contain numerous minute, colourless spores, about 4 μ long.

Pycnidia were not observed.

ACAROSPORA HEPPII.

NAEG.

(Plate 50).

On flint. By the Firth of *Skelskør, Seeland.* J. BRANTH.

The thallus consists of a single, somewhat angular and plane areole with a margin which in places is a little darker than the otherwise light grey areoles. (Several areoles occur on the substratum, but they do not seem to be mutually connected, each thallus consisting of a single areole as in the specimen described here).

The areole has a colourless cortex of chiefly dead, compressed hyphæ. The gonidial and medullary layers are loose in texture, with numerous intercellular spaces between the colourless, short-celled hyphæ. Haustoria were not observed.

The apothecia were grouped four together in one areole (in another areole, an independent individual, only one apothecium was found). They have a light, somewhat transparent, reddish-grey disc, surrounded by a thick reddish-grey proper margin. Being immersed the apothecia have no genuine margo thallinus.

The exciple of the apothecia consists of a well developed calyx without a genuine stipes. At the bottom of the calyx the hyphæ are densely interwoven and run horizontally; from this bottom the hyphæ continue upwards into a very well developed proper margin of densely interwoven hyphæ surrounding the hymenium. Numerous ascogenous hyphæ occur in the colourless hypothecium. The paraphyses are thin; in one single case two anastomosed paraphyses were observed. The paraphyses are not thickened at the tips, and the upper layer of the hymenial gelatine is coloured faintly reddish from a non-granular pigment. A cuticle-like, colourless epithecium is situated above this layer. The asci are long, almost cylindric or somewhat clavate; their walls are a little thickened at the top. They contain numerous minute, colourless spores, about 3 μ long.

Pycnidia were not observed.

OCHROLECHIA

OCHROLECHIA. MASS.

Phylogeny. The species belonging to this genus are often referred to the genus *Lecanora* on account of their one-celled spores. But they differ from other, undubious species of *Lecanora* in the exorbitant size of the spores and in the long, slender, branched, and anastomosed paraphyses. If the descent of *Ochrolechia* from *Lecanora* were to be maintained, we have as yet no knowledge of unmistakable, intermediate forms between the two genera; in Denmark, at any rate, we have no such plants. Otherwise the genus *Mycoblastus* agrees in some points with *Ochrolechia,* the former genus having long, slender, branched paraphyses and very big spores (*vide* Part III, Plates 40—43). Whether *Ochrolechia* is descended from *Mycoblastus,* and if so, through which intermediate links, cannot be ascertained but only be suggested.

As to the natural history of the Danish species the descriptions are referred to.

OCHROLECHIA PARELLA.
L.

(Plate 51—52—53).

Specimen 1. On a small, flat stone. *Nexelø* 1923. F. MATHIESEN.

The thallus has a whitish thin margin, which gradually passes into a light yellowish-grey metathallus. The younger portions of the latter are rather thin and are indistinctly subdivided into confluent areoles, the surface of which is uneven, warty. The older portions of the thallus are distinctly areolate, with considerably thicker, well defined areoles, which are very irregular in outline, with an uneven surface.

The cortex is thick, with minute intercellular spaces and short cells, which are alive quite up to the very surface of the thallus, where they are approximately entirely hidden under a layer of big, yellowish, roundish granules of a substance which was not subjected to chemical examination.

The hyphæ of the gonidial layer have the same structure as those of the cortex. Haustoria do not occur. The gonidia are cystococcoid. The medulla is considerably looser in texture and is composed of big, somewhat stretched cells, which in several places are joined in parallel bundles and contain plenty of air in the intercellular spaces.

The apothecia are spread evenly over the thallus. At first they have a thick, somewhat irregular margin and an almost invisible small disc, which gradually widens and gets a granular surface. The margin is of much the same colour as the thallus; the disc is faintly lighter. There exists a distinct calyx, above forming a proper margin, which, however, is only visible in anatomical sections. The calyx entirely surrounds the hypothecium and the hymenium; its bottom is very thin and has no distinct stipes; on the contrary, several gonidia occur under it. The calyx is composed of densely interwoven, short-celled hyphæ. In the upper portions of margo proprius the same big granules are found as in the cortex. The hypothecium is colourless and built of small paraphysogenous and bigger ascogenous hyphæ without intercellular spaces. The paraphyses are long, slender, winding, branched at the tips and provided with an indistinct epithecium. In the upper parts of the hymenium numerous very small, yellowish granules occur in the hymenial gelatine. The asci are big, with thick walls; they may contain up till 8 spores, although the number is frequently smaller. The spores are about 75—80 μ long; they are colourless, 1-celled, often provided with oil drops. All the tissues of the apothecium are colourless, apart from the above-mentioned light-yellow granules in margo proprius and in the hymenium.

The calyx is entirely surrounded by a mighty thalline margin. The borderline between the thalline and the proper margins is not morphologically recognizable.

Pycnidia were not observed.

Specimen 2. On stone. *Frederiksdal.* HERBARIUM LIEBMANN.

This specimen agrees with specimen 1 in every detail, morphologically and anatomically; its apothecia are, however, must bigger than those of specimen 1, but their anatomical structure completely agrees with specimen 1.

OCHROLECHIA TARTAREA.

L.

(Plate 54—55).

On a heath near *Vilsted*, on the ground. TH. JENSEN.

The thallus is light reddish-grey and spreads on the ground over dead remains of *Cladonia*-podetia and other plant-remnants. It is filmy but very slightly coherent as it expands from one remnant to another and thus follows all the irregularities of the substratum. The upper layers of the cortex are dead and cuticle-like while the deeper layers are living, rather short-celled; the walls of the latter are coloured

faintly brown by a non-granular pigment. The g o n i d i a l layer is a little looser in texture and short-celled. The gonidia are cystococcoid. Haustoria were not met with. The m e d u l l a is loose in texture, composed of hyphæ of the same structure as those of the gonidial layer.

The a p o t h e c i a are at first semiglobular, without a visible disc. By degrees the disc appears as a small, punctiform depression, surrounded by a thick, orbicular thalline margin. Gradually the disc widens and is at first concave; later it becomes plane or convex. The margin is thick and originally even; later on it develops subulate, radiating protuberances. At the same time the apothecia may become somewhat stalked. The margin has nearly the same light colour as the thallus; the disc is a little darker brownish.

The exciple consists of stipes and calyx, which directly surrounds the hypothecium and the hymenium; at the top the calyx forms a narrow proper margin. Externally, the stipes-calyx is surrounded by a thalline margin. The hyphæ of the stipes are rather short and thick-walled, while those of the calyx and the proper margin are more stretched and run upwards along the sides of the hymenium. The thalline margin has quite the same structure as the thallus. The hypothecium is thick and composed of numerous ascogenous hyphæ and small-celled paraphysogenous hyphæ. The hymenium consists of long, slender, winding paraphyses, which branch at the tips and pass into a structureless, thin epithecium, here and there containing scanty, dark granules. The p a r a p h y s e s are slightly thickened at the tips. When ripe the a s c i have very thick walls, especially at the top. They contain 8, or frequently a little fewer, big spores, about 50—60 μ long.

The pigmentation of the apothecium is entirely as in *Ochrolechia parella* only a little darker.

P y c n i d i a were not observed.

Ochrolechia tartarea and *Ochrolechia subtartarea* are very closely related. Whether they belong to the same species, i. e. may issue from one another under due conditions of life, is not known.

OCHROLECHIA SUBTARTAREA.

NYL.

(Plate 56—57—58—59).

On the periderm of *Betula*. *Lysbroskov* by *Silkeborg*. 1885.

The margin of the t h a l l u s is light and passes insensibly into the substratum. The metathallus is in some places coherent, even or indistinctly granular; in other places it is highly granular of granules which are papillose or cauliflower-like, and frequently sorediose at the top. The smooth portions of the thallus occur in such areas of the periderm as have recently been laid bare by tensions of growth; when

they grow older they, too, assume the cauliflower-like, sorediose appearance. The colour of the thallus is light greenish-grey while the soredia are somewhat lighter.

The upper layers of the c o r t e x are formed of dead, colourless cells. The deeper layers are living, short-celled, coloured faintly brownish by a non-granular pigment. The hyphæ of the g o n i d i a l layer are colourless, short-celled, and a little looser in texture than the cortex. The gonidia are cystococcoid. Haustoria do not occur. The m e d u l l a r y - r h i z o i d a l layer is very loose in texture, with stretched cells. In the deeper layers of the thallus were found scattered groups of *Chroococcaceæ,* the gelatinous cell-walls of which were penetrated by scanty hyphæ without haustoria.

As to the inner structure the s o r e d i a differ but very little from the other parts of the thallus; they are provided with a distinct cortex.

The a p o t h e c i a are sessile and have at first a thick margin and a very small disc; by degrees the disc widens and becomes concave or plane. At all ages the apothecia are rather regularly orbicular. The margin and the disc are almost similar in colour, light-ochraceous. The youngest apothecia have an exciple without a genuine stipes, but are provided with a transparent calyx of densely interwoven, short-celled, and thick-walled hyphæ surrounding the hypothecium and the hymenium. Externally the calyx is covered by a thalline margin, which is much thicker than the calyx but very scantily provided with gonidia. Considerable portions of the apothecium have thus a pseudo-lecanorine character. Anatomically the thalline margin is easily distinguished from the proper margin in being of the same structure as the cortex of the thallus, even when the gonidia are absent. The hypothecium is thick and provided with numerous very small ascogenous hyphæ mixed up with paraphysogenous hyphæ. The hymenium consists of long, thin, winding p a r a p h y s e s, branching copiously at the tips, which latter are moderately or not at all thickened, forming a thin structureless epithecium of colourless, dead hyphæ.

The a s c i are clavate, each containing up till 8, or more frequently a smaller number of, big, 1-celled spores, about 50 μ long.

A faintly ochraceous non-granular pigment colours the peripheral portions of the paraphyses, the margin of the calyx, and the thalline margin; the uppermost superficial layers of hyphæ are, however, colourless like the epithecium. All the interior parts of the apothecium are colourless.

P y c n i d i a were not observed.

PERTUSARIA

PERTUSARIA D. C.

Phylogeny. Common to all species of this genus is the occurence of enormous, one-celled, hyaline, or more rarely, extremely slightly brownish spores. In this respect they agree with *Ochrolechia* and *Mycoblastus,* to which genera they also bear resemblance in their long, branched, and anastomosed paraphyses. It does not seem improbable that the species of *Pertusaria* may have arisen from species of *Ochrolechia* and through these from *Mycoblastus*. If so, we may imagine the phylogeny to have taken the following course: The primitive species of *Pertusaria* are descended from *Ochrolechia,* having only one lecanorine apothecium in each verruca (among our Danish species e. g. *Pertusaria Wulfeni*; other species of the same type occur in foreign countries). From these the *Pertusariæ* having several (or numerous) apothecia in each verruca may be issued.

Several morphological and anatomical details are in favour of such a supposition. The occurrence of isidia — so common in *Pertusariæ (Pertusaria coccodes,* etc.) — is already found in *Ochrolechia tartarea;* soredia, which are widely distributed in *Pertusaria* (*'Variolaria'*), are met with in *Ochrolechia subtartarea.* Anatomically the thalli of *Ochrolechia* and *Pertusaria* are rather similar. Finally, we note a very interesting series of transitions from *Ochrolechia* through *Pertusaria Wulfeni* into the other *Pertusariæ* with several apothecia in each verruca: the calyx-stipes is gradually reduced and at length nearly effaced in the most differentiated species (e. g. *Pertusaria coccodes*).

The phylogeny, briefly outlined here, will presumably be much more strongly supported when in future the foreign species have been explicitly examined and pictured. For the time being, considerations concerning the phylogeny of this genus must — unfortunately — be of a rather hypothetical nature.

In the profusely sorediose *Pertusariæ (Variolaria')* the occurrence of apothecia seems to have a certain correlation to the occurrence of soredia: the apothecia disappear in proportion to the increased abundance of the soredia.

As to the natural history of the species of *Pertusaria, vide* the descriptions of each species.

PERTUSARIA WULFENI.
D. C.

(Plate 60—61—62).

On the periderm of *Fagus silvatica*. *Frederiksdal*. March 1921. O. GALLØE.

The thallus has a narrow, white, mycelial margin, which at a little distance from the edge becomes somewhat thicker, faintly brownish, with concentric, shallow furrows, probably due to variations in the rate of growth. Inside the brownish zone the thallus becomes greenish-grey and smooth, and in these portions of the thallus the development of its granular-aerolate structure is initiated. When quite young the areoles of the thallus are irregular in outline, low, pulvinate, smooth, and are smoothly continued into each other, connected as they are through a thin inter-areolar thallus. As they grow older the areoles become much higher, irregular in outline, the surface being subdivided into smaller granules. The fully developed metathallus thus exhibits a confusion of small and big, smooth or superficially granular, greenish-grey areoles separated by deep furrows, but yet connected through the inter-areolar thallus.

The anatomical structure of the edge of the thallus is as follows: The extreme edge of the white, mycelial margin is chiefly composed of horizontal, uniform hyphæ, which very clearly are employed in the taking in of gonidia. At a little distance behind this purely meristematic margin the thallus is already differentiated into a cortex, a gonidial layer, and a medulla. The cortex is formed of obliquely ascendent hyphæ, the plurality of which gradually die out and together form a thick transparent cortex. Several of its hyphæ may, however, still be alive, so that their direction of growth will easily be recognized. In the gonidial layer the hyphæ are short-celled and somewhat irregularly interwoven. Haustoria do not occur. The gonidia are cystococcoid. The medulla is chiefly composed of horizontal hyphæ, running, however, in part downwards at the surface of the substratum. In the older areoles the hyphæ as a whole run upwards and outwards from the substratum towards the horizontal and vertical surfaces of the areole, on which they stand rather erect. The cortex is thus formed of erect hyphæ, forming a thick, colourless, dead cuticle continued downwards into a living, short-celled cortex. The gonidial layer contains large quantities of angular or roundish, single or crowded, colourless granules. Similar granules occur in the medulla, though more scantily.

The apothecia are formed by ones in the areoles, in which they are immersed. At first they have a dark, punctiform, roundish or somewhat oblong disc, surrounded by the whole of the areole as a thalline margin. By degrees the disc widens, but is still surrounded by a thick, often uneven, granular-crenate thalline margin.

The thalline margin is identical with the original areole and is described anatomically above. The exciple of the apothecium itself consists of a thin calyx without a stipes, composed of dense hyphæ with medium-sized cells. The hyphæ run horizontally at the bottom of the calyx, spreading outwards and next into the erect sides of the calyx. The sides of the calyx are sometimes raised above the level

of the hymenium as an easily recognizable proper margin, in which the apical cells of the hyphæ are dead and cuticle-like. The hypothecium is thin and colourless, with very scanty ascogenous hyphæ clustered in small groups, from which the asci issue. The paraphyses are long, thin, branched (especially so at the tips), often anastomosed not thickened worth mentioning at the tips. The hymenial gelatine is well developed. When ripe the asci are very big, few in number, provided with walls which are rather equally thickened everywhere. They contain 8 colourless spores, which in ripe condition have double walls. Their length is rather varying; often it is about 90 μ.

Fewer than 8 spores have been recorded to occur in the ascus. I did not succeed in refinding this condition in the present specimen.

PERTUSARIA COCCODES.

ACH.

(Plate 63—64—65—66—67).

Specimen 1. On the periderm of *Fraxinus excelsior*. *Leerbæk* Forest, 1874.

The natural margin of the thallus is absent. The metathallus is rather thick, coherent; its surface may be almost even, granular, or isidiose. Between these three types of surface there exist intermediate forms. The colour is greyish-green. The apothecia are gathered in especially big granules of thallus (verrucæ, warts), which are raised considerably above the level of the other portions of the thallus and have an irregular outline and a wrinkled-granular surface. The anatomical structure of the thallus between the verrucæ is as follows: From the substratum the hyphæ ascend obliquely towards the surface of the thallus in much the same way as f. inst. in *Pertusaria communis*. A cortex, a gonidial layer, and a medulla are found differentiated. The upper layers of the cortex are chiefly formed of dead cells of a cuticle-like character; there are, however, also several living hyphæ scattered among the dead ones. Under the cuticle follows a living cortex of short-celled hyphæ, between which numerous minute, yellowish granules of pigment occur. The hyphæ of the gonidial layer are looser in texture, short-celled and likewise provided with yellow granules. Haustoria were not met with. The gonidia are cystococcoid. The medulla is thick, composed of long-celled, colourless hyphæ with numerous intercellular spaces. Numerous groups of big, white, irregular granules are deposited in the medulla.

The anatomical structure of the apothecial verrucæ entirely agrees with that of the other portions of the thallus. Their hyphæ stand rather distinctly erect on the substratum. The apothecia are gathered in the verrucæ. As these verrucæ are confluent in several cases, it is difficult to state a definite frequency of apothecia. Even in rather small verrucæ, however, there often occur more than ten apothecia. The apothecia have a dark-greyish punctiform disc, surrounded by a thin thalline margin. The apothecium has a distinct exciple consisting of a calyx without a stipes.

The calyx is composed of dense, short-celled, erect, colourless hyphæ without intercellular spaces. Combined they form above a colourless proper margin, on a somewhat lower level than the adjacent thalline tissue, which thus presents itself as a low but distinct thalline margin, raised a little over the adjacent thalline tissue of the verrucæ. The hypothecium is a little looser in texture than the calyx, with scanty ascogenous hyphæ. The paraphyses are long, slender, branched, anastomosed, colourless, and thickened at the tips. They are embedded in a thick hymenial gelatine. The asci are very big; their walls are equally thickened everywhere. In the few asci occurring in this specimen each ascus contained two big, colourless spores with double walls, the inside of which is smooth. The length of the spores was about 180 μ.

Pycnidia were not observed.

Specimen 2. On *Fagus silvatica*. *Leerbæk* Forest, 1874.

The present specimen is similar to specimen 1 in the whole of its morphological and anatomical structure except in one respect: Some of the areoles contain no apothecia, being on the surface provided with numerous small, branched or unbranched, isidia, built as in specimen 3, to which is referred.

The structure of the apothecia is quite the same as in specimen 1.

Pycnidia were not observed.

Specimen 3. On bark. *Leerbæk* Forest, 1879.

This specimen consists of a rather thin, even thallus with verrucæ, quite as in specimens 1 and 2. The verrucæ are very irregular in outline, sterile, and copiously provided with isidia, which in fully developed condition are coralline and greatly branched.

The morphological and anatomical structure of the specimen may be studied in the plates, to which is referred.

Apothecia and Pycnidia were not observed.

PERTUSARIA GLOBULIFERA.

TURN.

(Plate 68—69—70—71).

Specimen 1. On the periderm of *Fagus silvatica*. *Frederiksdal* Skov. July 1933. O. GALLØE.

The thallus is nearly oval in outline, of a dark greenish-grey colour, while the colour of the margin is a little lighter. The margin is somewhat membraneous, unevenly wrinkled. A little within the margin an areolation is gradually developed by the thallus being partitioned off by rather deep furrows into irregular, confluent areoles with granular surfaces.

In the metathallus the hyphæ are chiefly, but not exclusively, erect. The cortex is thick, to a great extent composed of dead, cuticle-like, colourless tissues mixed, however, with several living, irregularly branched, short-celled hyphæ. The gonidial layer is loose in texture, short-celled, without haustoria. The gonidia are cystococcoid.

The medulla is thick, colourless, chiefly composed of erect, short-celled hyphæ with numerous intercellular spaces. Plenty of minute white granules are deposited in the medulla between the hyphæ, especially so in the layers immediately below the gonidial layer.

Soralia occur in great numbers. At first they appear as exceedingly minute, orbicular or a little stretched, white spots, surrounded by a thick margin of thallus, which is recurved by the outbreak of the soredia. By degrees the soralia greatly increase in size and become orbicular or slightly sinuose, with a thick persistent thalline margin, surrounding a plane or slightly concave, white, farinose spot of soredia, which are not bitter to the taste.

Already before the soralia open, the soredia have to some extent been individualized as separate endogenous soredia. When the soral has opened, the soredia are big, white, stalked, and built of cystococcoid gonidia surrounded by short-celled hyphæ, chiefly standing erect as in the rest of the thallus. Each soredium may have a thin-cortex of dead hyphæ on its morphological surface.

Apothecia were not found.

Pycnidia were not observed.

Specimen 2. On mosses and hepatics growing on the periderm of *Fagus*. *Silkeborg* Sønderskov. O. GALLØE.

The thallus forms a greenish-grey film incrusting the moss. The margin is thin, of much the same colour as the metathallus, composed of horizontal, rather densely interwoven, long-celled, living and gonidia-less hyphæ, densely agglutinated to the substratum. At a short distance behind the margin the thallus is gonidiiferous and fully developed. Here the cortex is thick, transparent, composed of horizontal hyphæ, which to a great extent seem dead although several living hyphæ are still present. The gonidial layer consists of loosely interwoven, irregularly running hyphæ without haustoria. The gonidia are cystococcoid. The hyphæ of the medulla run chiefly horizontally and have rather thick cell-walls with numerous intercellular spaces.

Apothecia did not occur.

Soralia are spread over the thallus in great numbers. They arise partly near the margin of the thallus, partly intercalarily between older soralia on the metathallus. At first they are covered by the cortex but gradually break through it as small white dots.

When fully developed the soralia have a margin raised above the level of the rest of the thallus and surrounding the soredia, which are developed in the middle of the soral. The soredia are white and not bitter to the taste; each of them may be slightly corticate by a partially dead cortex.

Pycnidia were not observed.

PERTUSARIA LEIOPLACA.

ACH.

(Plate 72—73—74—75).

On the periderm of *Fagus silvatica.* September 1904. O. GALLØE.

The thallus is everywhere surrounded by other crustaceous lichens, among others *Phlyctis argena* and *Lecanora subfusca;* it is thin, smooth, in several places distinctly hypophloeodic, while in other places it is incompletely covered by the periderm, especially so in the verrucæ containing the apothecia. Its surface is very finely granular from minute, smooth granules. The biggest, pulvinate granules contain the apothecia. The hypophloeodic, thin portions of the thallus are nearly homoeomerous, the gonidia being frequently almost evenly distributed in the whole of the thallus. A genuine cortex and medulla ar not differentiated or at least very incompletely so. The thick verrucæ containing the apothecia and functioning as their thalline margin are built of short-celled hyphæ, to a great extent rising erect from the substratum, from where they spread in every direction upwards and outwards towards the surface of the verrucæ, on which they stand tolerably erect. In the apothecial warts there is a distinct differentiation into a cortex, a gonidial layer, and a medulla. The outer layers of the cortex are dead, colourless, cuticle-like; under these follows a thin living cortx, insensibly passing into the short-celled hyphæ of the gonidial layer. Haustoria were not met with. The gonidia are cystococcoid. The medulla is loose in texture, composed of hyphæ with medium-sized cells.

The apothecia are formed by ones or some few together in especially increased verrucæ. They have a punctiform disc, surrounded by the rest of the verruca functioning as a common thalline margin for all its apothecia.

The exciple of the apothecium is very indistinctly bordered to the surrounding tissues. It consists of a calyx without a stipes and rests immediately on the periderm of the substratum; it is composed of loosely interwoven hyphæ, which partly are ascendent, partly run concentrically round the hymenium. In some places the calyx borders distinctly to the more densely woven gonidial layer; in other places there is a distinct medulla inserted between the two tissues; a similar medulla is put in between the different apothecia, when several of them are gathered in the verrucæ. Indistinct ascogenous hyphæ are found in the thin, colourless hypothecium. The paraphyses are long, thin, colourless, branched, frequently anastomosed, not thickened at the tips. They are embedded in a thick hymenial gelatine.

The asci contain 2—4 colourless spores; when ripe they are about 90 μ in length, (they vary, however, somewhat in size); their wall is double.

PERTUSARIA COMMUNIS.
D. C.

(Plate 76—77—78—79).

On the periderm of *Fagus silvatica*. *Grib* Forest. August 1921. O. GALLØE.

The outline of the thallus is elliptic (16 × 7 cm.), the short axis being parallel to the longitudinal axis of the tree; it grows free and unchecked by other lichens. The colour is yellowish or greenish dark-grey. The margin is thin, membraneous; its very edge is mycelial, affixed to the substratum; in places, however, it is membraneous and free of the substratum. Just behind this mycelial edge the margin is rather even, although provided with traces of low, pulvinate, confluent protuberances, the beginning areoles (verrucæ, warts). At a distance of about one centimeter from the edge of the thallus the areoles rather suddenly become considerably bigger, and the metathallus as a whole consists of very closely crowded verruccæ cohering at the base, each containing 1—8 apothecia.

The verrucæ vary much in size and form. Their circumference may be almost orbicular or somewhat angular by mutual pressure; their surface is convex or plane.

In the deeper layers of the margin of the thallus the hyphæ as a whole run parallel to the substratum, rising from there obliquely upwards towards the surface of the thallus. The peripheral, mycelial edge of the margin takes in gonidia — a fact long ago detected and described by DARBISHIRE and now confirmed by my own researches.

Very soon, at a short distance from the edge, a cortex is formed of obliquely ascendent, short-celled hyphæ, which to a great extent die out and are transformed into a transparent, cuticle-like layer, here and there mixed with living hyphæ. The other portions of the still filmy margin of the thallus are differentiated into a thick cortex, a gonidial layer, and a medulla. The cortex has the structure described above. The hyphæ of the gonidial layer are obliquely ascendent, somewhat irregularly interwoven, without haustoria. The gonidia are cystococcoid. The hyphæ of the medullary layer are on the whole similar to those of the gonidial layer.

The anatomy of the apothecial warts is as follows: The hyphæ run chiefly from the substratum upwards and outwards, towards every part of the verruca, on which they stand approximately erect; they pursue, however, other courses too, arranging themselves, for instance, concentrically round the apothecia. The hyphæ form a cortex, a gonidial layer, and a medulla. The cortex has a thick, dead cuticle, followed by a living cortex of medium-sized cells. The hyphæ of the gonidial layer are looser in texture. Haustoria were not met with. The gonidia are cystococcoid. The hyphæ of the medulla are more long-celled and very faintly brownish.

The apothecia are formed in groups in the verrucæ. They have no genuine exciple; in the intervals between the apothecia there is a medulla, the hyphæ of which partly stand erect in the verrucæ, partly are concentrically arranged round each single apothecium, surrounding a hymenium of distinct paraphyses with hymenial gelatine. The asci are not, however, exclusively found among the genuine paraphyses,

but also far off among the genuine concentric, medullary hyphæ, rich in intercellular spaces, in places where a marked calyx would be expected to appear.

The paraphyses are stretched, branched, anastomosed, not thickened at the tips; they are embedded in a thick hymenial gelatine.

The ascogenous hyphæ at the base of the paraphyses are not especially distinct. The asci are scanty, somewhat concentrically arranged in the hymenium and the adjacent medulla; they are very big; their walls are rather evenly thickened everywhere, although occasionally provided with a thinner porus at the top, by which the shedding of the spore is prepared. They contain one or two very big spores, which in ripe condition have a double cell-wall. The interior wall has numerous pore-like alveoles on the inside.

In the present specimen the spores were 200—290 μ long.

Pycnidia were not observed.

PERTUSARIA FAGINEA.
L.

(Plate 80—81).

On the periderm of *Fagus silvatica. Frederiksdal.* March 1921. O. GALLØE.

The thallus is dark greenish-grey. The margin is somewhat membraneous and in part free of the substratum; its surface is rather uneven and faintly wrinkled. At a short distance behind the margin the thallus begins to get somewhat warty-areolate, which feature is still more strongly marked in the central parts of the thallus.

In the margin of the thallus the hyphæ run horizontally, while they are somewhat more ascendent in the older portions of the thallus. The cortex is thick, colourless, chiefly composed of dead hyphæ, although several living hyphæ, too, are intermingled among the dead ones. The gonidial layer is composed of loosely interwoven, short-celled and long-celled, hyphæ without haustoria. The gonidia are cystococcoid. The medulla is loose in texture, rather long-celled, in places provided with numerous minute, colourless granules between the hyphæ. Soralia are very numerous; at first they appear as small white spots of an orbicular, oblong or irregular, outline, most frequently gathered in confluent groups. They quickly become flat or convex, to a great extent confluent; their thalline margin becomes so strongly recurved that it cannot be detected when the soral is seen from above.

The soredia differ a little in structure from those of *Pertusaria globulifera,* as they are not so distinctly stalked and, besides, are composed of less regularly arranged hyphæ. Otherwise they are endogenous and break through the surface of the thallus in a similar way as in *P. globulifera.* They are bitter to the taste.

Apothecia were not found.

Pycnidia were not observed.

GYALOLECHIA

GYALOLECHIA (MASS.) TH. FR.

Phylogeny. If we search among other lichens for species from which our two species of *Gyalolechia* described here may be descended, we must in the first place stop at species of the genera *Lecania* and *Protoblastenia*.

Both our two Danish species *(Gyalolechia luteoalba* and *Gyalolechia calcicola)* have ordinarily two-celled, non-polary spores, in which detail they resemble species of *Lecania,* while they differ from these in their apothecia being strongly suffused with parietine.

With *Protoblastenia* they agree in the presence of parietine, but differ from this genus in having two-celled spores. To which of these two structural details — the structure of the spores or the presence of parietine — we should assign the greater phylogenetic importance, is questionable. To me, however, it seems most probable that the phylogeny in the course of time produced our two species of *Gyalolechia* as descendants of *Protoblastenia* (having one-celled spores and apothecia containing parietine), and this view seems the more likely if we compare *Protoblastenia (Lecidea) rupestris* (Part I, Plates 1—3) with *Gyalolechia calcicola.* The two species, both of them growing on lime-stone, are so much alike in almost all details that the main difference is the occurrence of 1-celled spores in *Protoblastenia* and two-celled spores in *Gyalolechia calcicola.*

I dare not say whether *Gyalolechia luteoalba* may be derived in the same way from one certain species of *Protoblastenia,* because no researches into anatomical details of other species than those described in the present work *(Protoblastenia rupestris)* have so far been published.

Whether our species of *Gyalolechia* are closely related to *Caloplaca,* is uncertain; whether *Caloplaca* (with polary-dyblast spores) is descended from *Gyalolechia* (with ordinary two-celled spores) or from *Blastenia* (with polary-dyblast spores) is uncertain, and will not be ascertained with some certainty untill all the species of *Caloplaca* and *Gyalolechia* of foreign countries have been examined anatomically. So far I take the phylogeny outlined here to be the most probable:

Protoblastenia < *Gyalolechia (luteoalba, calcicola)*
Blastenia — Caloplaca

If this phylogeny holds true, the affinity of *Gyalolechia* and *Lecania* would be rather distant, and so would the affinity to other crustaceous lichens, lecideine or lecanorine, with ordinary two-celled spores.

GYALOLECHIA LUTEOALBA.

TURN.

(Plate 82—83).

On the periderm of *Populus*. *Lyngby*. 1. April 1905. O. GALLØE.

The thallus is thin, smooth, light-greyish, somewhat cracked.

The cortex is in places rather thick, cuticle-like, composed of dead cells. The gonidial layer is composed of irregularly interwoven, short-celled hyphæ without haustoria. The gonidia are cystococcoid. The medullary-rhizoidal layer is thin, built of hyphæ similar to those of the gonidial layer.

The apothecia are very numerous, scattered over the thallus without any visible order, young and old mixed together. At first they are rather regularly orbicular, flat, with an orange-red disc surrounded by a slightly lighter proper margin. There is no macroscopically visible thalline margin. Later on the apothecia get somewhat lowly convex, and the lighter-coloured margin becomes concolourous with the disc.

The exciple of the apothecium consists of a colourless, short-celled calyx without a stipes and with well developed sides, which are formed of ascendent hyphæ surrounded by a well developed yellow proper margin. The ascogenous cells of the hypothecium are not very conspicuous. The paraphyses are long-celled and branched above; the apical cells are gradually coloured yellow from a pigment (parietine), which partly occurs diffused in the cell-walls, partly as yellow granules on the outside of the cell-walls. The asci are rather narrowly clavate; their walls are not thickened at the top. They contain 8 colourless, generally 2-celled (not polari-bilocular) spores with thin transverse walls.

The thalline margin partakes but very little in the growth of the apothecium, being at once overgrown when the apothecium has broken through the surface of the thallus. For this reason this species of *Gyalolechia* takes up an intermediate position between lecideine and lecanorine lichens.

Pycnidia were not observed.

GYALOLECHIA CALCICOLA.

O. GALLØE nov. sp.

(Plate 84—85—86).

On a limestone-boulder. On a plain strewn with boulders in *Melby Overdrev*. F. MATHIESEN.

The thallus is for the greater part endolithic, but here and there portions of it protrude to the surface of the stone, where they form blackish-grey, extremely

minute, irregular dots mutually connected through the endolithic thallus hidden in the interior of the substratum. The endolithic part of the thallus consists of densely interwoven, short-celled, colourless hyphæ penetrating the substratum and making its surface brittle. The hyphæ are mingled with big, cystococcoid gonidia gathered into irregular groups lying close under the surface of the substratum, most often, however, covered by the latter.

In spots, however, the thallus penetrates to the surface of the substratum as small granules (areoles), presumably in such places where gonidia have been lying very superficially on the substratum before they were captured by the underlying hyphæ. These areoles are built of loosely interwoven hyphæ without haustoria and with cystococcoid gonidia; their cortex is thin, formed of living, short-celled hyphæ with faintly olivaceous walls.

The apothecia are abundant; they are developed without any visible order, young and old being mingled together; they are always developed in gonidiiferous portions of the thallus, either epilithic or endolithic. When the apothecia are cautiously removed from the substratum, they always leave behind small pits as they carry with them their basal gonidiiferous thallus. This phenomenon makes it quite evident that the substratum is made brittle by the growth of the lichen in its interior.

The apothecia are at all stages provided with an orange-yellow, rather thick and regular proper margin and with a plane disc of much the same colour. The exciple consists of a well developed calyx with stipes and thick sides surrounding the hymenium. In stipes the hyphæ are dense and the cells of medium size; at the bottom of calyx the hyphæ have the same structure; from the bottom the hyphæ radiate outwards to the proper margin, in which their apical cells are coloured yellow by minute granules of parietine. The hypothecium is colourless, with numerous ascogenous cells. The paraphyses are rather long-celled, their upper ends unbranched or branched with walls suffused with parietine. Asci are rather narrow, their walls moderately thickened at the top; they contain 4—8 colourless, ordinarily two-celled spores with thin septum and no isthmus, 14—18 μ long. It is rather a matter of opinion whether the apothecium is to be considered lecideine or lecanorine; it depends of whether the gonidiiferous tissue existing under the thick proper margin is to be considered a primitive margo thallinus or a veritable areole, in which the apothecium — in this case lecideine — has arisen. The latter interpretation would seem to me the most probable.

This species (and specimen) was collected by F. MATHIESEN and identified by him as a *Caloplaca pyracea*. The plurality of lichenologist would no doubt have agreed with him. Nevertheless, I prefer to establish it here as a separate new species, first and foremost on account of the structure of the spore and the mainly lecideine structure of the exciple. The species greatly reminds of *Gyalolechia luteoalba,* and it would seem to be very tempting to unite the two species, both having ordinarily two-celled spores, to a separate genus, differing from *Caloplaca* just in the structure of the spores. The genus-name *Gyalolechia* TH. FR. would then be assigned to them.

In the present specimen was found a rather profusely occurring fungus, a pyrenomycete *Tichothecium pygmaeum* (det. KEISSLER, *Vienna),* which attacks both the endolithic thallus and the apothecia. The latter are to a great extent discoloured by the attack, and the formation of asci is stopped.

Plate 86 gives information about the structure of the fungus.

CALOPLACA

CALOPLACA. TH. FR.

Phylogeny. All species of *Caloplaca* described in this work have colourless, polary-dyblast spores, while the species of *Gyalolechia* with ordinarily two-celled spores have been dealt with as a separate genus. In the discussion of the phylogeny of *Gyalolechia* I propounded the view that our species of *Caloplaca* may be descended from species of *Blastenia* by the exciple having become lecanorine in the genus *Caloplaca*.

Among our Danish species of *Caloplaca* a distinctly progressive line of evolution may be traced from primitive species to more elaborately differentiated species. The progression manifests itself in the following characters:

1). In the primitive species the thallus is grey, without parietine (e. g. *Caloplaca cerina);* in the more differentiated species it is coloured yellow by parietine. Occasionally this state of things is somewhat effaced, because the yellow thallus of the more differentiated species gradually turns a little greyish in their central parts (*Caloplaca murorum*), but this is due to a greyish cuticle being formed above the otherwise yellow cortex.

2). In the primitive species the thallus is purely crustaceous, while it is microphylline in the more differentiated species.

3. The apothecium is always lecanorine, provided with a thalline margin. In the primitive species the thalline portion of the margin is grey like the thallus itself; in the more differentiated species it is yellow like the yellow thallus. In all cases the disc and the proper margin are yellow. In these structural features the species agree very well with their probable ancestors, *Blastenia,* in which the disc and the proper margin are yellow from parietine.

The progression — briefly given here — from lower to higher species, from species with a purely grey thallus (*Caloplaca cerina*), passing through species variegated with grey and yellow (*Caloplaca aurantiaca*), to microphylline, yellow species (*Caloplaca murorum*) is illustrated by the sequence in which they are described in this book.

Presumably, this progression would stand out more clearly, if we could insert the species of *Caloplaca* of foreign countries in the series, but this cannot be done, as their anatomical structure has neither been examined nor pictured as yet.

CALOPLACA CERINA.

EHRH.

(Plate 87—88).

On bark. Habitat not exactly recorded. F. MATHIESEN.

The thallus is very thin, smooth, light greyish; its margin passes insensibly into the substratum.

The cortex is thin; its uppermost layer is dead, cuticle-like; the deeper layers are living, short-celled. The gonidial layer has intercellular spaces between short-celled hyphæ. Haustoria were not met with. The gonidia are cystococcoid. The hyphæ of the medullary-rhizoidal layer are similar to those of the gonidial layer.

The apothecia are formed in centrifugal order, the youngest being placed near the margin of the thallus. In addition, young apothecia are gradually intercalated between the old ones. At first the apothecium appears as a small, semiglobular protrusion of the same colour as the thallus; then the protrusion bursts at the top, and a minute, punctiform disc appears at its centre. By degrees the apothecium becomes sessile, with a wax-coloured, plane or somewhat wavy disc, surrounded by a rather regular, thick thalline margin. The disc stains red by addition of K O H.

The exciple of the apothecium consists of a calyx with a thick bottom, a very short stipes and distinct sides surrounding the hymenium as a proper margin; the whole of the calyx is composed of short cells and is, moreover, surrounded by a thalline margin. The hypothecium contains distinct ascogenous hyphæ. The paraphyses are long-celled, branched at the tips or unbranched, with swollen apical cells, which are either colourless or yeollow from a pigment apparently diffused in the cell-walls and also deposited as minute yellow grains on their outside.

All parts of the apothecium (the proper margin too) are colourless except the tips of the paraphyses. The asci are somewhat irregularly distended by the spores; their walls are moderately thickened at the top. They contain from 4 up to 8 colourless, polari-dyblast spores, about 12—15 μ long.

Pycnidia were not observed.

CALOPLACA CHLORINA.

FLOT.

(Plate 89—90—91—92).

Specimen 1. On the periderm of *Populus tremula. Borreby.*

The thallus is rather dark greenish-grey, thin, coherent, or somewhat cracky-granular; its margin passes gradually into the substratum without any distinct mycelial hyphæ.

The cortex is rather thick and chiefly dead, cuticle-like. The hyphæ of the gonidial layer are short-celled, irregularly and loosely interwoven, without haustoria.

The gonidia are cystococcoid. The medullary-rhizoidal layer is rather thin, composed of hyphæ similar to those of the gonidial layer. They show no signs of chemically attacking the periderm-cells of the substratum plant.

The apothecia are numerous and are first formed in all fresh and young parts of the thallus, i. e. in such portions where it has recently been regenerated because breaks due to tensions of growth have laid freshly accessible substratum bare. Secondly, young apothecia may apparently be intercalated between older ones in old portions of the thallus.

At first the apothecia appear as extremely small, orange-coloured discs breaking through the thallus, surrounded by a light thalline margin. The light colour of the latter is no doubt due to its own rapid growth and to its partaking in the growth of the other parts of the apothecium. When the disc has broken wholly through, the apothecium consists of a concave disc surrounded by a thick and distinctly orange proper margin, which externally is surrounded by a light, thick thalline margin. Later on the proper margin is less distinct and becomes, like the disc, darker-yellow, ochraceous and finally dark-brown. The thalline margin, too, gradually becomes darker, assuming the same colour as the old parts of the thallus.

The exciple of the apothecium consists of a calyx without a distinct stipes; it is built of densely woven hyphæ. Above, its bottom passes smoothly into a colourless hypothecium with numerous, rather distinct, ascogenous hyphæ and further continues into erect sides built of rather long-celled hyphæ surrounding the hymenium. The paraphyses are long-celled, sparingly branched at the tips, and with knobby apical cells, which at first are colourless but later on become coloured yellow from a pigment (parietine) partly diffused in the walls, partly occurring as minute grains on the outside of the hyphæ. The same pigment occurs in the upper parts of the hyphæ of margo proprius. The asci are stretched, their walls are scarcely thickened at the top. Most often they contain 8 colourless, distinctly polari-dyblast spores, about 12—14 μ long. Unlike the other parts of the thallus, the thalline margin has a rather thick, living cortex.

Pycnidia were not observed.

The present specimen was identified by DEICHMANN BRANTH as a '*Placodium cerinum var. gilvum Ach.*' I consider it, however, as being more alike to specimen 2 following next, especially when the colour of the thallus and the stages of development of the young apothecia are taken into consideration.

Specimen 2. On granite. *Holmdrup, Funen.* 10. April 1867. E. ROSTRUP.

The thallus is a little thicker than in speciment 1, coherent, granular-areolate, dark greenish-grey. Where it ends free on the substratum, without any surrounding competitors, scarce mycelial hyphæ are here and there seen radiating from the margin of the thallus. The anatomical structure is much the same as in specimen 1 — as seen in the figures.

The apothecia are rather regular, with ochraceous, flat discs, surrounded by a thalline margin of the same colour as the rest of the thallus. Some few of the

oldest apothecia had dark brown discs like those in specimen 1. Quite young apothecia were not found, for which reason it could not be stated how far the likeness of the young apothecia to those of specimen 1 goes as to colour and other conditions.

Anatomically the apothecia of the two specimens agree in every respect except that specimen 2 has a rather thick stipes. As for the rest, the figures must be referred to.

P y c n i d i a were not observed.

CALOPLACA PYRACEA.

ACH.

(Plate 93—94).

On bare wood. *Bregentved* Mølle. J. BRANTH.

The t h a l l u s is very thin, coherent, rather smooth and light-greyish.

The c o r t e x is very thin and loose in texture. The gonidial layer is likewise very loose in texture, with big intercellular spaces, without haustoria. The gonidia are cystococcoid. The medullary-rhizoidal layer is formed of irregularly interwoven, rather long-celled hyphæ with big intercellular spaces. The a p o t h e c i a are narrowly crowded, often angular by mutual pressure. At first they are of a rather regular outline, with a thick orange-yellow proper margin and a plane orange-yellow disc. Later on they become convex, and the margin apparently disappears (when examined with the pocket-lens); microscopically it can always be distinguished.

The exciple consists of a faintly developed thalline margin of much the same structure as the rest of the thallus. Inside the exciple there is a well developed calyx-stipes formed of densely interwoven hyphæ, running perpendicularly through the stipes and the bottom of the calyx and from there upwards through the thick sides of the calyx surrounding the hymenium. The apical cells of the proper margin are coloured yellow from granules of parietine. The hypothecium contains numerous ascogonia. The tips of the p a r a p h y s e s are branched, swollen, and suffused by numerous granules of parietine. The a s c i are rather short and broad: they usually contain eight colourless, polari-dyblast spores measuring about 10—12 μ in length.

P y c n i d i a were not observed.

Between the hyphæ just beneath the gonidial layer numerous cells of a *Chroococcacea* occurred in some places, embedded in a thick gelatine penetrated by the hyphæ of the lichen; the hyphæ had no haustoria.

CALOPLACA AURANTIACA.

LIGHTF.

(Plate 95—96—97).

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

The t h a l l u s is thin, coherent, and somewhat granular, especially so in some parts of the thallus spreading over hepatics (*Frullania*) growing on the bark. The

young parts of the thallus are yellowish, the older parts are light-grey: this distinction, however, is not entirely carried out, for which reason the thallus as a whole is somewhat variegated in grey and yellowish colours.

The upper layers of the c o r t e x are dead, cuticle-like; the deeper layers consist of living, short-celled hyphæ with several intercellular spaces. The g o n i d i a l and m e d u l l a r y layers are not very distinctly separated; they are both formed of short-celled, irregularly woven hyphæ with intercellular spaces. Haustoria were not observed. The gonidia are cystococcoid.

The a p o t h e c i a are spread over the thallus without any visible order; young and old side by side. At all stages of development they are pseudo-biatorine in as far as they have a yellow disc surrounded by a yellow margin. This margin, however, is entirely thalline (and gonidiiferous) although it is yellow, whereas the portions of the thallus surrounding the apothecia are grey.

At first the apothecia are orbicular, with a concave, citrine disc, surrounded by a thick, citrine margin. By degrees the disc gets considerably darker, orange-coloured, while the margin persistently is somewhat lighter than the disc.

The exciple of the apothecium consists of a calyx with a short stipes and thick sides surrounding the hymenium and above forming the yellow proper margin. The hyphæ radiate from the centre of the bottom of the calyx outwards and upwards through the sides and are densely woven, with rather thick cell-walls. The hypothecium is colourless, dense, and very rich in minute oil-like drops, deposited between the hyphæ and partly concealing their course. The p a r a p h y s e s are rather long-celled, somewhat branced at the tips, and provided with apical cells, the walls of which are coloured yellow from grains of parietine; when quite young the apical cells are, however, colourless. The a s c i are clavate; their walls are moderately thickened at the top. They contain 8 colourless, polari-dyblast spores, about 12—16 μ long.

The thalline margin has a cortex of much the same structure as the rest of the thallus; it is, however, coloured yellow from parietine in the portions bordering on the likewise yellow proper margin. By this distribution of colours the apothecium acquires a biatorine aspect.

P y c n i d i a were not observed.

Specimen 2. On granite. *Arupgaard.* October 1869. Th. Jensen.

The t h a l l u s is thin, coherent, somewhat granular. The granules are light-yellow, mutually connected by a greyish thallus. At the margin of the thallus very slender, mycelial hyphæ, measuring up to 5 mm., were seen in an artificially stained preparation, whereas they were not distinguishable in unstained preparations.

The c o r t e x is rather loose in texture, composed of short-celled hyphæ, in most places coloured yellow by numerous grains of parietine. The hyphæ of the g o n i d i a l and medullary layers are loose in texture. Haustoria do not occur. The gonidia are cystococcoid.

The a p o t h e c i a are densely crowded; they arise partly in centrifugal order, partly, too, intercalarily by fresh apothecia being developed between the older ones.

At first they are rather regularly orbicular, with a thick and slightly lighter margin (which anatomically is a thalline and a proper margin at the same time) and a plane, orange-yellow disc. Later on they become more angular, frequently owing to mutual pressure.

The exciple consists of a thalline margin, which most often is indistinguishable when the apothecium is seen from above, as it is entirely covered by the proper margin. The borderline between the two margins can only be seen in anatomical sections. Inside the thalline margin follows a calyx-stipes of densely woven hyphæ, which have yellow apices in the proper margin. The hypothecium is rich in ascogonia. The tips of the paraphyses are branched, somewhat swollen, and coloured yellow from parietine. The asci contain eight colourless, polari-dyblast spores, about 10—12 μ long.

Pycnidia were not observed.

The present specimen was identified by DEICHMANN BRANTH as a '*Placodium cerinum α pyraceum var. holocarpum*'. In the colour of the thallus it agrees with *Caloplaca aurantiaca;* in the densely crowded, small apothecia it is similar to *Caloplaca pyracea.* In antomical structure it agrees with both species. It is therefore rather a mere matter of opinion to which species it should be referred, as the two species seem to pass insensibly into one another. Here I have referred it to *Caloplaca aurantiaca* on account of its yellowish thallus; otherwise, only experiments will settle whether a form like this is an independent species, or whether it may issue from one or the other of the two species: *Caloplaca aurantiaca* and *Caloplaca pyracea.*

CALOPLACA PHLOGINA.

ACH.

(Plate 98—99).

On dead wood. *Sneptrup.* I. D. BRANTH.

The thallus is widely effuse, thin, almost farinose, and faintly cracked; its surface is sorediose. Originally, the colour is light-grey; by degrees, however, the soredia become greenish-yellow, so that the colour of the thallus is variegated with grey and yellow.

There is no distinct cortex, as the surface is transformed into soredia at various ages. The gonidial layer, which gradually produces soredia, is built like these: The hyphæ are short-celled, loosely interwoven, without a fixed direction of growth, and without haustoria. The gonidia are cystococcoid. The medullary layer may differ rather distinctly from the gonidial layer; the hyphæ are still looser in texture and still more long-celled.

The apothecia are spread over the thallus without any visible order. They are sessile. At first they have a small, concave, orange-coloured disc surrounded by a comparatively thick margin of the same colour, for which reason they acquire

a pseudo-biatorine appearance. Anatomically, however, they are always lecanorine. Later on the disc widens considerably, and the yellow margin persists, although in some apothecia it is, in addition, surrounded by a more or less complete margo thallinus of a greyish colour.

The exciple of the apothecium consists of a distinct calyx with a long stipes. The hyphæ of the stipes and at the bottom of the calyx are somewhat irregularly interwoven; in the sides of the calyx they run upwards towards the proper margin, which is broad and well developed. The ascogenous cells of the hypothecium are distinct. The paraphyses are long-celled, branched or unbranched at the tips and with a capitate apical cell, coloured yellow by parietine, which is partly diffused in the cell-walls, partly granular. Calyx is surrounded by a thalline margin of much the same structure as the rest of the thallus; it does not, however, produce soredia. The same yellow pigment as is found in the paraphyses also occurs in the apical cells of the hyphæ of margo proprius and in the portions of the thalline margin bordering to the proper margin. Asci contain up to eight colourless polari-dyblast spores.

Pycnidia were not observed.

The present specimen is no doubt closely allied to *Caloplaca citrina*. Whether together they represent one species, i. e. whether they may issue one from the other and vice versa under due life-conditions, cannot be settled without cultivation-experiments.

CALOPLACA CITRINA.

HOFFM.

(Plate 100—101).

Specimen 1. On mortar. *Lundum Præstegaard* 1885. J. BRANTH.

The thallus is formed as a dense, irregularly orbicular network incompletely covering the substratum. The margin has no free mycelial hyphæ but is very finely granular to the very edge. The whole of the thallus is everywhere finely granular, and in places its surface is transformed into citrine soredia. Here and there the margin of the thallus is light-greyish. In places thallus has a fainty developed cortex of densely woven cells; otherwise the surface of thallus develops soredia, which in some cases are rather colourless but most often are citrine. Each of them consists of one alga or several algæ surrounded by short-celled hyphæ, the walls of which are rather colourless or most often yellow from a diffuse pigment (parietine). The hyphæ of the gonidial layer are short-celled, rather loose in texture, without haustoria. The gonidia are cystococcoid. Medulla is loose in texture, composed of long-celled hyphæ.

The apothecia are arranged in one circle, which fact suggests that they are all nearly of the same age. A single apothecium was placed nearer the centre of the thallus. The apothecia are sessile and have an almost plane, orange-coloured disc

surrounded by a thin citrine margin, which at the same time represents the proper margin and the thalline margin. The exciple of the apothecium consists of a calyx with a rather thin stipes. The bottom and the stipes of the calyx are rather densely woven, provided, however, with several intercellular spaces. The sides of the calyx are denser in structure; the hyphæ go obliquely upwards towards the proper margin; the latter is thick and well developed, and the top-cells of its hyphæ are coloured citrine from a diffused and also granular parietine. The hypothecium is colourless with distinct ascogenous hyphæ. The p a r a p h y s e s are long-celled. usually unbranched, with widened top-cells, the walls of which are coloured yellow from diffuse and granular parietine. A s c i contain eight polari-dyblast, colourless spores, about 12 μ long. The calyx and the proper margin of the apothecium are surrounded by a thalline margin, which may develop soredia on its surface.

P y c n i d i a were not observed.

Specimen 2. On a wall of concrete. *Lyngby,* 28th November 1932. O. GALLØE.

This specimen is very small and sterile and is pictured here only to show the structure of a seedling of this species.

The thallus consists of very small, greyish, rather smooth, confluent areoles without distinct mycelial marginal hyphæ. These areoles, originally smooth, gradually become very finely granular. The granules are at first grey, later on citrine.

Anatomically the present specimen fully agrees with specimen 1. The stages of development it passes through suggest that the grey colour of the thallus is the original colour of primitive species of *Caloplaca,* while the yellow colour is a structural feature of secondary, more recent, origin.

CALOPLACA MURORUM.

HOFFM.

(Plate 102—103—104).

Specimen 1. On flint. *Hanstholm.* F. J. MATHIESEN.

The t h a l l u s is nearly orbicular, closely appressed to the substratum. Its margin consists of short, relatively broad and thick, somewhat irregularly dichotomous lobules with narrow incisions between the branches of the lobules. The colour is shining yellow. The metathallus is coherent, with an uneven, granular surface. The granules are yellow like the margin of the thallus, while the thallus between the granules is grey with a yellowish shade. When the granules are distant from each other, the grey colour is very distinct; where they are closely crowded, the thallus acquires an almost areolate character and appears almost purely yellow.

The a p o t h e c i a arise in the lobules of the margin of the thallus and are, in addition, developed in the yellow grains (areoles) of the methallus. At first they appear as small, orange-coloured depressions, the discs, each surrounded by a thick, even margo thallinus. Later on, they rise above the level of the thallus and become sessile

or grow radially over the underlying thallus. When fully developed they have an orange-coloured disc surrounded by a margo thallinus of the same colour.

Anatomically, the present specimen entirely agrees with specimen 2, to which is therefore referred.

Specimen 2. Growing on the same substratum, side by side with specimen 1.

The thallus is orbicular, a little smaller than that of specimen 1. From the latter it differs chiefly in colour, being considerably darker reddish-yellow, with faint traces of a greyish shade in the older parts of the thallus.

In a longitudinal section of a lobule the following anatomical structure is seen: The cortex is thick and well developed; its upper layers are colourless, structureless, and cuticle-like; below, it is followed by a living cortex of nearly erect medium-sized cells. The upper half of the cortex is coloured yellow from parietine deposited between the cells as yellow granules; the lower half of the cortex is colourless.

The hyphæ of the gonidial layer are somewhat irregularly arranged; they are composed of medium-sized cells without haustoria. The gonidia are cystococcoid. The medulla is very loose in texture, with numerous big intercellular spaces; the course of the hyphæ is very irregular; the cells are stretched.

At the very edge of the margin of thallus these tissues can be seen passing into each other and bordering to each other with distinct limits, the cortex being suddenly replaced by very short radiating hyphæ, which cannot be recognized macroscopically but exclusively in anatomical sections.

The apothecia arise and are developed in quite the same way as in specimen 1, only both disc and margin being darker reddish-yellow. The exciple of the apothecium consists of a calyx with a short stipes and with sides surrounding the hymenium and above forming a broad proper margin. The hyphæ of calyx-stipes are densely woven and of medium size; in the sides of the calyx they are erect, and their apical cells in the proper margin are slightly thickened and coloured yellow from diffuse and granular parietine. In the colourless hypothecium there are numerous, distinct ascogenous cells. The paraphyses are long-celled, unbranched or sparingly branched at the tips, with swollen top-cells, which are coloured yellow by diffuse and granular parietine, like the condition in the proper margin. The asci are narrowly clavate, with 8 colourless, polari-dyblast spores, about 10—14 μ long.

Margo thallinus has the same structure as the rest of the thallus.

Pycnidia were not observed.

Specimen 3. On a wall of concrete. *Lyngby,* 21st November 1932. O. GALLØE.

The thallus is very small, sterile, a seedling. It consists of extremely small, grey, irregularly dichotomous lobules with yellow margins. Anatomically it fully agrees with specimen 2.

This specimen is figured here only to point out the difference between young individuals of *Caloplaca murorum* and *Caloplaca citrina.* These two species differ from the very first beginning.

CALOPLACA LOBULATA.

FLK.

(Plate 105—106).

On granite. *Hammershus, Bornholm,* 1st June 1903. O. GALLØE.

The thallus consists of scattered, very small, cushion-shaped, orange-red areoles of rather varying outline, roundish or oblong, sometimes faintly branched. Our specimen is very indistinctly limited and effuse but is, however, in places provided with an indistinct margin composed of indistinctly effigurate, microphylline areoles showing centrifugal directions of growth. Otherwise it is difficult or even impossible to point out with any certainty how many of the areoles belong to one individual as apparently they are most often mutually independent. Thus it may be that an 'individual' in reality may have casually arisen by the coalescence of several individuals, originally independent. The possibility, however, must not be disregarded that the areoles are connected by basal hyphæ embedded in the interior of the substratum, thus together forming one true individual. Here and there the areoles are confluent, sometimes connected by a thinner, inter-areolar, greyish thallus, reminding of the conditions occurring in *Caloplaca murorum*. Part of the areoles is provided with blackish-grey, radiating, mycelial hyphæ of every thinkable direction of growth, centrifugal, centripetal, etc.

The cortex is rather thick, formed of living cells, which, however, gradually die off on the surface of the thallus. Numerous yellow granules of parietine are deposited between the hyphæ. The gonidial layer is loose in texture, short-celled, without haustoria. The gonidia are cystococcoid. The hyphæ of the medulla are similar to those of the gonidial layer. The apothecia arise in the areoles, each of which is frequently entirely transformed into one apothecium, as the whole of the areole partakes in the formation of a thalline margin. The latter is thick, orange-yellow, often with faint radial furrows. The disc is rather small, of a somewhat lighter colour. The exciple consists of this margo thallinus, which has the same anatomical structure as the rest of the thallus. Inside the thalline margin there is a calyx with distinct stipes, both composed of dense, rather short-celled hyphæ running upwards and outwards through the sides of the calyx surrounding the hymenium. In the proper margin the apical cells are greatly suffused with parietine. The hypothecium is rich in ascogonia. The tips of the paraphyses are frequently branched, somewhat swollen and densely covered with parietine. Asci are rather broad, their walls but slightly thickened at the top; they contain eight colourless, polari-dyblast spores, measuring about 12 μ in length.

Pycnidia were not observed.

Phenologically the present species differs greatly from *Caloplaca murorum*; whether it differs genealogically, too, from the latter, or whether it is a *forma depauperata* of *Caloplaca murorum,* is not known. Such views have been proposed by some lichenologists, but have not been ascertained experimentally.

GYALECTA

GYALECTA ACH.

Phylogeny. For the time being it is difficult to form a well-founded opinion of the origin of the present genus, because as yet no explicit researches have been made and no pictures given of the lichens which may be regarded as its nearest relations. Several foreign species, of which some are lecideine, others lecanorine, have been referred to the genus. It would be of great interest to know whether an anatomical examination of these species would present a plain, naturally progressive, sequence of primitive lecideine species passing into higher developed, lecanorine species, similar, f. inst., to the well known series *Lecidea-Lecanora,* or other analogous series. As far as our present — unfortunately very defective — anatomical knowledge goes, it seems possible that our Danish *Gyalecta Ulmi* may be descended from a lecideine *Gyalecta,* which latter may be derived — through the genus *Bombyliospora* —from a *Rhizocarpon,* in which genus we meet with some species having colourless spores with uni-seriate cell-lumina like those of *Gyalecta.*

GYALECTA ULMI.

Sw.

(Plate 107—108).

Spreading over moss on the periderm of *Fagus silvatica. Hald Bøgeskov.* J. BRANTH.

The thallus is thin, filmy, whitish-grey; it spreads over the moss following its roughnesses very closely. The margin has no distinct mycelial hyphæ.

The cortex is thin, chiefly formed of dead cells. The hyphæ of the gonidial layer are irregularly interwoven, short-celled, without haustoria. The gonidia belong to Trentepohlia. The rhizoidal hyphæ overgrow the moss and kill it by overshadowing, whereas no signs were found of their attacking the moss directly.

The apothecia are very numerous, somewhat cup-like. Apart from their difference in size they have almost the same appearance at all stages of development; the

discs are strongly reddish, a little concave, surrounded by a thick and somewhat crenate margin.

The exciple of the apothecium consists of a very well developed calyx without a stipes, surrounded by a thalline margin of the same structure as the rest of the thallus.

The calyx consists of dense, thick-walled hyphæ, which at the bottom of the calyx run chiefly horizontally, going from there upwards through the sides of the calyx surrounding the hymenium. In places the hyphæ reach the very surface of the apothecium, while in other places they are entirely covered by the thalline margin, which thus comes right up to the hymenium. The hypothecium is colourless and contains distinct ascogenous cells. The paraphyses are long-celled, unbranched, not thickened at the tips. The red pigment colouring the upper ends of the paraphyses is seen in teased-out preparations as peculiar sockets surrounding each single paraphysis.

The asci are rather short, clavate, with a rather thin wall. They contain 8 colourless, 4-celled spores.

Pycnidia were not observed.

DIPLOSCHISTES

DIPLOSCHISTES NORMAN.

Phylogeny. In the structure of the spore this genus resembles *Diplotomma*. In other respects, too, the two genera agree, f. inst. in the distribution of colours in the interior of the apothecium, as it is evident from Plates 110, 111, and 116 in Part III. It seems possible, then, that *Diploschistes* represents the lecanorine stage of *Diplotomma*.

DIPLOSCHISTES SCRUPOSUS.
L.

(Plate 109—110).

On moss over stony substratum. *Svebølle,* $^{4}/_{12}$ 1886. W. TOUSSIENG.

The thallus is rather thin, coherent, wrinkled-areolate. The margin is somewhat more finely granular, without radiating mycelial hyphæ.

The upper layer of the cortex is dead, cuticle-like; under it follows a living cortex of living cells. The hyphæ of the gonidial layer are more loosely interwoven and short-celled, without haustoria. The gonidia very often show pleurococcus-like cell-divisions. Medulla is relatively thick, of a considerably looser structure, composed of long-celled hyphæ.

The apothecia are spread over the thallus one by one or gathered in small groups. At first they appear as small black or sometimes slightly bluish pruinose discs; each surrounded by an elevated proper margin, which again is surrounded by an additional thalline margin. By degrees the limits between the two layers of the margin may be either effaced or still further distinguished by the formation of a distinct, deep furrow between the proper and the thalline margins.

The exciple of the apothecium consists of a very distinct calyx without a stipes, in addition surrounded by a thalline margin of the same structure as the rest of the thallus.

The calyx has a bottom formed of horizontal hyphæ, radiating from the centre of the bottom in all directions towards the sides of the calyx, in which they run obliquely upwards, finally forming a very thick and distinct proper margin. The colours of the hyphæ are as follows: In the bottom and the sides of the calyx they are dark brown, whereas in margo proprius the distribution of colours is very peculiar, as in places the hyphæ are colourless, especially so in their apical parts.

The hypothecium lying just above the brown bottom of the calyx is colourless, with ascogenous cells. The p a r a p h y s e s are long-celled and unbranched; their tips are brown. The a s c i are thin-valled, clavate. Most often they contain 4 colourless, muriform spores; some of the oldest spores may be brown. They measure about 28—38 μ in length.

In some few cases prolifications were found, i. e. apothecia of secondary order, in the margin of an old apothecium; *vide* the figures.

P y c n i d i a were not observed.

THELOTREMA

THELOTREMA Ach.

Phylogeny. The plates show clearly that there is some resemblance between *Thelotrema* and *Gyalecta* in their anatomical structure. It must not, however, be overlooked that the structure of the exciple and especially of the proper margin of *Thelotrema* is very peculiar and rather different from that of *Gyalecta*. Nevertheless, I am inclined to believe that the lecanorine *Thelotrema* derives its origin from a lecideine *Gyalecta*, through which it is distantly related to *Bombyliospora* and *Rhizocarpon*. It must, however, be emphasized that the foundation of this supposition is rather feeble, because we have no explicit pictures of lecideine species of *Gyalecta* from foreign countries. On the whole it must be remembered that our conceptions of the taxonomy and phylogeny of the lichens cannot be expected to make any decisive progress until lichenologists will undertake a thorough exploration and picturing of the anatomy of each single species.

THELOTREMA LEPADINUM.

Ach.

(Plate 111—112—113).

On the periderm of *Fagus silvatica*. *Rold Skov, Jutland*. O. Galløe.

The thallus is elliptic in outline, stretched across the trunk of the tree. The margin of the thallus is very thin, greyish-green, smooth, insensibly passing into the substratum. Just behind the margin the thallus by degrees becomes finely wrinkled-granular and faintly darker. The granules in which the apothecia are formed become by far the largest and are semiglobular, cushion-shaped. A distinct cortex is wanting, and in several places the thallus is covered with cells loosened from the periderm of the substratum-plant. The gonidial layer thus reaches the very surface of the thallus and is composed of loosely interwoven, short-celled hyphæ without haustoria. The gonidia belong to *Trentepohlia*, which here and there are rather regularly catenate.

The m e d u l l a is loose in texture, short-celled, and well developed, frequently strongly mixed with peeled-off lamellæ of the substratum-periderm. Mighty groups of white granules of oxalate of lime frequently occur in the gonidial layer and upper layers of the medulla.

The a p o t h e c i a are formed partly in centrifugal order in young, growing portions of the thallus, partly intercalarily between older apothecia in the centre of the thallus. At first they appear as a low, cushion-shaped protuberance, representing the future thalline margin, in the centre of which there is a small, irregular aperture. Soon afterwards there appears in the aperture an interior, irregular, radiately cracked margin, the proper margin. When ripe the apothecium has a black disc, surrounded by the stellular proper margin, which most often appears as light-greyish to the naked eye. Outside this margin follows a thick, even or somewhat crenate, greenish-grey thalline margin, which usually is broadest at the base but sometimes may be somewhat constricted.

Anatomically the exciple consists of a calyx without a stipes; it has a thin, very light-brown bottom and stouter sides surrounding the hymenium and raising the proper margin high over the paraphyses. The calyx is surrounded by a thick thalline margin, which is frequently detached from the calyx nearly down to the bottom. By this circumstance the charateristic appearance mentioned above comes into existence.

The calyx is built of rather dense, short-celled, slightly brownish hyphæ, which at the bottom of the calyx run nearly horizontally outwards in all directions towards the erect sides of the calyx; in the sides the hyphæ are darker brown, erect, and in addition provided with horizontal branches groving centripetally towards the sides of the hymenium. Above the bottom of the calyx there is a colourless hypothecium with distinct ascogenous cells. The p a r a p h y s e s are long, slender, unbranched, scarcely thickened at the brown tips. The a s c i are long, narrow, thin-walled. They frequently contain 4 colourless, muriform spores, about 26—44 μ long, or 4 considerably longer spores, about 60 μ long, with cell-lumina arranged in one series.

P y c n i d i a were not observed.

PHLYCTIS

PHLYCTIS WALLR.

Phylogeny. In the structure of the spore *Phlyctis* is rather similar to the genera *Lopadium* and *Rhizocarpon*. It does not seem improbable that the species of *Phlyctis* have arisen from one of the two genera. The exciple of *Phlyctis*, accordingly, has been greatly reduced in correlation to the fact that, to a large extent, the apothecium remains embedded in the thallus and protected by it. Similar conditions are met with in *Pertusaria*, in which genus the stipes-calyx is greatly reduced in correlation to the apothecia being embedded in the thallus.

PHLYCTIS ARGENA.

ACH.

(Plate 114—115—116).

On the periderm of *Fagus silvatica*. July 1933. O. GALLØE.

The thallus is somewhat isodiametric-angular, everywhere surrounded by other crustaceous lichens; it is very thin, slightly wrinkled, presumably owing to the roughnesses of the substratum; the colour is grey.

There is no distinct cortex; the hyphæ of the surface of the thallus are living, short-celled, without intercellular spaces; in several places peeled-off lamellæ of the substratum periderm are embedded in the cortex above the gonidial layer. The uppermost hyphæ of the surface have somewhat darkened walls.

The hyphæ of the gonidial layer are loose in texture, short-celled, without haustoria. The gonidia are cystococcoid. The medulla is rather dense; its hyphæ make their way between the periderm-lamellæ of the substratum. They show no sign of chemically attacking the periderm.

Soralia are scattered over the thallus in great numbers. They have a very irregular circumference, roundish or angular, unbranched or strongly and irregularly branched, always plane, without distinct thalline margins. In fresh condition they are

light greenish; in the herbarium they turn light reddish-grey. Each of the soredia may be rather big; they consist of numerous gonidia, surrounded by a loose, short-celled tissue of hyphæ without any trace of a cortex.

Only one apothecium was found in the present specimen. It was situated in a small soral near the margin of the thallus. All other soralia in which apothecia were sought for proved destitute of them. Whether apothecia are always formed in the soralia, or whether they may also appear directly in the thallus, is not known with certainty. The apothecium consists of a greyish, plane disc surrounded by a thalline margin, inside which there is a thin, though distinct exciple formed of a calyx without a stipes. At the bottom of the calyx the extremely light-brownish hyphæ partly run horizontally, partly radiate centrifugally outwards towards the sides of the calyx, in which they rise upwards towards the surface of the thallus; there they gradually pass into ordinary thalline hyphæ, for which reason there is no markedly distinct proper margin. Scanty ascogenous hyphæ occur in the colourless, thin hypothecium. The paraphyses are long-celled, thin, very slightly thickened and brownish at the tips. Asci are few in number; when unripe they are long and almost cylindric; when ripe they become more inflate, thin-walled; they contain 2 colourless, big, uniform spores, each composed of hundreds of cells. They measure about 120 μ in length.

Pycnidia were not observed.

PHLYCTIS AGELÆA.

Ach.

(Plate 117—118—119).

On the periderm of *Fraxinus excelsior. Korsør.* F. Mathiesen.

The thallus is in places very thin, at first coherent and smooth, later on rather finely cracked, greenish-white; in other places it is somewhat thicker and very uneven; the incrassated portions are either rather distinctly limited to eachother, or they are confluent, somewhat reminding of the 'verrucæ' in *Pertusaria;* their surface is very uneven, presumably owing to the formation of apothecia, which exclusively takes place in the incrassations.

The cortex is in some places rather distinct, formed of rather short-celled hyphæ, which above form a cuticle-like layer; in other places the cortex is very thin and exclusively composed of living cells. The hyphæ of the gonidial layer are somewhat irregularly interwoven, short-celled, with intercellular spaces, but without haustoria. The gonidia are cystococcoid. The medullary-rhizoidal layer is still looser in texture and makes its way between the cells of the periderm but does not show any sign of chemically attacking them.

The apothecia are formed in the above-mentioned indistinct 'verrucæ.' The limits between the latter being often effaced, reliable numbers of the frequence of the apothecia cannot be given; they are, however, usually gathered in great numbers in

groups. Their discs appear as dark, greatly irregular, almost black minute dots embedded in a confusion of irregular, granular portions of thallus, in part overlapping each disc and causing it to appear irregular in circumference. Any genuine formation of soredia in these apothecia-producing verrucæ does not seem to take place. As the apothecia are embedded in the thallus, a genuine margo thallinus surrounding the apothecia can scarcely be pointed out. On the contrary, the apothecia have a thin but rather distinct exciple consisting of a calyx without a stipes and with thin sides surrounding the hymenium. At the bottom of the calyx the hyphæ are rather loose in texture, with intercellular spaces; in the sides of the calyx the hyphæ are erect, short-celled, with intercellular spaces. The hypothecium is colourless and produces distinct ascogenous cells. The p a r a p h y s e s are long, slender, scarcely branched, slightly brown, and thickened at the tips. They are embedded in a rather thick hymenial gelatine and are frequently anastomosed. When ripe the a s c i contain 2 spores (other numbers are recorded in the literature but were not met with in the present specimen); they are colourless, muriform, provided with a colourless, transparent papilla at either end. They measure about 65 μ in length.

P y c n i d i a were not observed.

The present specimen differs from *Phlyctis argena* in having papillose spores and in lacking genuine soredia.

RINODINA

RINODINA Mass.

Phylogeny. As it is evident from the following descriptions this genus is similar to the genus *Buellia* in several respects and must be supposed to have arisen from *Buellia* in much the same way as *Lecanora* has arisen from *Lecidea*. Indeed, some of the species of the genus have been referred by the authors now to one, now to the other of these genera. Such is the case f. inst. with our Danish species *Buellia (Rinodina) verruculosa* Borr. (Part IV, Plates 31 and 32). In fact, it is frequently a mere matter of opinion whether an apothecium which is embedded in the thallus is to be considered as lecanorine (belonging to *Rinodina*) or lecideine (belonging to *Buellia*). As a rule, the authors establish an—artificial—line of demarcation by referring species provided with a markedly dark hypothecium and ordinary 2-celled spores to *Buellia*, while species in which all the spores or part of them are of a polari-dyblast type and the hypothecium of a light colour are referred to *Rinodina*.

The **spores** are most often, or perhaps always, ordinary 2-celled in *Rinodina pyrina* and *Rinodina Bischoffii;* in *Rinodina sophodes* and *Rinodina atrocinerea* they are polari-dyblast with or without an isthmus; in *Rinodina milvina, astroides,* and *confragosa* they are polari-dyblast with an isthmus; in *Rinodina Conradi* they are at first 2-celled, but finally they become 4-celled and are provided with an isthmus (analogous to the conditions in *Buellia triphragmia,* in which the spores likewise are 4-celled).

Morphology. The thallus is always crustaceous; in *Rinodina pyrina, exigua* and *Conradi* the margin is not mycelial, while in *Rinodina milvina, astroides, demissa, Bischoffii,* and *atrocinerea* it is mycelial and radiating. In the lithophilous species *Rinodina atrocinerea* and *astroides* the thallus is distinctly areolar.

Anatomy. In *Rinodina exigua* and *Conradi* the cortex has no distinct cuticle, while a cuticle is developed in *Rinodina confragosa* and *atrocinerea*. The gonidia are mostly cystococcoid; however, not a few specimens of *Trentepohlia* were found in *Rinodina Bischoffii*. For the anatomical details of the apothecia, vide the descriptions of the species.

P y c n i d i a were found in *Rinodina pyrina, demissa, atrocinerea,* and *confragosa.* The conidia are straight, short, rod-like; in *Rinodina atrocinerea* they are, however, somewhat longer and slightly curved.

RINODINA PYRINA.

ACH.

(Plate 120—121).

On the periderm of *Salix. Rispelbjerget. Bornholm* 1884. P. HELLBOM.

The t h a l l u s is extremely thin, in some places smooth, in others faintly granular; the colour is greenish-grey; the margin of the thallus shows no distinct mycelial hyphæ but passes insensibly into the substratum.

The c o r t e x is thin; its upper layer is cuticle-like, while the deeper layers are living and formed of short-celled, irregularly interwoven hyphæ. The g o n i d i a l layer is rather loose in texture, short-celled, without haustoria. The gonidia are chiefly cystococcoid. In addition *Trentepohlia* chains were found embedded here and there in the thallus.

The m e d u l l a is thin, composed of very loosely woven, more long-celled hyphæ.

The a p o t h e c i a are spread over the thallus without any visible order, here and there somewhat crowded. At first, when just breaking out of the thallus, they have a dark, brownish-black disc, which is not always accompanied by a thalline margin. When older, they have a rather plane disc surrounded by a persistent, grey thalline margin.

The exiple of the apothecium consists of a calyx with an indistinct stipes and indistinct sides surrounding the hymenium. All the hyphæ of the calyx are rather short-celled. Distinct ascogenous hyphæ are found in the colourless hypothecium. The p a r a p h y s e s are unbranched or branched, with brown, capitate top-cells; they are embedded in a well developed hymenial gelatine. The a s c i are clavate; their walls are slightly thickened at the top. They contain 8 brown, sometimes slightly curved spores with a rather thin transverse-wall; length about 11—15 μ.

Margo thallinus has the same structure as the rest of the thallus. P y c n i d i a are embedded in the thallus; they are composed of colourless, short-celled hyphæ radiating towards the centre of the pycnide; each hypha cuts off an oblong conidium from the apical cell.

RINODINA EXIGUA.

ACH.

(Plate 122—123).

On bare wood. *Ferslev.*

The thallus is thin, granular, sordidly greyish; its margin has no distinct mycelial hyphæ.

There is no distinct cortex, as the hyphæ are living and mixed with gonidia almost to the very surface of the thallus. The gonidial layer is composed of irregularly interwoven, short-celled hyphæ with intercellular spaces, but without haustoria. The gonidia are cystococcoid. The medulla is very loose in texture and built of long-celled hyphæ.

The apothecia are numerous; they are formed partly in centrifugal order, partly they are intercalated among the older ones. At first they have a plain, brownish-black disc surrounded by a crenate, greyish thalline margin; later on the disc turns almost purely black while the thalline margin is persistently crenate and grey.

The exiple of the apothecia consists of a thalline margin of the same structure as the rest of the thallus. Inside this margin there is a calyx of rather short-celled, densely woven, colourless hyphæ; the bottom of the calyx has a rather distinct stipes, its sides (parathecium) are rather thin and formed of a few cell-layers. In the colourless hypothecium there are distinct ascogenous hyphæ. The paraphyses are rather long-celled, branched or unbranched at the tips, with swollen brown apical cells; there is a rather well developed hymenial gelatine.

The asci are clavate; their walls are somewhat thickened at the top. They contain 8 brown, 2-celled spores with a distinct isthmus connecting the lumina; they measure 12—13 μ in length.

Pycnidia were not observed.

Rinodina pyrina and *Rinodina exigua* are no doubt closely allied. TH. FRIES refers them to one species. Whether they really represent one species, whether they may issue from one another under due life-conditions, is, however, unknown.

The most conspicuous difference between the two specimens described here is found in the structure of the spore: Ordinary 2-celled spores were found in *Rinodina pyrina* while in *Rinodina exigua* they were polari-dyblast. Whether this structural detail is constant or not, is unknown; the question can only be settled by cultivation-experiments.

RINODINA CONRADI.

KOERB.

(Plate 124—125).

On moss. On the roof of »*Bakkehuset*«. *Skaarup, Fyn.* E. ROSTRUP.

The thallus spreads over the moss as a thin, rather light, greyish film, going from one stem to another, for which reason the thallus becomes rather uneven. The ex-

treme margin of the thallus shows no distinct mycelial hyhpæ but is composed of small, confluent granules.

There is no genuine c o r t e x, as the gonidia nearly go to the very surface, only covered by one layer or some few layers of living, short-celled hyphæ. The g o n i d i a l layer has short-celled, irregularly woven hyphæ without haustoria. The gonidia are cystococcoid. The hyphæ of the m e d u l l a are still looser in texture; they show no signs of chemically attacking the cell-walls of the moss, but kill the moss by overshadowing.

The a p o t h e c i a arise in centrifugal order. The disc is plane, chestnut-coloured, surrounded by a greyish, even or slightly crenate, thalline margin.

The exiple of the apothecium consists of a thalline margin of the same structure as the rest of the thallus. Inside the thalline margin follows a calyx with a distinct stipes and thin but very distinct sides surrounding the hymenium and above forming a colourless, narrow margo proprius. The hyphæ of the stipes are erect, short-celled, dense; above, they spread in all directions through the bottom of the calyx, from where they run upwards through the sides of the calyx. In the colourless hypothecium there are distinct ascogenous cells. The p a r a p h y s e s are long-celled, branched or unbranched at the tips, with brown, swollen apical cells; they are embedded in a copious hymenial gelatine.

The a s c i are broadly clavate; their walls are slightly thickened at the top. They contain 8 brown, 4-celled spores with thick walls and usually provided with an isthmus connecting all four cells. Their length varies from 24 to 28 μ.

P y c n i d i a were not observed.

RINODINA SOPHODES.

ACH.

(Plate 126).

On the periderm of *Quercus*. *Hjortenæs ved Sorø*. J. LANGE.

The t h a l l u s is coherent, granular, faintly brownish-grey. The granules are small, irregular, of varying size and form. The c o r t e x is composed of irregularly interwoven, short-celled, dense, and living hyphæ with faintly brownish cell-walls; above they gradually die off, thus forming a colourless cuticle.

The g o n i d i a l layer is looser in texture, without haustoria. The gonidia are cystococcoid. The m e d u l l a r y-r h i z o i d a l layer is very loose.

The a p o t h e c i a are very numerous, rather crowded, and sometimes coalescent. At first they are regularly orbicular, with a blackish-brown disc and a slightly crenate, light margo thallinus; by degrees they become more irregular, with a somewhat convex disc and a persistent, crenate thalline margin, which occasionally is not entire.

The calyx-stipes is rather low, going, however, to the very surface of the substratum. The bottom of the calyx is formed of irregularly interwoven, dense, short-celled hyphæ; its sides are thin and formed of ascendent, colourless hyphæ, the uppermost cells of which (in the proper margin) are brown. In the colourless hypothecium there are numerous, distinct ascogonia. The paraphyses are rather long-celled, branched at the top and with somewhat swollen tips, coloured brown from a non-granular pigment. The asci are rather narrow, their walls moderately thickened at the top. Most often they contain eight brown, two-celled spores, which sometimes have an isthmus connecting the two cell-lumina. They measure 16—20 μ in length. The thalline margin has the same anatomical structure as the rest of the thallus.

Pycnidia were not observed.

This species agrees so accurately with *Rinodina milvina* in all anatomical structures that they may possibly constitute only one species. Whether they may issue from one another under due life-conditions, is not known and cannot be ascertained without experiments.

RINODINA MILVINA.

WAHLENBG.

(Plate 127—128).

Specimen 1. On granite. *Vilsted*. TH. JENSEN.

The thallus is rather thick; its margin has free, mycelial, radiating, black hyphæ continuing into a dark-brown, thin, smooth, inter-areolar thallus, which is rather well developed at the vicinity of the margin of the thallus, and in which the areoles gradually arise. Near the margin of the thallus the areoles are scattered, lowly cushion-shaped, regularly roundish or quite irregular in outline. In the older portions of the thallus the areoles are so closely crowded that the thallus is granular-areolate there, with chestnut-coloured, confluent, roundish areoles varying much in size.

The cortex has a colourless cuticle of dead, compressed cells; next follows a living, rather thin cortex of short-celled, slightly brownish hyphæ. The gonidial layer is formed of loosely interwoven hyphæ with rather short cells without haustoria. The gonidia are cystococcoid. The medulla is thick, loose in texture, with hyphæ quite similar to those of the gonidial layer.

The apothecia are formed in centrifugal order in the areoles; in addition, young areoles are intercalated between the older ones. At first they have a small, dark-brown disc, surrounded by a thick, smooth, somewhat lighter margo thallinus. Later on the plane, dark disc is surrounded by a thick, persistent, crenate thalline margin.

The exciple of the apothecia consists of the thick thalline margin, which some-

times differs a little from the rest of the thallus in having no cuticle. Inside this margin follows a distinct calyx with a well developed stipes and with sides surrounding the hymenium and above forming a distinct proper margin. In the stipes the hyphæ are ascendent, colourless, thin, rather long-celled; they have the same character at the bottom and in the sides of the calyx; the uppermost cells of margo proprius have brown cell-walls. In the colourless hypothecium there are distinct ascogenous hyphæ. The paraphyses are long-celled, branched at the tips, with brown apical cells. When ripe the asci are rather broadly clavate and contain 8 brown, polari-dyblast spores. In a very few spores, however, there was found a septum with remains of an isthmus connecting the cells. The spores measure about 14—20 μ in length.

Pycnidia were not observed.

Specimen 2. On granite. Near *Hammershus. Bornholm* 1903. O. GALLØE.

The present specimen is of a considerably darker colour than specimen 1, but it agrees entirely with it in anatomical structure.

RINODINA ASTROIDES.

FL. DAN.

(Plate 129).

On a whitish flint without a covering layer of chalk. *Hofmannsgave, Funen.* J. VAHL.

The thallus is very small, light brownish-white. The margin consists of radiating, somewhat darker brownish, gonidialess hyphæ, at back passing into the coherent, thin, finely granular metathallus. The granules arise as isolated, small areoles in places where the marginal hyphæ take in gonidial algæ. The thallus is very minute and thin. The cortex is thin, composed of some few layers of living hyphæ, which here and there die off and assume a cuticle-like character. The hyphæ are sometimes coloured very faintly brown by a non-granular pigment. The gonidial and medullary layers are very loose in texture, built of irregularly interwoven hyphæ without haustoria. The gonidia are cystococcoid.

The apothecia are rather regularly orbicular, with a dark-brown disc surrounded by a thick, entire, even, and light thalline margin. The exciple consists of a thalline margin structurally similar to the rest of the thallus. Inside this margin there is a calyx with a short stipes, both composed of densely woven hyphæ, which chiefly run vertically through the stipes and upwards through the bottom of the calyx, from where they run outwards and upwards through the sides of the calyx; the apical cells of their hyphæ of the proper margin are faintly brown.

Paraphyses, which are branched at the top, with brown, somewhat swollen tips, issue from the colourless hypothecium. The asci are rather short and broad; most often they contain eight polari-dyblast, brown spores usually provided with an isthmus. They measure about 14 μ in length.

Pycnidia were not observed.

This plant takes up an intermediary position between *Rinodina sophodes* and *Rinodina milvina*. It resembles *Rinodina sophodes* in the light thallus and *Rinodina milvina* in the radiating marginal hyphæ and in the spore usually desplaying an isthmus.

DEICHMANN BRANTH determined this specimen as follows: *Rinodina sophodes, Lichen astroides* FL. DAN.

Whether it may issue from one or both of these species, or whether it is an independent species, can only be ascertained by experiments.

RINODINE DEMISSA.

LAUR.

(Plate 130—131).

On granite. *Hammershus, Bornholm.* 1884. P. J. HELLBOM.

The thallus is very thin, dark brownish-grey. The margin is provided with distinct radiating, dark hyphæ. Immediately behind these hyphæ the thallus is coherent, faintly granular and gonidiiferous; its central parts are somewhat thicker and cracky-areolate.

The cortex is thin, in places provided with a colourless cuticle and beneath the latter with a cortex of living, erect hyphæ with swollen, brown top-cells, which impart a brownish colour to the thallus. The gonidial layer is formed of short-celled, irregularly interwoven hyphæ without haustoria. The gonidia are cystococcoid. The medulla is still looser in texture and is built of long-celled hyphæ.

The apothecia are scattered over the thallus without any visible order. At first they have a small, punctiform disc, surrounded by a comparatively thick thalline margin of the same dark colour as the rest of the thallus. When ripe they are rather regularly orbicular, with a plane, black disc and a high, thick, persistent, dark-brown margo thallinus. Accordingly, they have an almost biatorine appearance, whereas their anatomical structure is truly lecanorine.

The exciple of the apothecia consists of a thick thalline margin of the same structure and the same dark colour as the rest of the thallus. Inside the margin follows the calyx with a distinct stipes, bottom, and sides. The stipes is composed of erect, short-celled, dense hyphæ, above running radially outwards and upwards at the bottom of the calyx, from where they continue upwards through the sides of the calyx and surround the hymenium. On a level with the epithecium the calyx has a broad proper margin with swollen, brown top-cells. Distinct ascogenous hyphæ occur in the colourless hypothecium. The paraphyses are rather long-celled, unbranched or branched at the tips, with brown, swollen apical cells; they are embedded in a copious hymenial gelatine. The asci are rather short and broadly clavate; their walls are

thickened at the top. They contain from 4 to 8 brown, 2-celled spores with a thick wall and an isthmus connecting the cell-lumina; they measure 10—12 μ in length.

A single p y c n i d e was found, of which I did not succeed in cutting a complete microtome-section, as the whole of its lower half was cut away. The upper half consists of short-celled, colourless hyphæ radiating from the periphery towards the centre of the pycnide; each of the hyphæ cuts off an oblong conidium at its apical cells.

RINODINA BISCHOFFII.

HEPP.

(Plate 132—133).

On stone. *Billegrawsgaarden, Bornholm.* 1888. P. J. HELLBOM.

The t h a l l u s is nearly orbicular, very thin, dark-sordidly brownish-grey. The margin passes almost insensibly into the substratum, although radiating, mycelial hyphæ of the same colour as metathallus may with some difficulty be distinguished. The metathallus is coherent, slightly granular-areolate, with closely crowded areoles.

The upper layer of the c o r t e x is dead, colourless, cuticle-like; living hyphæ follow deeper down, the top-cells of which are swollen and dark-brown, but scarcely as regular in structure as in *Rinodina demissa*. The hyphæ of the g o n i d i a l layer are short-celled, loose in texture, without haustoria. Two types of gonidia seem to occur, *Cystococcus* and *Trentepohlia*, the latter occurring very copiously; *Trentepohlia* was not found in *Rinodina demissa*. The hyphæ of the m e d u l l a r y layer are chiefly built as those of the gonidial layer.

A p o t h e c i a are very numerous. They are regularly orbicular, with a dark, brownish-black, flat disc, surrounded by a thick, regular, slightly lighter margo thallinus. Thus aparently they have an almost biatorine aspect, but anatomically they are nevertheless truly lecanorine and gonidiiferous. When moistened they become much lighter in colour, as both the margin and the disc assume a sordidly ochraceous colour.

The exciple of the apothecium consists of a thick thalline margin of the same structure as the rest of the thallus. Inside the margin follows a calyx, consisting of a thick, dense bottom with a short stipes, both built of erect, short-celled hyphæ. Thin sides of erect, somewhat longer-celled, colourless hyphæ, the top-cells of which are swollen and brown in the proper margin, issue from the bottom. Distinct ascogenous hyphæ are found in the colourless hypothecium. The p a r a p h y s e s are branched or unbranched at the tips, with swollen, brown top-cells. The a s c i are broadly clavate; they contain eight brown, ordinarily 2-celled spores, without an isthmus, about 8—10 μ long. This species differs from *Rinodina demissa* in wanting an isthmus. Otherwise the two species are very much alike. Whether they may issue from one another under due life-conditions, is not known and can only be settled by experiments.

RINODINA ATROCINEREA.

DICKS.

(Plate 134—135—136—137—138).

Specimen 1. On granite. *Bornholm.* P. J. HELLBOM.

The thallus is rather thin, with a thin, black margin bordering on a specimen of *Ochrolechia parella*. Scattered, fine, black hyphæ or strands of hyphæ spreading over the substratum issue here and there from the margin. Metathallus is dark-greyish, with a faint reddish shade; it consists of closely crowded areoles with a sinuose, irregular outline and rather plane surfaces with very fine wrinkles and roughnesses. Between the areoles there is a thin, very dark inter-areolar thallus (»hypothallus«), which is scarcely visible on account of the close position of the areoles. The areoles are chiefly built of erect hyphæ, which, accordingly, run parallel with the surface of the sides of the areoles; they do not form any true cortex on these sides, whereas there is a cortex on the surface of the areoles. There the cortex is composed of a rather thick, colourless and structureless, cuticle formed by the dying-off of the hyphæ of the underlying cortex. Beneath the cuticle follows a rather thick cortex of erect, short-celled, brown hyphæ. The hyphæ of the gonidial layer are likewise erect, short-celled, but colourless, without haustoria. The gonidia are cystococcoid. The medulla is thick, chiefly brown, yet colourless in places, built of erect, short-celled hyphæ. This layer connects the areoles, thus functioning as an interareolar thallus ('hypothallus').

The apothecia are few in number, extremely small and placed by ones or some few together in each areole. They have a markedly lecideine appearance and are, besides, little lecanorine in anatomical character. Their outline is orbicular, the disc is nearly black, plane, and surrounded by a thin, very slightly lighter margin.

The exciple of the apothecium is purely lecideine in most cases, as the thallus does not partake in the growth, when the apothecium rises above the level of the surface. In some few cases, however, there occurs a low margo thallinus of the same structure as the thallus. Otherwise the apothecium has a well developed calyx with a stipes and with thick sides surrounding the hymenium and above forming a distinct margo proprius. In the stipes the hyphæ are colourless, erect, short-celled; they continue upwards into the bottom of the calyx, which likewise is colourless, and into the sides of the calyx ('the parathecium'), the hyphæ of which are erect, short-celled, colourless, provided, however, with brown apices. The hypothecium is colourless, with distinct ascogenous hyphæ. The paraphyses are unbranched or branched at the tips, with swollen, brown top-cells. The asci are rather broadly clavate; they contain — in this specimen — 6 ordinarily 2-celled spores, which are greyish in unripe state, with unbroken, thick septum, while in ripe state they are very dark-brown, 18—20 μ long. Usually, the spores have no isthmus connecting the cell-lumina; some few, however, were found provided with an isthmus.

Pycnidia are numerous, often several together in each areole. They are deep,

pear-shaped. The perithecium is colourless, composed of short-celled hyphæ, each cutting off an oblong, straight or slightly curved, conidium.

The present specimen was determined by HELLBOM as a *'Buellia moriopsis'* Mass. J. DEICHMANN BRANTH identifies it as a *'Buellia badioatra'*.

I cannot accept these determinations. *Buellia moriopsis* has a dark 'hypothecium' and is in other respects a pronounced *Buellia* as to structure.

I cannot acquiesce in BRANTH's determination either, because, although there are many points of resemblance (vide Part III of the present work, Plates 57—63), there is, however, the conspicuous difference that the present specimen has a 'halo' round its spores. Besides, these spores are much more thick-walled than in *Buellia* (*Catocarpon*) *badioatrum;* in addition, our specimen has a colourless hypothecium, while the hypothecium is brown in *Catocarpon.*

Specimen 2. On granite. *Læsø.* 1870. I. P. JACOBSEN.

The margin of the thallus and the metathallus are very similar to those of specimen 1; here and there, however, the areoles are a little more convex and slightly purer grey than in specimen 1. Anatomically they completely agree.

The shape, colour, and arrangement of the apothecia on the thallus are likewise the same as in specimen 1; distinctly lecanorine apothecia were, however, found, raised over the level of the thallus and increasing radially in area over the underlying areole. In all other features, in the structure of the calyx, stipes, parathecium, margo proprius, hypothecium, paraphyses, asci, and spores, specimens 1 and 2 completely agree.

Pycnidia were quite as in specimen 1.

It is quite evident that specimens 1 and 2 are so much alike in structure that they must be given the same name. The occurrence of markedly lecanorine apothecia in specimen 2 makes it still more evident that these two specimens belong to *Rinodina,* not to *Buellia.*

Specimen 2 was determined as a *Buellia petræa* by CHR. GRØNLUND.

RINODINA CONFRAGOSA.

ACH.

(Plate 139—140).

On granite. *Skaarup, Funen.* June 1871. E. ROSTRUP.

The thallus is thin, yellowish-white, cracky areolate. The areoles are confluent, irregular in outline, nearly plane, and rather smooth on the surface. The margin of the thallus is thin, yellowish-white, without distinct mycelial hyphæ. The hyphæ of the areoles are fairly erect, having, however, a somewhat irregular course. In all parts of the thallus they are rather short-celled and densely woven. There is no distinct cortex on the sides of the areoles, while their surfaces are provided with a colourless and structureless cuticle, under which there follows a living cortex of

erect hyphæ with brown tips. The hyphæ of the g o n i d i a l layer have no haustoria. The gonidia are cystococcoid. The m e d u l l a is rather thick, chiefly colourless and short-celled.

The a p o t h e c i a are numerous, scattered over the thallus without any visible order; here and there they are somewhat crowded. At first they appear as small brownish dots (the discs) on a level with the surface of the thallus. Next they rise above the level and have blackish-brown discs, surrounded by a thick margin. The latter is either light, concolourous with the thallus, or dark like the disc. In the fully developed apothecia the same condition is prevailing: The disc is deeply blackish-brown and rather plane, while the margin is light and thalline, in anatomical structure too, or dark lecideine, without gonidia.

In the lecanorine apothecia there is a margo thallinus of the same structure as the rest of the thallus; otherwise they are built as the lecideine apothecia. The latter have an exciple consisting of a well developed calyx with a distinct stipes and thick sides, above forming a proper margin. The hyphæ of the stipes and of the bottom of the calyx as well as in the sides immediately in contact with the hymenium are rather densely woven and thin. In the periphery of the calyx the cells are shorter and thicker, rather more similar to the other hyphæ of the thallus, e. g. to those of the medulla. In the hypothecium there are distinct ascogenous hyphæ. The p a r a p h y s e s are branched at the tips, with brown, swollen apical cells. The a s c i are broadly clavate, their walls are slightly thickened at the top. They usually contain 8 brown, polari-dyblast spores, about 16—25 μ long.

P y c n i d i a are rather numerous. Their walls are formed of colourless, short-celled hyphæ, from which conidiiferous hyphæ radiate towards the centre of the pycnide. Each hypha cuts off an oblong, thin conidium at the apex.

This species has some resemblance in habit to *Rinodina exigua,* among other things in the light colour of the thallus. Anatomically, however, it is much more similar to *Rinodina atrocinerea, Bischoffii,* and *demissa.*

PLATES

PLATE 1.

ASPICILIA CINEREA (L.).

SMRFLT.

Fig. 1. Thallus with apothecia at all ages. (× 20).

Fig. 2. Areole with two apothecia. The left one has a thalline margin on one side only (to the left). The other apothecium has an exclusively proper margin. (× 80).

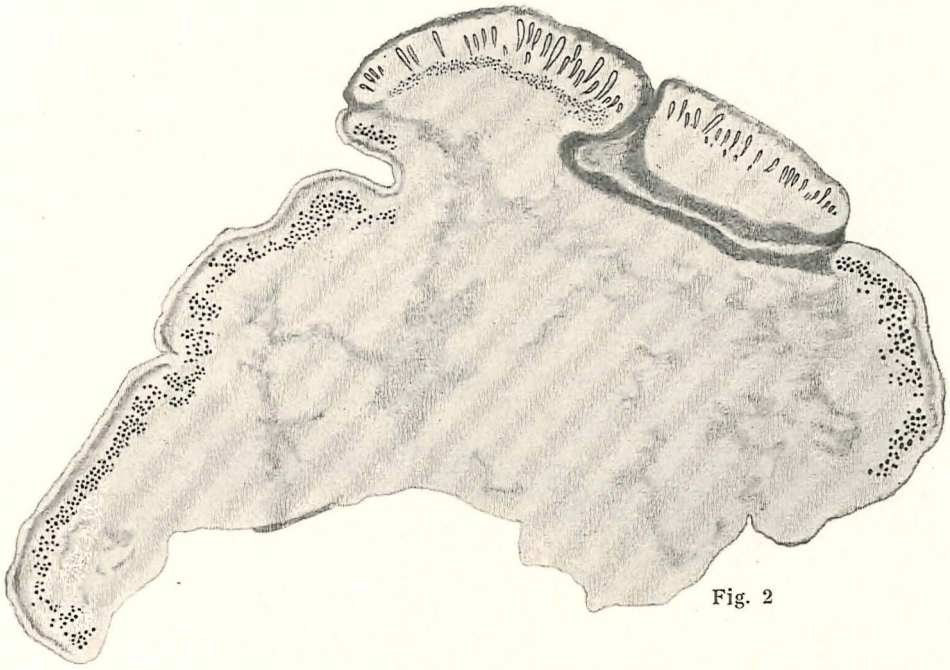


Fig. 2

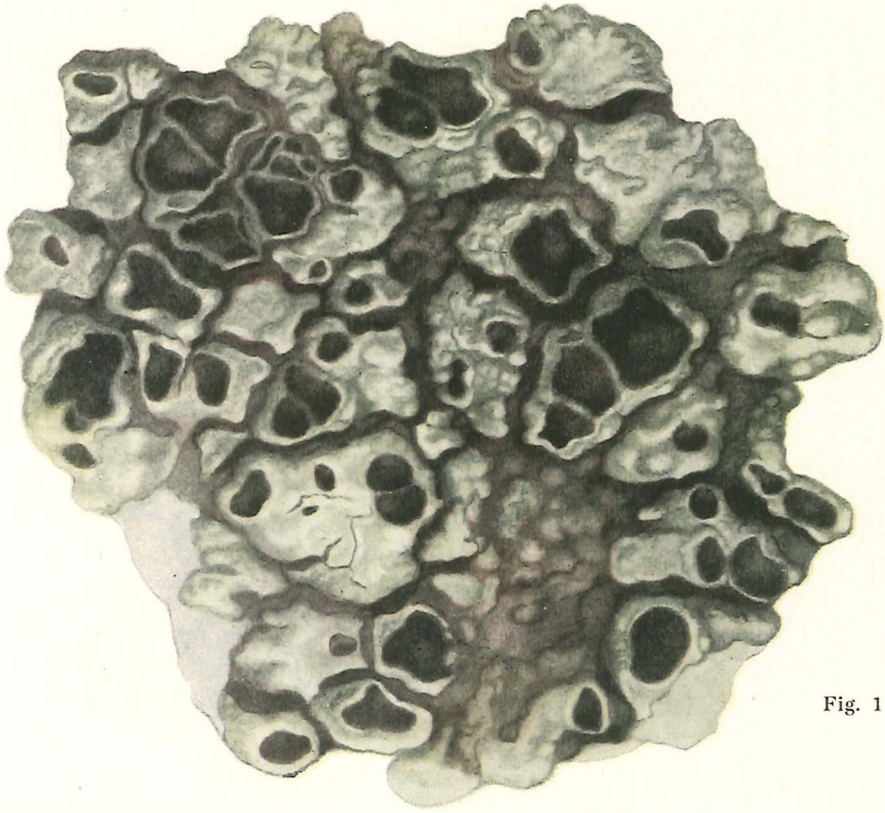


Fig. 1

O. Galløe del.

ASPICILIA CINEREA (L.) SMRFLT.

PLATE 2.

ASPICILIA CINEREA (L.).

SMRFLT.

Fig. 3. Margin of areole with an immersed apothecium provided with distinct hyphæ of calyx and a proper margin. (× 620).

Fig. 4. Margin of areole. (× 620).

Fig. 5. Cuticle, cortex, and gonidial layer. (× 1053).

Fig. 6. Three living gonidia and one dead, empty gonidium. (× 1053).

Fig. 7. Living hyphæ from medulla. (× 1053).

Fig. 8. Dying out hyphæ from medulla, with brown granules in the interior of the cells. (× 1053).

Fig. 9. Ripe ascus. (× 747).

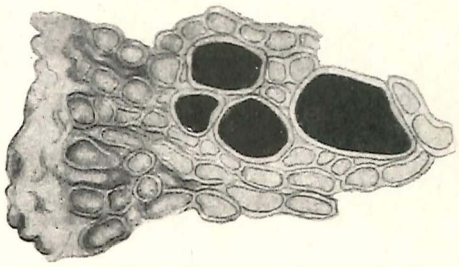


Fig. 5

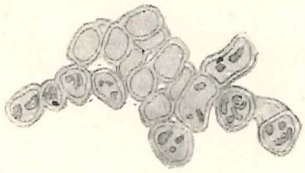


Fig. 8

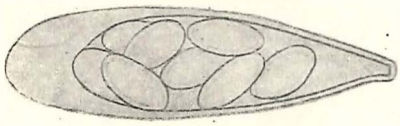


Fig. 9

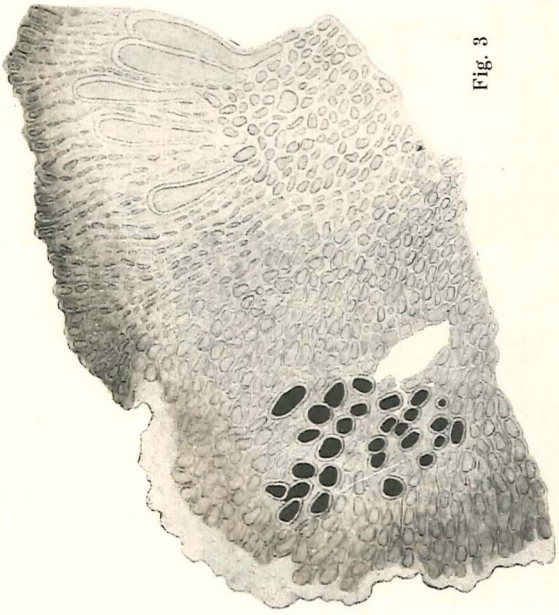


Fig. 3

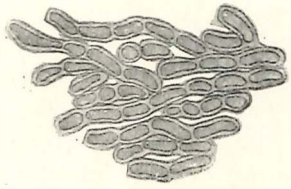


Fig. 7

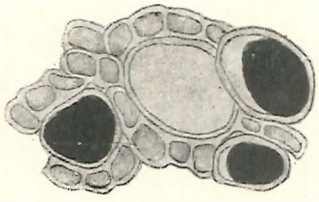


Fig. 6

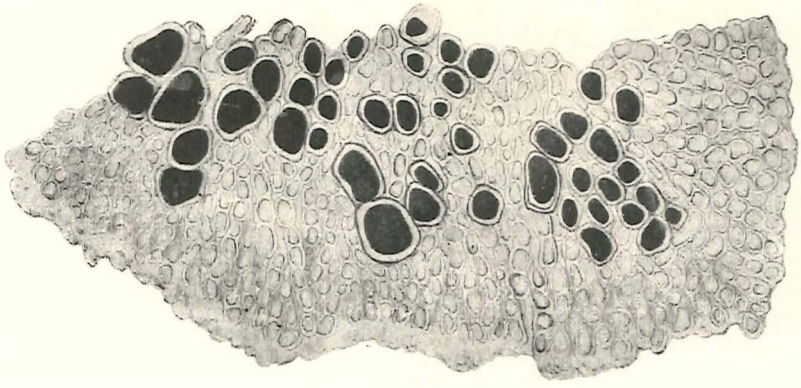


Fig. 4

O. Galløe del.

ASPICILIA CINEREA (L.) SMRFLT.

V. P 1*

PLATE 3.

ASPICILIA FLAVIDA.

HEPP.

Fig. 10. Thallus with apothecia at all ages. (× 18).

Fig. 11. Young apothecia with immersed, black discs. (× 93).

Fig. 12. Areole with six pruinose apothecia. (× 93).

Fig. 13. Areole with two apothecia, of which the left one is entirely lecideïne, while the right one is slightly lecanorine. (× 80).

Fig. 14. Cortex with numerous small brown, and some few white, granules between the hyphæ. Under the cortex follows the gonidial layer. (× 1053).

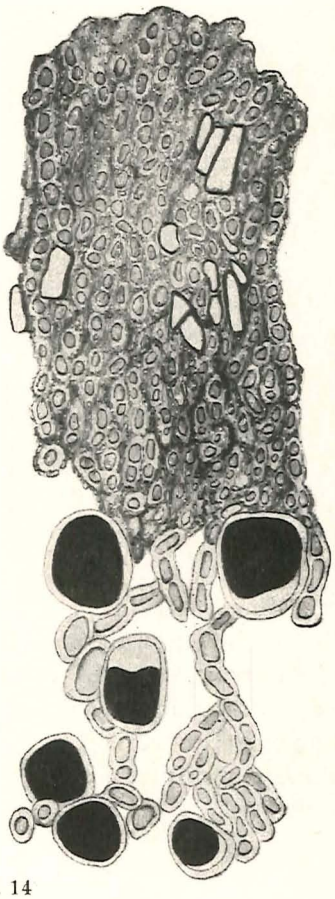


Fig. 14

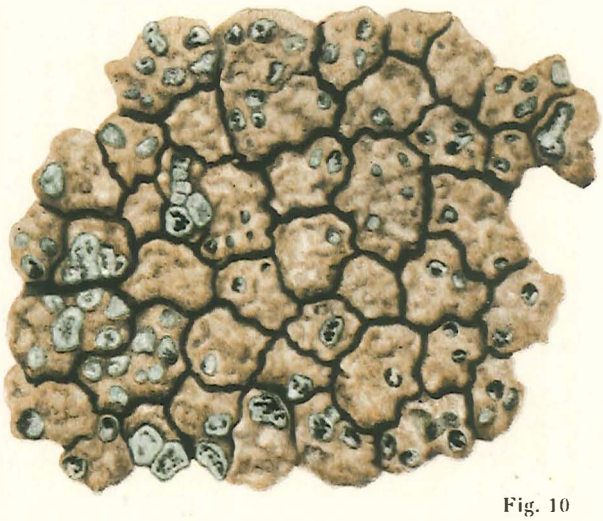


Fig. 10

Fig. 13

Fig. 12

Fig. 11

O. Galløe del.

ASPICILIA FLAVIDA HEPP.

PLATE 4.

ASPICILIA FLAVIDA.

HEPP.

Fig. 15. Margin of an apothecium bordering on the thallus. (× 620).
Fig. 16. Medulla, partly hyaline and partly opaque from white granules. (× 1053).
Fig. 17. Hyaline medullary hyphæ from the base of an areole. (× 1053).
Fig. 18. Isolated cortical hyphæ with small brown granules on their surface; the wall itself is coloured brown from a non-granular pigment. (× 1053).
Fig. 19. Ascogenous hyphæ with young asci, and three paraphyses. (× 747).
Fig. 20. Isolated paraphyses. (× 747).
Fig. 21. Ripe asci. (× 747).

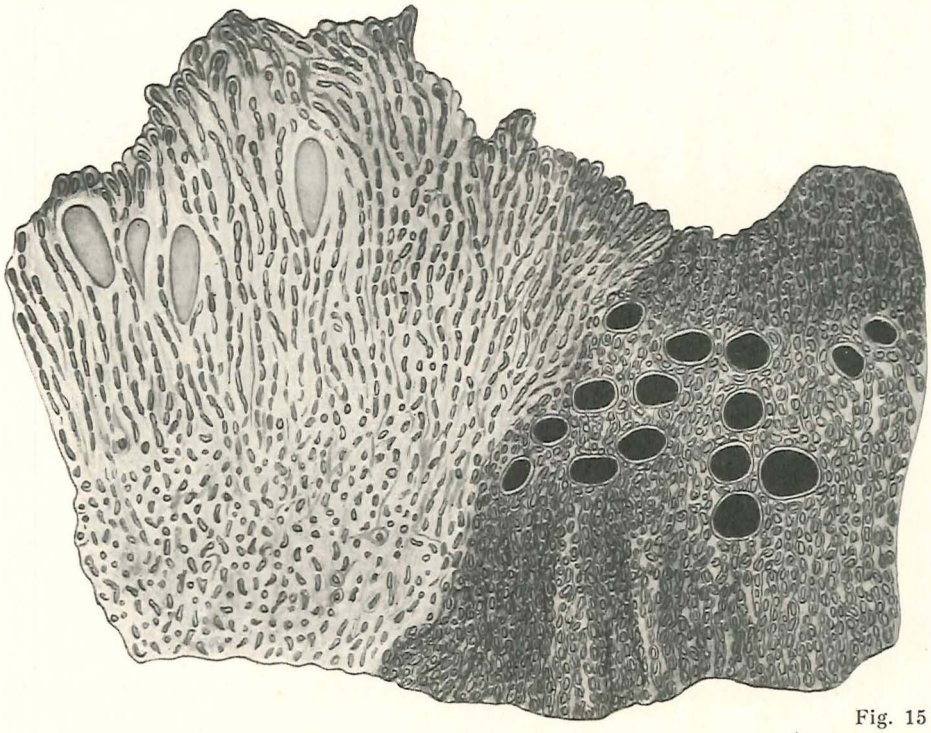


Fig. 15

Fig. 18

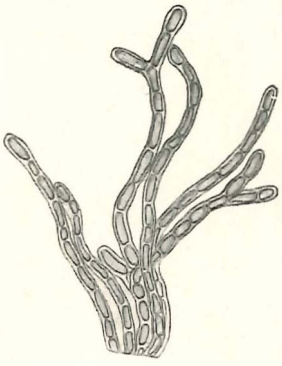


Fig. 20

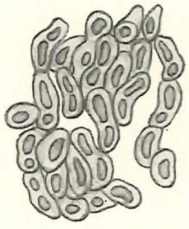


Fig. 17

Fig. 16

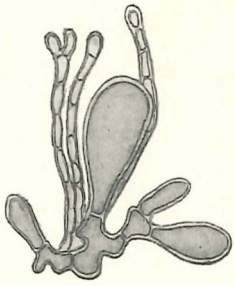


Fig. 19

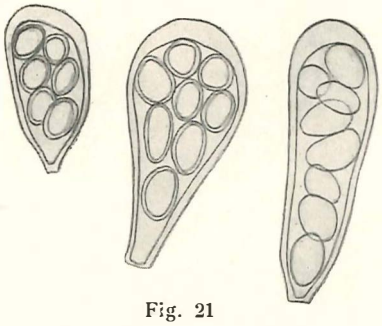


Fig. 21

O. Galløe del.

ASPICILIA FLAVIDA Hepp.

PLATE 5.

ASPICILIA GIBBOSA.

ACH.

Specimen 1.

Fig. 22. Margin of thallus with incipient areoles and fully developed areoles containing apothecia. (× 20).

Fig. 23. Areole with to immersed apothecia. There is no stipes. The dark portions of medulla represent hyphæ which are brown from minute granules on the outside of the cell-wall. (× 93).

Fig. 24. Three apothecia. (× 90).

Fig. 25. Above, a young areole connected with the margin of thallus, which did not contain gonidia in this section. Below, a young areole on the margin of thallus. (× 140).

Fig. 26. Margin of thallus, with thick cuticle and brown horizontal hyphæ. (× 1053).

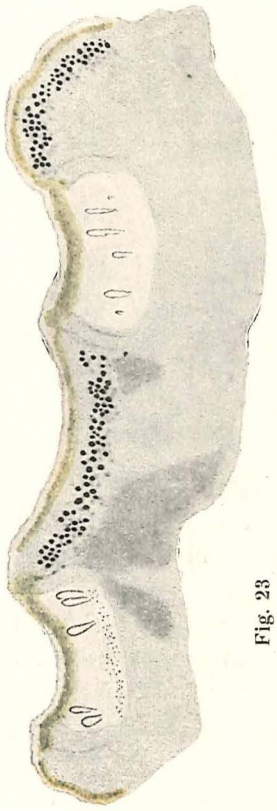


Fig. 23

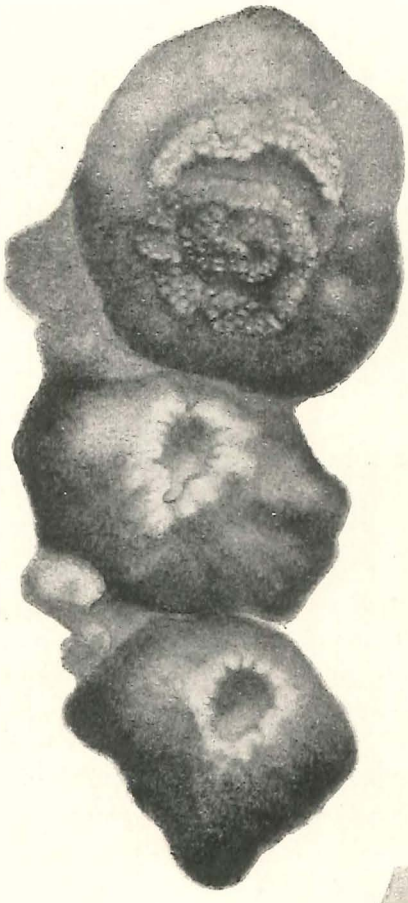


Fig. 24

Fig. 25

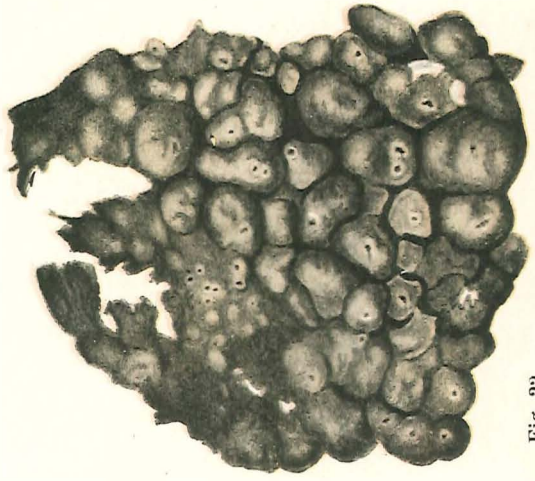


Fig. 22

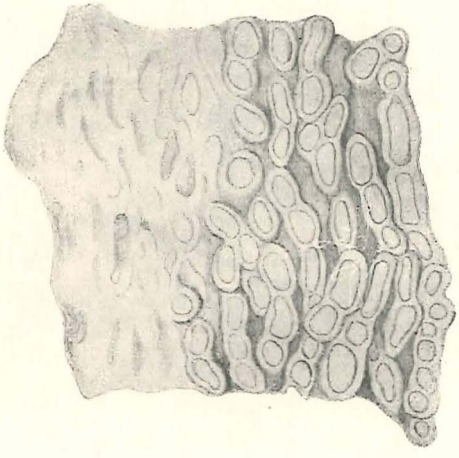


Fig. 26

O. Galloe del.

ASPICILIA GIBBOSA Ach.
(Specimen 1).

V. P 2

PLATE 6.

ASPICILIA GIBBOSA.

ACH.

Specimen 1.

Fig. 27. Two corticate areoles connected with inter-areolar thallus. (× 747).

Fig. 28. Two cells from medulla; slightly brownish granules are deposited on the outside of the wall. Cells of this character occur here and there among ordinary, colourless medullary cells. (× 1053).

Fig. 29. Portion of areole, with the margin of an apothecium (provided with calyx and proper margin). To the right, a cross-section of hyphæ from calyx. (× 1053).

Fig. 30. Paraphyses and a young ascus. (× 747).

Fig. 31. Ripe ascus. (× 747).

Fig. 32. Ripe ascus. (× 747).

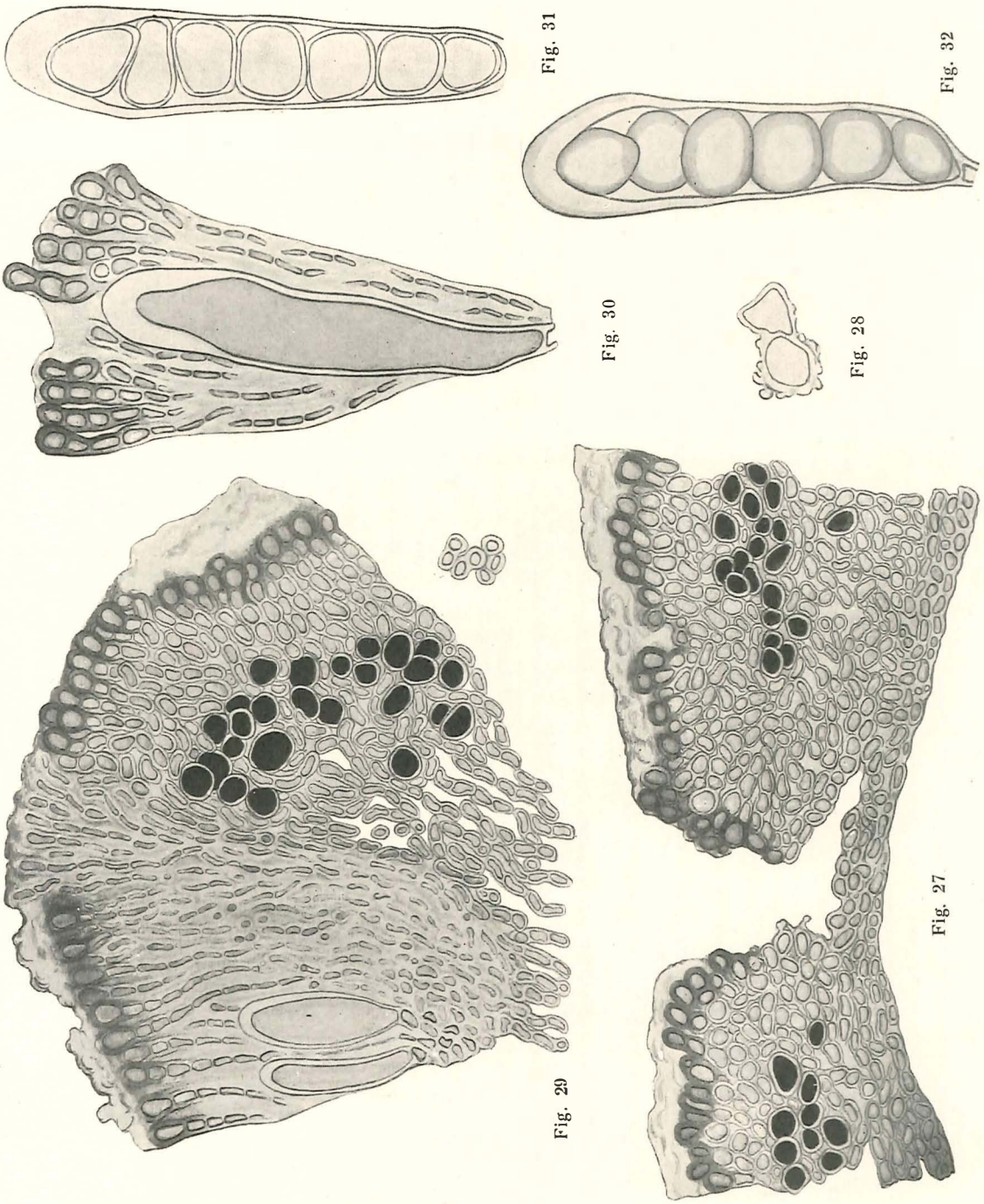


Fig. 31

Fig. 32

Fig. 30

Fig. 28

Fig. 29

Fig. 27

O. Galløe del.

ASPICILIA GIBBOSA Ach.
(Specimen 1).

PLATE 7.

ASPICILIA GIBBOSA.

ACH.

Specimen 2.

Fig. 33. Areoles near the margin of thallus, with young immersed apothecia. (× 10).

Fig. 34. Older, immersed apothecia. (× 10).

Fig. 35. Young apothecia. Their margins are proper margins (i. e. parathecial margins of calyx), without gonidia but still of the same colour as the thallus. (× 10).

Fig. 36. A group of confluent, small apothecia, and a big, older, somewhat convex apothecium, almost entirely deprived of a thalline margin. (× 10).

Fig. 37. Old areoles with immersed apothecia. (× 15).

Fig. 38. Two neighbouring areoles, thinly corticate on half of the right lower surface, which latter is squamiform and free of the substratum. The left areole contains a young apothecium. (× 80).

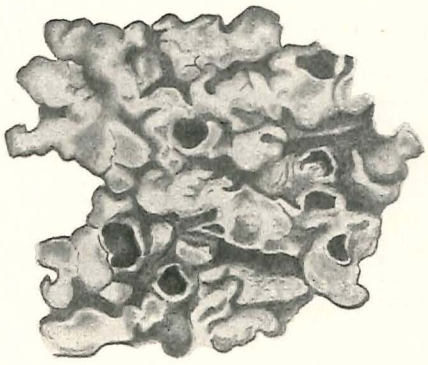


Fig. 34

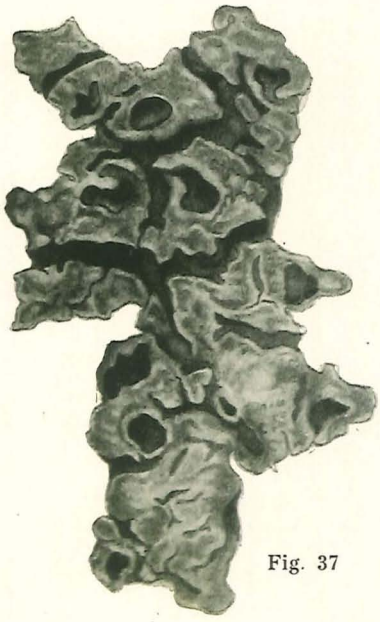


Fig. 37

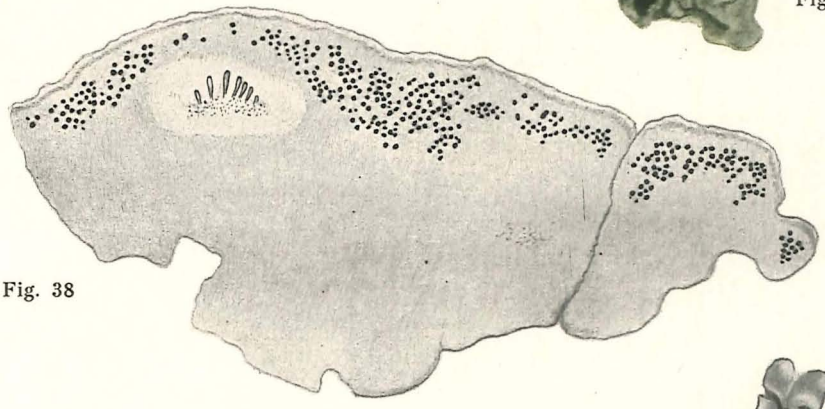


Fig. 38

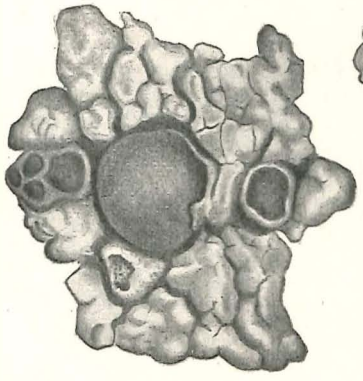


Fig. 36

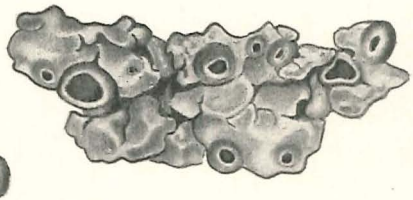


Fig. 35

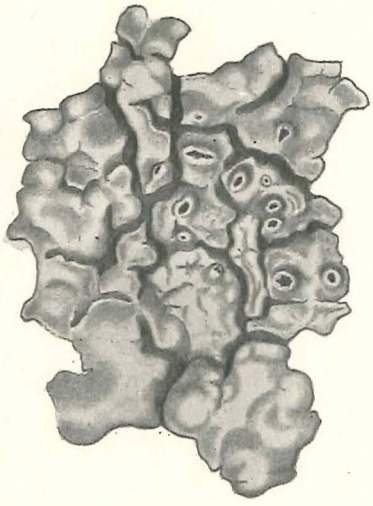


Fig. 33

O. Galløe del.

ASPICILIA GIBBOSA Ach.
(Specimen 2).

PLATE 8.

ASPICILIA GIBBOSA.

ACH.

Specimen 2.

Fig. 39. Two entire areoles and part of a third one (to the right in the figure). Note the arrangement of the gonidia in the areole. The central areole contains an (unripe) apothecium with a distinct, gonidia-less proper margin, the outside of which has the same colour as the thallus. (× 80).

Fig. 40. Cortex and gonidial layer. (× 1053).

Fig. 41. Medulla. (× 1053).

Fig. 42. Margin of apothecium, with a well developed proper margin rising above the level of the adjacent thallus; it has the same colour as the thallus and thus imparts a false impression of the apothecium having a true margo thallinus. (× 620).

Fig. 43. Hyphæ from a longitudinal section of stipes. (× 1053).

Fig. 44. Paraphyses cut horizontally. (× 1053).

Fig. 45. Hymenium and hypothecium. (× 1053).

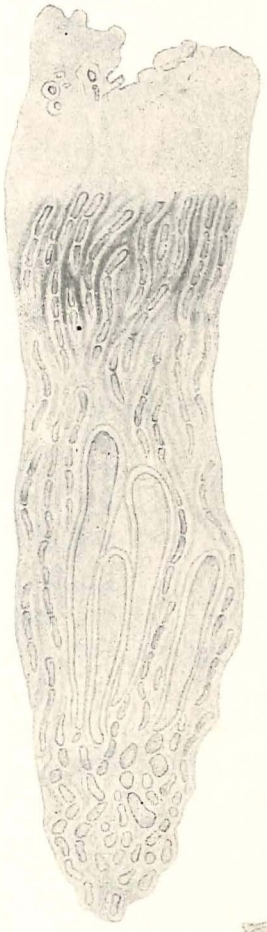


Fig. 45

Fig. 40

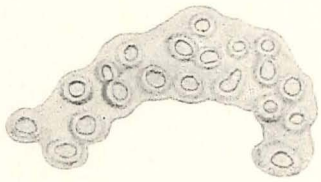


Fig. 44

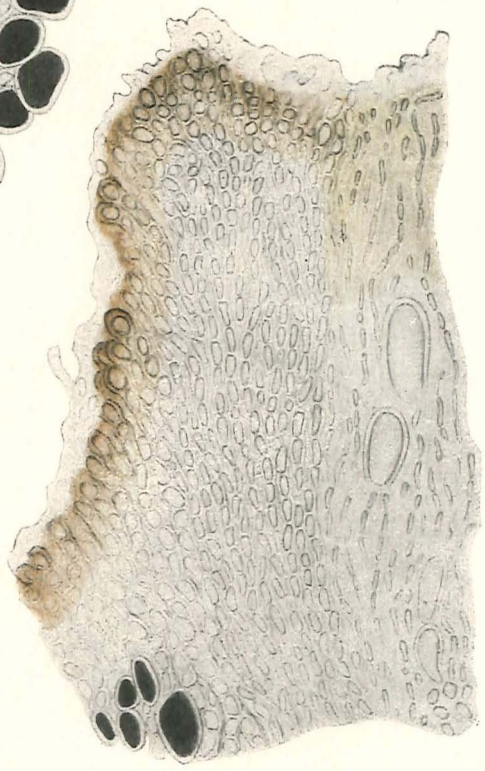


Fig. 42

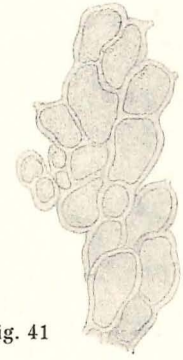


Fig. 41

Fig. 43

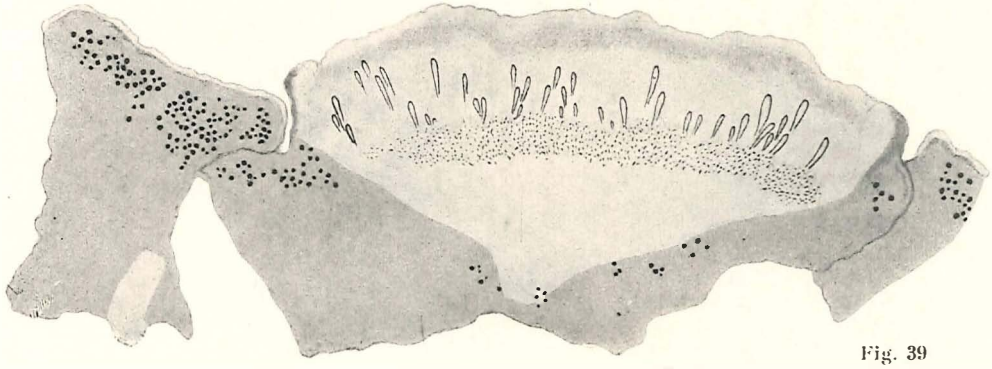


Fig. 39

O. Galløe del.

ASPICILIA GIBBOSA Ach.
(Specimen 2).

PLATE 9.

ASPICILIA CONTORTA.

ACH.

Fig. 46. Thallus with apothecia. Below in the figure is seen a white dot representing a grain of quartz of the substratum, over which a minute margin of thallus is spreading. (× 15). Above is seen a very young apothecium. (× 15).

Fig. 47. Stipitate areole, which at the top widens into a minute squamule. (× 80). It contains an apothecium without stipes, provided with a thick thalline margin. (× 80).

Fig. 48. Margin of a squamiform areole, the upper surface of which has a partly dead cortex, whereas the cortex of the lower surface is living. (× 620).

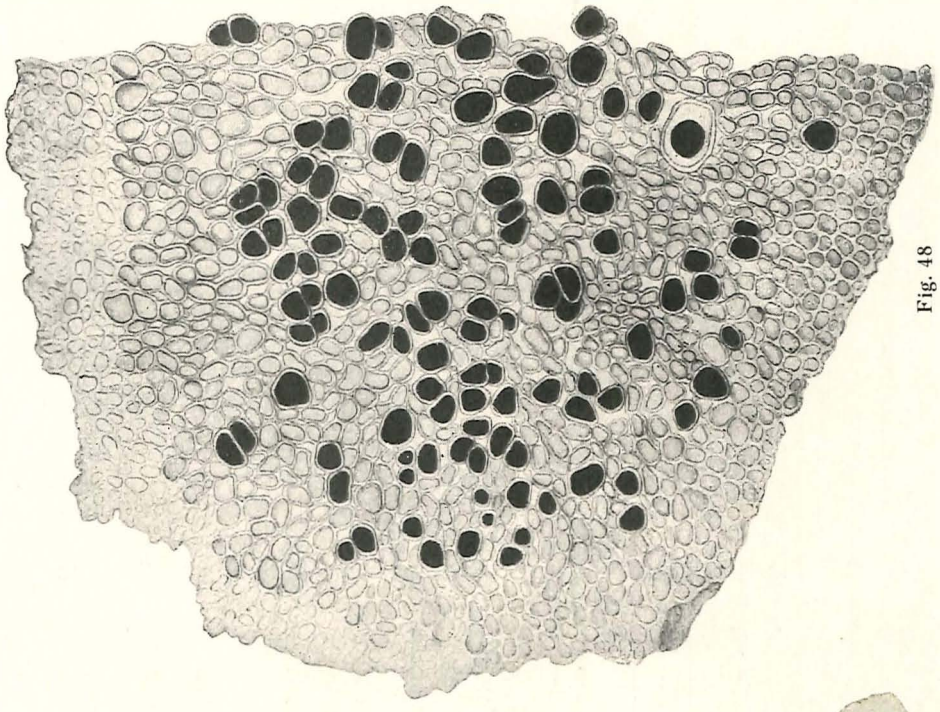


Fig. 48

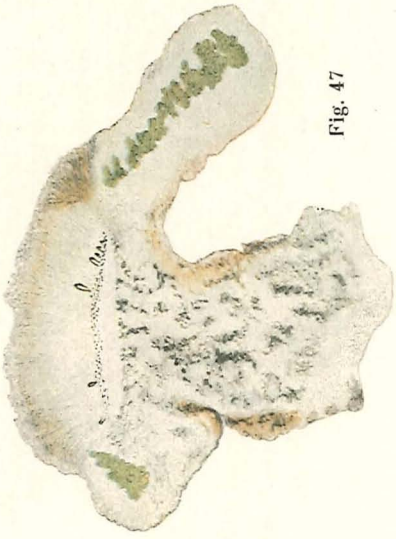


Fig. 47

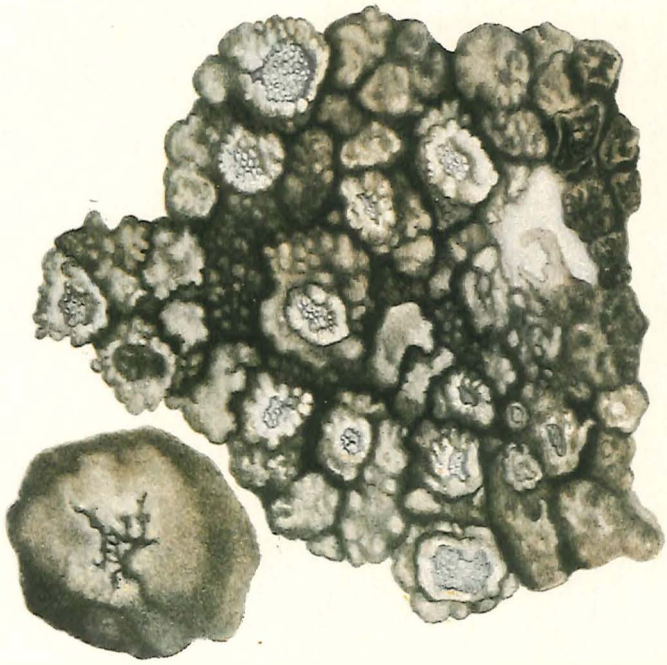


Fig. 46

O. Galløe del.

ASPICILIA CONTORTA Ach.

V. P 3

PLATE 10.

ASPICILIA CONTORTA.

ACH.

Fig. 49. The limit between thallus and the calyx of the apothecium; calyx widens above in either direction. (× 620).

Fig. 50. Above, hyphæ from the part of calyx lying just beneath the hypothecium; below, medullary hyphæ from the portions of thallus directly in contact with the substratum. (× 620).

Fig. 51. Hymenium; some crystals are seen in the epithecium. The big cells occurring in the hypothecium are ascogonia. (× 620).

Fig. 52. Four ripe asci, and two crystals from the epithecium. (× 620).

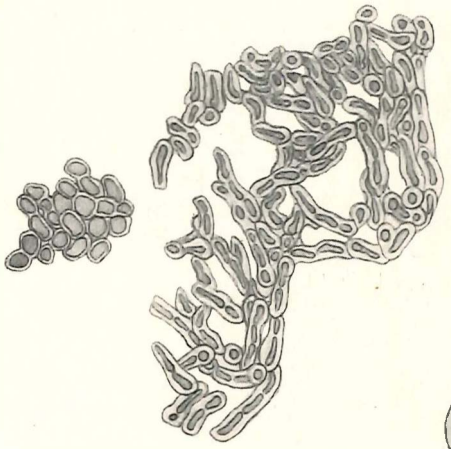


Fig. 50

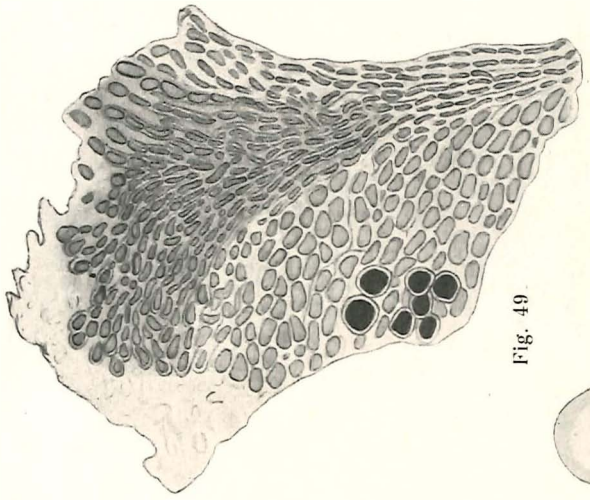


Fig. 49

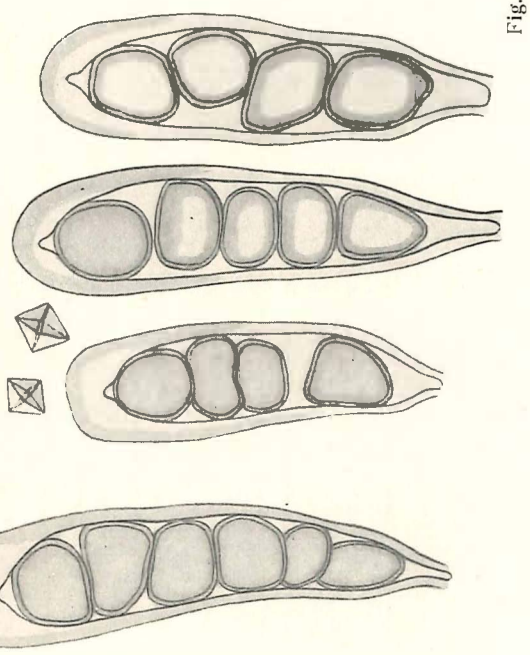


Fig. 52

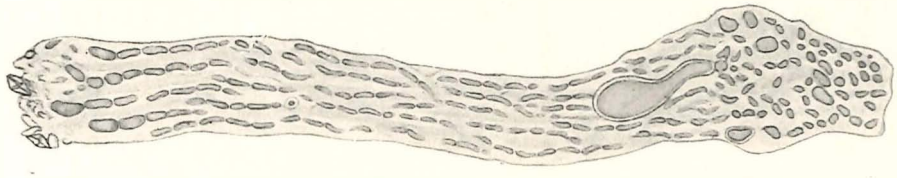


Fig. 51

O. Galløe del.

ASPICILIA CONTORTA Ach.

PLATE 11.

ASPICILIA CALCAREA.
L.

Fig. 53. Thallus growing on mortar; the reddish spots represent grains of quartz. (× 16).

Fig. 54. Young apothecium with pruina. (× 80).

Fig. 55. An entire areole with an apothecium. (× 80).

Fig. 56. An entire areole with an apothecium. (× 80).

Fig. 57. An entire areole with a slightly pruinose apothecium. (× 80).

Fig. 58. Three areoles with apothecia, of which some have no pruina. (× 80).

Fig. 59. Apothecium; there are no ascogenous hyphæ in the apothecium, possibly owing to the fact that a pycnide is formed beneath the hypothecium extending far upwards along the sides of the hymenium, inside the calyx. (× 140).

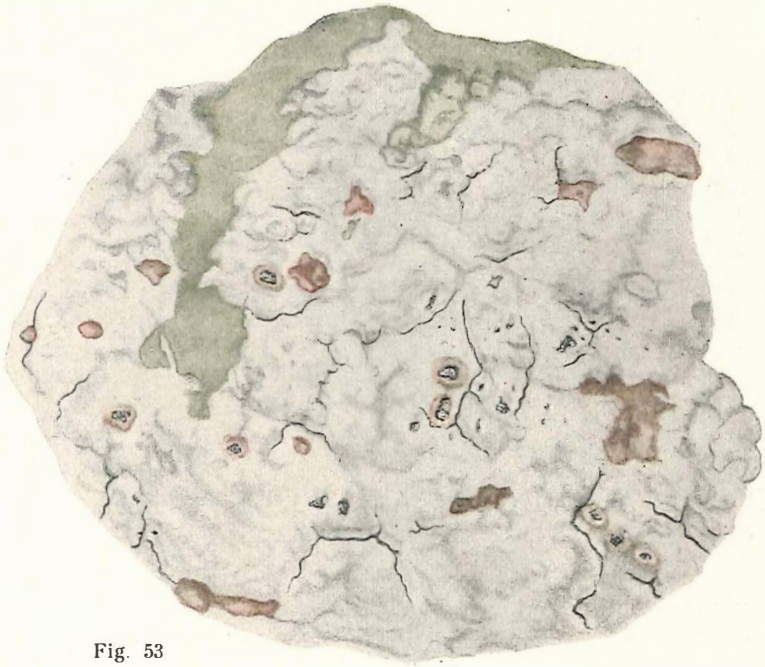


Fig. 53

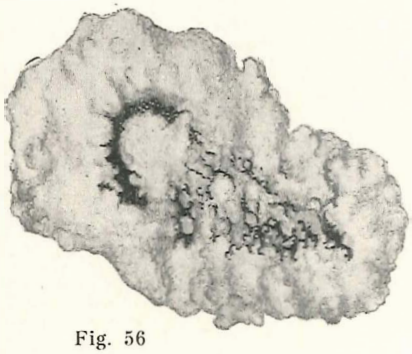


Fig. 56

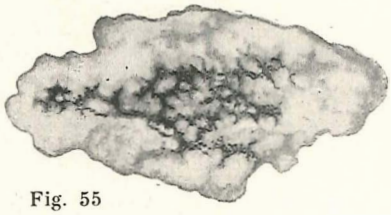


Fig. 55

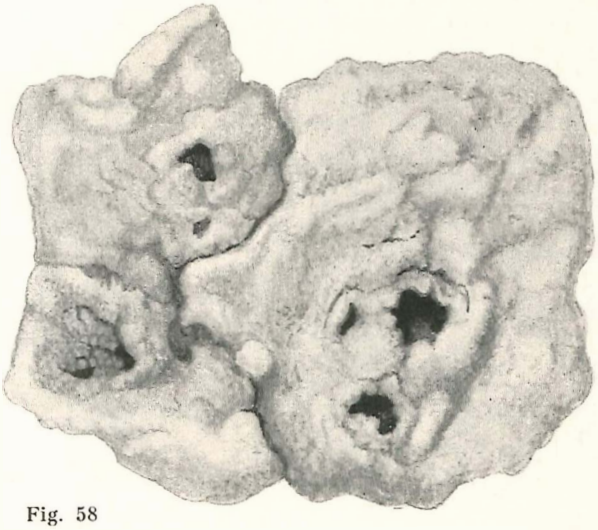


Fig. 58

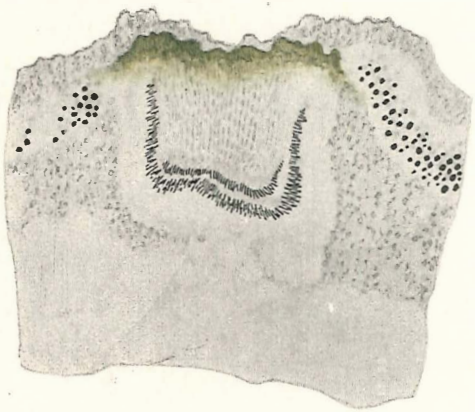


Fig. 59

Fig. 57

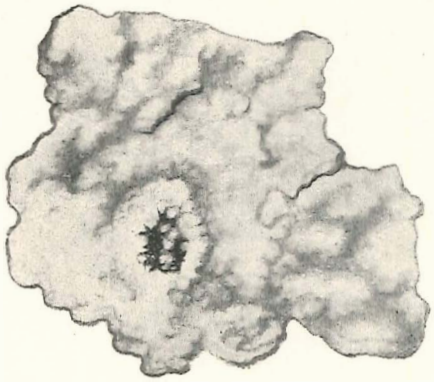


Fig. 54

O. Galløe del.

ASPICILIA CALCAREA L.

PLATE 12.

ASPICILIA CALCAREA.
L.

Fig. 60. Areole, with a pruinose apothecium. (× 80).

Fig. 61. Areole with an apothecium; the grey portions of medulla are opaque owing to the occurrence of granules between the hyphæ. (× 80).

Fig. 62. Margin of areole, the free margin of which is to the right. (× 620).

Fig. 63. Cortex with numerous white granules between the hyphæ. The deeper parts of the cortex are living, without granules. The gonidial layer is seen beneath the cortex. (× 1053).

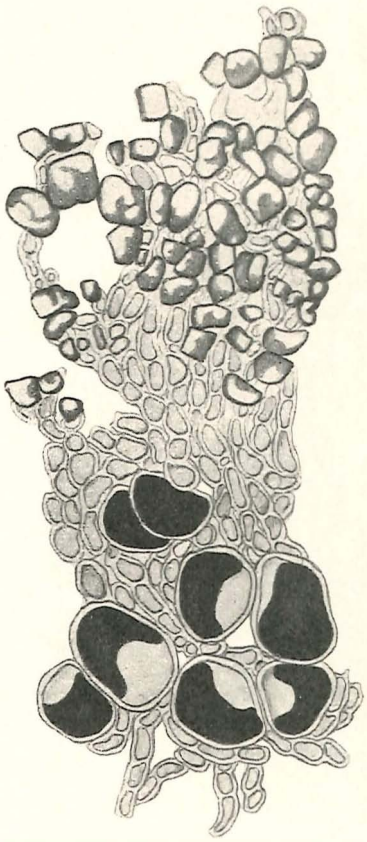


Fig. 63

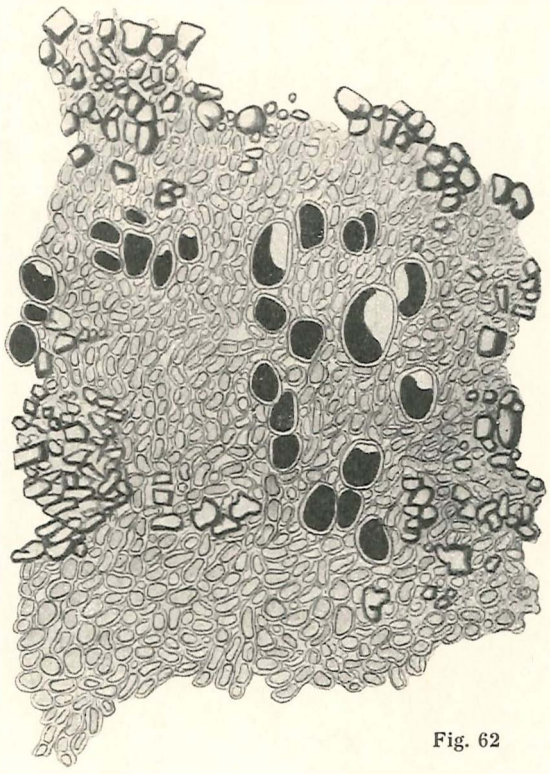


Fig. 62

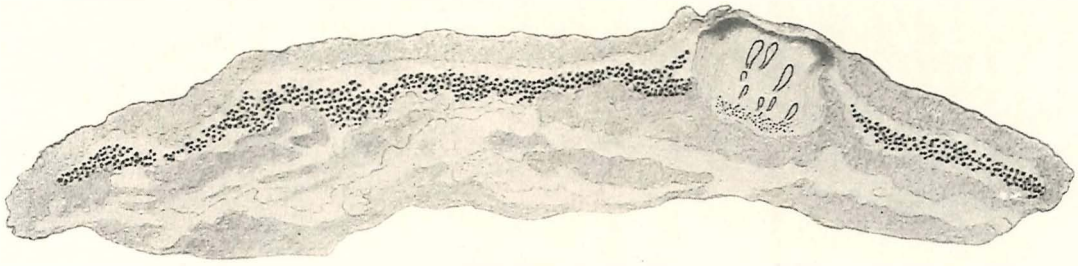


Fig. 61

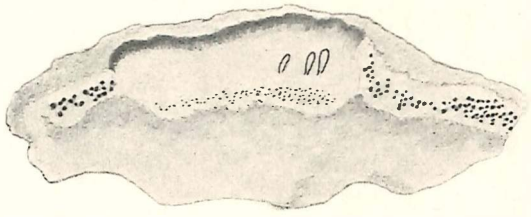


Fig. 60

PLATE 13.

ASPICILIA CALCAREA.
L.

Fig. 64. A single cortical hypha with adhering granules. (× 1053).

Fig. 65. Medulla, transparent and without granules. Some few granules are still present in the upper parts of the section. (× 1053).

Fig. 66. Thallus with one apothecium, two pycnidia, and a partly granular, opaque medulla. (× 140).

Fig. 67. Margin of apothecium, with distinct calyx and adjacent margo thallinus. (× 620).

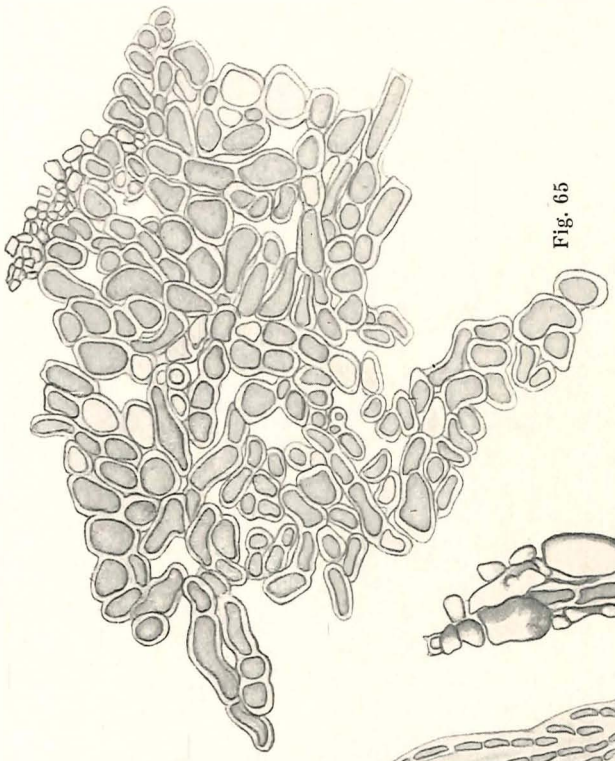


Fig. 65

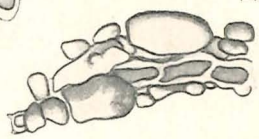


Fig. 64

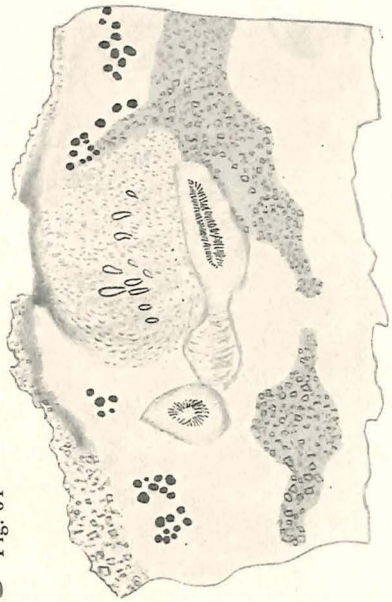


Fig. 66

Fig. 67

O. Galløe del.

ASPICILIA CALCAREA L.

PLATE 14.

ASPICILIA CALCAREA.
L.

Fig. 68. Hymenium with asci and paraphyses, cut horizontally. (× 1053).

Fig. 69. Horizontal section of hymenium, bordering on a pycnide which has been formed between the hymenium and the calyx (comp. Fig. 59). (× 620).

Fig. 70. Three ripe asci. (× 747).

Fig. 71. Perithecium of pycnide, together with three conidiiferous hyphæ and four isolated conidia. (× 1053).

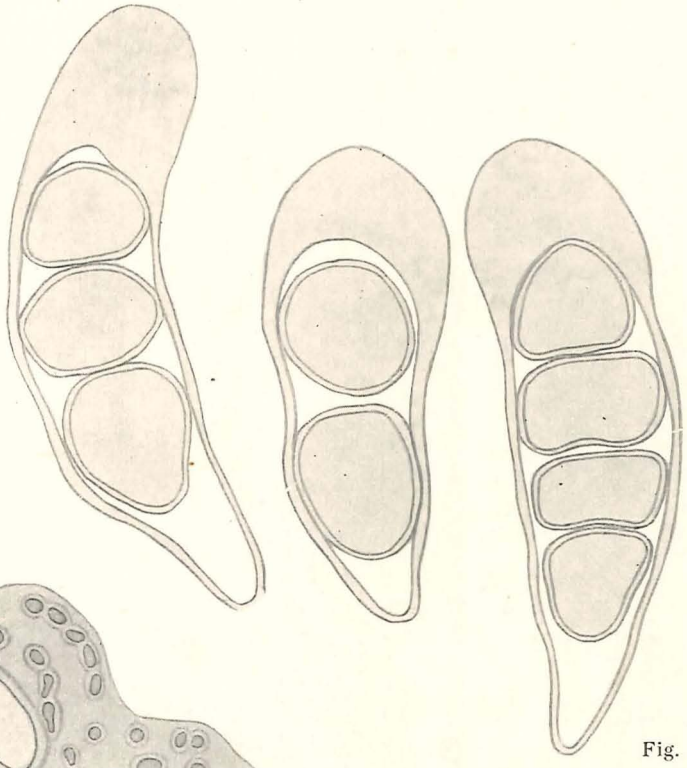


Fig. 70

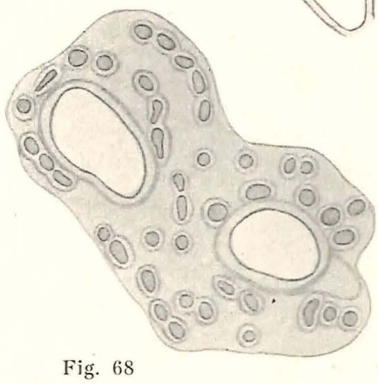


Fig. 68

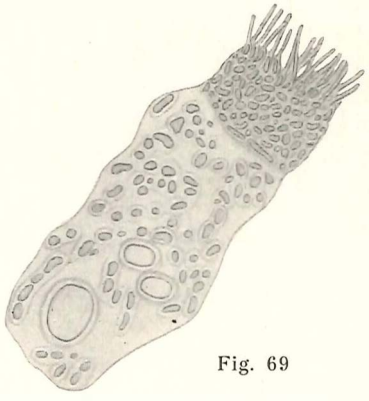


Fig. 69

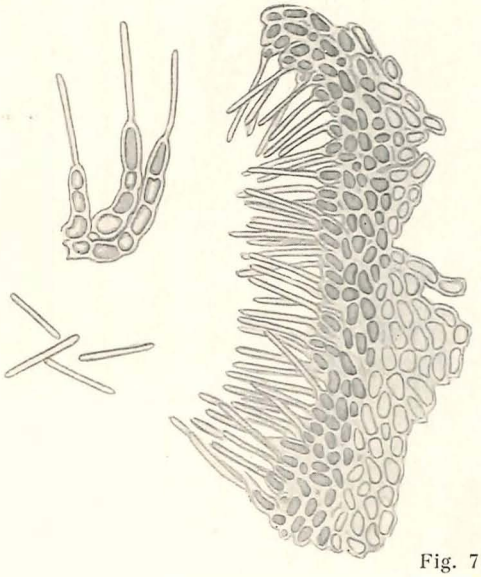


Fig. 71

O. Galløe del.

ASPICILIA CALCAREA L.

PLATE 15.

ASPICILIA LACUSTRIS.

WITH.

Fig. 72. Thallus, on flint. It is areole-like incrassate round the apothecia. The dark margin above to the left belongs to a *Rhizocarpon reductum* (left out in the figure); next follow a *Lecidea crustulata* and another specimen of *Rhizocarpon reductum*. These three neigbours are on the point of suppressing *Aspicilia lacustris* (× 20).

Fig. 73. Four apothecia at different ages. (× 80).

Fig. 74. Entire areole with an apothecium. (× 140).

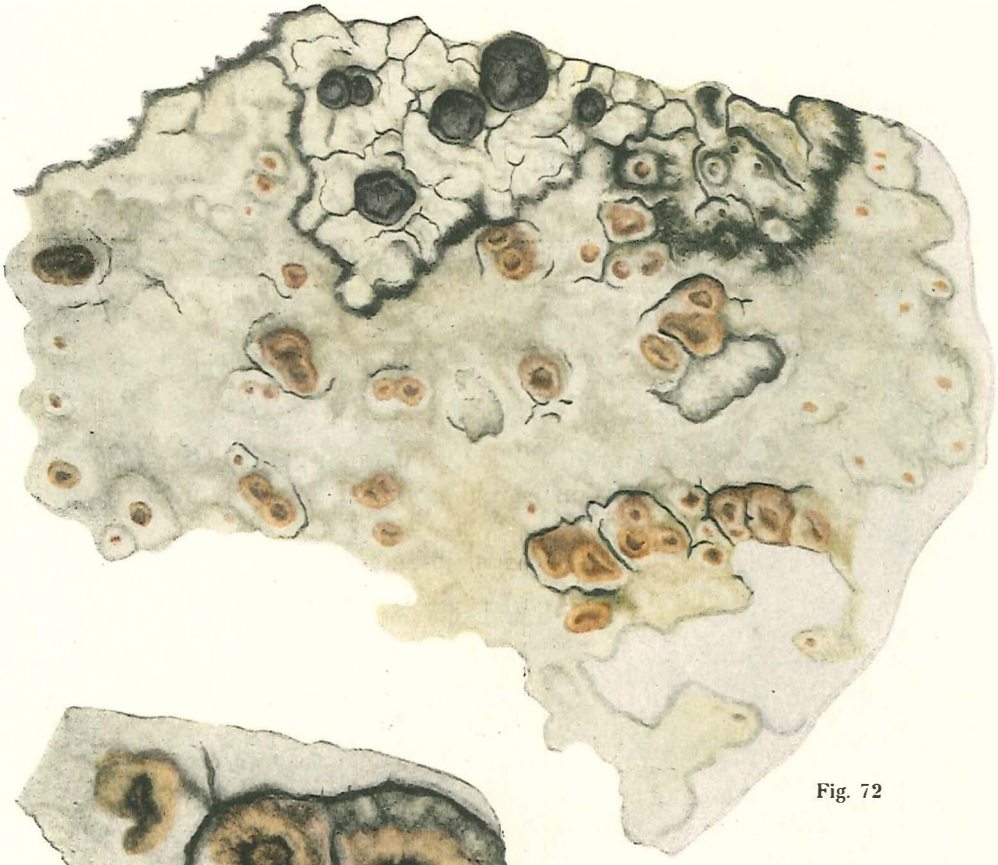


Fig. 72

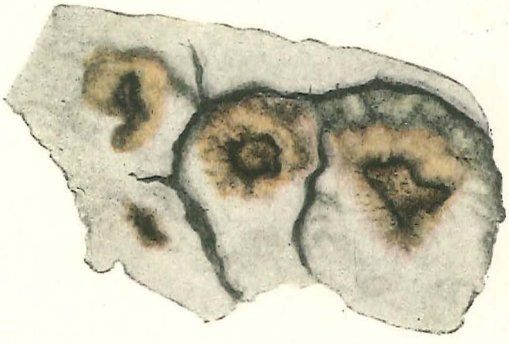


Fig. 73

Fig. 74

O. Galloe del.

ASPICILIA LACUSTRIS With.

PLATE 16.

ASPICILIA LACUSTRIS.

WITH.

Fig. 75. Margin of an areole, acting as margo thallinus of the apothecium developed in it. The apothecium has a distinct calyx. Minute brown granules occur in the epithecium on the apices of the paraphyses. (× 620).

Fig. 76. Cortex, above coloured brown from a non-granular pigment and, moreover, copiously provided with various small granules between the hyphæ. Beneath cortex follows the gonidial layer. (× 1053).

Fig. 77. A gonidial alga on the point of dividing. (× 1053).

Fig. 78. Three paraphyses, in part provided with small brown granules at their apices. (× 1053).

Fig. 79. Above, three ripe spores. Below, hypothecium and a young ascus together with two basal cells of paraphyses. (× 1053).

Fig. 80. Ripe ascus. (× 747).

Fig. 81. Ripe ascus. (× 747).

Fig. 75

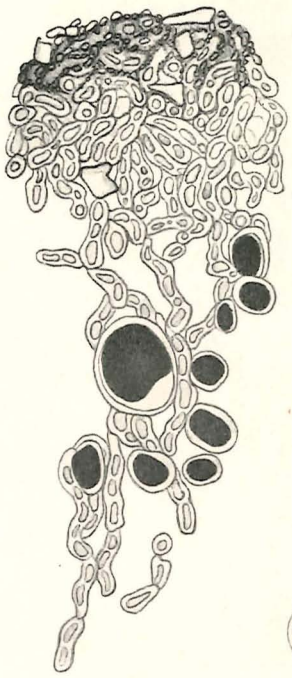


Fig. 76

Fig. 78

Fig. 77

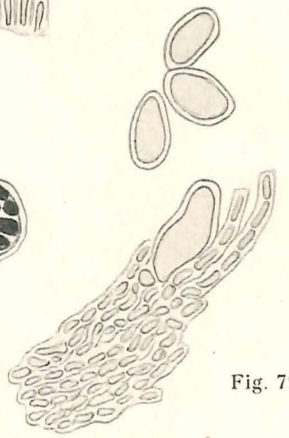


Fig. 79

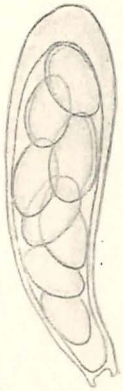


Fig. 80

Fig. 81

O. Galløe del.

ASPICILIA LACUSTRIS With.

PLATE 17.

PLACODIUM CIRCINATUM.

PERS.

Fig. 82. Thallus with apothecia. (× 4).

Fig. 83. Margin of thallus and portions of metathallus, with young apothecia. (× 13).

Fig. 84. Portions of the central parts of thallus, with old apothecia and some few young intercalary apothecia. (× 13).

Fig. 85. Margin of thallus, running over a sterile, areolate crustaceous lichen. The portions of the latter which have recently been overgrown are still alive and have still living gonidia, while other areoles (to the right) are on the point of being destroyed, having only dead and empty gonidia. In this section the course of the hyphæ is shown, as well as the uneven cuticle, the brown cortex, the granular upper medulla, and the downwards turned hyphæ fixing the thallus to the substratum. (× 33).

Fig. 86. Young apothecium. (× 140).

Fig. 87. Old apothecium, with distinct calyx-stipes. (× 140).

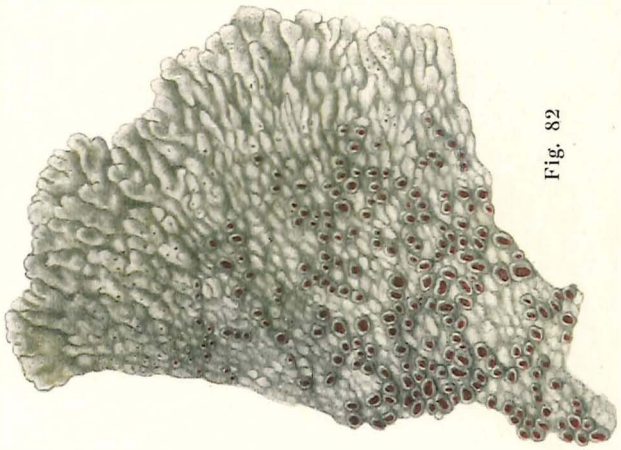


Fig. 82

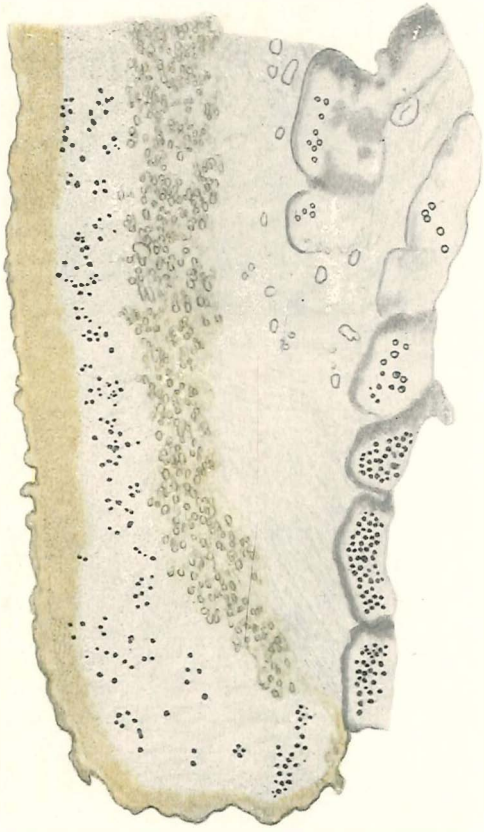


Fig. 85

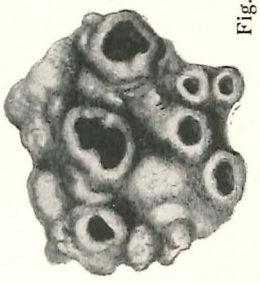


Fig. 84

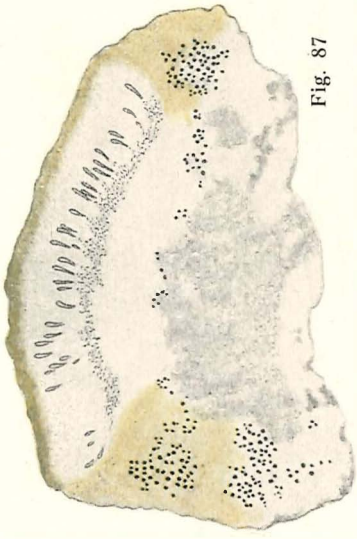


Fig. 87

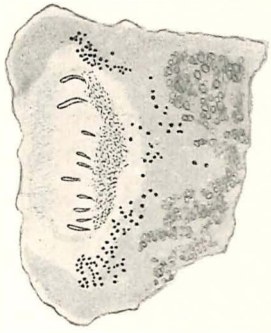


Fig. 86

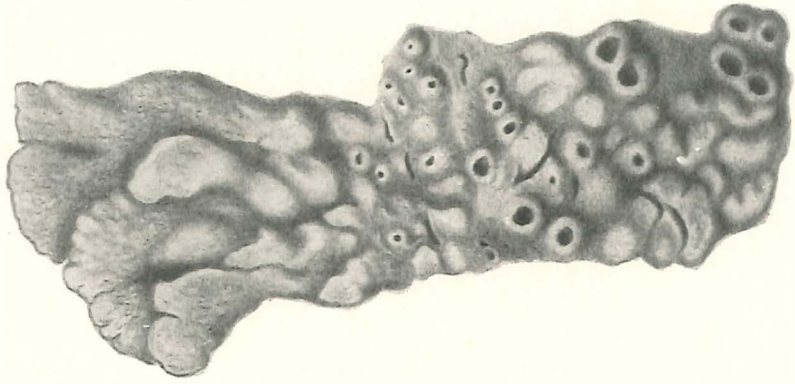


Fig. 83

O. Galløe del.

PLACODIUM CIRCINATUM PERS.

PLATE 18.

PLACODIUM CIRCINATUM.

PERS.

Fig. 88. Hyphæ from the granular medulla. The plurality of the hyphæ are so densely covered with granules that their structure cannot be distinguished, while other hyphæ are more distinct. (×1053).

Fig. 89. Hyphæ from the lower cortex making their way between two areoles of the crustaceous lichen which serves as a substratum for the thallus of *Placodium*. (× 1053).

Fig. 90. Primordium of apothecium, still covered by cortex. The primordium consists of ascogenous hyphæ and young asci, between which latter paraphyses are seen. The whole primordium is surrounded by calyx. This section is somewhat extra-axial. (× 620).

Fig. 91. Margin of apothecium, showing epithecium, paraphyses, young asci, ascogenous hyphæ in the hypothecium, calyx with a proper margin, and, outside the latter, the thalline margin. (× 620).

Fig. 92. Ripe ascus. (× 747).

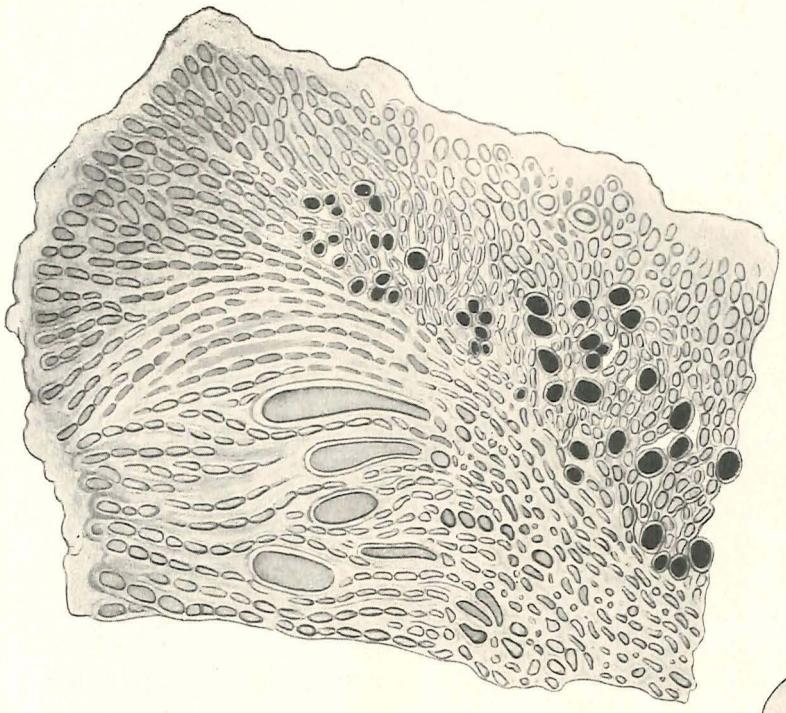


Fig. 91

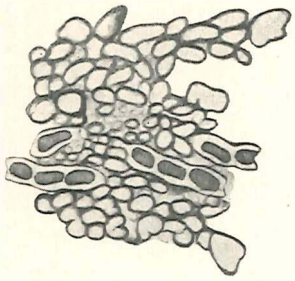


Fig. 88

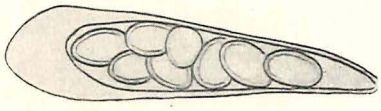


Fig. 92

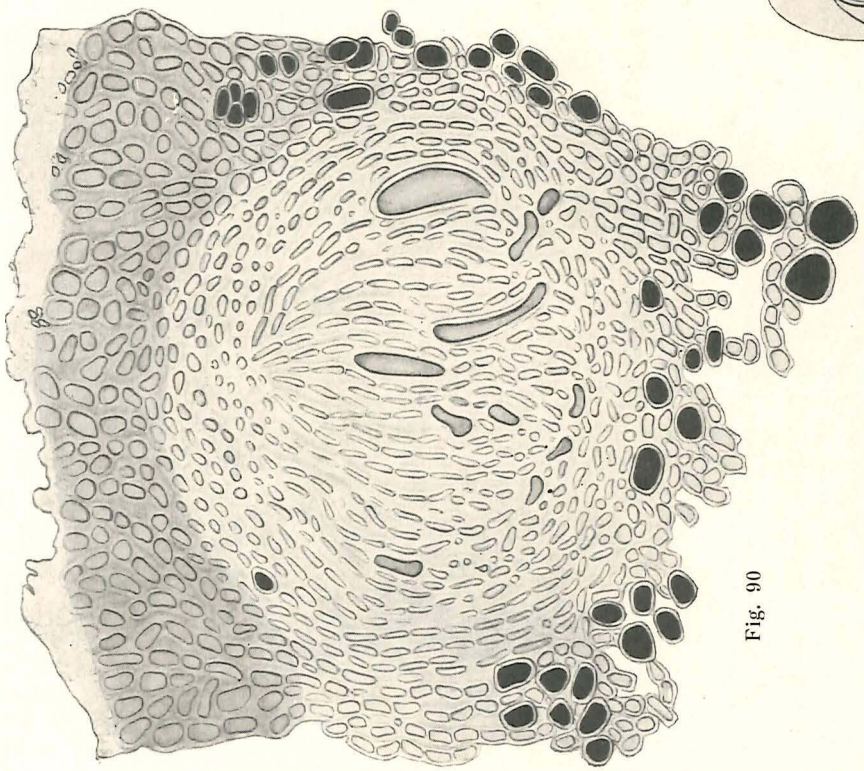


Fig. 90

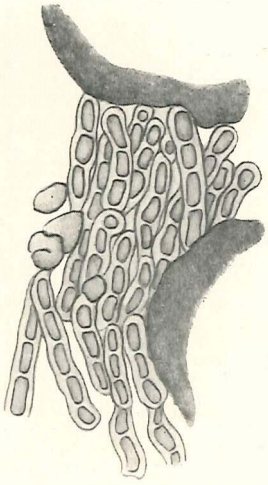


Fig. 89

O. Gallœ del.

PLACODIUM CIRCINATUM PERS.

PLATE 19.

PLACODIUM SAXICOLA.

POLL.

Specimen 1.

Fig. 93. Young, entire plant, consisting of two areoles connected by an inter-areolar thallus. The bigger of the areoles contains a pycnide. (× 23).

Specimen 2.

Fig. 94. Young, entire specimen, consisting of four areoles resting on a common inter-areolar thallus. The areoles are on the point of assuming the shape of genuine lobules. (× 23).

Specimen 3.

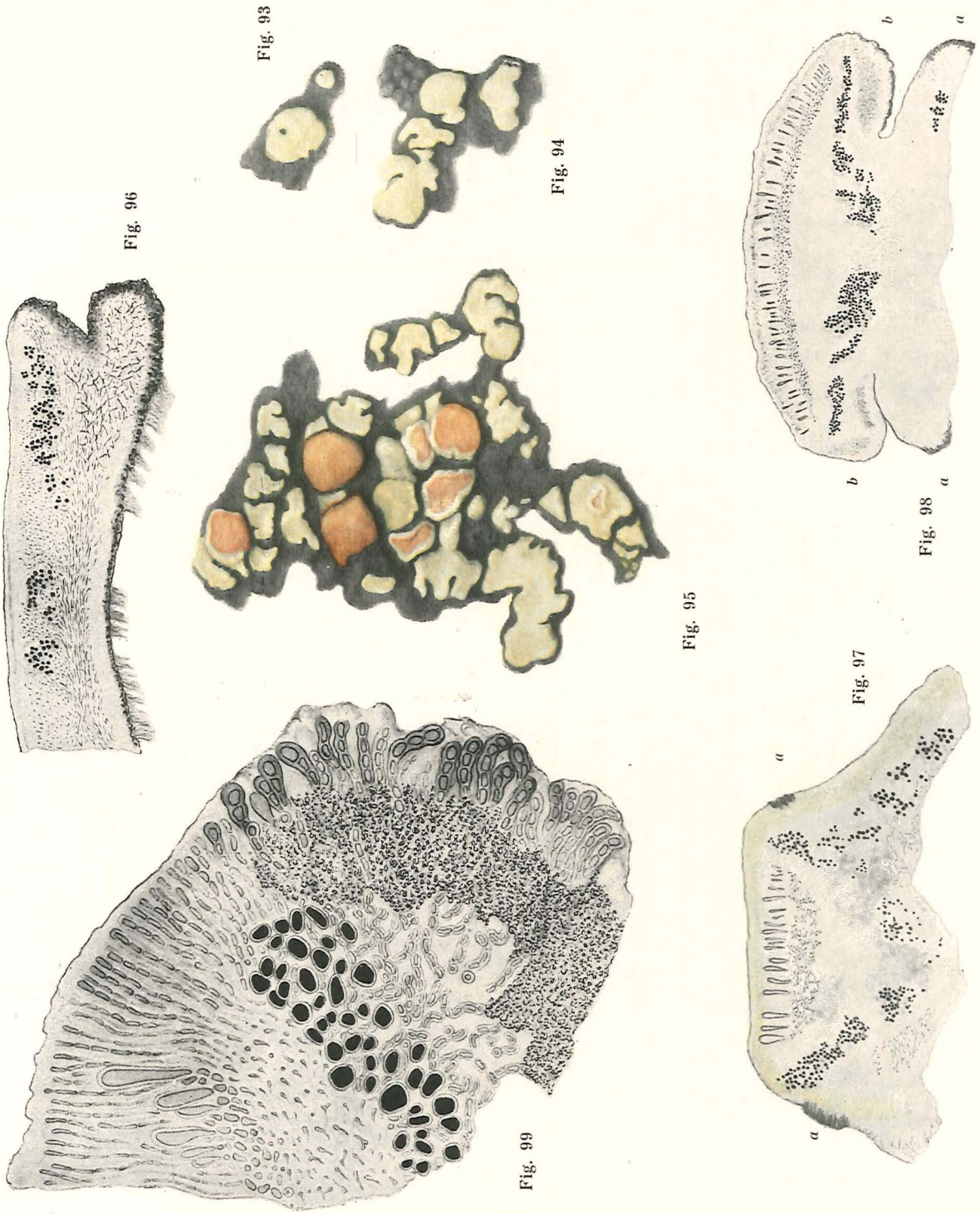
Fig. 95. Young, entire thallus with apothecia at all stages of development. (× 20).

Fig. 96. Margin of thallus showing the course of the hyphæ. At the extreme right of the picture the margin is greenish-black. Rhizoids protrude from the cortex of the lower surface of thallus. (× 140).

Fig. 97. Thallus with a young apothecium. The section shows a well developed stipes-calyx. At *a* are seen dark hyphæ. (× 140).

Fig. 98. Older apothecium. At *a* dark hyphæ. At *b* numerous brownish granules between the hyphæ of the thalline margin.

Fig. 99. Margin of apothecium, with distinct calyx and thalline margin; in the latter are seen numerous (brownish) granules between the hyphæ, and numerous dark hyphæ. (× 620).



O. Galløe del.

PLACODIUM SAXICOLA Poll.
(Specimen 1, 2, 3).

PLATE 20.

PLACODIUM SAXICOLA.

POLL.

Specimen 3.

Fig. 100. Chondroid hyphæ of calyx, hypothecium with distinct ascogenous hyphæ, and hymenium with homogenous epithecium. (× 747).

Fig. 101. Pycnide, cut extra-axially and — consequently — lacking an ostiole. The conidia are embedded in a common gelatine. (× 620).

Fig. 102. Conidiiferous hyphæ with four conidia. (× 1053).

Fig. 103. Cuticle, cortex, gonidial layer, and portion of medullary layer. (×1053).

Fig. 104. Above, horizontal medullary hyphæ passing downwards into the cortex of the lower surface of thallus; the upper layers of the cortex are black. (× 1053).

Fig. 105. Cortex of the lower surface of thallus. The outside layers of the walls of the hyphæ are black. To the right in the picture the hyphæ are developing into rhizoids. (× 1053).

Fig. 106. Hyphæ from the black margin of thallus; above they pass into the medullary hyphæ. (× 1053).

Fig. 107. To the left, ascogenous hyphæ with young asci; to the right, ascogonium with two young asci and a ripe ascus. (× 747).

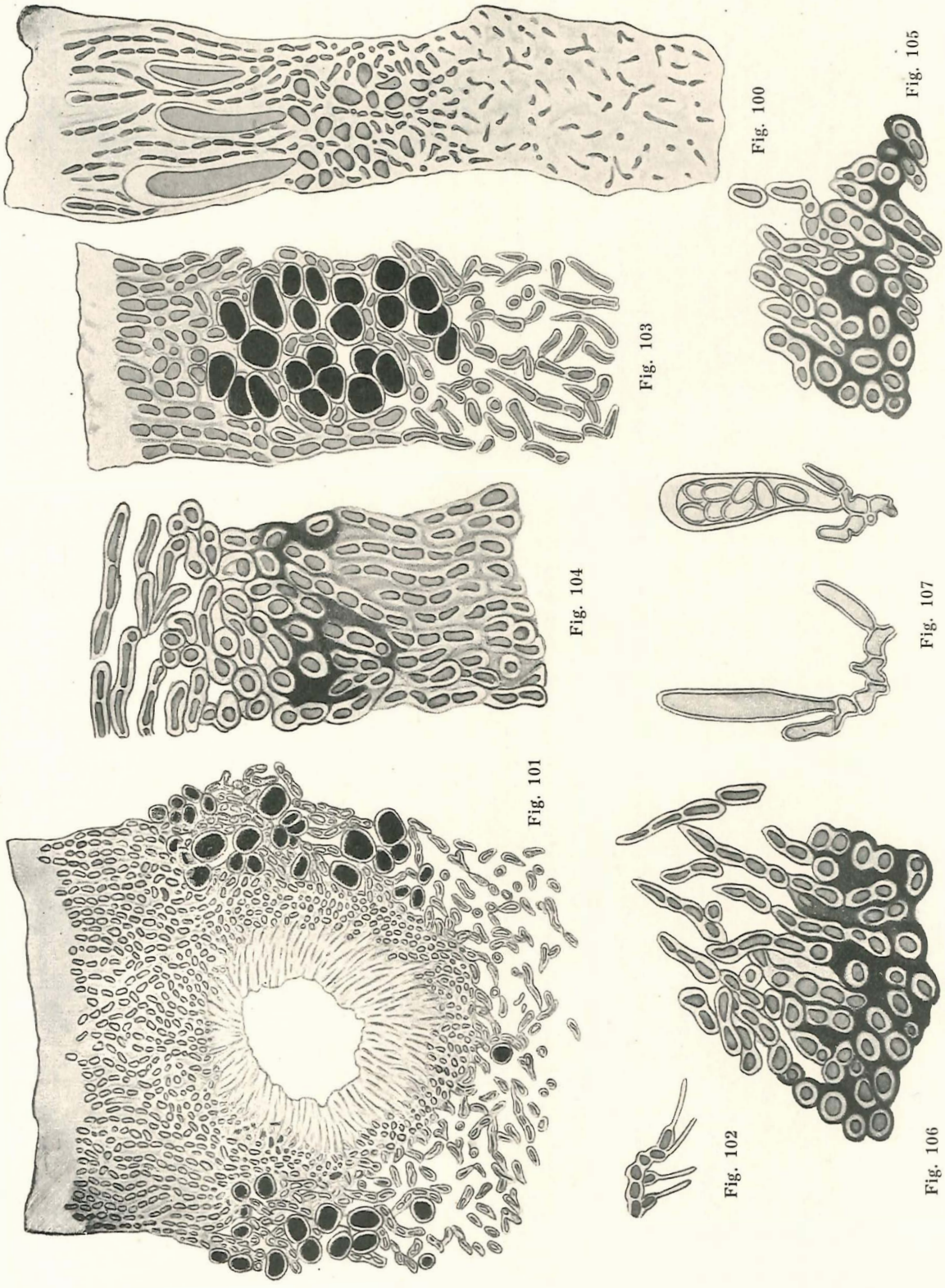


Fig. 100

Fig. 101

Fig. 102

Fig. 103

Fig. 104

Fig. 105

Fig. 106

Fig. 107

O. Galloe del.

PLACODIUM SAXICOLA POLL.
(Specimen 3).

PLATE 21.

PLACODIUM SAXICOLA.

POLL.

Specimen 4.

Fig. 108. A sand-blown pebble with numerous specimens of *Placodium saxicola*. Specimen 4 extends from *a* obliquely inwards to the left in the picture. Note that several of these specimens have a partially dark thallus (*vide* the text for further information). (× 5).

Fig. 109. The picture shows how the margin of thallus (above in the figure) gradually develops areoles, the margins of which are dark, greenish. In the margin of thallus three ostioles of pycnidia. Below in the picture a very young apothecium. (× 14).

Fig. 110. Portion of the central parts of thallus, with apothecia at all stages of development. (× 14).

Fig. 110

Fig. 108

Fig. 109

O. Gallœe del.

PLACODIUM SAXICOLA Poll.
(Specimen 4.)

V. P 6

PLATE 22.

PLACODIUM CARTILAGINEUM.

ACH.

Fig. 111. Thallus with apothecia. (× 10).

Fig. 112. Thallus with very young apothecia. At this age the apothecia do not contain asci as yet. (× 13).

Fig. 113. Squamule with a young apothecium, the latter still only consisting of a stipes-calyx surrounded by a thalline margin, further of a hypothecium with ascogenous hyphæ, of paraphyses but no asci. (× 140).

Above to the right a transverse section of paraphyses embedded in hymenial gelatine, and two asci. (× 747).

Fig. 114. Longitudinal section of two lobules of thallus. The right one is partially overgrown; its overgrown portions have lost their gonidia and are about to turn brownish. The left squamule was entirely hidden under another squamule (left out in the picture); its gonidia were dead and empty, whereas the hyphæ were still alive. (× 140). Below to the right a free, branched, rhizoidal hypha. (× 747).

Fig. 115. Upper cortex (with brown granules betwen the hyphæ), and gonidial layer. (

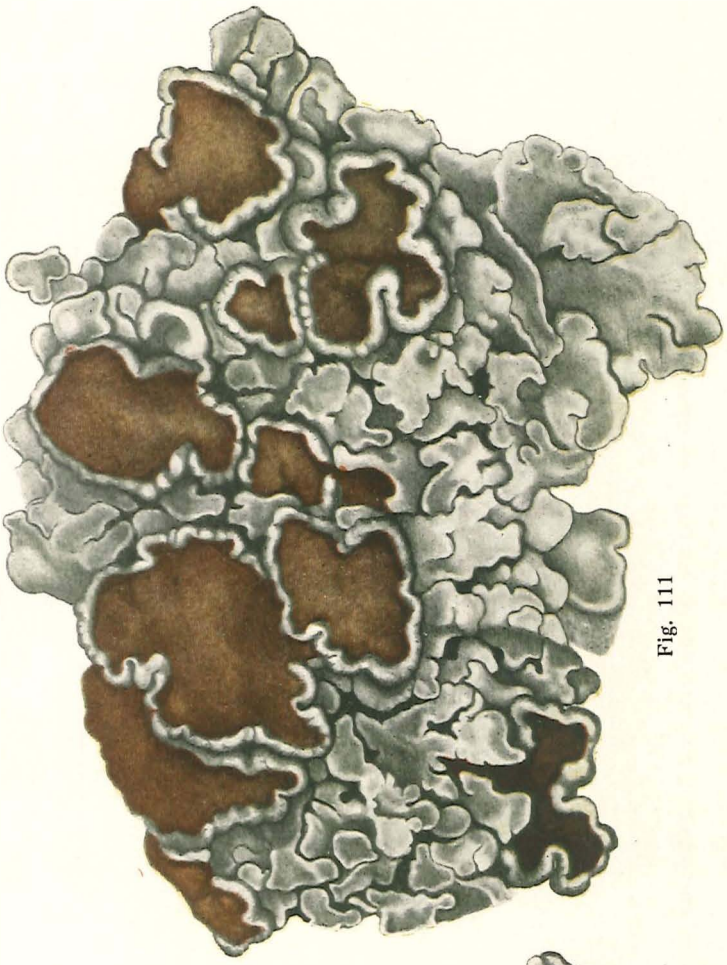


Fig. 111

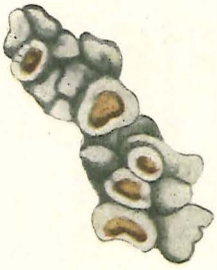


Fig. 112

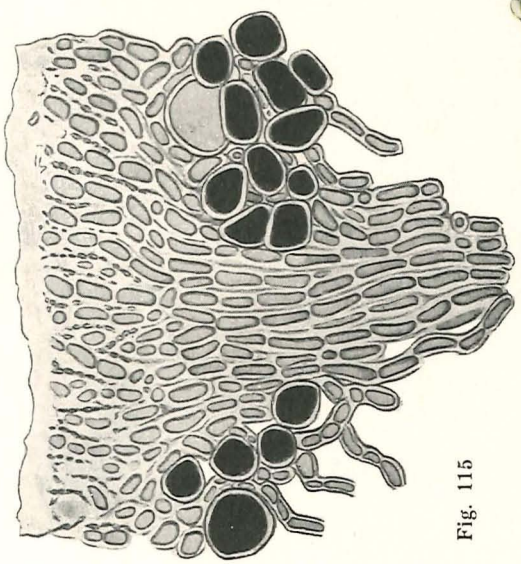


Fig. 115

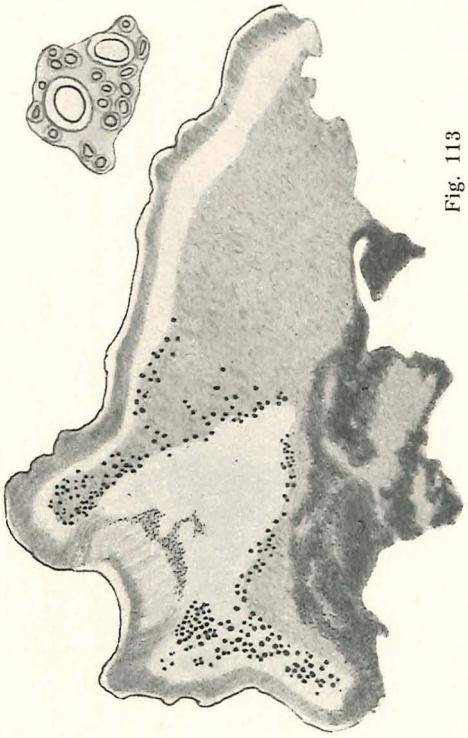


Fig. 113

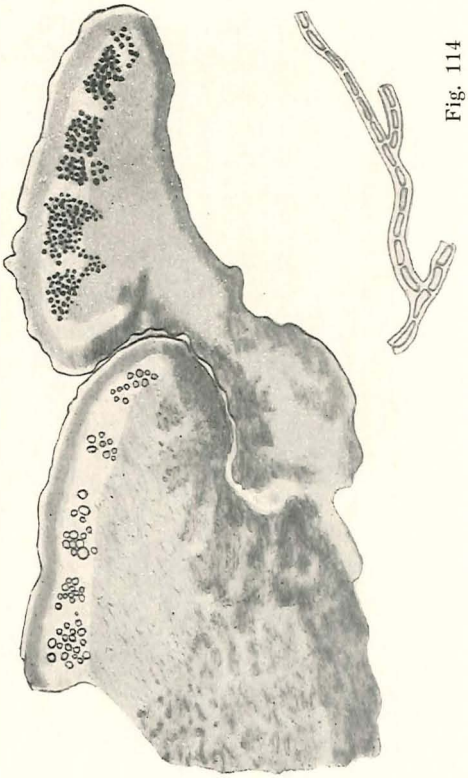


Fig. 114

O. Galløe del.

PLACODIUM CARTILAGINEUM Ach.

V. P 6*

PLATE 23.

PLACODIUM CARTILAGINEUM.

ACH.

Fig. 116. Medullary, colourless hyphæ, passing into the cortex of the lower surface of thallus, from which issue colourless rhizoidal hyphæ developing dense bundles of rhizoids at the bottom of the picture. (× 1053).

Fig. 117. Old apothecium with a broad, low, colourless stipes entirely surrounded by the original, gonidiiferous squamule forming a cup-like exciple (with a dark lower cortex) round the whole of stipes-calyx. At the base it adheres to another overgrown apothecium. (× 93).

Fig. 118. Margin of an old apothecium showing the arrangement of stipes-calyx and margo thallinus, the dark peripheral portions of which are identical with the original lower cortex of the squamule. (× 140).

Fig. 119. Borderline between margo thallinus and calyx-stipes. Note the chondroidal structure of the stipes. Numerous, rather minute ascogenous hyphæ in the hypothecium. (× 747).

Fig. 120. Two ripe asci, and an isolated ripe spore. Further, an unripe ascus and a paraphysis, the upper end of which is a dead appendix representing part of the epithecium. (× 747).

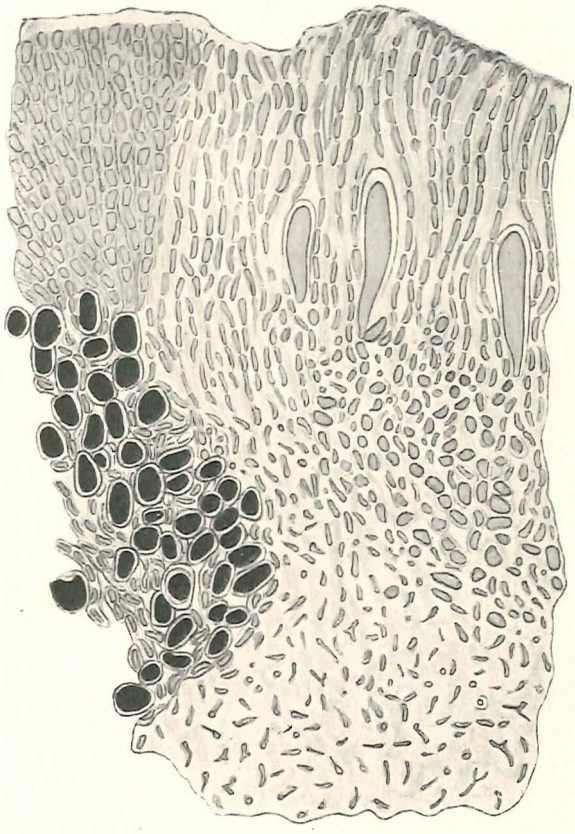


Fig. 119

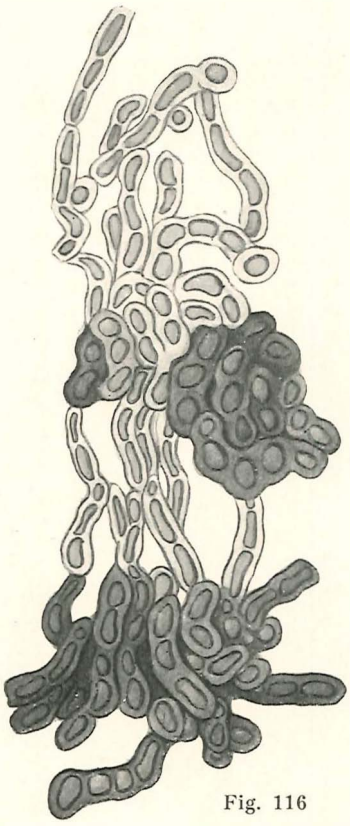


Fig. 116

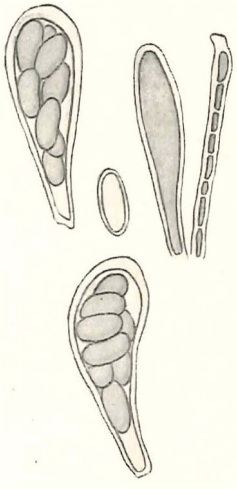


Fig. 120

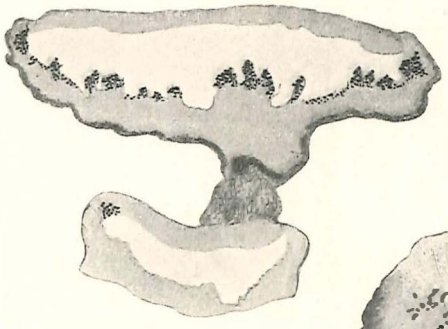


Fig 117

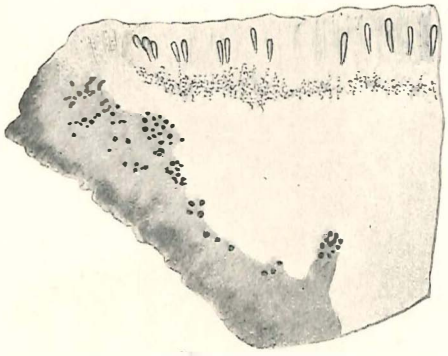


Fig. 118

O. Galløe del.

PLACODIUM CARTILAGINEUM Ach.

PLATE 24.

LECANIA SYRINGEA.

ACH.

Fig. 121. Thallus on bark, with apothecia at all stages of development. (× 14).
Fig. 122. Young apothecium. (× 80).
Fig. 123. A somewhat older apothecium. (× 80).
Fig. 124. The oldest of the apothecia found in this specimen. (× 80).
Fig. 125. Apothecium, on thallus. It is provided with a distinct stipes-calyx. (× 90).
Fig. 126. Thallus and margin of apothecium. (× 620).
Fig. 127. Hypothecium and hymenium. (× 747).
Fig. 128. Two anastomosed paraphyses. To the left a ripe spore. (× 747).

Fig. 121

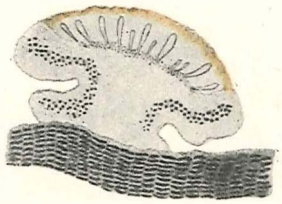


Fig. 125

Fig. 122

Fig. 123

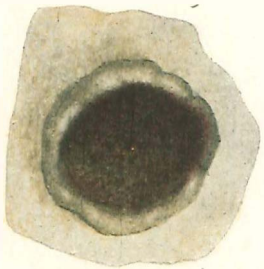


Fig. 124

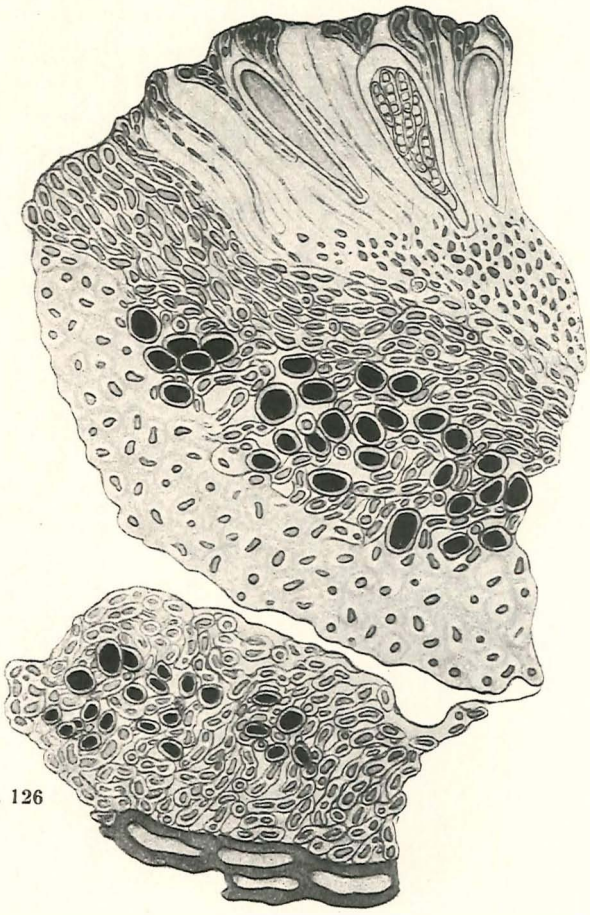


Fig. 126

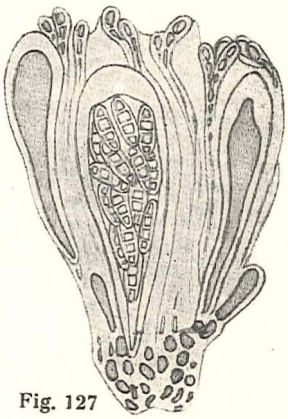


Fig. 127

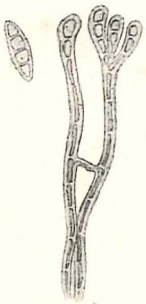


Fig. 128

O. Galløe del.

LECANIA SYRINGEA ACH.

PLATE 25.

LECANIA CYRTELLA.

ACH.

Fig. 129. Thallus on the periderm of *Sambucus,* with apothecia at all stages of development. (× 26).

Fig. 130. Thallus with apothecium. (× 80).

Fig. 131. Ripe spores. (× 747).

Fig. 132. Thallus on the periderm of *Sambucus,* with an apothecium. To the left the thallus is filmy, to the right it is granular. (× 80).

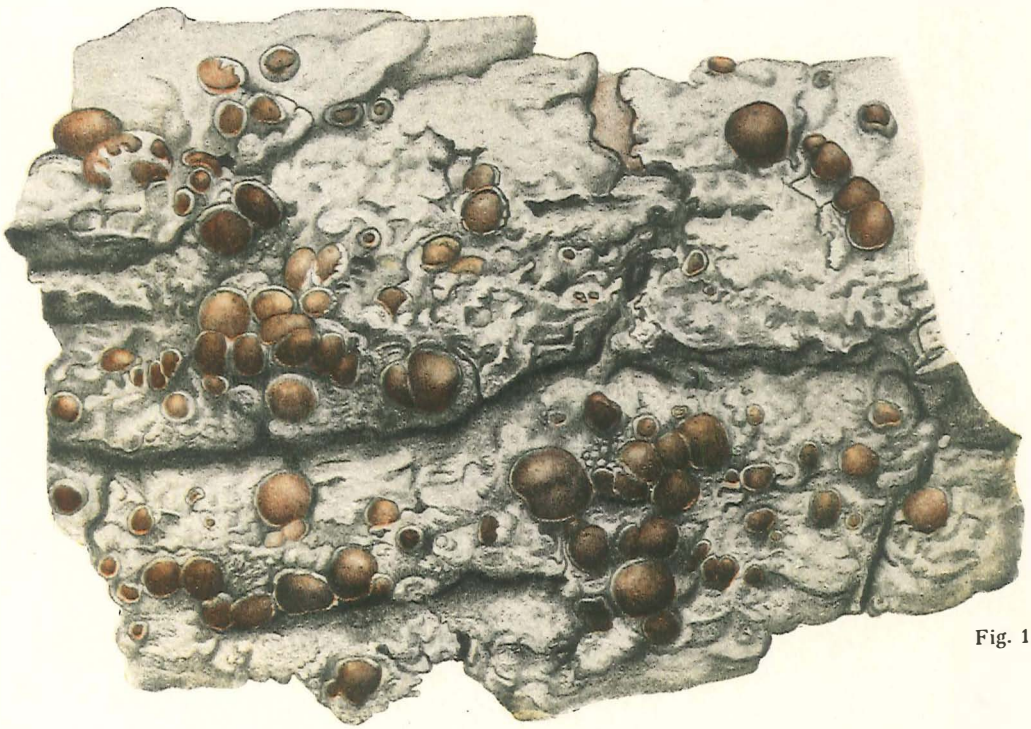


Fig. 129

Fig. 131

Fig. 130

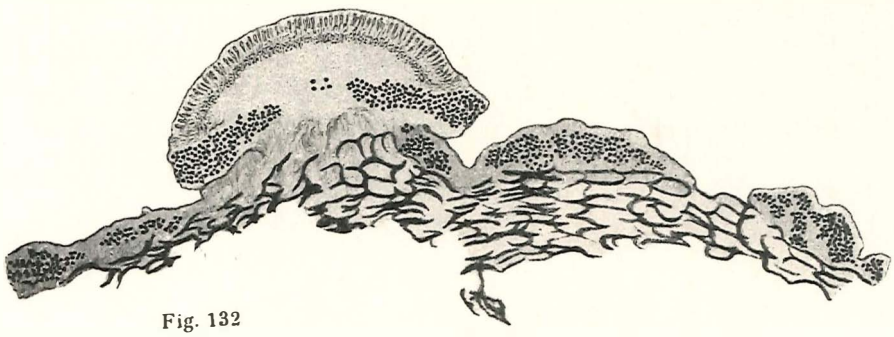


Fig. 132

LECANIA CYRTELLA Ach.

O. Galløe del.

V. P 7

PLATE 26.

LECANIA CYRTELLA.

ACH.

Fig. 133. Thallus. Fragments of periderm-cells of *Sambucus* are seen in the cortex and the medullary-rhizoidal layers. (× 747).

Fig. 134. Margin of apothecium, and thallus. (× 747).

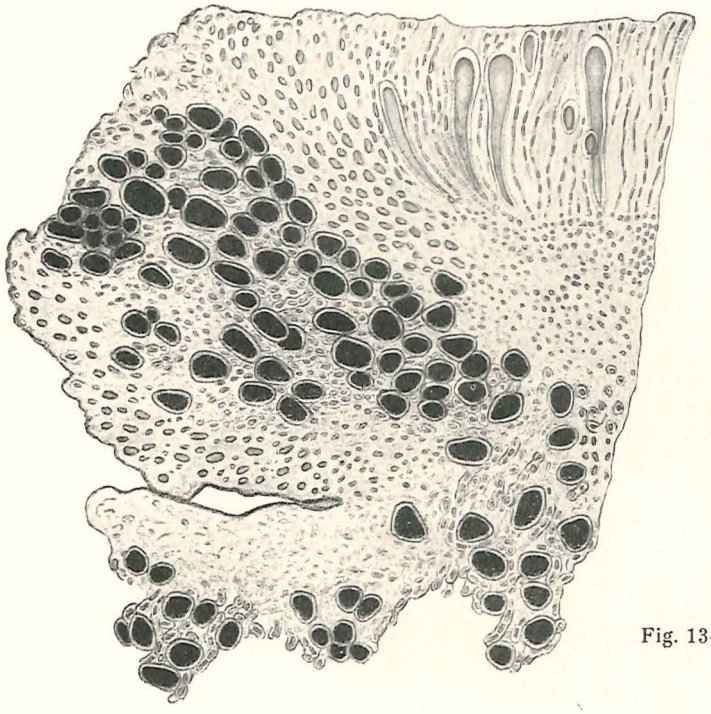


Fig. 134

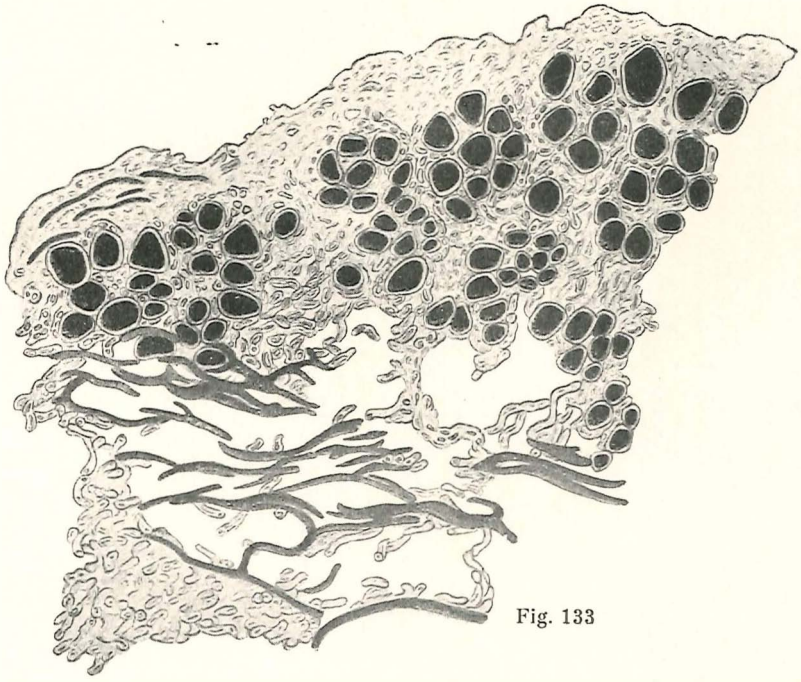


Fig. 133

O. Galløe del.

LECANIA CYRTELLA Ach.

PLATE 27.

LECANIA CYRTELLA.

ACH.

Fig. 135. Vertical section of the central portions of the apothecium. The hymenium passes downwards
observed; next follows calyx, in which three gonidia are embedded. Below, stipes passes into the loose medulla. The dark portions represent periderm-cells of *Sambucus*. (× 747).

Fig. 136. Cortex and gonidial layer. (× 1053).

Fig. 137. Paraphyses; the left one is branched at the top. (× 747).

Fig. 138. Ascus with ripe spores. (× 747).

Fig. 139. Horizontal section of hymenium, showing transverse sections of asci and paraphyses embedded in hymenial gelatine. (× 747).

Fig. 140. Calyx, above passing into the hypothecium, in which two young asci are situated. (× 1053).

Fig. 141. Cortex from the surface of margo thallinus. (× 1053).

Fig. 142. Hyphæ from margo proprius. (× 1053).

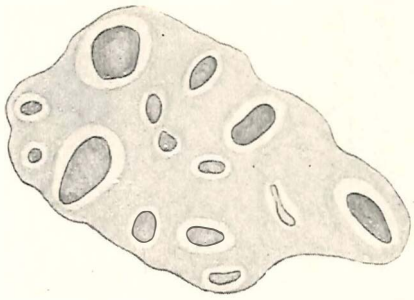


Fig. 139

Fig. 140

Fig. 138

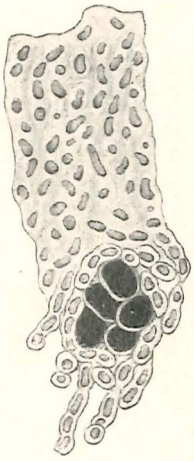


Fig. 136

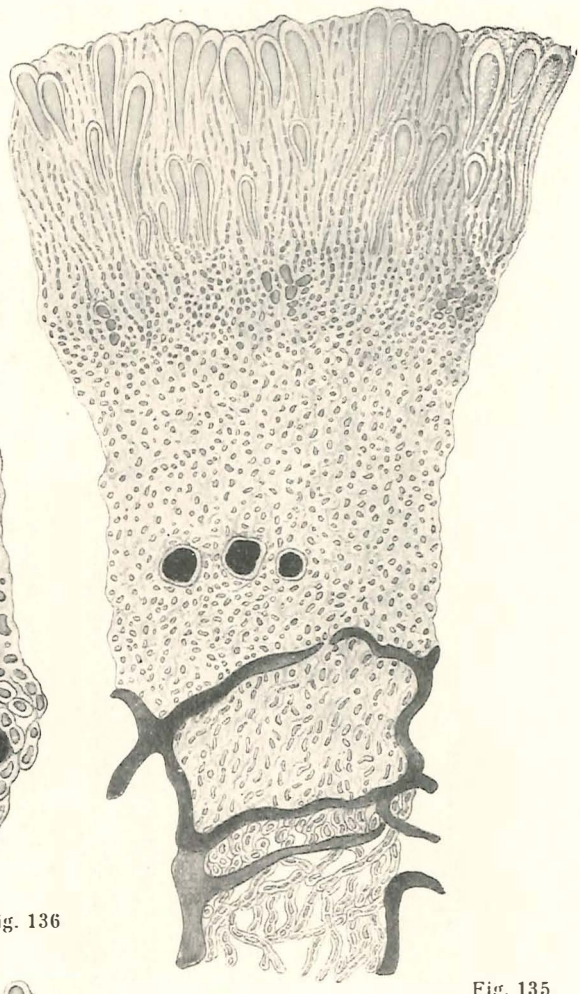


Fig. 135

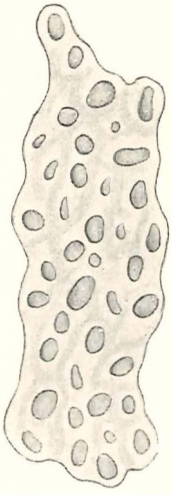


Fig. 141

Fig. 137

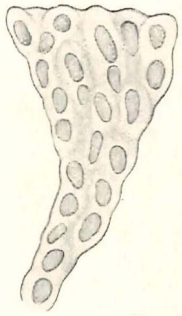


Fig. 142

PLATE 28.

LECANIA ERYSIBE.

ACH.

Fig. 143. Thallus with two young apothecia. The dark portions of the picture represent the substratum. (× 26).

Fig. 144. Thallus with old apothecia. (× 26).

Fig. 145. Portion of a grain of quartz of the substratum. Several grains of thallus are seen growing on it, in which the green colour of the gonidia may be distinguished; from the grains connecting mycelial hyphæ radiate in all directions. (× 90).

Fig. 146. Thallus with an old apothecium. Note the thin, yet distinct yellowish proper margin. Eight very big gonidia are embedded in stipes-calyx. (× 140).

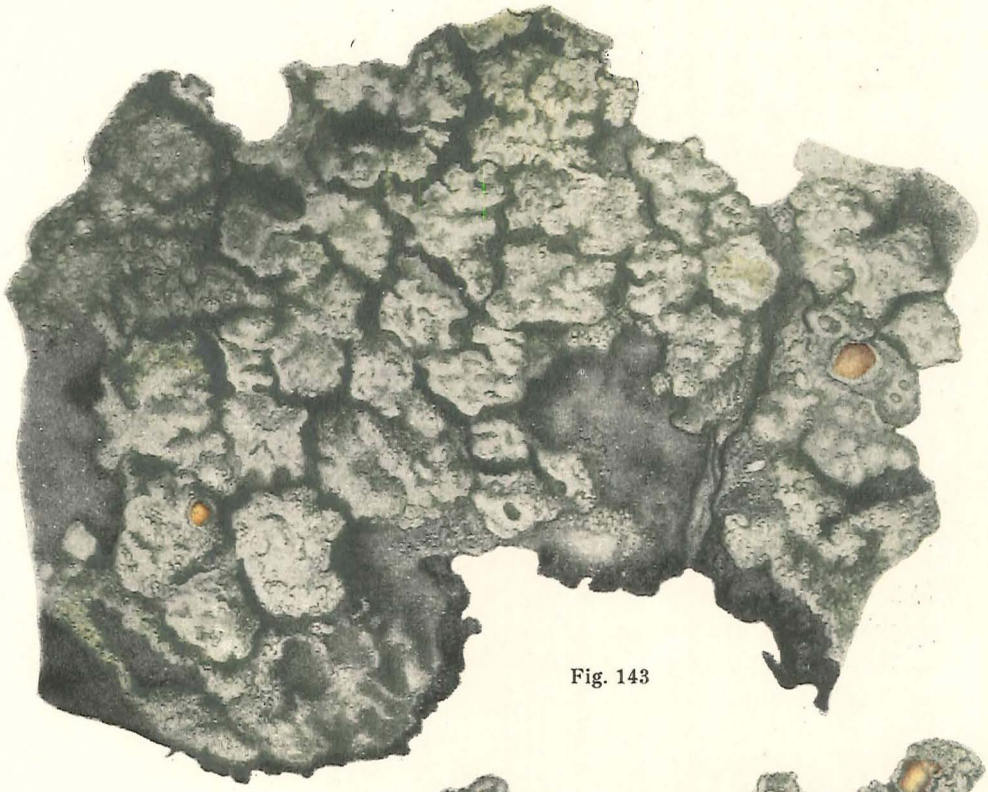


Fig. 143

Fig. 145

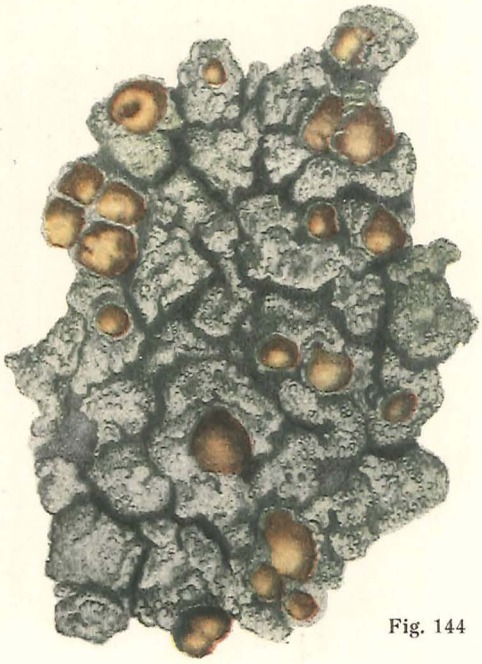


Fig. 144

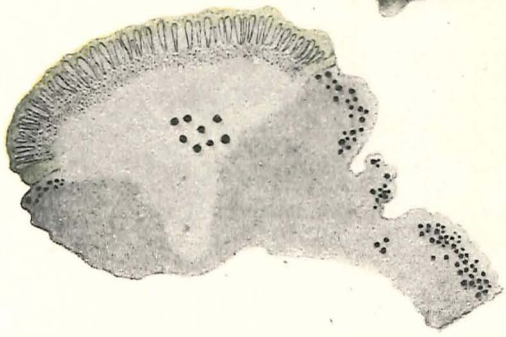


Fig. 146

O. Galløe del.

LECANIA ERYSIBE Ach.

PLATE 29.

LECANIA ERYSIBE.

ACH.

Fig. 147. Section of the surface of thallus, which lacks a genuine cortex, thus having the character of a gonidial layer. (× 620).

Fig. 148. Deeper portions of thallus. on the whole having the character of a medullary layer. A grain of the substratum is seen below to the left. (× 620).

Fig. 149. Portion of the surface of thallus, particularly loose in texture; it is of sorediose character; each single gonidial alga is densely clasped by hyphæ. (× 620).

Fig. 150. Hyphæ from margo proprius; their walls are brownish. (× 1053).

Fig. 151. One half of an apothecium, with distinct proper margin, and numerous ascogenous hyphæ in the hypothecium. The thalline margin is seen beneath the proper margin. (× 620). Above to the left one ripe spore. (× 747).

Fig. 152. Horizontal section of hymenium, with hymenial gelatine, paraphyses, and asci cut across. (× 747).

Fig. 153. To the left hymenium and hypothecium with young asci. To the right a ripe ascus. (× 747).

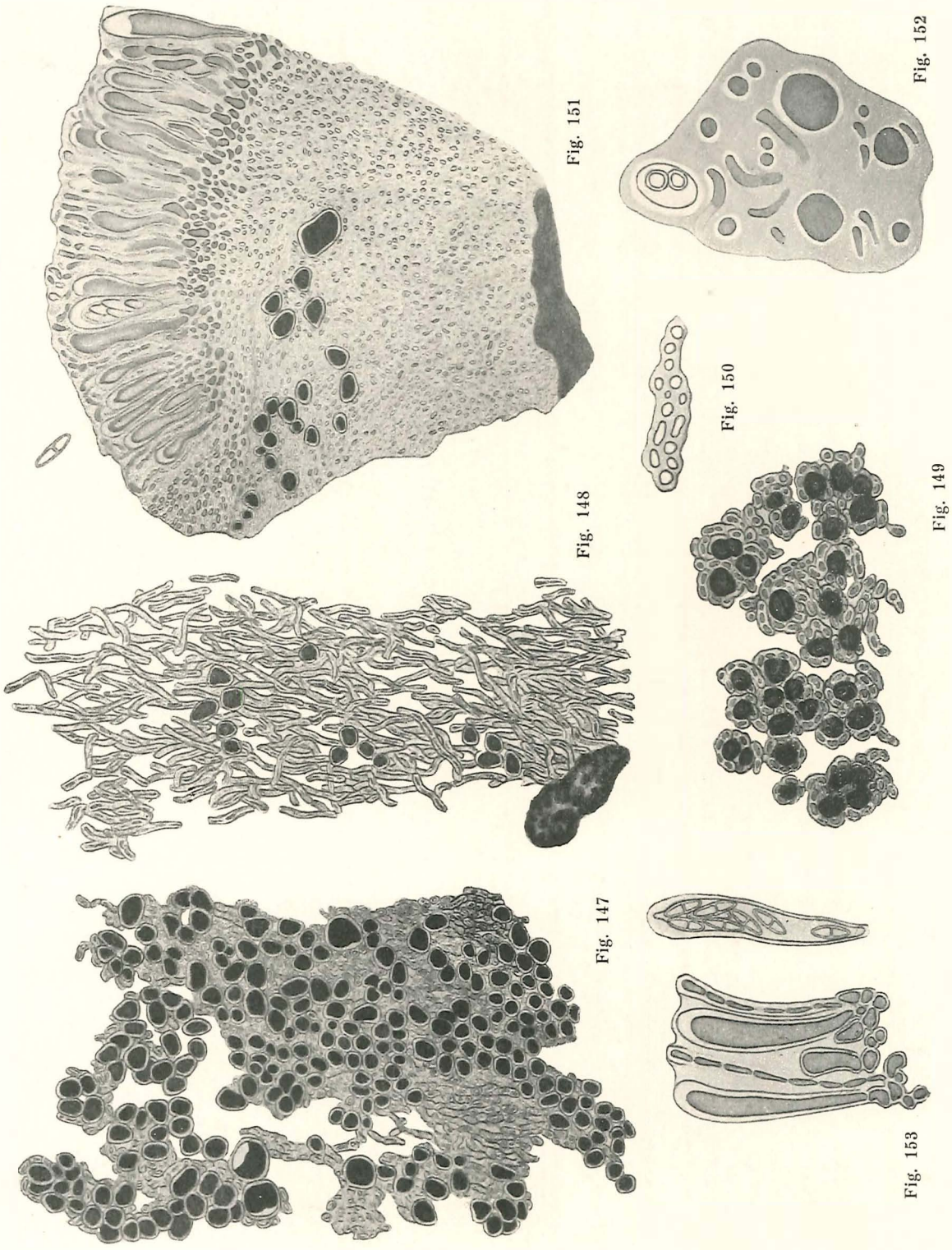


Fig. 151

Fig. 152

Fig. 150

Fig. 149

Fig. 148

Fig. 147

Fig. 153

O. Galløe del.

LECANIA ERYSIBE Ach.

PLATE 30.

CANDELARIELLA VITELLINA.

EHRH.

Fig. 154. Thallus with apothecia at all ages. (× 10).

Fig. 155. Margin of thallus, formed of scattered, roundish, microphylline grains. (× 33).

Fig. 156. Portion of the central parts of thallus, with microphylline granules and a young apothecium. (× 33).

Fig. 157. Thallus with apothecium. The picture shows how the grains overgrow and suppress each other; the upper grains are yellow, the suppressed ones are colourless and with dying-off gonidia. The apothecium has a distinct stipes-calyx with a proper margin. To the right in the picture the thalline margin is but faintly developed. (× 80).

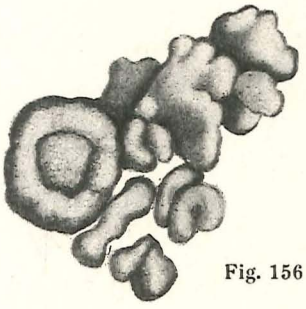


Fig. 156

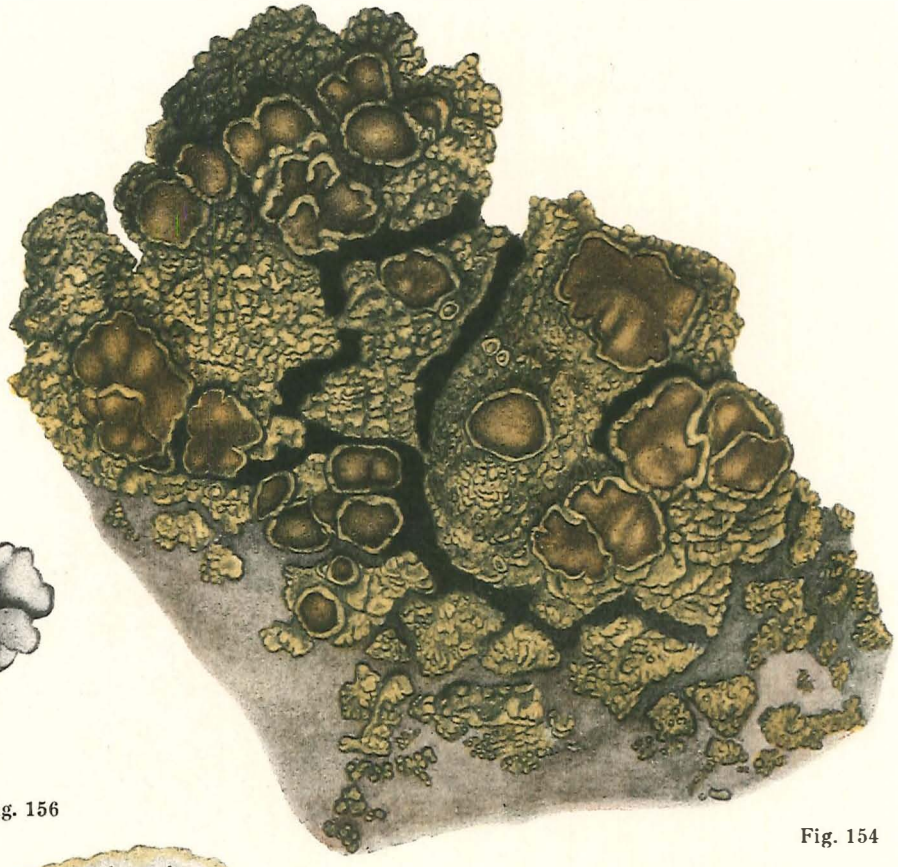


Fig. 154

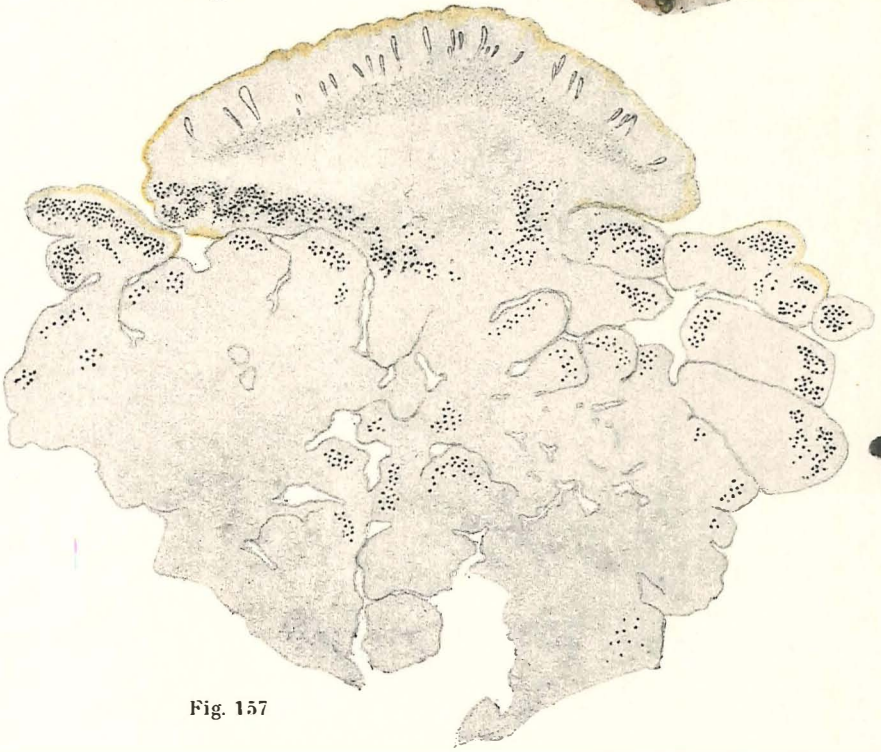


Fig. 157

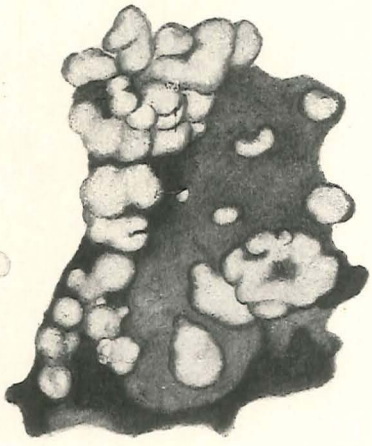


Fig. 155

O. Galløe del.

CANDELARIELLA VITELLINA Ehrh.

V. P 8*

PLATE 31.

CANDELARIELLA VITELLINA.

EHRH.

Fig. 158. Microphylline grain of thallus from the surface of thallus. Note the longitudinal hyphæ in the lower surface of the granule. The minute dark granules on the cortex represent the yellow granules of pigment. (× 620).

Fig. 159. Cortex, gonidial layer, and part of the medulla, taken from a suppressed granule of thallus. (× 1053).

Fig. 160. Section showing the borderline between hymenium (with young asci), margo proprius (formed of erect hyphæ), and margo thallinus. (× 747).

Fig. 161. Hyphæ from calyx just below the hypothecium, containing some few ascogenous cells. (× 747).

Fig. 162. Horizontal section of hymenium, with hymenial gelatine, paraphyses, and asci containing spores. (× 620).

Fig. 163. Above, a branched paraphysis, two unripe asci and ascogenous cells, and a ripe ascus with spores. (× 747). Below, tips of paraphyses with grains of pigment and a group of ripe spores, of which some are 1-celled, each being provided with two roundish, refringent bodies, while three of them are distinctly 2-celled. (× 1053).

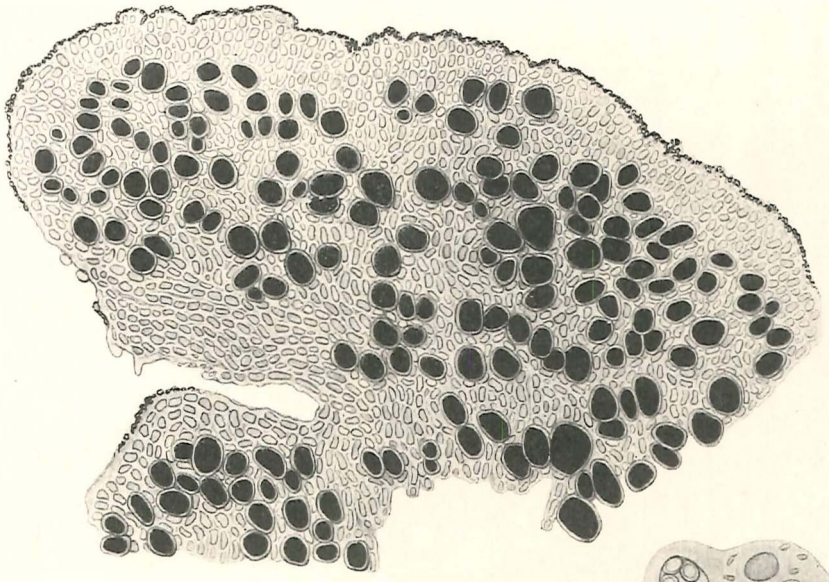


Fig. 158

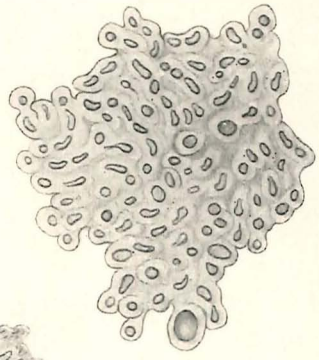


Fig. 161

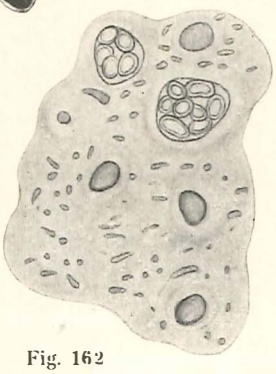


Fig. 162

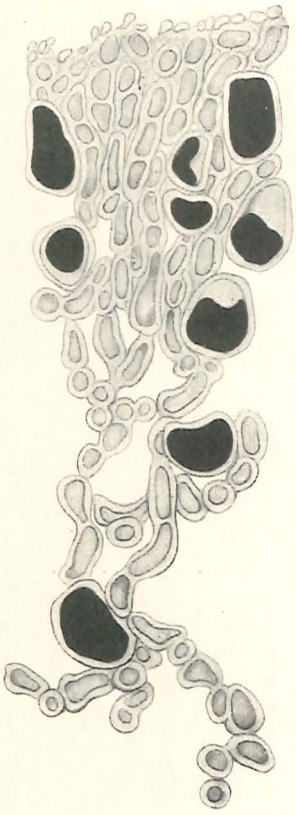


Fig. 159

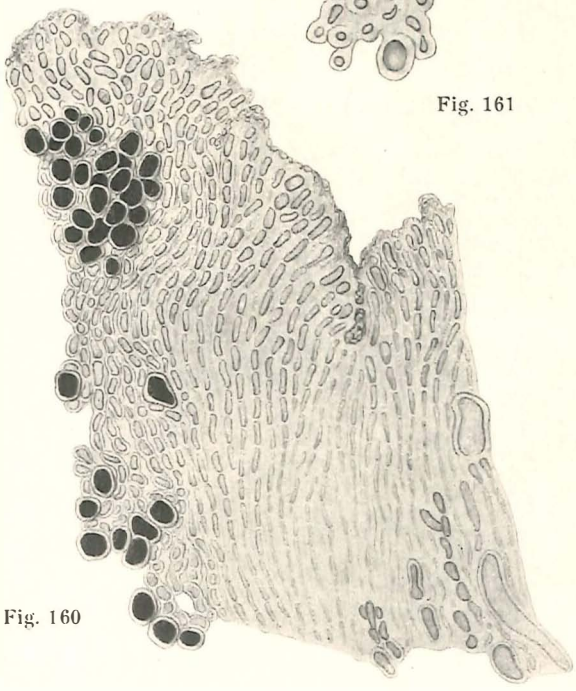


Fig. 160

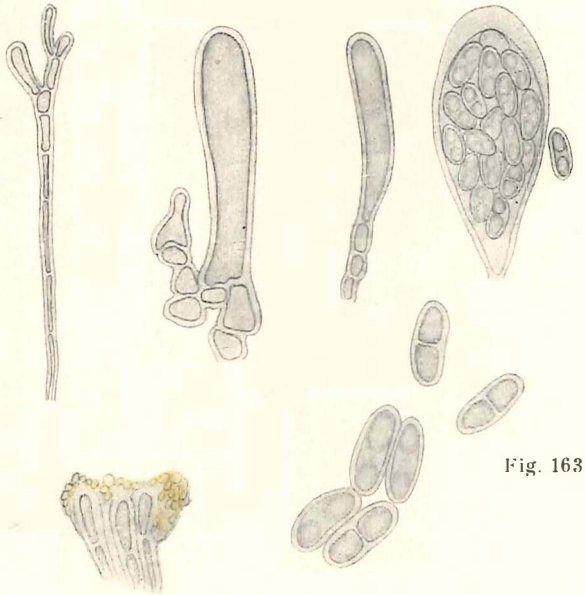


Fig. 163

O. Galløe del.

CANDELARIELLA VITELLINA EHRH.

PLATE 32.

CANDELARIA CONCOLOR.

DICKS.

Fig. 164. A piece of bark with numerous granules of thallus or microphylline squamules at all stages of development. (× 25).

Fig. 165. A piece of bark with two small, independent young squamules, and a bigger squamule, attached unilaterally (above in the picture) and protruding from the point of attachment free of the substratum. The free margin is incised and sorediose (especially so above to the left). (× 80).

Fig. 166. A small fragment of bark (coloured brown), to which a microphylline squamule, seen from below, is attached; the lower surface is palely yellowish. Yellow soredia are seen along the margin of the squamule. (× 80).

Fig. 167. Squamule, the point of attachment of which is to the left in the figure (where portions of the substratum bark are seen in the thallus). The margin with a soredium and the base of the squamule are drawn to a greater magnification in the two following pictures. (× 140).

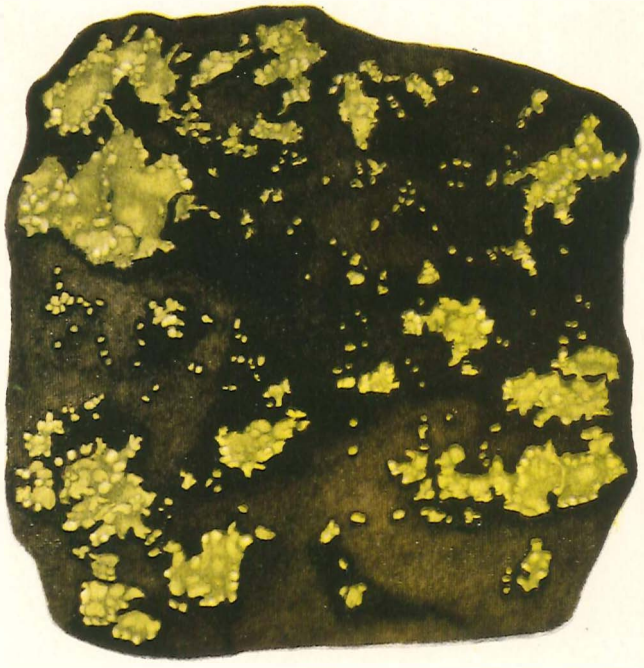


Fig. 164

Fig. 165

Fig. 166

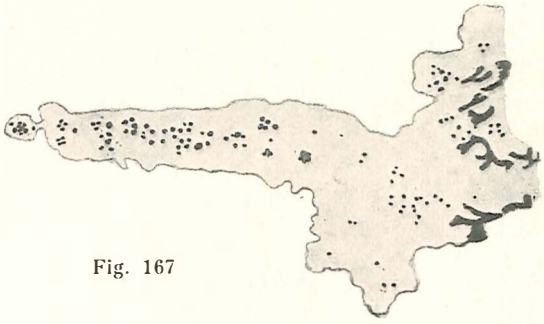


Fig. 167

O. Galløe del.

CANDELARIA CONCOLOR Dicks.

PLATE 33.

CANDELARIA CONCOLOR.

DICKS.

Fig. 168. The free margin of a squamule with a soredium nearly set free (to the left in the figure). Minute (yellow) grains of pigment lie on the surface of the thallus. (× 840).

Fig. 169. Base of a squamule; the cortex is above, the gonidial-medullary layer below. (× 840).

Fig. 170. Pycnide, surrounded by gonidia. (× 840).

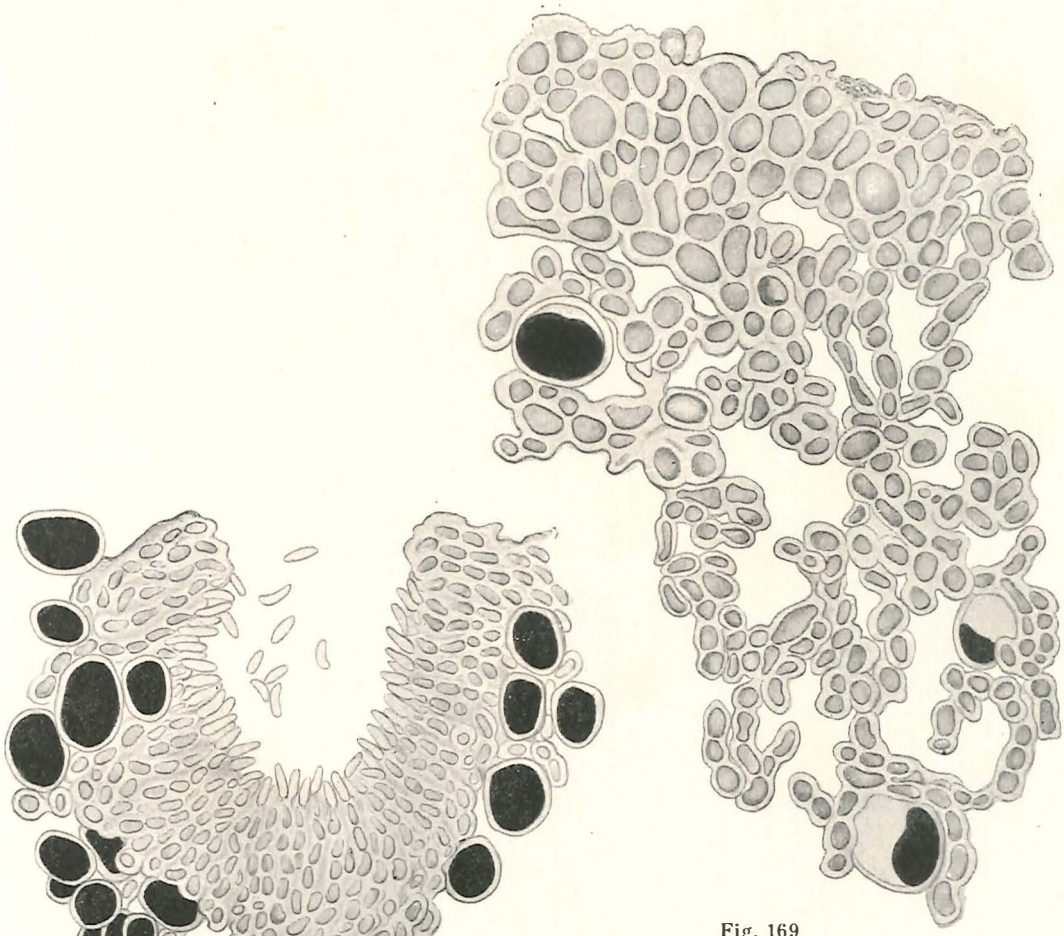


Fig. 169

Fig. 170

Fig. 168

O. Galløe del.

CANDELARIA CONCOLOR DICKS.

PLATE 34.

HAEMATOMMA COCCINEUM.

DICKS.

Specimen 1.

Fig. 171. Thallus with apothecia at various ages. (× 20).

Fig. 172. Young apothecium, the ascus of which is still on a level with the surface of the thallus. (× 90).

Fig. 173. Thallus with apothecia, on bark of *Fagus silvatica*. Note the deep furrow between the proper and the thalline margin. The surface of the thallus is sorediose. (× 80).

Specimen 2.

Fig. 174. Sorediose margin of thallus spreading over a hepatic *(Frullania)*. (× 20).

Fig. 175. Portion of thallus with two pycnidia, of which one (the darker red one) is formed like a shallow cup. (× 80).

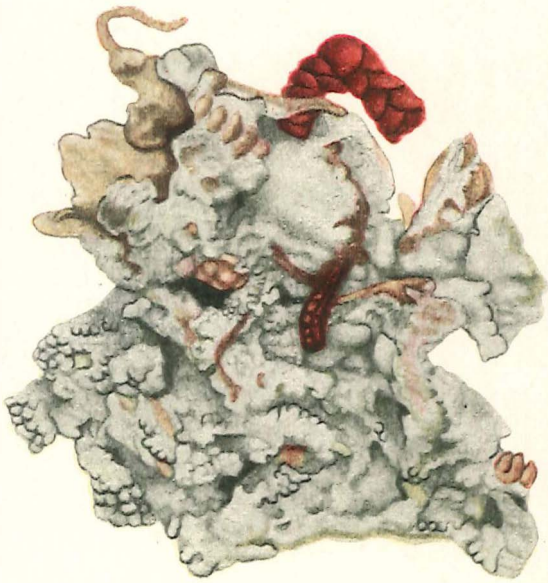


Fig. 174

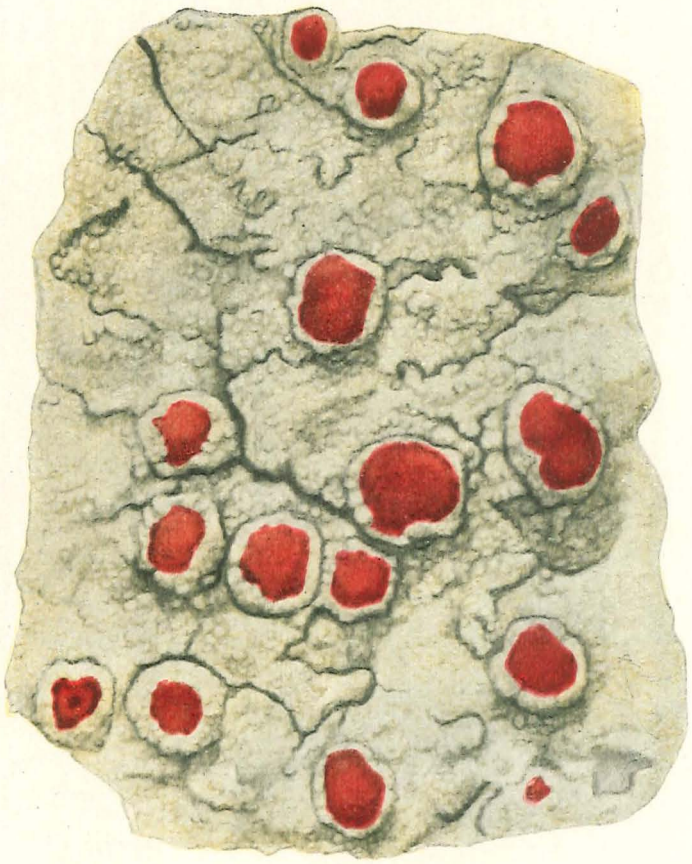


Fig. 171

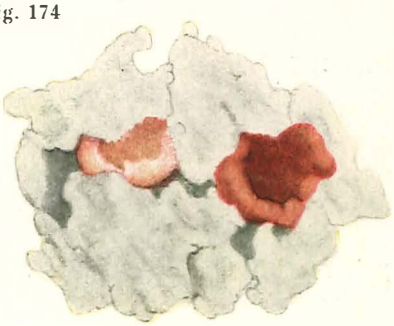


Fig. 175

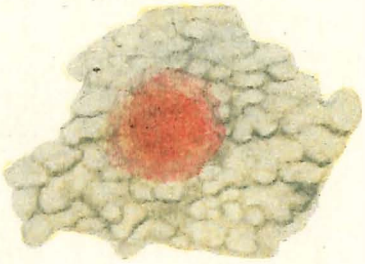


Fig. 172

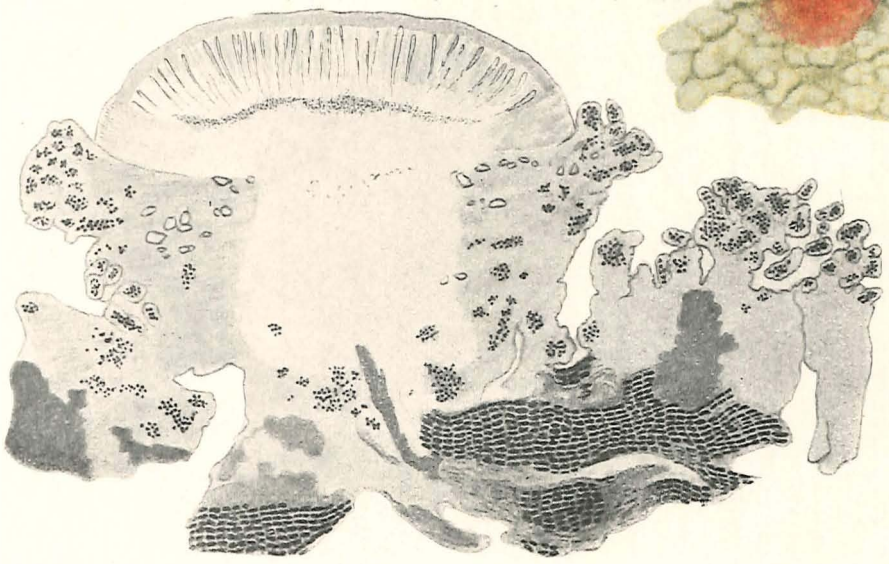


Fig. 173

O. Galløe del.

HAEMATOMMA COCCINEUM DICKS.
(Specimen 1, 2).

PLATE 35.

HAEMATOMMA COCCINEUM.

DICKS.

Specimen 1.

Fig. 176. Portion of the sorediose surface of thallus. (× 620).

Fig. 177. Free soredium. (× 1053).

Fig. 178. Two gonidia in sporulation. (× 747).

Fig. 179. Hyphæ from stipes. (× 1053).

Fig. 180. Hyphæ from the surface of margo proprius. Their apices are faintly reddish-yellow. (× 747).

Fig. 181. One unripe ascus and two ripe asci, together with two ripe spores. (× 747).

Fig. 182. Hymenium with young asci. (× 747).

Fig. 183. Paraphyses, seen from above. (× 747).

Fig. 184. Horizontal section of paraphyses. (× 747).

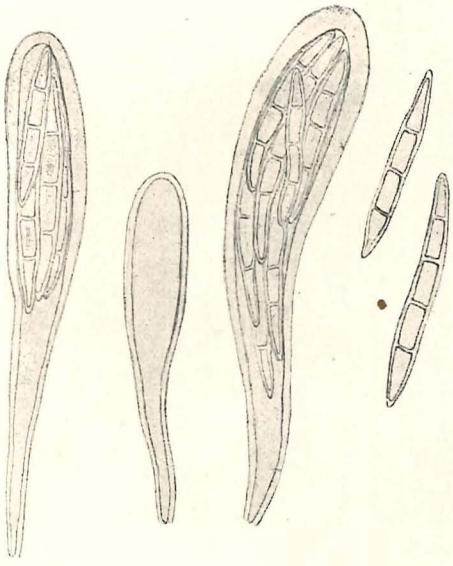


Fig. 181

Fig. 177

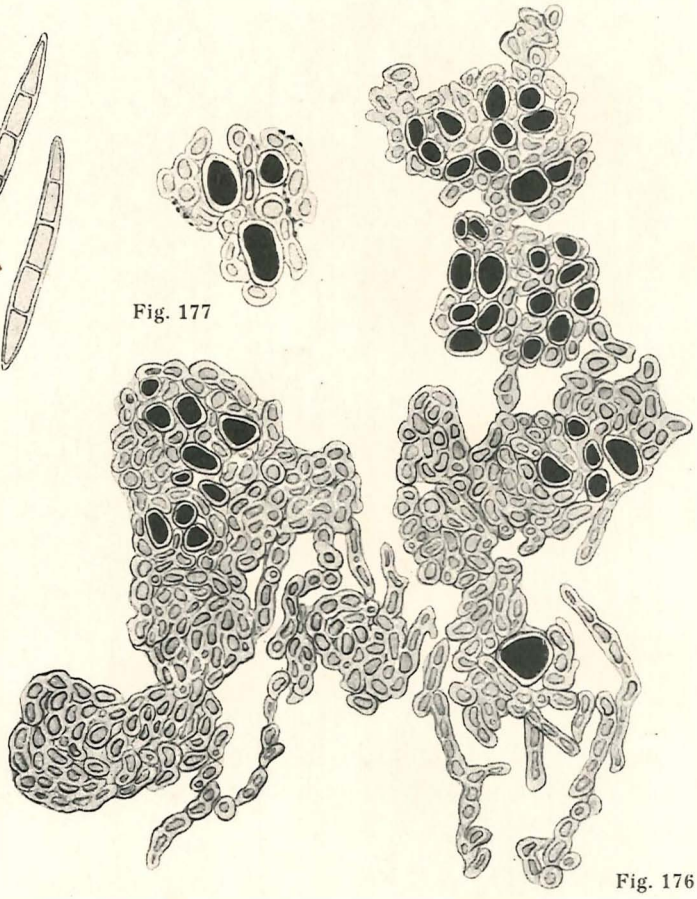


Fig. 176

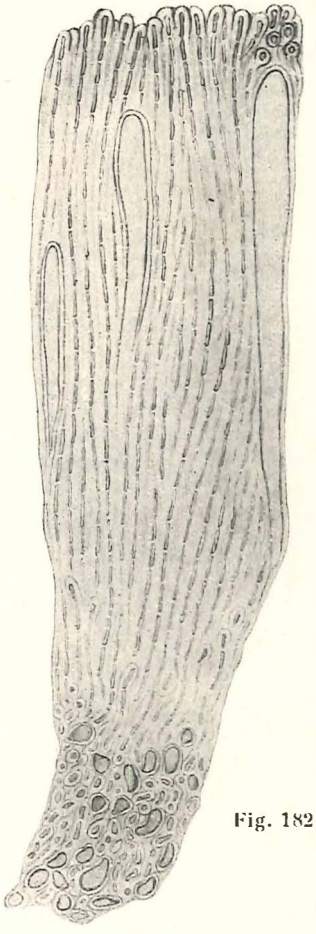


Fig. 182

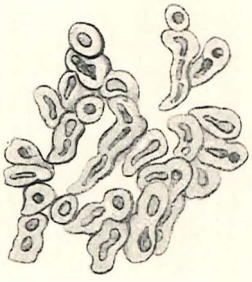


Fig. 179

Fig. 178

Fig. 180

Fig. 184

Fig. 183

O. Galløe del.

HAEMATOMMA COCCINEUM DICKS.
(Specimen 1).

PLATE 36.

HAEMATOMMA COCCINEUM.

DICKS.

Specimen 2.

Fig. 185. Longitudinal section of pycnide embedded in the sorediose thallus. Plenty of gonidia lie in the interior of the pycnide. (× 100).

Fig. 186. Pycnide. The section is not axial; consequently, the ostiole is wanting. Numerous conidia lie in the interior of the pycnide. (× 620).

Fig. 187. Conidiiferous hyphæ with conidia. (× 1053).

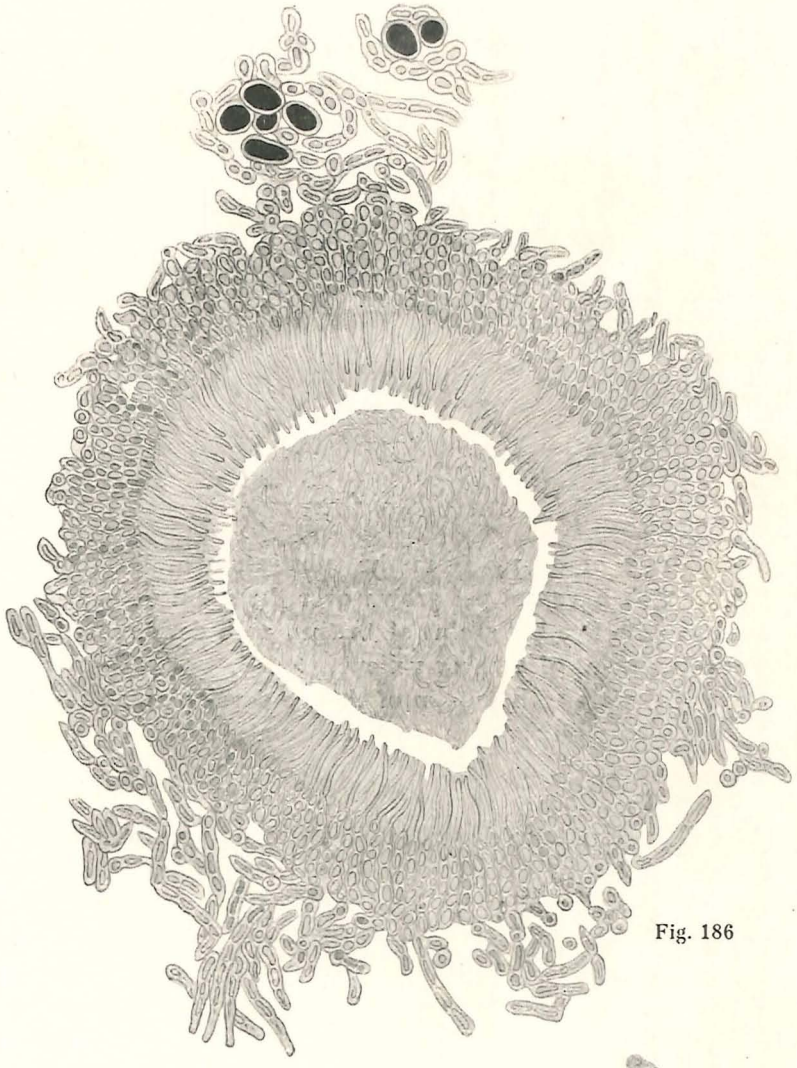


Fig. 186

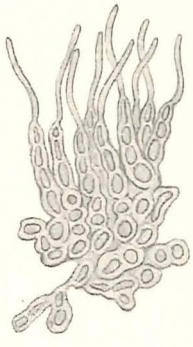


Fig. 187

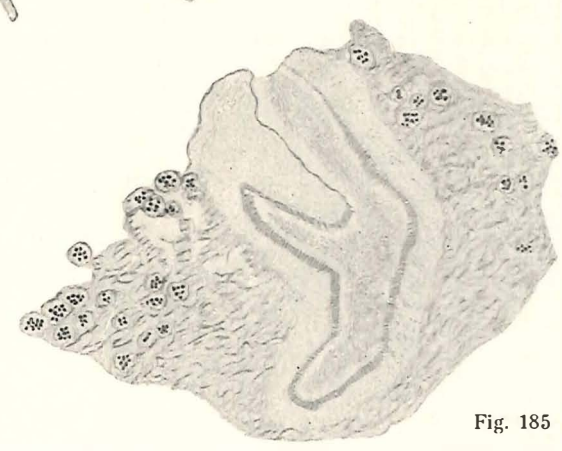


Fig. 185

O. Galløe del

HAEMATOMMA COCCINEUM Dicks.
(Specimen 2).

PLATE 37.

ICMADOPHILA ERICETORUM.

L.

Fig. 188. Two portions of thallus with apothecia; the latter have incomplete thalline margins. (× 20).

Fig. 189. A big grain of quartz from the substratum of the plant, surrounded by grains of thallus, which have not yet grown over the grain of quartz. (× 80).

Fig. 190. Thallus with five big grains of thallus, each developing into an apothecium. The disc is on the point of turning yellow. (× 20).

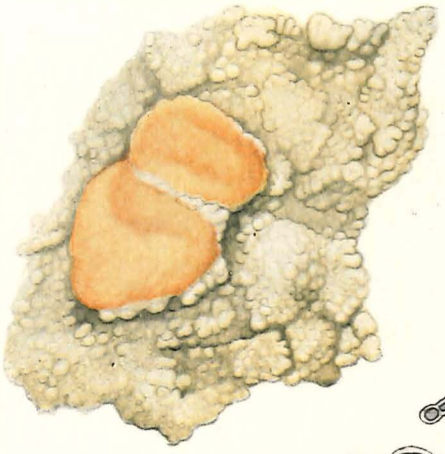
Fig. 191. Portion of thallus with a grain of thallus developing an apothecium, with distinct margo thallinus and with remains of cortex situated on the yellowish disc. (The present apothecium does not yet contain recognizable ascogonia and asci, but has distinct paraphyses). (× 80).

Fig. 192. Thallus, with granular surface and with big lumps of humus between the rhizoidal hyphæ. On the thallus is seen a big apothecial grain of thallus with a very young apothecium (corresponding to Fig. 191), displaying a stipes-calyx and paraphyses, but no unmistakable ascogonia (and still less recognizable asci). (× 80).

Fig. 193. Considerably older apothecium, with thalline covering layer ('margo thallinus') on the calyx-stipes. Note the distinct margo proprius, the ascogonia in the hypothecium, and numerous asci. (× 33).

Fig. 194. Three gonidia, and numerous isolated gonidial hyphæ. (× 1053).

Fig. 195. Portion of the stalk of an apothecium. Cortex and gonidia are seen to the right. The rest of the section shows the dense tissue of the stipes. (× 620).



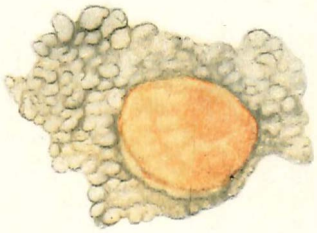


Fig. 188

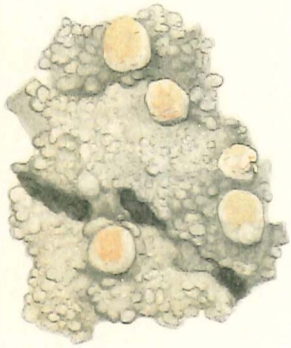


Fig. 190

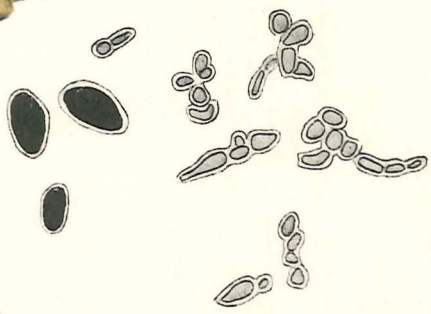


Fig. 194

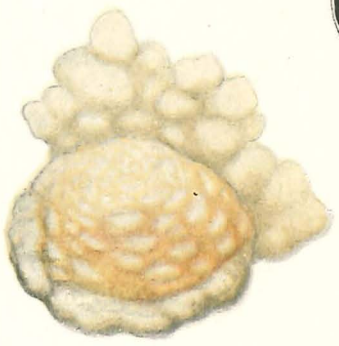


Fig. 191

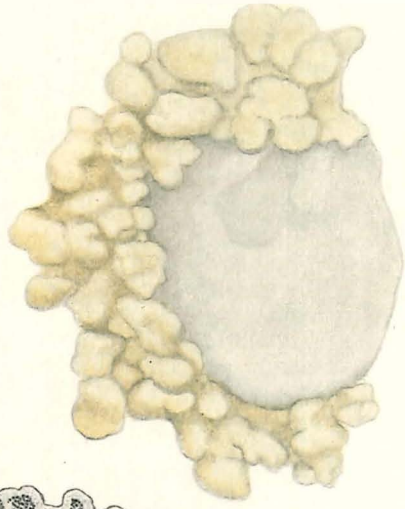


Fig. 189

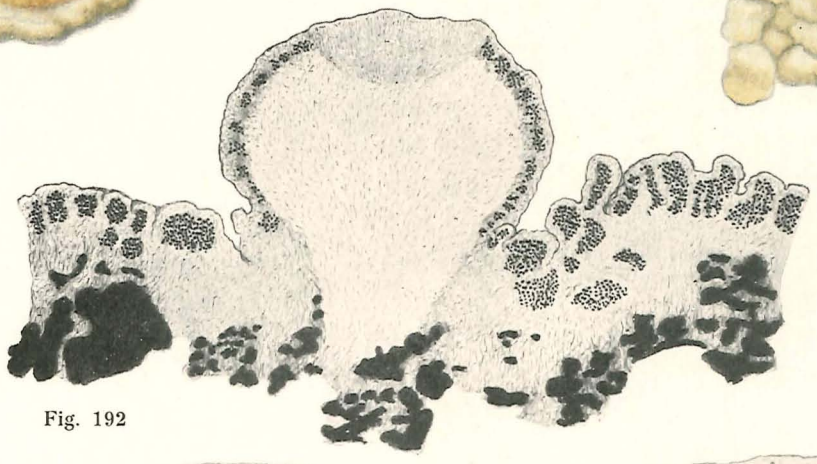


Fig. 192

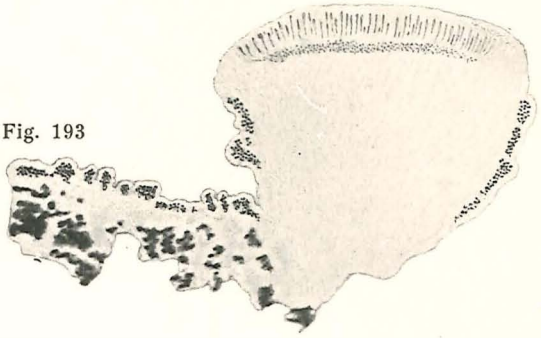


Fig. 193

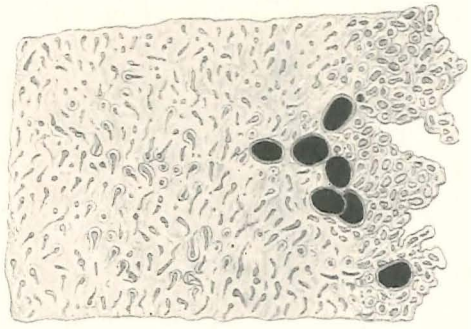


Fig. 195

O. Galløe del.

ICMADOPHILA ERICETORUM L.

PLATE 38.

ICMADOPHILA ERICETORUM.

L.

Fig. 196. Hyphæ from stipes. (× 1053).

Fig. 197. Hyphæ from the surface of margo proprius. (× 1053).

Fig. 198. Portions of hymenium. (× 620).

Fig. 199. Tips of paraphyses; they are extremely faintly yellow. (× 747).

Fig. 200. Two ripe asci. The left one contains three abortive and three ripe spores. The right one contains eight spores. (× 747).

Fig. 201. Vertical section of thallus with ordinary gonidia and with big Cyanogonidia with gelatinous cell-walls. A lump of humus is seen at the bottom of the section. (× 620).

Fig. 202. Cortex and two gonidia from the thallus. (× 1053).

Fig. 203. Medulla.

Fig. 204. Rhizoidal hyphæ. (× 1053).

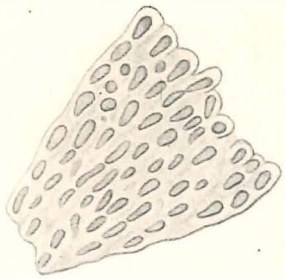


Fig. 197

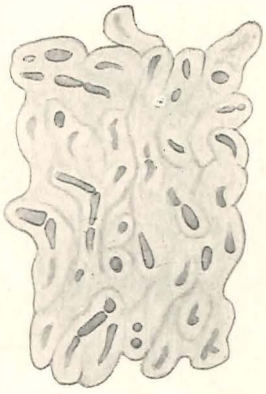


Fig. 196

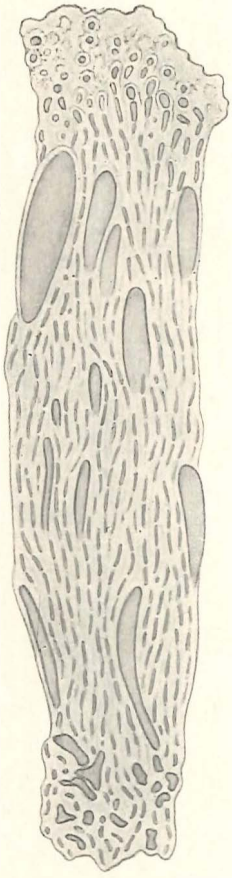


Fig. 198

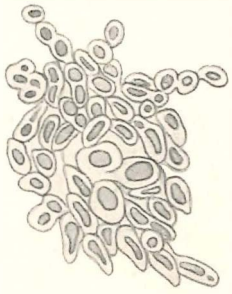


Fig. 203

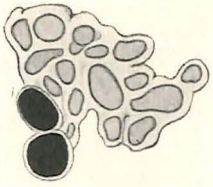


Fig. 202

Fig. 199

Fig. 201

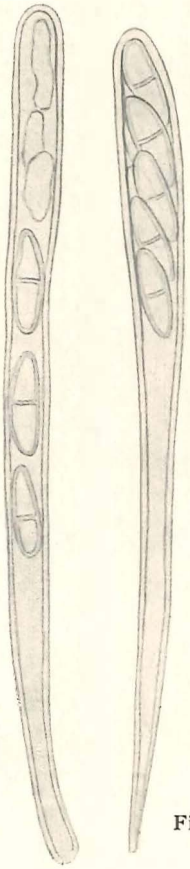


Fig. 200

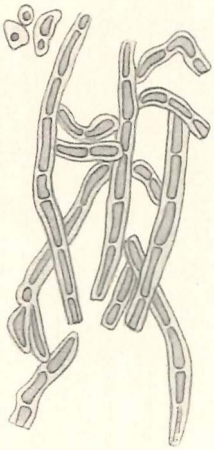


Fig. 204

O. Galløe del.

ICMADOPHILA ERICETORUM L.

PLATE 39.

SCHISMATOMMA ABIETINUM.

EHRH.

Fig. 205. Thallus with apothecia at all ages. (× 20).

Fig. 206. Two very young apothecia. Note the still linear form of one of them, a structural feature suggestive of the relation of this lichen to lichens of the group of *Graphidineæ*. (× 80).

Fig. 207. Thallus with pycnidia (× 20), together with six isolated conidia. (× 1053).

Fig. 208. Thallus with *Trentepohlia*-gonidia, and an apothecium with faintly developed margo proprius. (× 100).

Fig. 209. Thallus with a rather loose cortex, *Trentepohlia*-gonidia, and a colony of gelatinous *Cyanophyceæ* embedded between and surrounded by *Trentepohlia*-gonidia. (×620).

Fig. 210. Cyanophyceæ isolated from the thallus. To the left single cells, to the right a spheric group of cells embedded in a common gelatine. (× 1053).

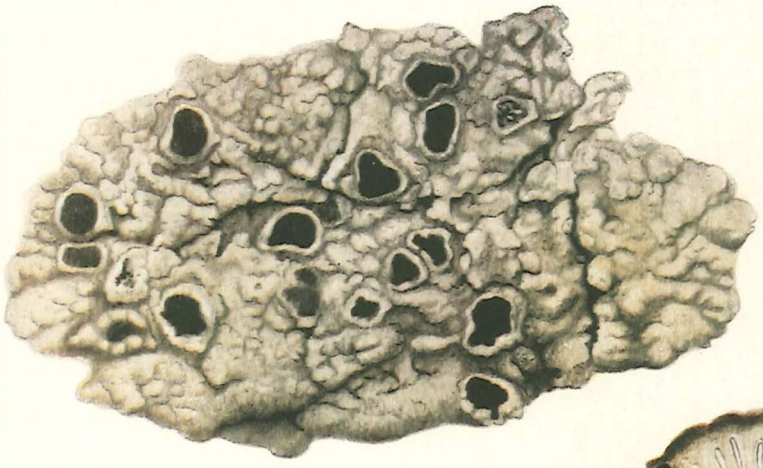


Fig. 205

Fig. 206

Fig. 208

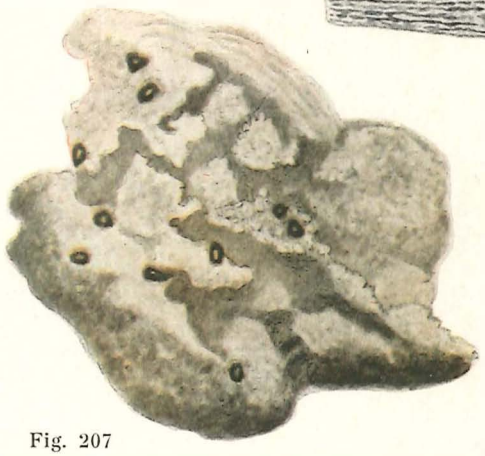


Fig. 207

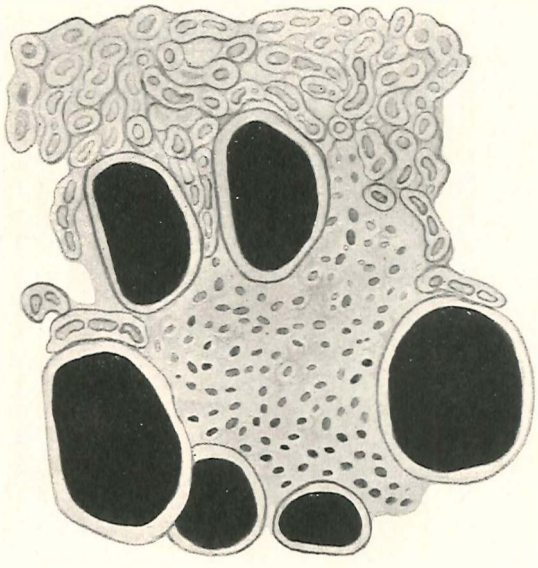


Fig. 209

Fig. 210

O. Galløe del.

SCHISMATOMMA ABIETINUM Ehrh.

PLATE 40.

SCHISMATOMMA ABIETINUM.

EHRH.

Fig. 211. Thallus. In the present case there is no cortex, and the gonidia protrude to the very surface. Fragments of the substratum are seen at the bottom. (× 620).

Fig. 212. Margin of apothecium; the proper margin is indistinctly bordered to the thalline margin. (× 620).

Fig. 213. Thallus with a pycnide. (× 620).

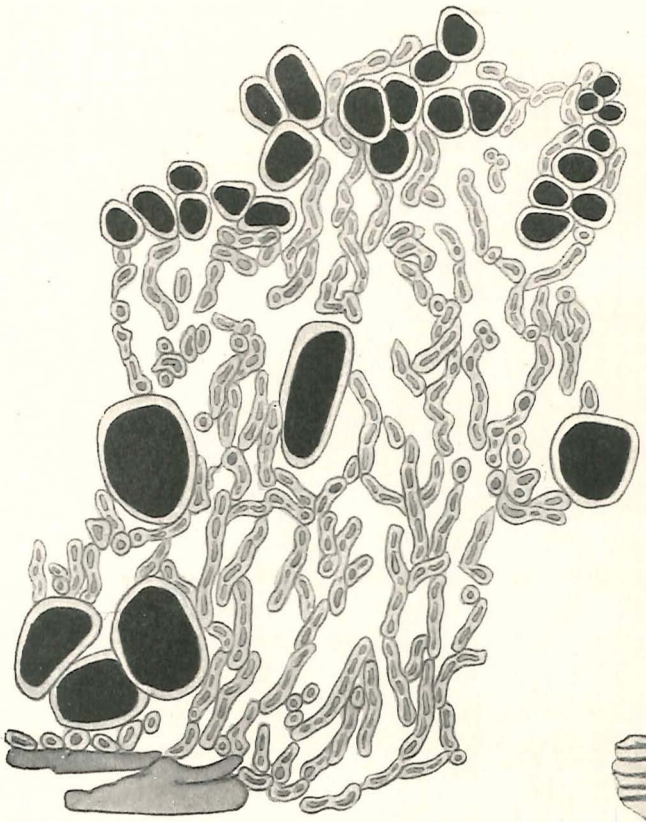


Fig. 211

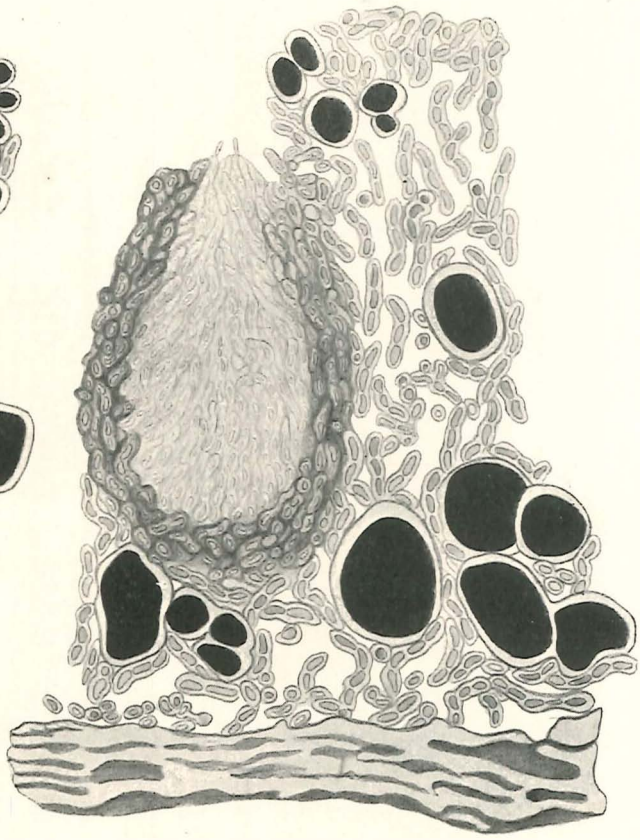


Fig. 213

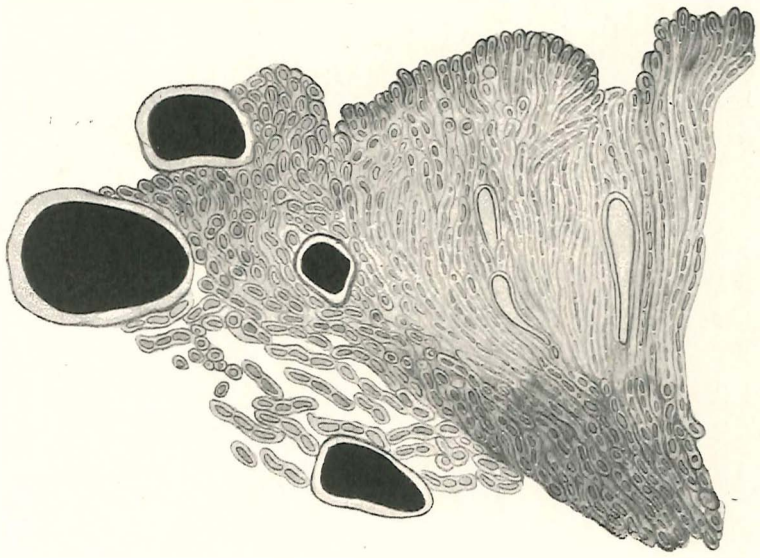


Fig. 212

PLATE 41.

SCHISMATOMMA ABIETINUM.
EHRH.

Fig. 214. Gonidia, isolated from the thallus. (× 620).

Fig. 215. Branched *Trentepohlia* with adhering hyphæ. (× 620).

Fig. 216. Horizontal section of hymenium, with asci and groups of brown and colourless paraphyses. (× 1053).

Fig. 217. Paraphyses, an unripe and a ripe ascus. (× 747).

Fig. 218. An isolated hypha from the thallus. (× 1053).

Fig. 219. To the left, dark hyphae from the wall of a pycnide; it issues a colourless branch, the apex of which does not (yet?) produce a conidium. To the right, a conidiiferous hypha. (× 1053).

Fig. 220. Two ripe spores. (× 77).

Fig. 221. Hyphæ from the base of stipes. (× 747).

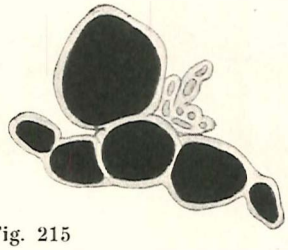


Fig. 215

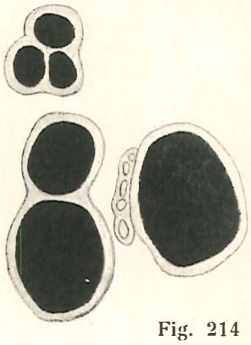


Fig. 214

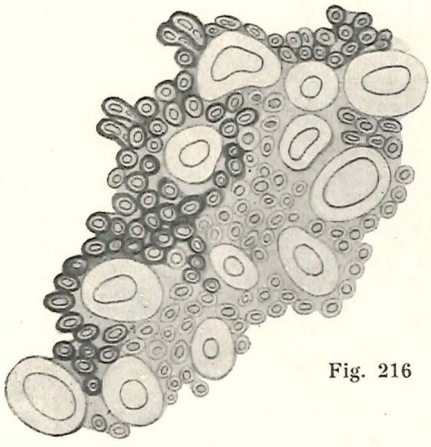


Fig. 216

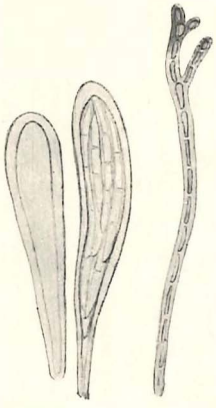


Fig. 217

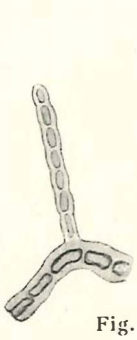


Fig. 219

Fig. 221

Fig. 220

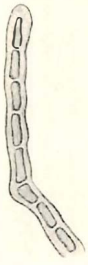


Fig. 218

PLATE 42.

SCHISMATOMMA RIMATUM.

FLOT.

Fig. 222. Entire thallus, with apothecia at all ages. Below to the left it borders on a *Lecidea*. (× 20).

Fig. 223. Portion of thallus with apothecia at different ages. (× 80).

Fig. 224. Thallus with apothecium. In the thallus are seen gonidia (drawn black) and numerous granules of oxalate of calcium. The apothecia rise rather considerably over the surrounding thallus. It is really a mere matter of opinion whether this apothecium is to be called lecanorine or lecideine; it takes up an intermediary position between the two types. (× 140).

Fig. 225. Thallus with gonidia (*Trentepohlia*) and numerous grains of oxalate of calcium. In this section there is a rather distinct cortex. (× 620).

Fig. 226. Thallus of a very loose texture. Large masses of oxalate of calcium, which have fallen out during the preparation, were accumulated in the big interstices between the hyphæ. In this section there are scarcely any traces of a cortex. (× 1053).

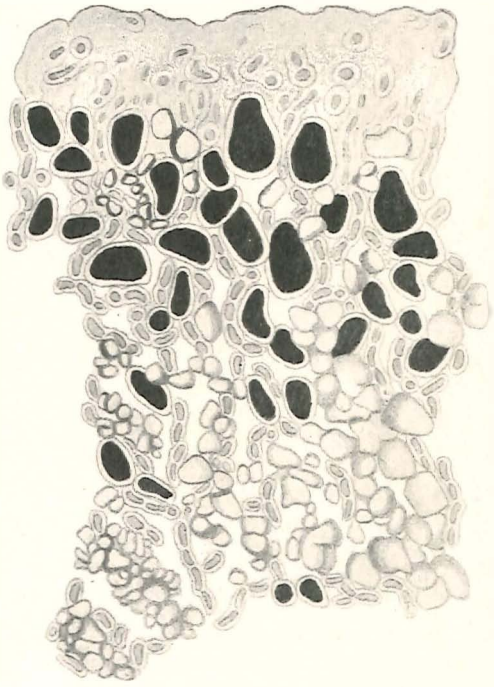


Fig. 225

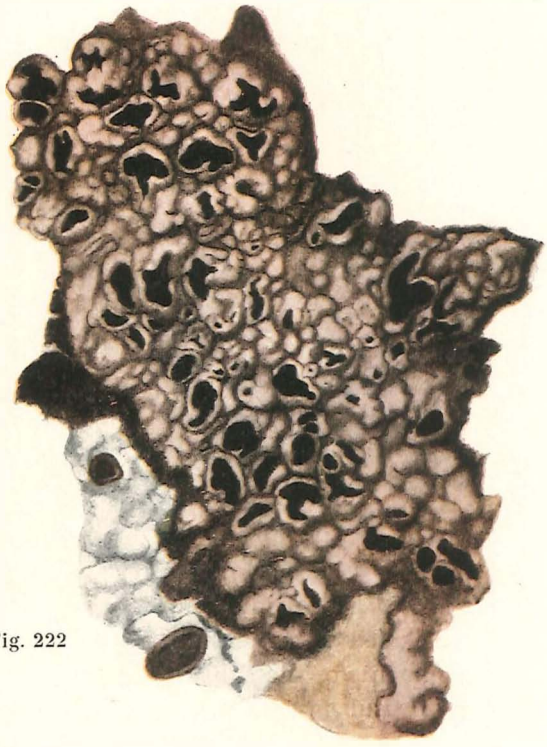


Fig. 222

Fig. 224

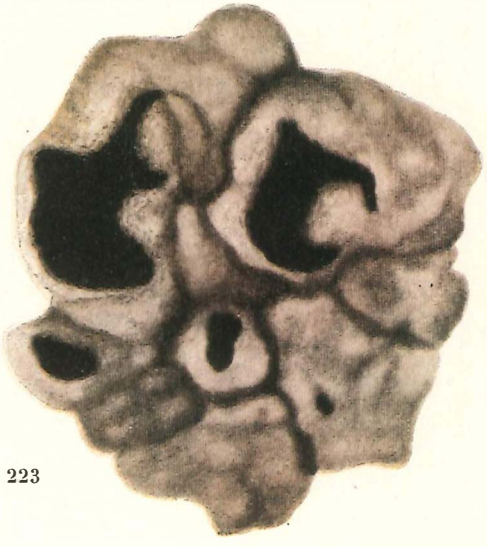


Fig. 223

Fig. 226

O. Galløe del.

SCHISMATOMMA RIMATUM FLOT.

PLATE 43.

SCHISMATOMMA RIMATUM.
FLOT.

Fig. 227. Young primordium of an apothecium; it consists of a colourless hypothecium with distinct ascogonia and paraphyses, which latter are still colourless, and of asci. The outermost erect hyphæ to the right and to the left will develop into an exciple. The primordium already contains young asci. The whole primordium is still embedded in the thallus, covered at the top by the thallus (containing gonidia and fragments of the substratum carried upwards to the surface of the thallus). Fragments of the substratum lie at the bottom of the section. (× 840).

Fig. 228. Vertical section of part of stipes-calyx from the central (axial) portions of the apothecium. At the bottom of the section is the base of the stipes (with nearly colourless hyphæ); next follow brown hyphæ of stipes, and, finally, at the top a colourless hypothecium. (× 1053).

Fig. 229. Portion of hymenium, below passing into a colourless hypothecium. (× 1053).

Fig. 230. Three ripe asci and an isolated spore. (× 747).

Fig. 231. To the left an almost colourless hypha from margo proprius. To the right an almost colourless paraphysis. (× 1053).

Fig. 232. To the left two brown, unbranched paraphyses. To the right two branched paraphyses with colourless bases and brown tips, and an ascus. (× 747).

Fig. 233. To the left and in the middle two sterile *Trentepohlia*-gonidia. (× 747). To the right a *Trentepohlia* in sporulation. (× 1053).

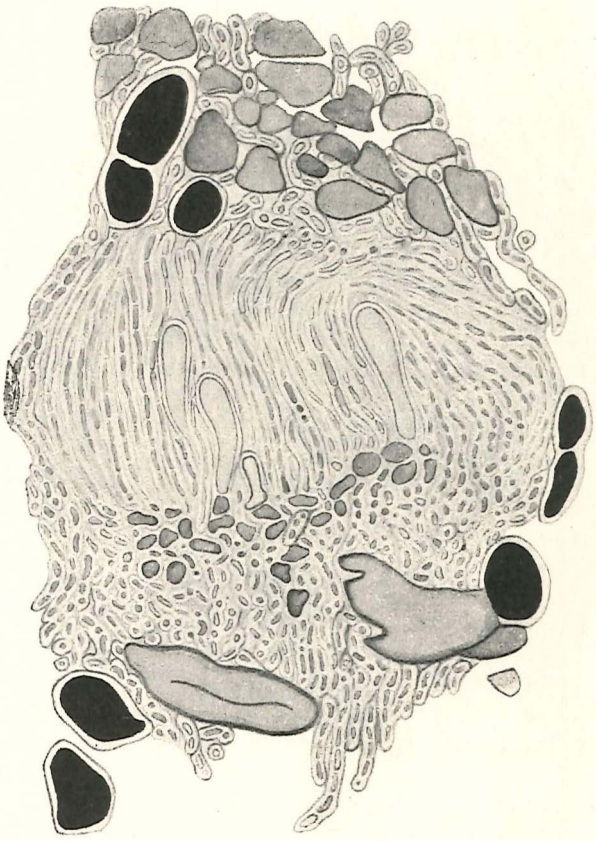


Fig. 227

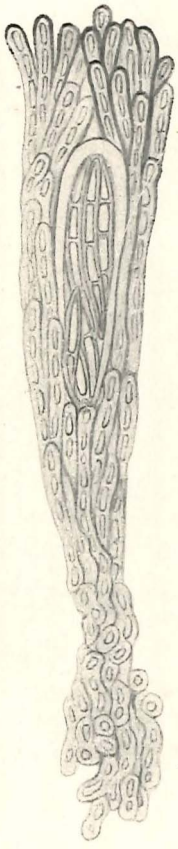


Fig. 229

Fig. 228

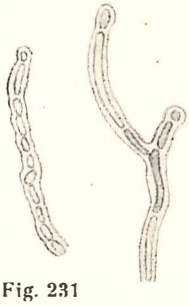


Fig. 231

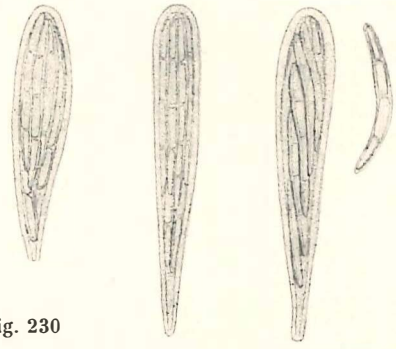


Fig. 230

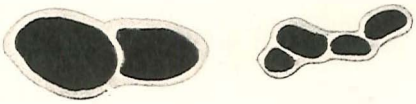


Fig. 233

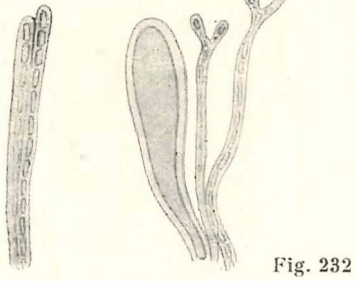


Fig. 232

O. Galløe del.

SCHISMATOMMA RIMATUM FLOT.

PLATE 44.

ACAROSPORA FUSCATA.

SCHRAD.

Fig. 234. Portion of thallus with marginal areoles at the top of the figure. The naked substratum is seen in places between the areoles (for further information *vide* the text). (× 10).

Fig. 235. Marginal areole. The free incised margin is to the left. Seven young apothecia and one pycnide. (× 40).

Fig. 236. A very young individual, being an independent areole with two depressions, the first beginnings of two apothecia. The margin of the areole is about to be lobulate. (× 80).

Fig. 237. Vertical section of the margin of an areole. The areole is free of the substratum up to the letter *a*; to the right of this there are rhizoids issuing from a primitive lower cortex on the underside of the areole. To the left in the section a pycnide; to the right a young apothecium still covered by cortex. (× 140).

Fig 238. Areole with three apothecia developed in centrifugal order in the areole. Note the exciple, everywhere lecideine and gonidialess. (× 80).

Fig. 239. Cuticle, brown cortex, colourless cortex, and gonidial layer. (× 1053).

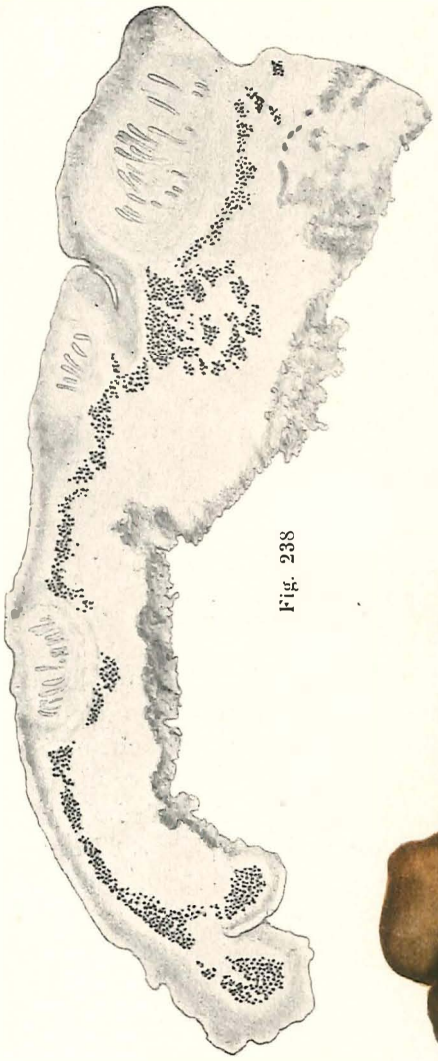


Fig. 238

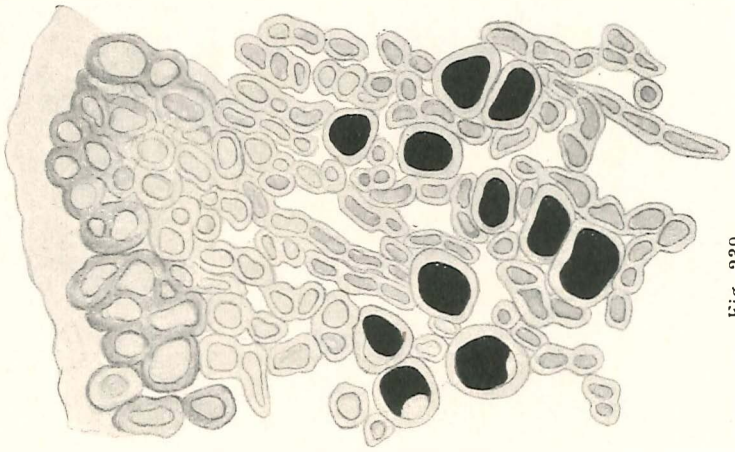


Fig. 239

Fig. 235

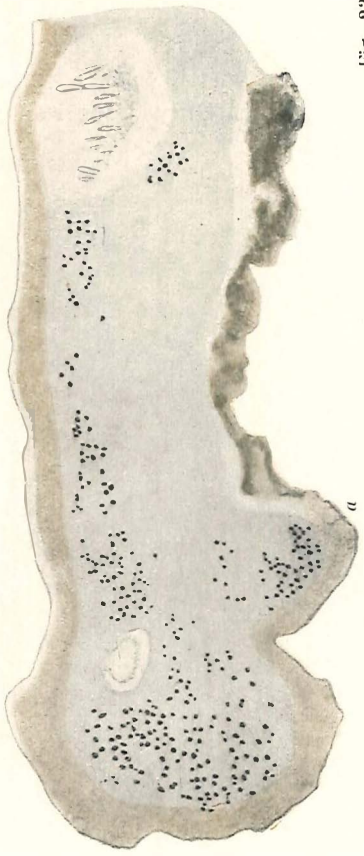


Fig. 237

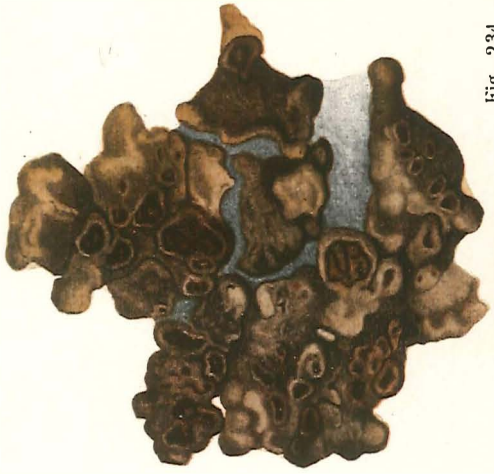


Fig. 234

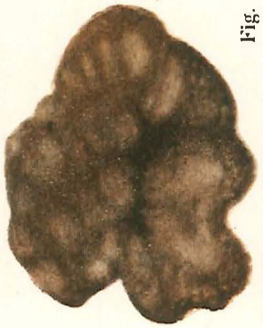


Fig. 236

O. Galløe del.

ACAROSPORA FUSCATA Schrad.

PLATE 45.

ACAROSPORA FUSCATA.

SCHRAD.

Fig. 240. Lower surface of the areole. The dark brown cortex is situated in the space between *a* and *b*; above it medulla is seen; below it are rhizoidal hyphæ and two particles of the substratum. (× 1053).

Fig. 241. Primordium of apothecium still covered by cortex. The hymenium has still entirely colourless paraphyses and unripe asci. Round the hymenium and under it are seen the hyphæ of the exciple, which latter consists of a calyx as yet without a distinct stipes. Numerous ascogonia occur in the hypothecium. (× 620).

Fig. 242. Two ripe apothecia. Note the prevailing lecideine character of their exciple. Only the left side of one of the apothecia contains a group of gonidia. (× 80).

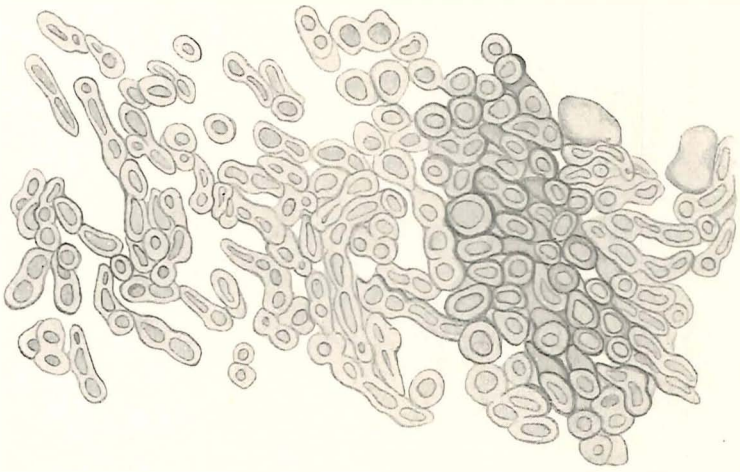


Fig. 240

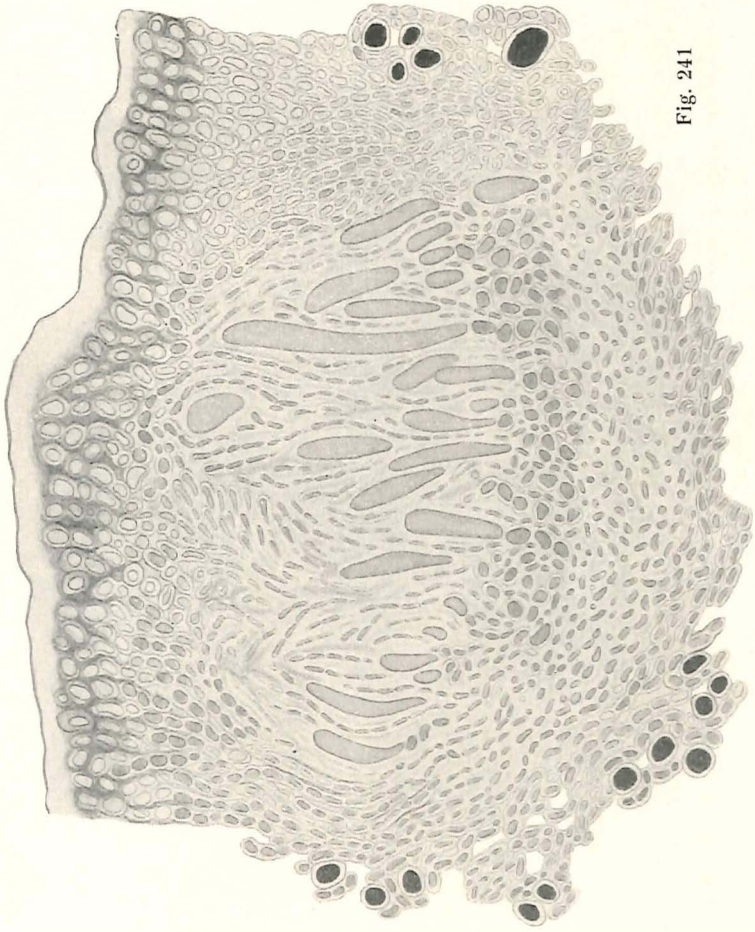


Fig. 241

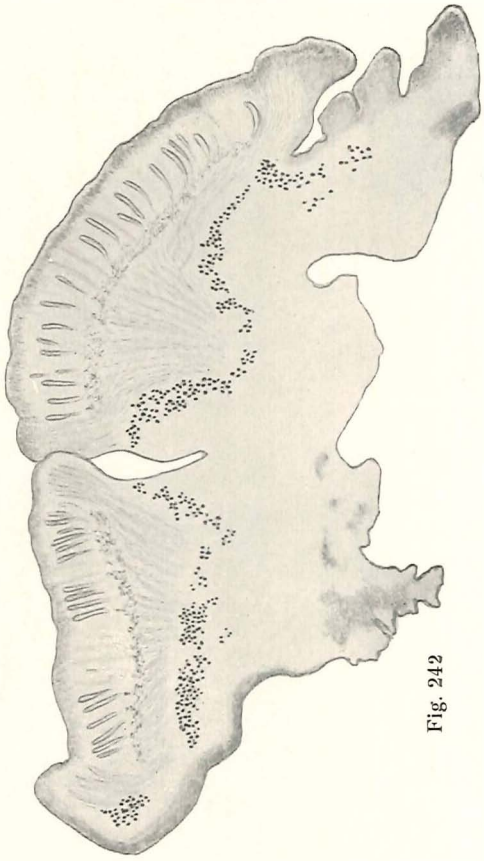


Fig. 242

O. Galløe del.

ACAROSPORA FUSCATA Schrad.

PLATE 46.

ACAROSPORA FUSCATA.

SCHRAD.

Fig. 243. Ripe ascus. (× 747).

Fig. 244. Hymenium with two young asci issuing from ascogonia in the hypothecium. The hyphæ of calyx-stipes are seen beneath the ascogonia. (× 747).

Fig. 245. Ascogonia, young asci, and bases of paraphyses. (× 747).

Fig. 246. Paraphyses with brown apices. Note that one of the paraphyses has a couple of small branches. (× 747).

Fig. 247. Hyphæ from margo proprius, with brown tips. (× 747).

Fig. 248. Pycnide, embedded in the gonidial layer and covered by cortex. (× 620).

Fig. 249. Conidiiferous, colourless hyphæ with conidia. (× 1053).

Fig. 244

Fig. 245

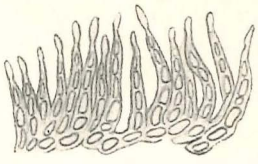


Fig. 249

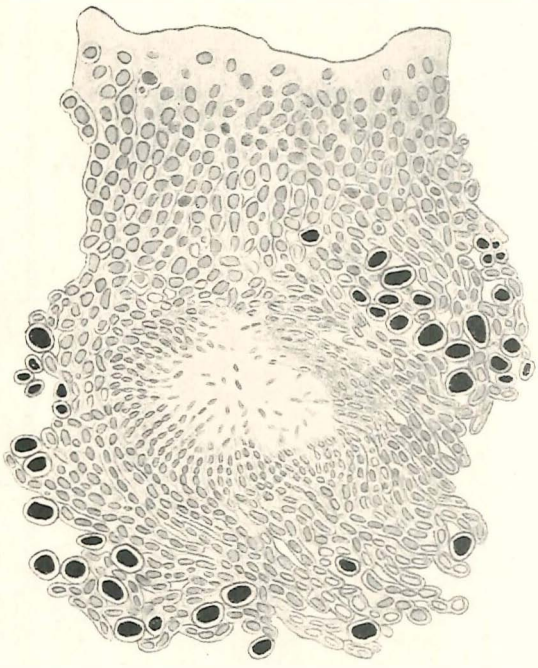


Fig. 248

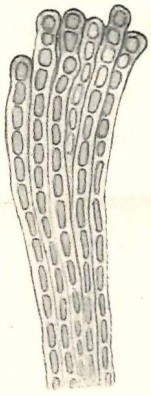


Fig. 247

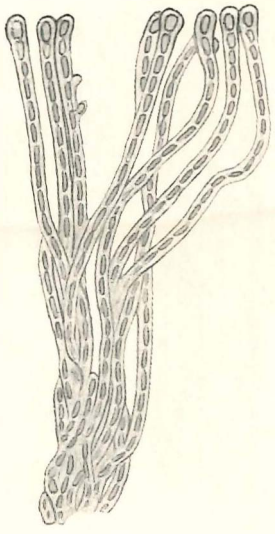


Fig. 246

Fig. 243

PLATE 47.

ACAROSPORA SMARAGDULA.

WNBG.

Fig. 250. Thallus on a red tile. (× 21).

Fig. 251. A young areole with radiating, black, marginal hyphæ, and a young apothecium. (× 80).

Fig. 252. A young areole, in the black marginal hyphæ of which fresh small areoles are developing. (× 80).

Fig. 253. Areole. Three small colonies of *Cyanophyceæ* are situated below to the right. (× 100).

Fig. 254. Areole with young apothecium. (× 100).

Fig. 255. Areole with one young and one ripe apothecium; their exciples are almost entirely lecideine. To the left in the figure is the margin of the areole, functioning, besides, as the thalline margin of the apothecium. (× 80).

Fig. 256. Margin of an areole. Below to the right a group of *Cyanophyceæ* is attached to the underside of the margin of the thallus. (× 620).

Fig. 250

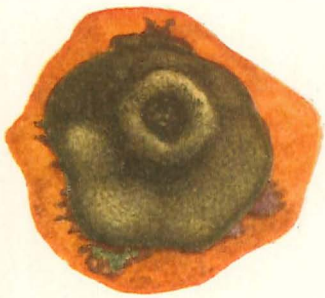


Fig. 251

Fig. 252

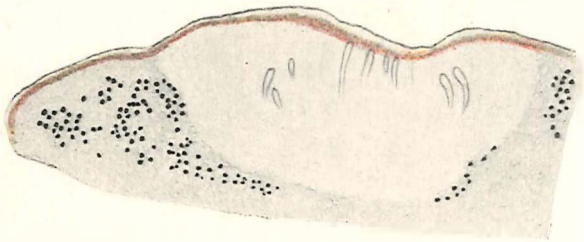


Fig. 254

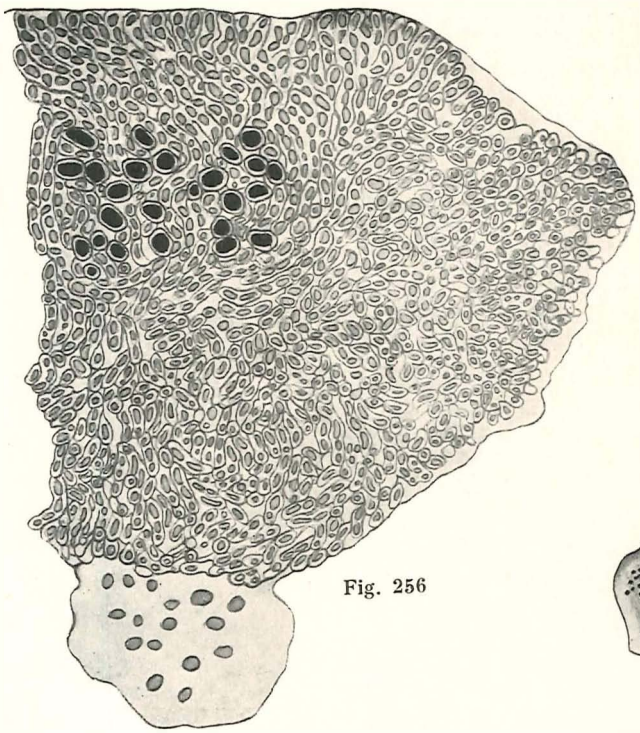


Fig. 256

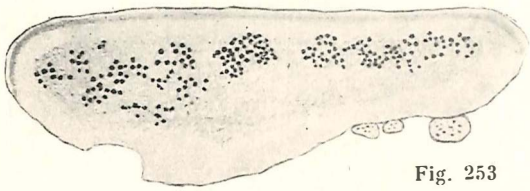


Fig. 253

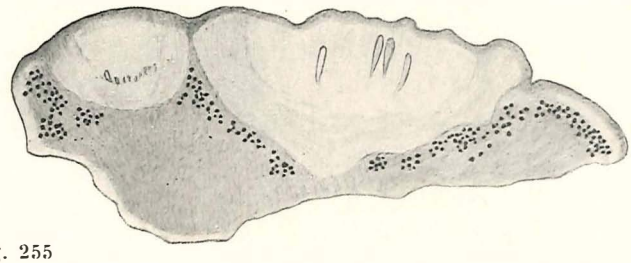


Fig. 255

ACAROSPORA SMARAGDULA WNBG.

●. *Galløe del.*

PLATE 48.

ACAROSPORA SMARAGDULA.

WNBG.

Fig. 257. Cuticle, brown cortex, colourless cortex, and gonidial layer. (× 840).

Fig. 258. Gonidial layer and, beneath this, the medullary layer. (× 840).

Fig. 259. Hyphæ fro the lower surface of thallus. (× 840).

Fig. 260. Hyphæ from calyx (between the letters *a* and *b*); above these, basal parts of paraphyses; below *b* the gonidial layer. (× 747).

Fig. 261. Hyphæ from the proper margin; their apical cells are brown. (× 747).

Fig. 262. Horizontal section of hymenium, with asci and paraphyses. (× 747).

Fig. 263. Paraphyses with cuticle. Asci are cut in an obliquely longitudinal section, for which reason they cannot be traced to their full length. (× 747).

Fig. 264. Above, a group of spores. Below these an isolated gonidial alga, and at the bottom a young ascus. (× 747).

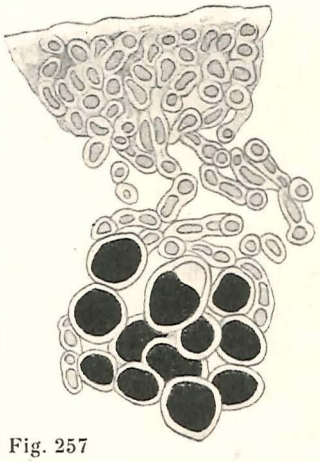


Fig. 257

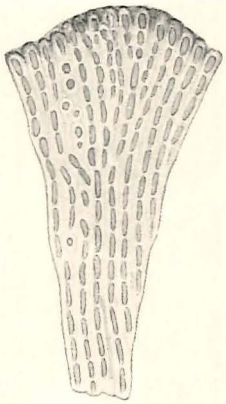


Fig. 261

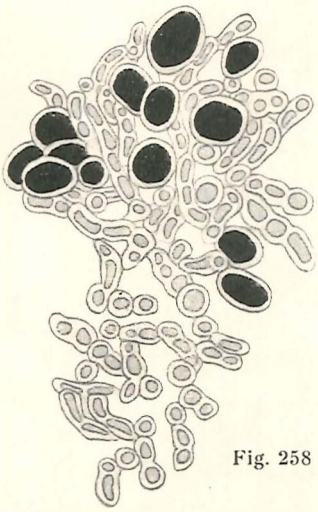


Fig. 258

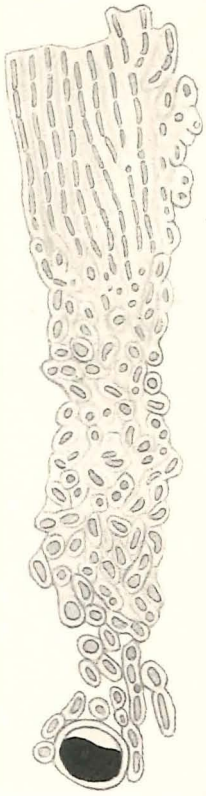


Fig. 260

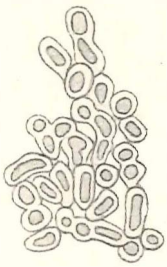


Fig. 259

Fig. 264

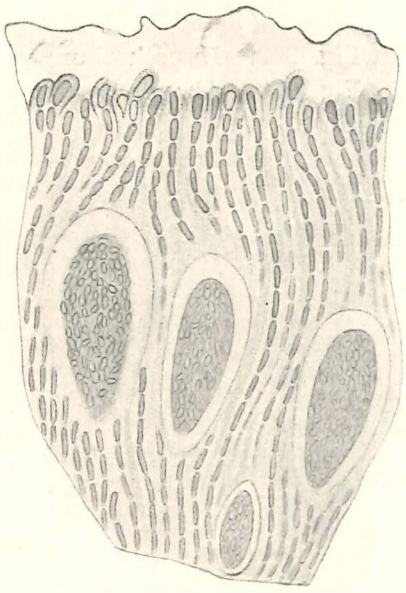


Fig. 263

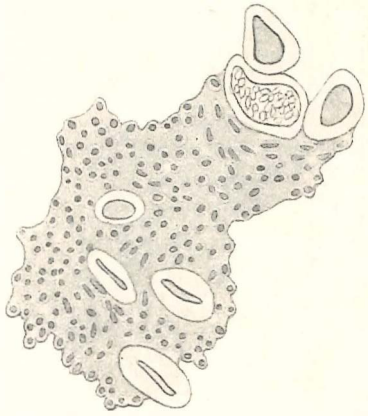


Fig. 262

O. Galløe del.

ACAROSPORA SMARAGDULA Wnbg.

PLATE 49.

ACAROSPORA VERONENSIS.

MASS.

Fig. 265. Thallus, consisting of areoles, mutually connected by scanty, radiating hyphæ. (× 35).

Fig. 266. Two connected areoles, each containing an apothecium. In the right areole the left side of the apothecium is entirely gonidialess. (× 80).

Fig. 267. Cortex, gonidial layer, and medulla. (× 840).

Fig. 268. Hyphæ from the lower surface of the areole; they form a very primitive cortex. (× 100).

Fig. 269. Hypothecium, young asci, and bases of paraphyses. (× 747).

Fig. 270. Above, a group of ripe spores. Below, ascogenous hyphæ and a young ascus. (× 747).

Fig. 271. Paraphyses, scantily branched and colourless at the tips. (× 747).

Fig. 272. Gonidia. (× 747).

Fig. 273. Hyphæ from the proper margin. The top cells are brown. (× 840).

Fig. 274. Hymenium with ripe spores. (× 840).

Fig. 265

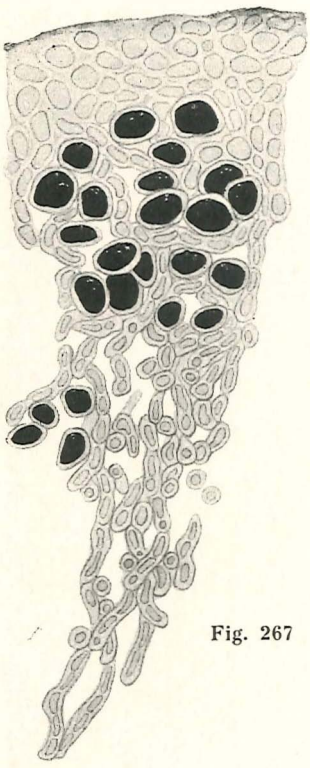


Fig. 267

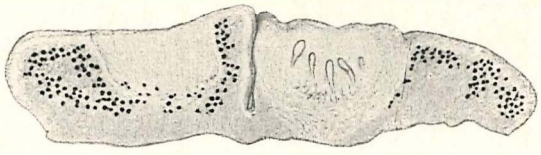


Fig. 266

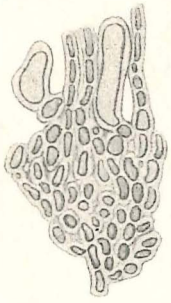
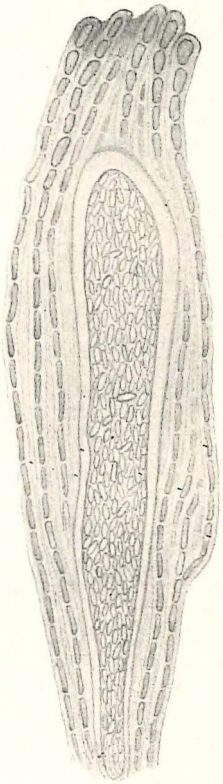


Fig. 269

Fig. 270

Fig. 272



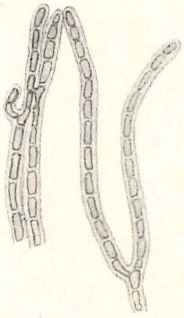
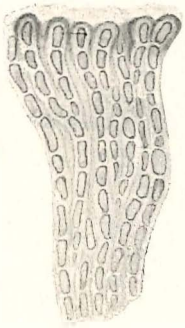


Fig. 271



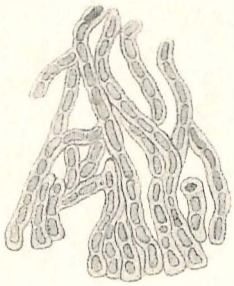


Fig. 274

Fig. 273

Fig. 268

O. Galløe del.

ACAROSPORA VERONENSIS Mass.

V. P 13

PLATE 50.

ACAROSPORA HEPPII.

NAEG.

Fig. 275. Entire thallus, consisting of one areole with four apothecia. (× 80). It is this specimen which is described and pictured anatomically here.

Fig. 276. Another specimen, likewise formed of one areole but containing only one apothecium. Anatomically it fully agrees with Fig. 275, but otherwise it is not described and pictured here. It was examined only for the sake of control. (× 80).

Fig. 277. A third specimen, with one apothecium. Here the apothecium is distinctly lecideine, but otherwise it is similar to Fig. 275 as to structure. (× 100).

Fig. 278. Areole (a microtome section of the specimen shown in Fig. 275), with three entire apothecia and part of a fourth one. The part between *a* and *b* is attached to the substratum. The margins of the areole to the left of *a* and to the right of *b* respectively are corticate, free surfaces of the areole. The apothecia are provided with distinct proper margins. (× 100).

Fig. 279. Margin of an areole, and, raised above this, the margin of an apothecium, with calyx, two anastomosed paraphyses, unripe asci, and colourless epithecium, below which latter are seen the brownish portions of the upper layers of the hymenial gelatine. (× 620).

Fig. 280. Ascogonia and young asci. (× 840).

Fig. 281. Gonidial layer. (× 840).

Fig. 282. Medulla. (× 840).

Fig. 283. Ripe ascus. (× 747).

Fig. 276

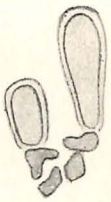


Fig. 280

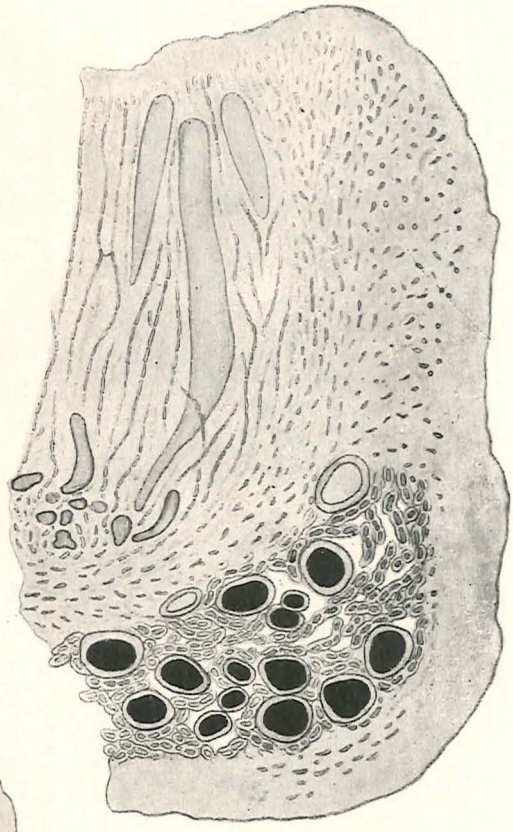


Fig. 279

Fig. 275

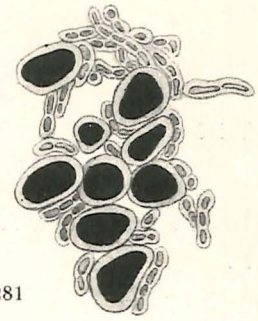


Fig. 281

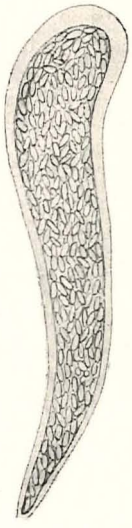


Fig. 283

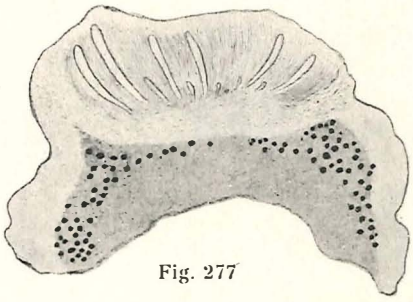


Fig. 277

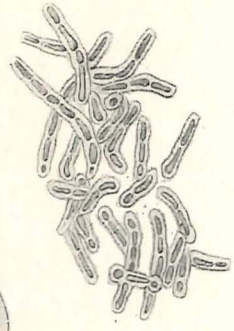


Fig. 282

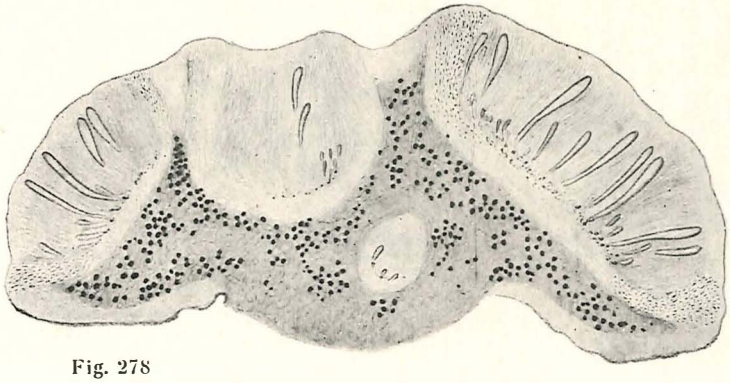


Fig. 278

O. Galløe del.

ACAROSPORA HEPPII NAEG.

PLATE 51.

OCHROLECHIA PARELLA
L.

Specimens 1 and 2.

Fig. 284. Margin of thallus and the substratum. (× 13).
Fig. 285. Areolate central portions of thallus with apothecia. (× 13).
Fig. 286. *Ochrolechia parella,* specimen 2. (× 13).

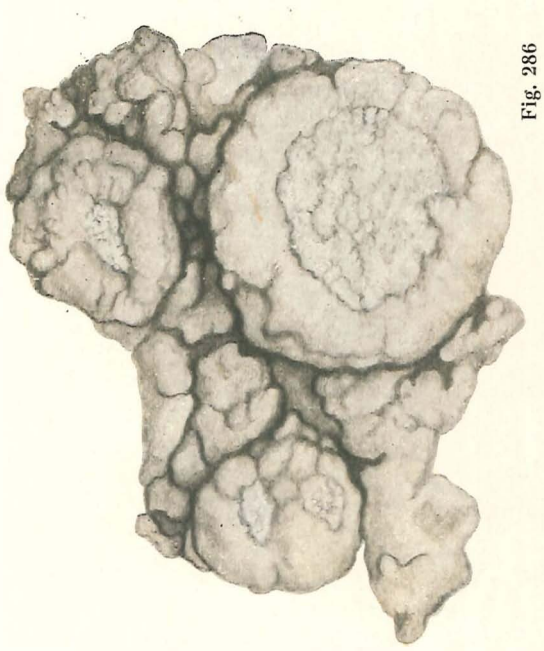


Fig. 286

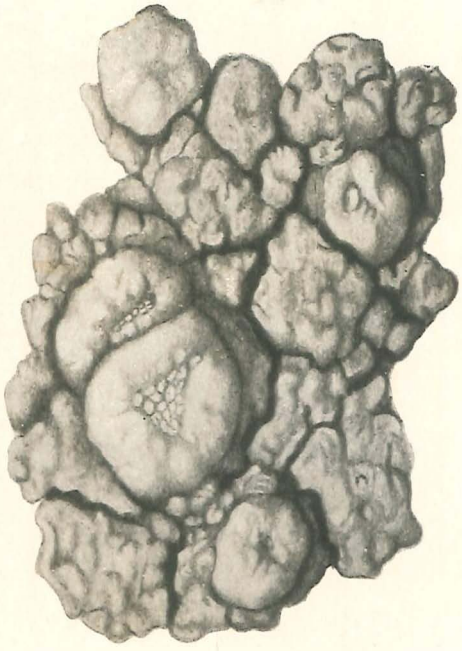


Fig. 285

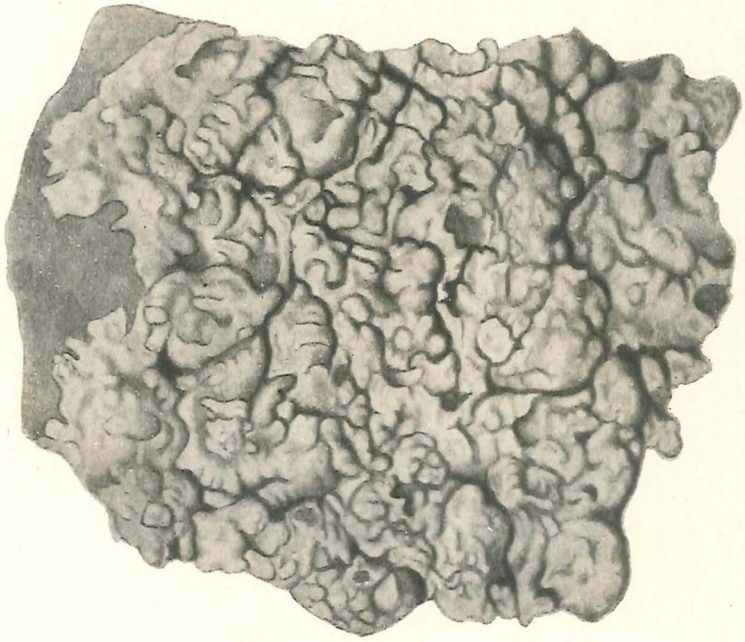


Fig. 284

O. Galløe del.

OCHROLECHIA PARELLA L.
(Specimen 1, 2).

PLATE 52.

OCHROLECHIA PARELLA
L.
Specimen 1.

Fig. 287. (The following pictures from 287 to 296 deal with *Ochrolechia parella,* specimen 1, exclusively). Thallus and one half of an apothecium. Note the granular cortex (comp. Fig. 290) and the light calyx surrounding the hypothecium and the hymenium. (× 80).

Fig. 288. Entire apothecium. (× 33).

Fig. 289. Margin of apothecium, with margo thallinus and margo proprius. The dark, peripheral portions of both these margins represent the yellowish-granular tissues (comp. Fig. 290 and Fig. 292). (× 80).

Fig. 290. Margo thallinus with a thick cortex, in the upper parts of which big, yellowish granules occur (vide the text). (× 1053).

Fig. 291. Medullary layer. (× 1053).

Fig. 292. Upper portion of margo proprius, with big yellowish granules on the surface. (× 1053).

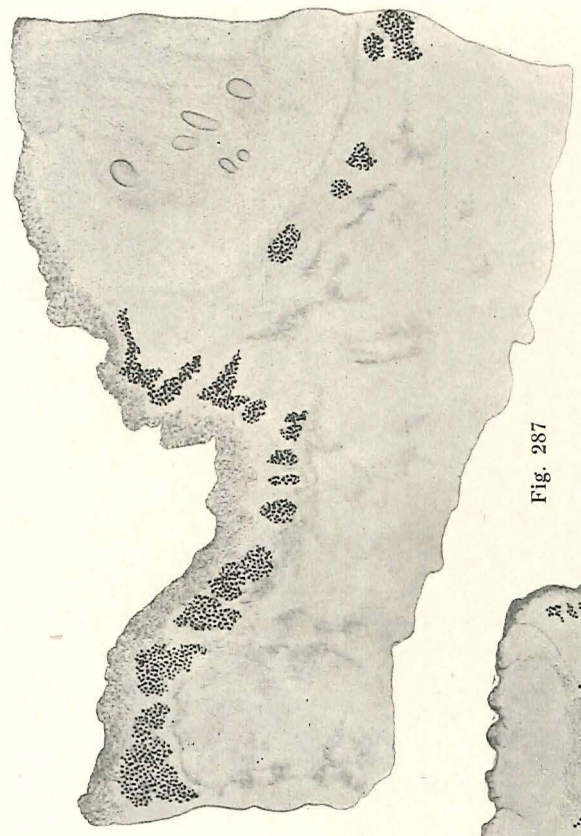


Fig. 287

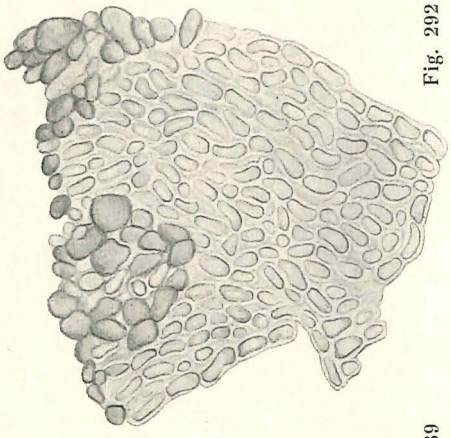


Fig. 292

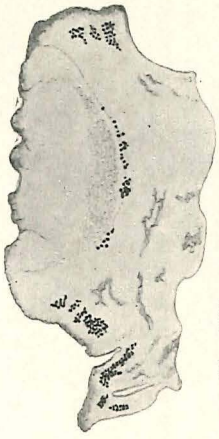


Fig. 288

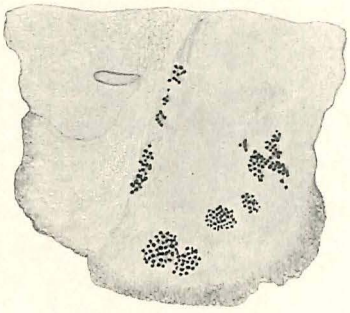


Fig. 289

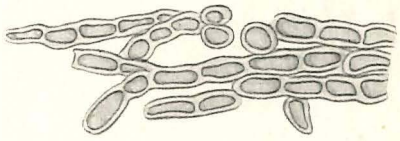


Fig. 291

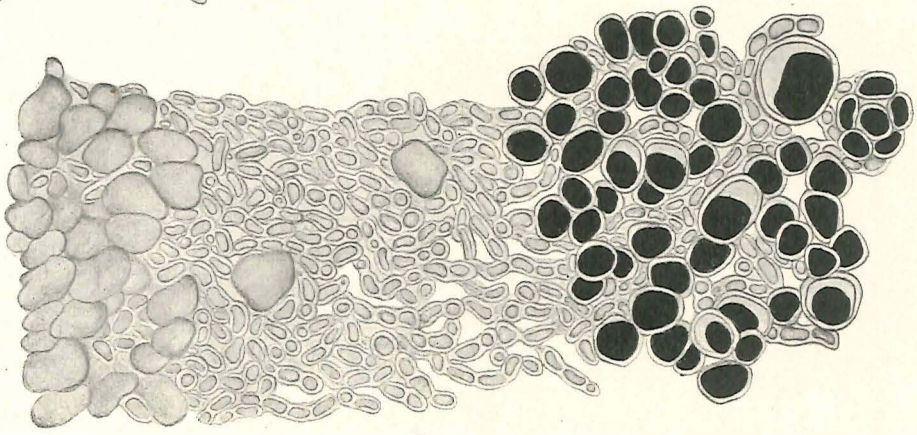


Fig. 290

PLATE 53.

OCHROLECHIA PARELLA

L.

Specimen 1.

Fig. 293. Hymenium and hypothecium. Minute, yellowish granules at the top in the hymenial gelatine. The first gonidia begin beneath hypothecium-calyx (comp. Fig. 288 and Fig. 289). (× 620).

Fig. 294. Ascus. (× 620).

Fig. 295. Ripe spores. (× 747).

Fig. 296. Ripe spores. (× 747).

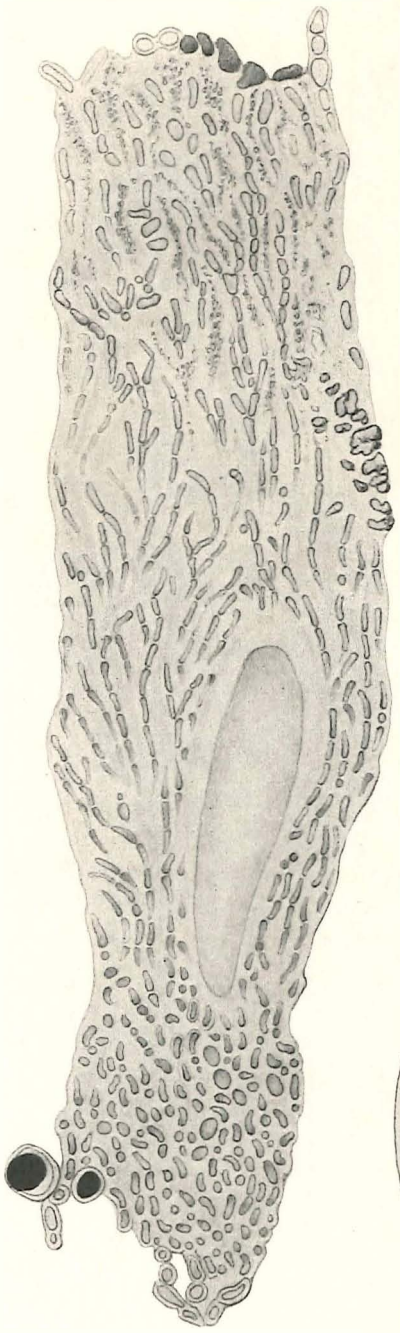


Fig. 293

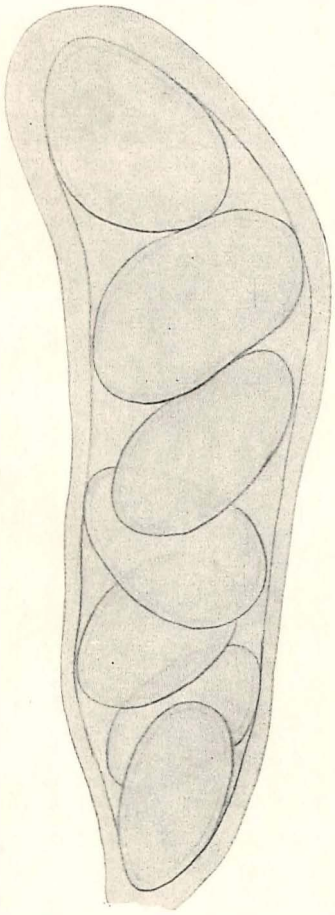


Fig. 294

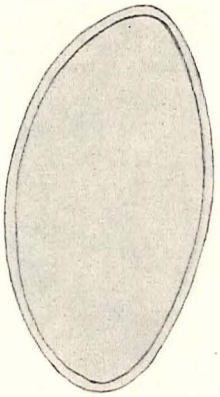


Fig. 296

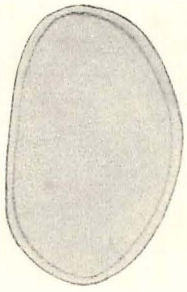


Fig. 295

O. Galløe del.

OCHROLECHIA PARELLA L.
(Specimen 1).

V. P 14

PLATE 54.

OCHROLECHIA TARTAREA
L.

Fig. 297 Thallus with apothecia of all ages, spreading over dead *Cladonias,* etc. (× 20).

Fig. 298. Rather young stipitate apothecium; it is provided with a distinct, long stipes, a calyx, and a proper margin surrounded by margo thallinus with gonidia. Note the thick hypothecium. (× 80).

Fig. 299. Old apothecium, growing on a dead podetium of *Cladonia* (which latter is cut across). The apothecium has a distinct stipes, calyx, and proper margin, surrounded by a thalline margin with arachnoid medullary layer (shaded dark in the picture). At the base the apothecium breaks through the podetium of *Cladonia,* of which four small fragments (shaded dark in the picture) are embedded in the tissues of *Ochrolechia.* To the left the thallus of *Ochrolechia* grows downwards over the podetium of *Cladonia.* (× 33).

Fig. 300. Portion of calyx, the proper margin being at the top. (× 1053).

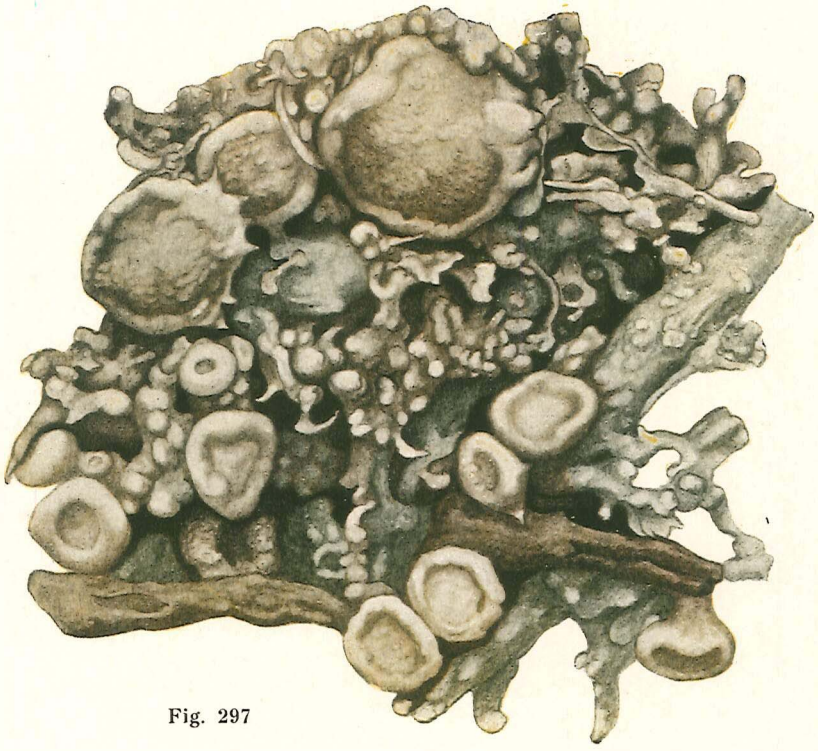


Fig. 297

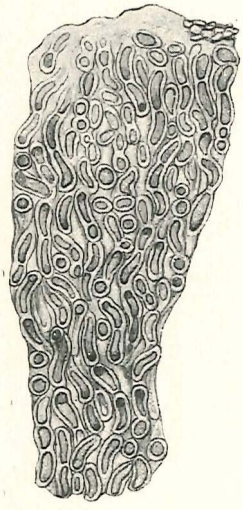


Fig. 300

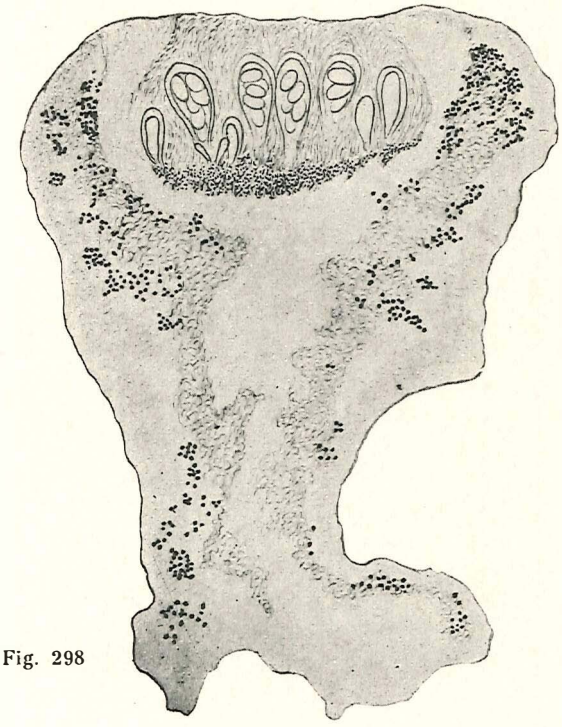


Fig. 298

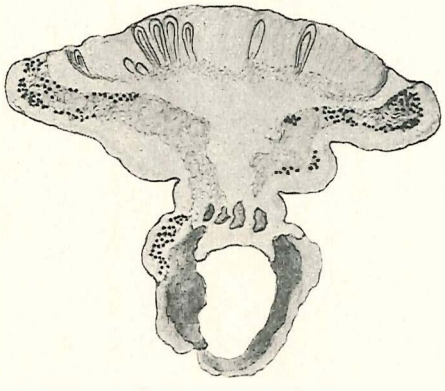


Fig. 299

O. Galløe del.

OCHROLECHIA TARTAREA L.

PLATE 55.

OCHROLECHIA TARTAREA L.

Fig. 301. Portion of thallus, with cuticle, living cortex, gonidial layer, and arachnoid medulla. (× 1053).

Fig. 302. Portion of stipes. (× 1053).

Fig. 303. The basal part of the stipes of the apothecium, which has broken through the wall of the podetium of *Cladonia* (comp. Fig. 299). The hyphæ of *Cladonia* have been omitted in the picture. (× 1053).

Fig. 304. Paraphyses with epithecium, and hypothecium with ascogenous hyphæ. (× 620).

Fig. 305. The upper, branched portions of the paraphyses, with epithecium. (× 1053).

Fig. 306. Ascus with spores. (× 620).

Fig. 307. Ripe ascus. (× 747).

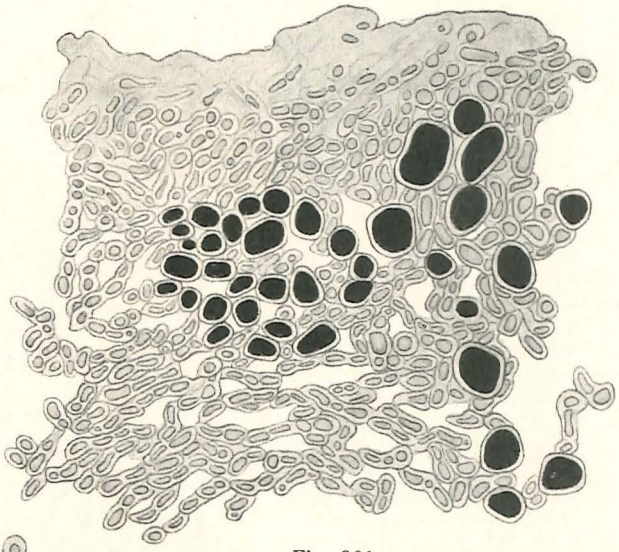


Fig. 301

Fig. 302

Fig. 305

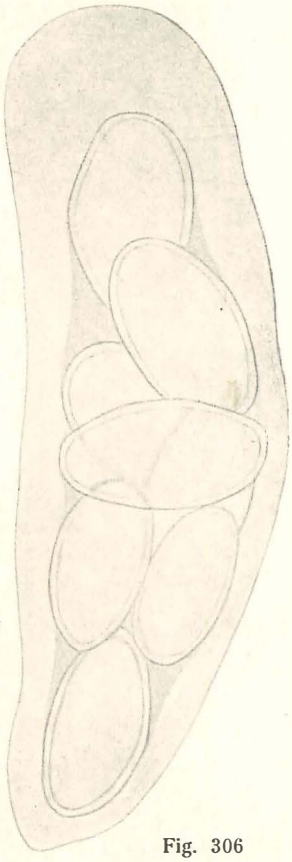


Fig. 306

Fig. 307

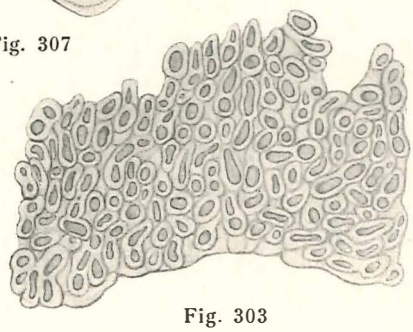


Fig. 303

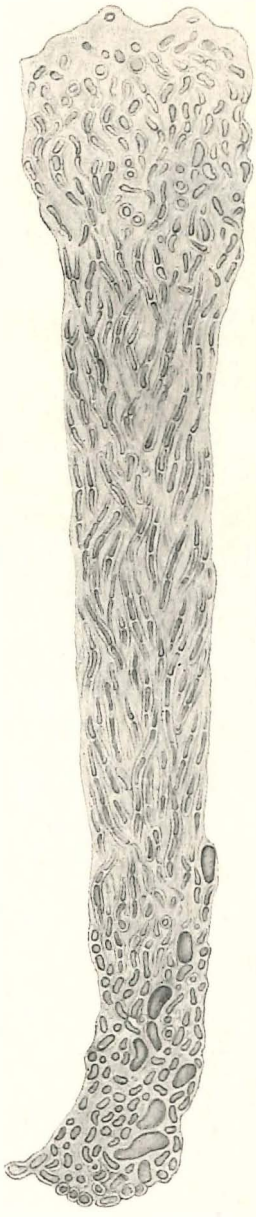


Fig. 304

O. Galløe del.

OCHROLECHIA TARTAREA L.

PLATE 56.

OCHROLECHIA SUBTARTAREA

NYL.

Fig. 308. Thallus with two apothecia, on bark of *Betula*. Thallus is partly smooth, partly granular-sorediose. (× 20).

Fig. 309. Two young apothecia. (× 20).

Fig. 310. Granular thallus. In two places gelatinous *Chroococcaceæ* lie in the medulla. At the bottom of the section there are remains of periderm. (× 80).

Fig. 311. Young, smooth thallus, on periderm. (× 140).

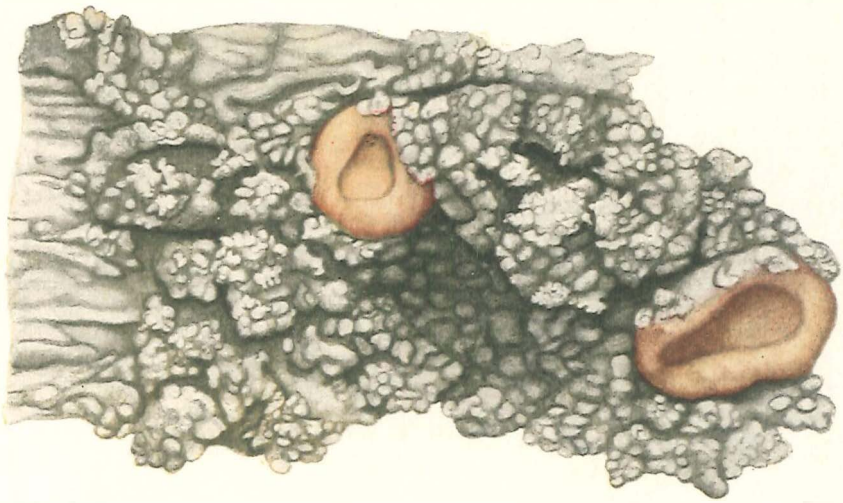


Fig. 308

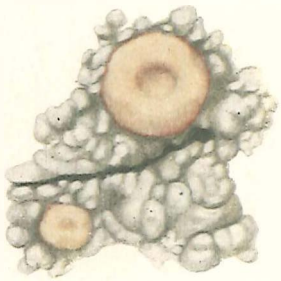


Fig. 309

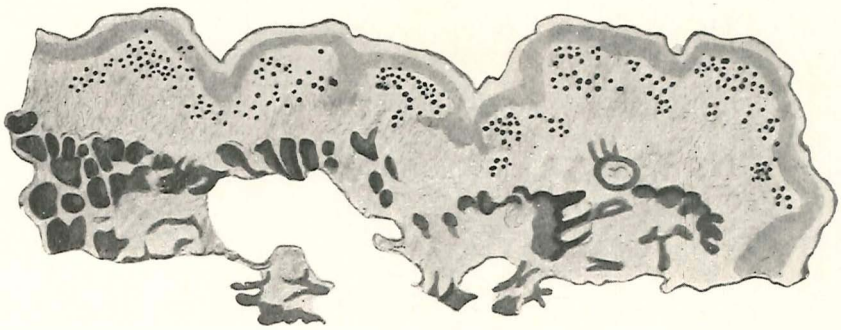


Fig. 311

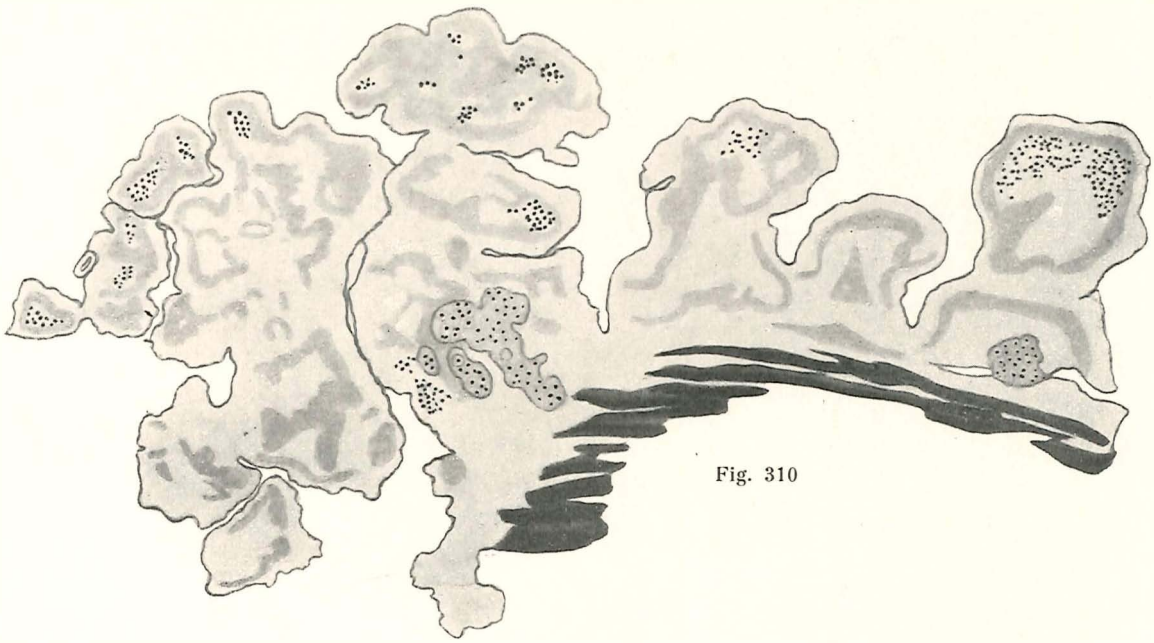


Fig. 310

O. Galløe del.

OCHROLECHIA SUBTARTAREA Nyl.

PLATE 57.

OCHROLECHIA SUBTARTAREA

NYL.

Fig. 312. Portion of thallus. At the bottom of the section there are remains of periderm. (× 620).

Fig. 313. *Chroococcaceæ,* with hyphæ, from the medullary layer. (× 620).

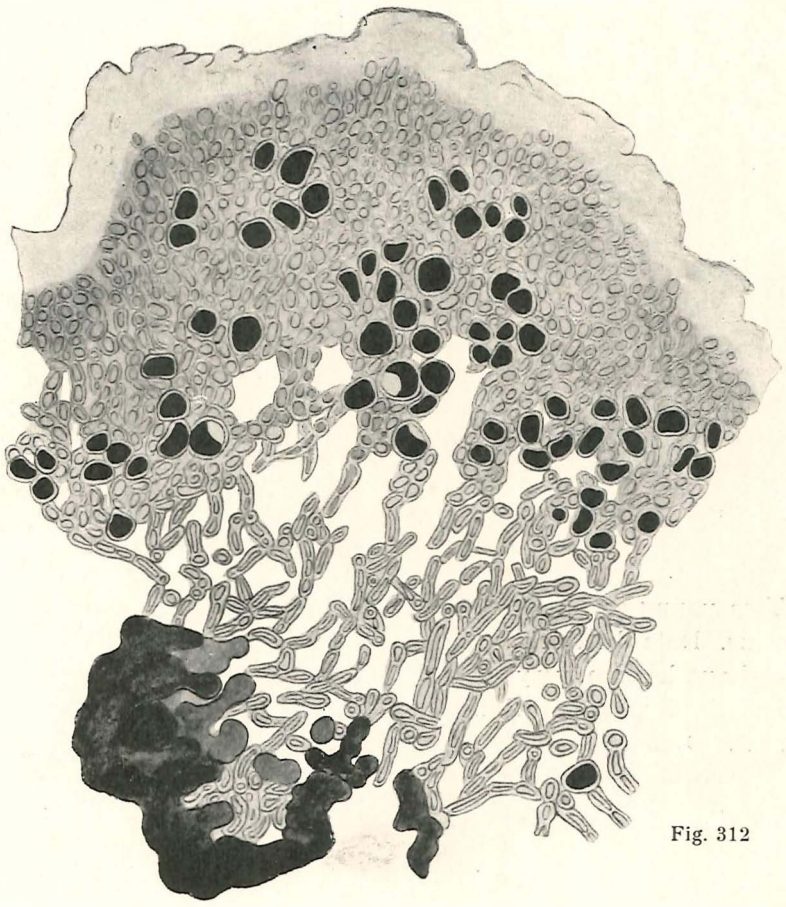


Fig. 312

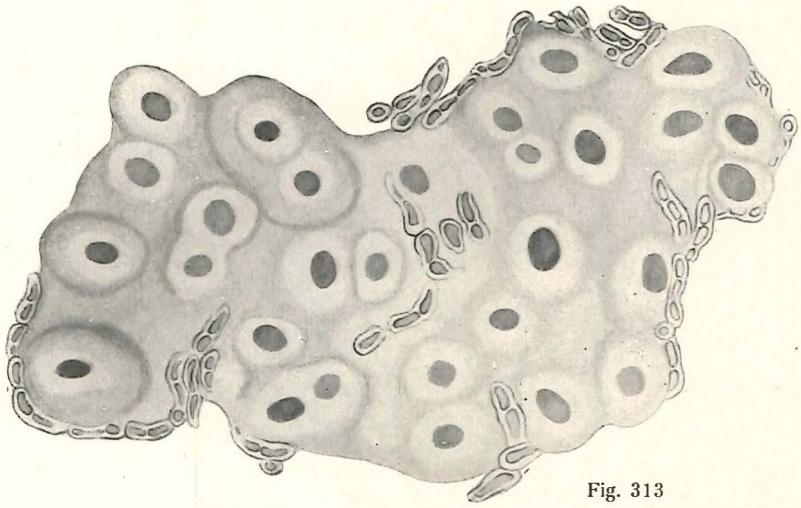


Fig. 313

O. Galløe del.

OCHROLECHIA SUBTARTAREA NYL.

PLATE 58.

OCHROLECHIA SUBTARTAREA

NYL.

Fig. 314. Two young apothecia; the left one is entirely lecideine, the right one is in part lecanorine. Note the thick hypothecium and the thin calyx. (× 140).

Fig. 315. Old apothecium, very poor in gonidia. Note the thin calyx surrounding the hymenium and the hypothecium and at the base insensibly passing into the medulla of the thallus. (× 80).

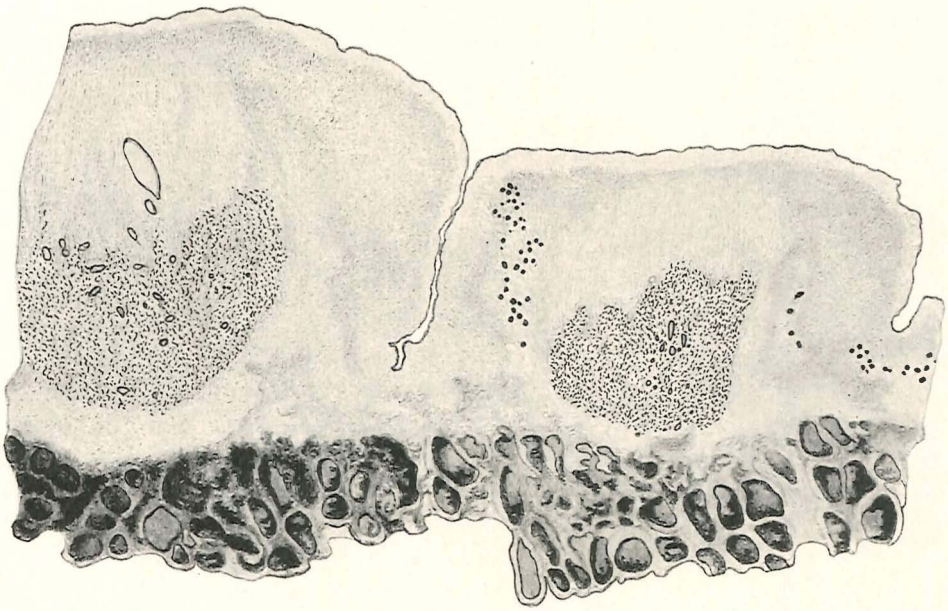


Fig. 314

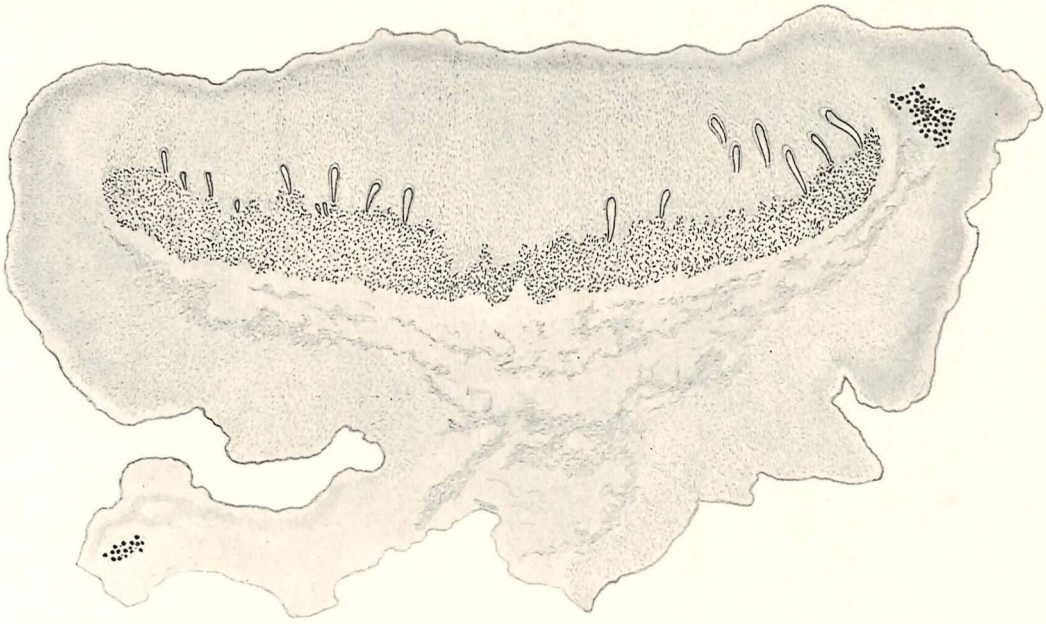


Fig. 315

O. Galløe del.

OCHROLECHIA SUBTARTAREA Nyl.

PLATE 59.

OCHROLECHIA SUBTARTAREA

NYL.

Fig. 316. Hymenium (with epithecium), hypothecium, and three young asci. (× 620).

Fig. 317. Borderline between calyx (to the left) and hypothecium (to the right). (× 1053).

Fig. 318. Hyphæ from stipes. (× 1053).

Fig. 319. Hyphæ from the surface of margo thallinus. (× 1053).

Fig. 320. Ripe spore. (× 747).

Fig. 321. Soredium. (× 620).

Fig. 316

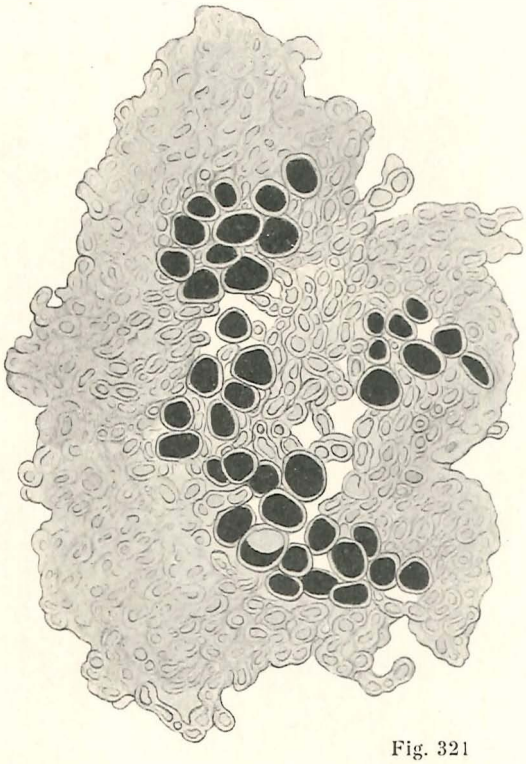


Fig. 321

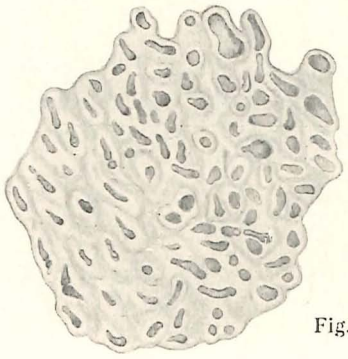


Fig. 317

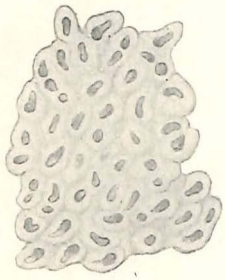


Fig. 318

Fig. 320

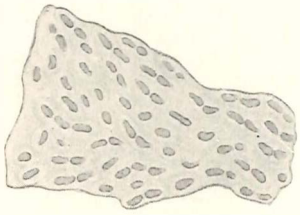


Fig. 319

PLATE 60.

PERTUSARIA WULFENI.

D. C.

Fig. 322. Margin of thallus with incipient differentiation of young areoles. (× 10).

Fig. 323. Older areoles, still rather smooth. Several of them contain young apothecia. (× 10).

Fig. 324. Old areoles with uneven, granular surface. Several of the areoles contain apothecia. A fully developed apothecium is seen near the middle of the picture. (× 10).

Fig. 325. Margin of thallus, its right side is mycelial, with recently captured gonidial algæ. Note the course of the hyphæ in cortex and other tissues. (× 140).

Fig. 326. Two neighbouring areoles, each containing an apothecium. (× 33).

Fig. 327. Areole with apothecium. (× 80).

Fig. 322

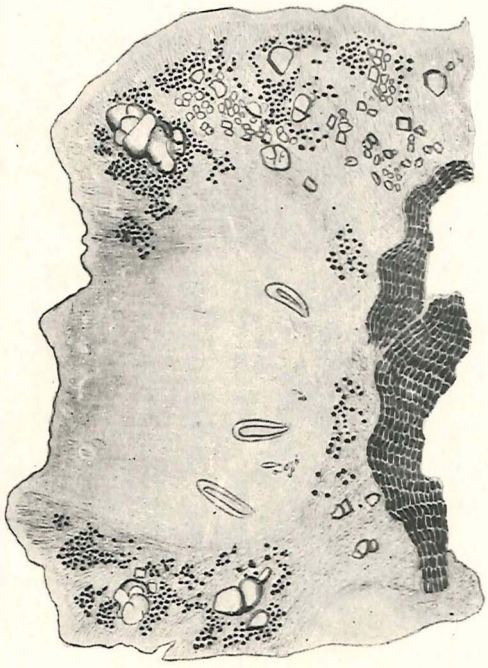


Fig. 327

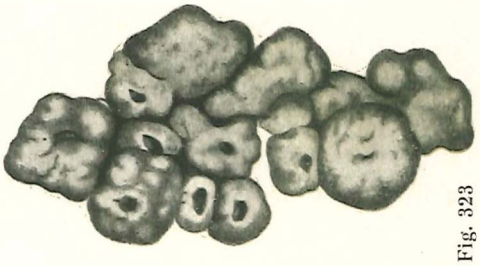


Fig. 323

Fig. 326

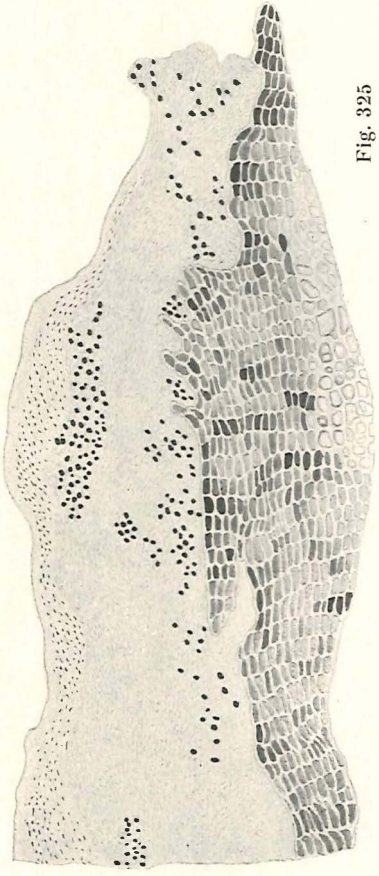


Fig. 325

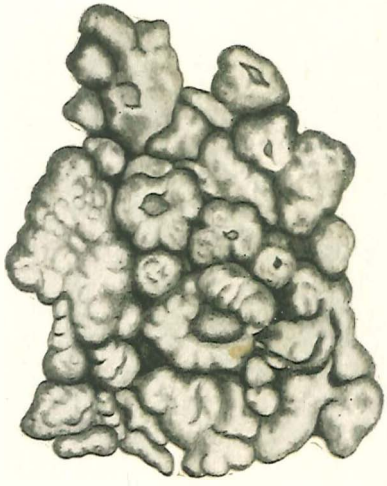


Fig. 324

O. Galløe del.

PERTUSARIA WULFENI D. C.

PLATE 61.

PERTUSARIA WULFENI.
D. C.

Fig. 328. Horizontal section of an entire areole, with an apothecium. The borderline between calyx and hymenium is not distinct. Two asci cut across are seen in the hymenium. (× 100).

Fig. 329. Hypothecium with big ascogenous hyphæ, and bases of paraphyses together with a young ascus. (× 620).

Fig. 330. Horizontal section of hymenium, with cross-sections of paraphyses and an ascus with spores. (× 747).

Fig. 331. Longitudinal section of paraphyses. Anastomosed or branched paraphyses are seen in not a few places. (× 620).

Fig. 332. Ascus with ripe spores with two-layered cell-walls. (× 620).

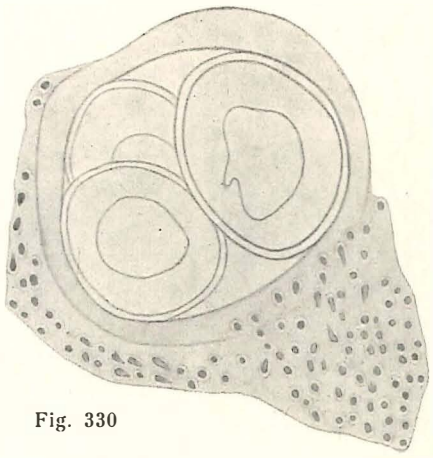


Fig. 330

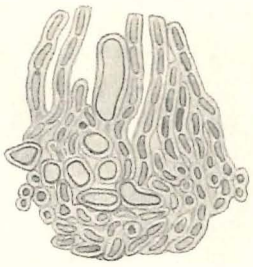


Fig. 329

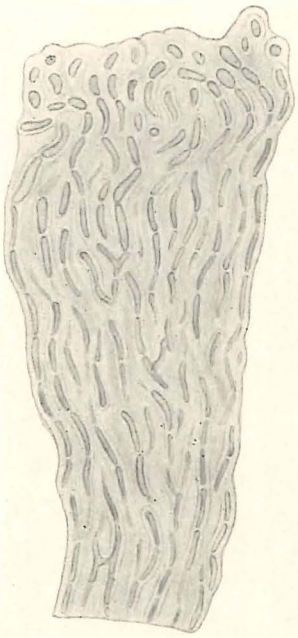


Fig. 331

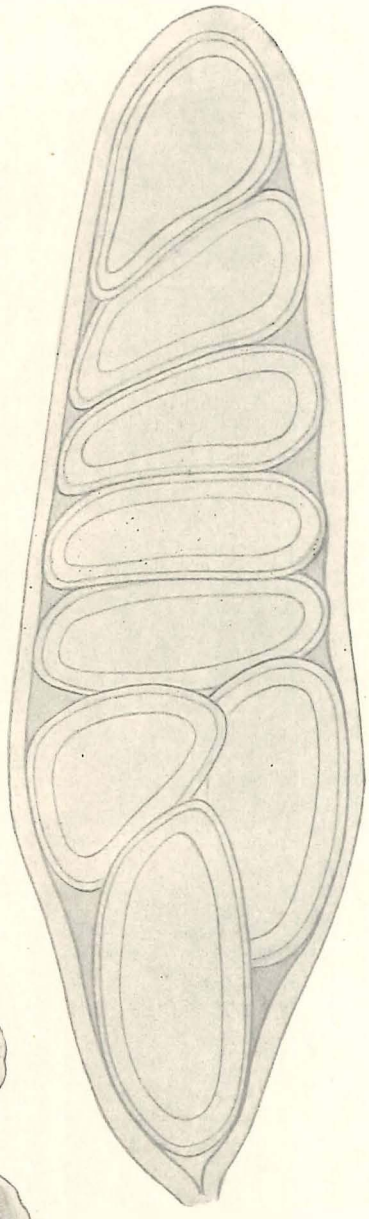


Fig. 332

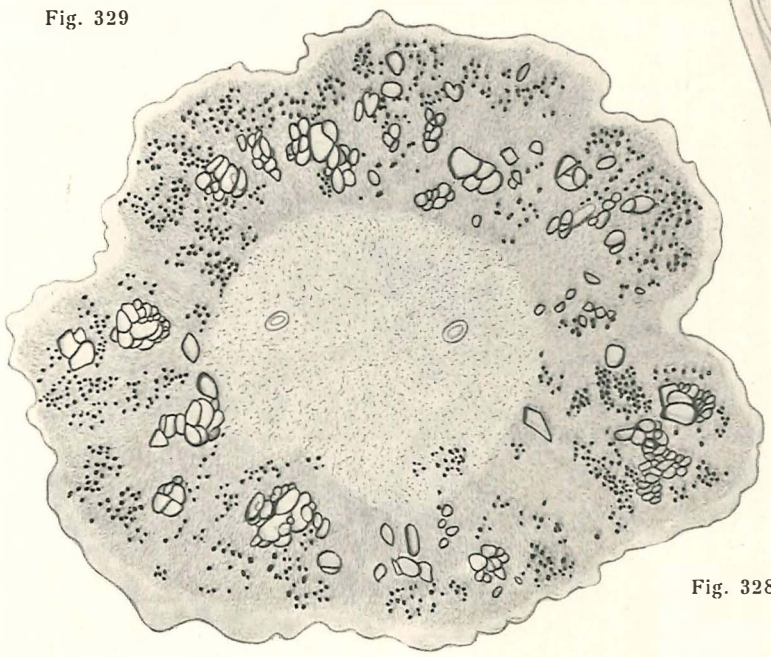


Fig. 328

O. Galløe del.

PERTUSARIA WULFENI D. C.

PLATE 62.

PERTUSARIA WULFENI.
D. C.

Fig. 333. Ripe spore. (× 747).

Fig. 334. Ascus with spores, which are not yet fully ripe, their walls being one-layered. (× 620).

Fig. 335. Margin of apothecium. The tips of the hyphæ of margo proprius are dead. (× 620).

Fig. 336. Horizontal section of the boundary area of the gonidial layer (in which gonidia and big, colourless granules are seen) and the hymenium, where calyx and hymenium insensibly pass into each other. (× 620).

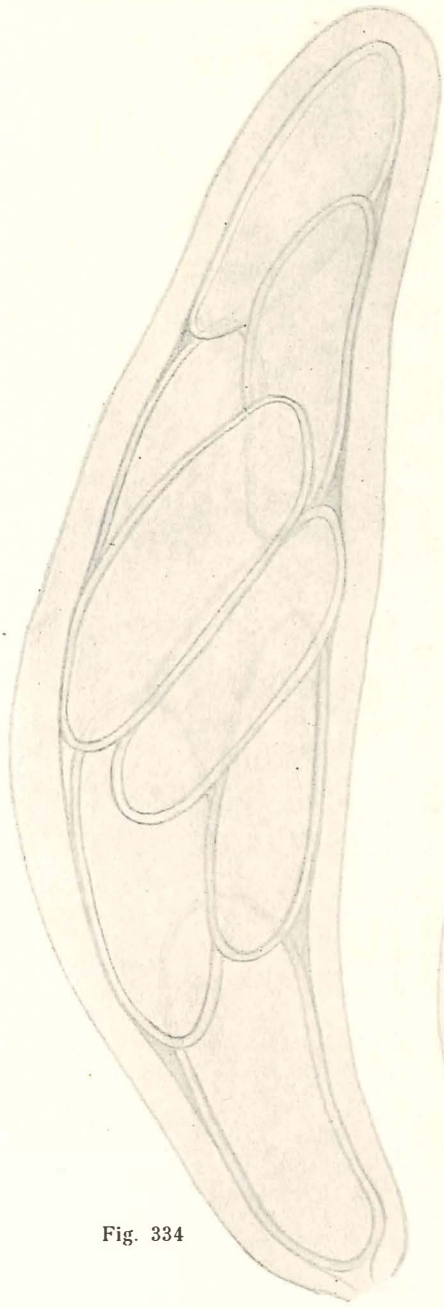


Fig. 334

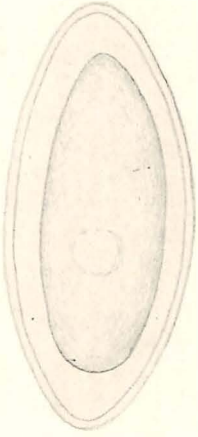


Fig. 333

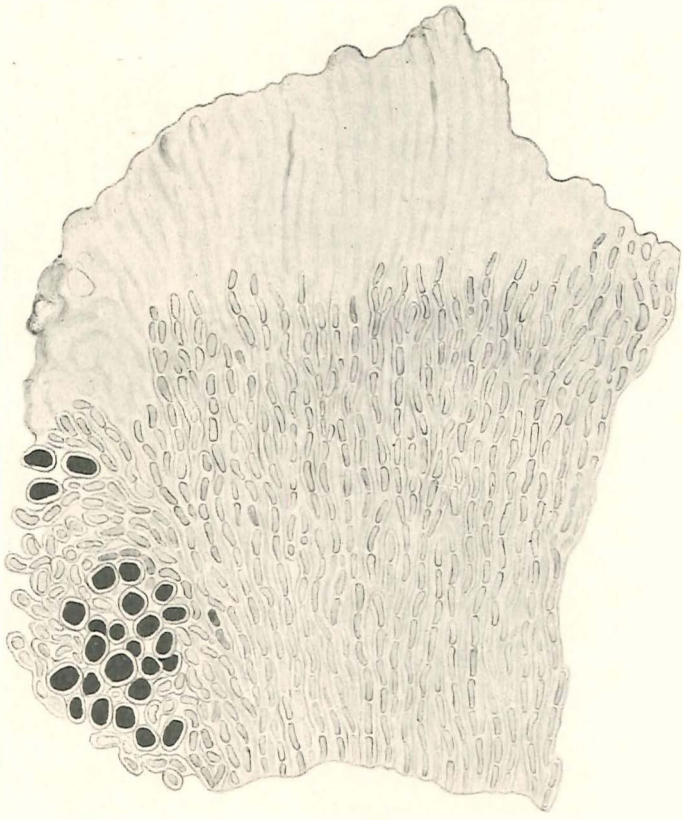


Fig. 335

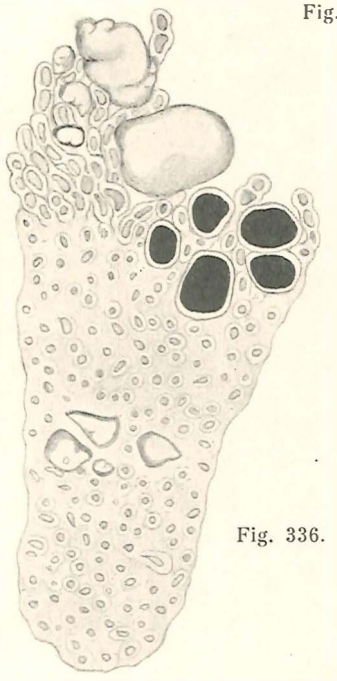


Fig. 336.

O. Galløe del.

PERTUSARIA WULFENI D. C.

PLATE 63.

PERTUSARIA COCCODES.

ACH.

Specimen 1.

Fig. 337. Thallus with apothecial verrucæ and scanty isidia. (× 12).

Fig. 338. Portion of a verruca with an apothecium. Its surface is finely granular, and the apothecium is surrounded by a thin margo thallinus, which is raised a little over the level of the thallus. (× 80).

Fig. 339. Thallus from the space between the veruccæ. Numerous minute, colourless granules and groups of big, colourless granules are situated in the medulla. (× 100).

Fig. 340. Entire verruca; vertical section. Two apothecia have been cut exactly axially and display a thin margo thallinus raised above the proper margin. (× 33).

Fig. 341. Portion of a verruca, with two apothecia. Groups of colourless granules occur in the medullary layer between the apothecia and under the gonidial layer. (× 100).

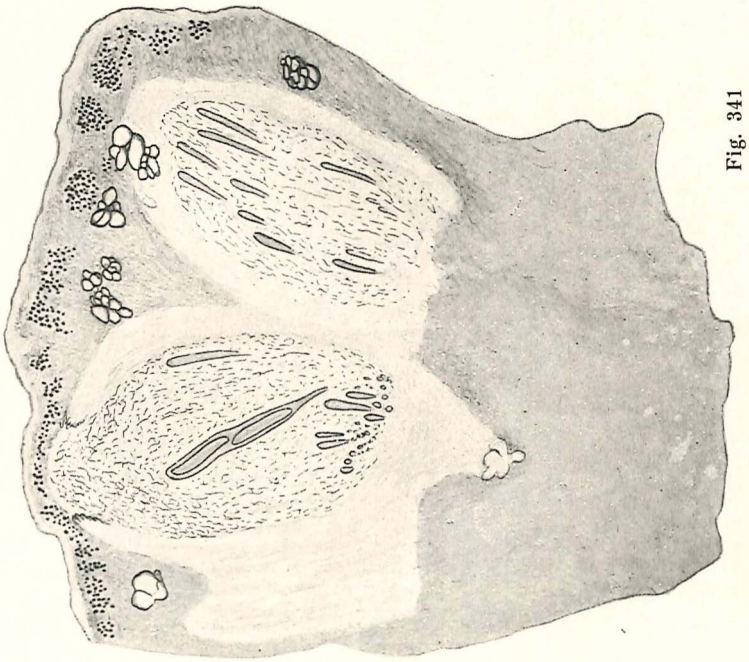


Fig. 341

Fig. 340

Fig. 339

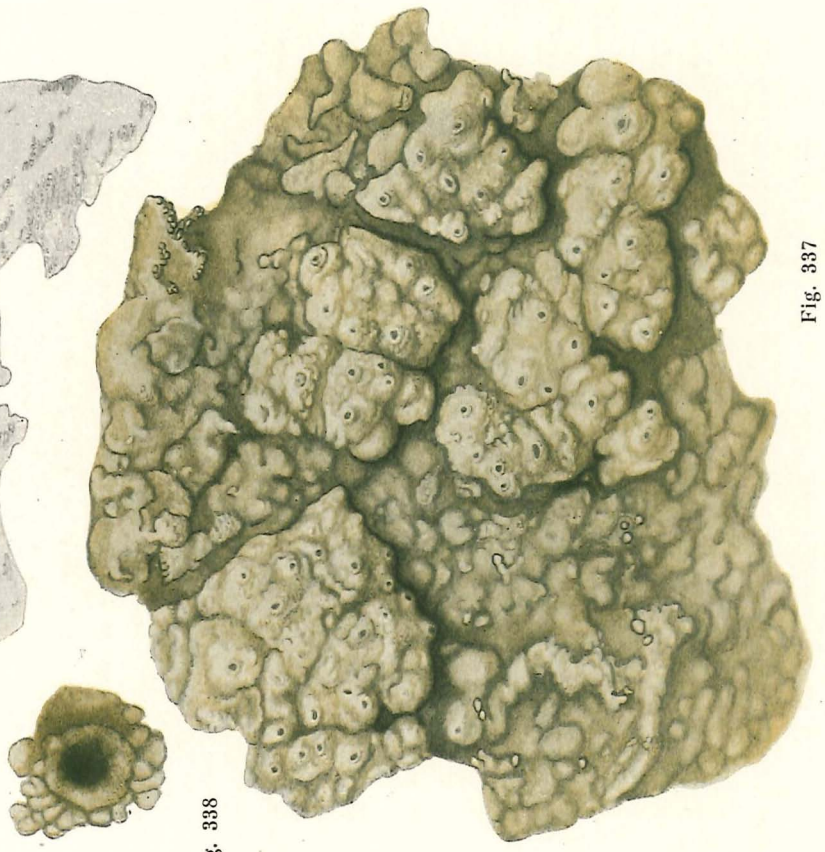


Fig. 337

Fig. 338

O. Galløe del.

PERTUSARIA COCCODES Ach.
(Specimen 1).

PLATE 64.

PERTUSARIA COCCODES.

ACH.

Specimen 1.

Fig. 342. Verruca, cut horizontally. (× 25).

Fig. 343. Portion of a verruca; horizontal section. The section shows a cuticle, a cortex, and a gonidial layer with yellow granules between the hyphæ. Next follow calyx (between *(a)* and *(b)*) and, beneath *(b)*, the hymenium with gelatine and paraphyses. (× 620).

Fig. 344. Cuticle (at the top of the section), and cortex; the latter has yellow granules between the hyphæ (at the bottom of the section). From a horizontal section of a verruca. (× 840).

Fig. 345. Gonidial layer from the same section. (× 840).

Fig. 346. Medullary layer from a verruca. (× 620).

Fig. 347. Hyphæ from the hypothecium; there are no ascogonia in this section. (× 620).

Fig. 348. Longitudinal section of the boundary area between calyx (between *(a)* and *(b)*) and hymenium (between *(b)* and *(c)*). The section shows the surface (the proper margin) of the calyx, and also the hymenium. (× 620).

Fig. 343

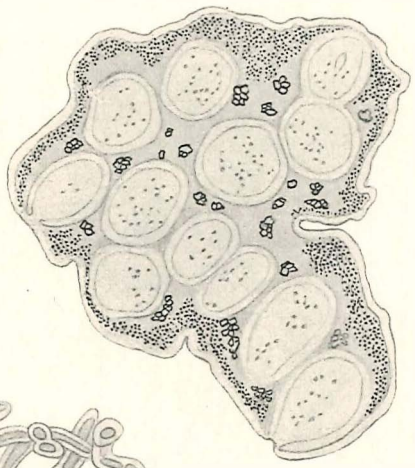


Fig. 342

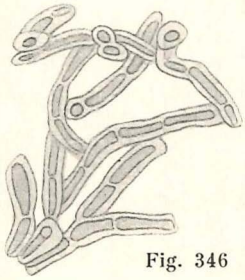


Fig. 346

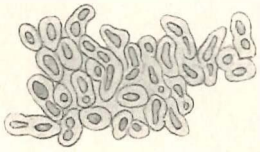


Fig. 347

Fig. 344

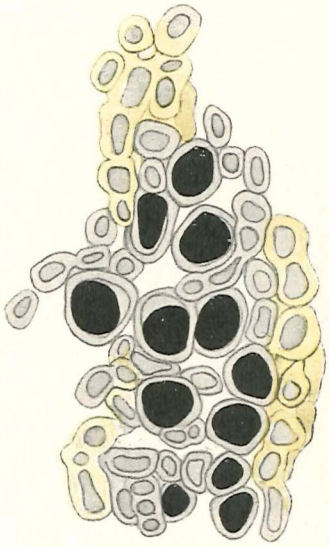


Fig. 345

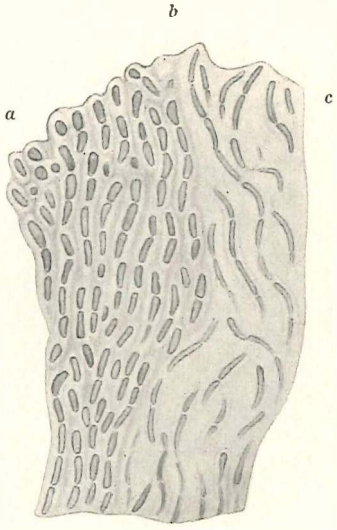


Fig. 348

O Galløe del.

PERTUSARIA COCCODES Ach.
(Specimen 1).

PLATE 65.

PERTUSARIA COCCODES.

ACH.

Specimen 1.

Fig. 349. Hymenium with asci and paraphyses. One of the asci contains a ripe spore (with two-layered membrane). (× 620).

Fig. 350. Two anastomosed paraphyses. Across the connecting tube there is a septum. (× 1053).

Fig. 351. Ascus with two nearly ripe spores. (× 620).

Fig. 352. Ripe spore, with two-layered cell-wall. (× 620).

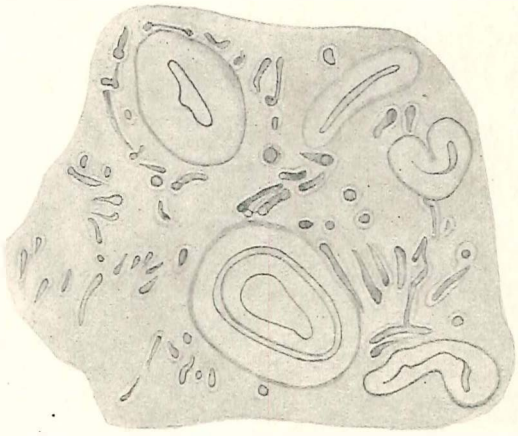


Fig. 349

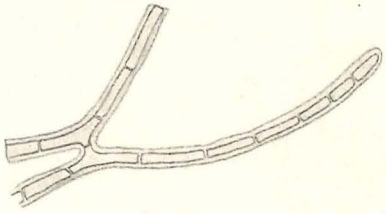


Fig. 350

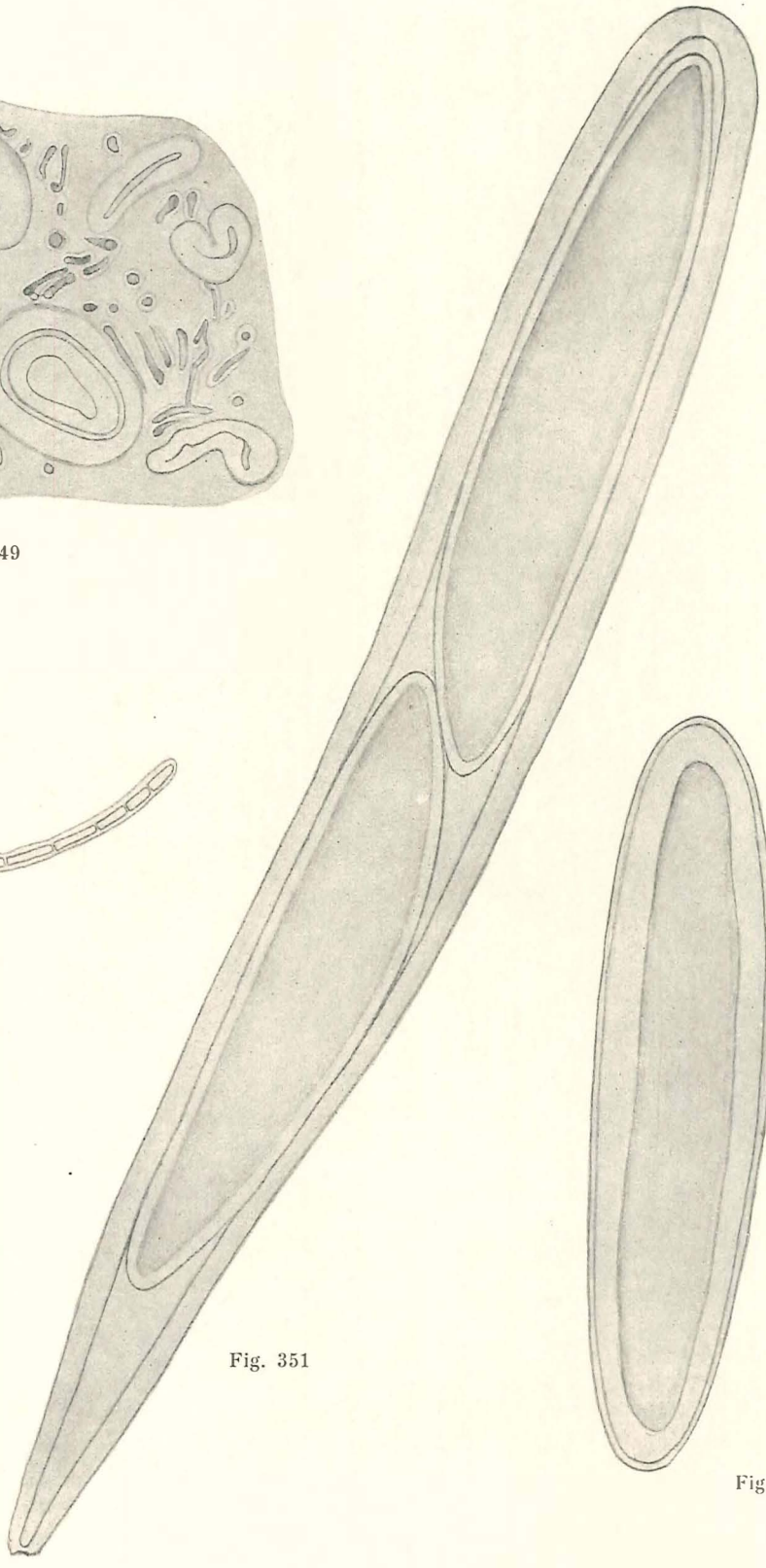


Fig. 351

Fig. 352

O. Galløe del.

PERTUSARIA COCCODES Ach.
(Specimen 1).

PLATE 66.

PERTUSARIA COCCODES.

ACH.

Specimen 2.

Fig. 353. Thallus. Below to the right a verruca with apothecia; a branched isidium issues from the surface. All the other verrucæ are considerably smaller and have numerous isidia but no apothecia. (× 15).

Fig. 354. Thallus, made uneven by very short isidia. (× 100).

Specimen 3.

Fig. 355. Thallus with confluent areoles (verrucæ), which are all highly isidiose. At *(a)* is seen an areole, which is pictured under greater magnification in Fig. 356. (× 15).

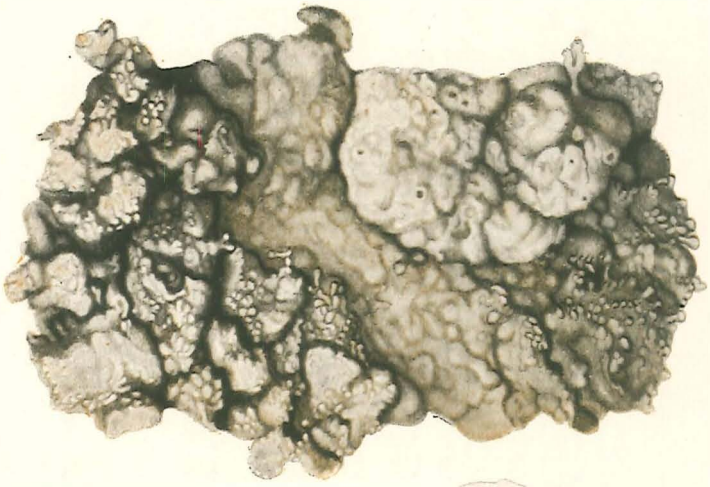


Fig. 353

Fig. 355

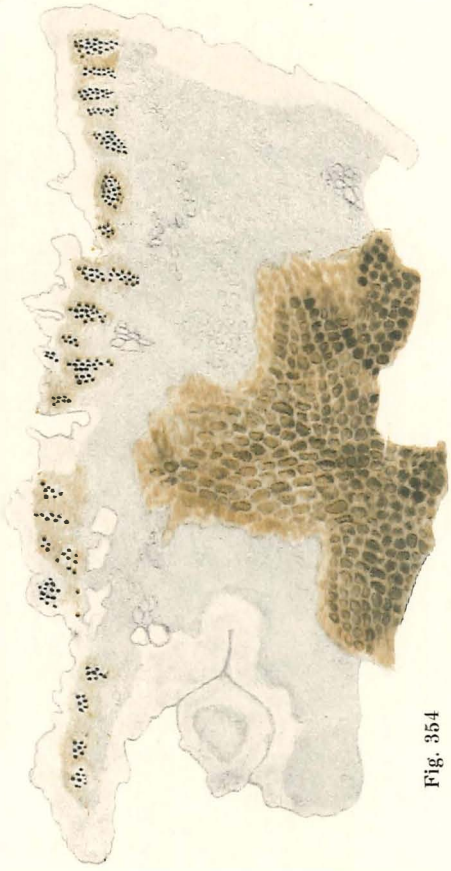


Fig. 354

O. Galløe del.

PERTUSARIA COCCODES Ach.
(Specimen 2, 3).

PLATE 67.

PERTUSARIA COCCODES.

ACH.

Specimen 3.

Fig. 356. Areole (verruca), at the top transformed into isidia. (× 33).

Fig. 357. Portion of the surface of a verruca with branched isidia. (× 80).

Fig. 358. Horizontal section of a branch of an isidium, with a colourless and dead cuticle, a cortex (which is yellow, partly from yellow granules of pigment deposited between the hyphæ), and a gonidial layer. (× 840).

Fig. 359. Longitudinal section of a branched isidium. (× 157).

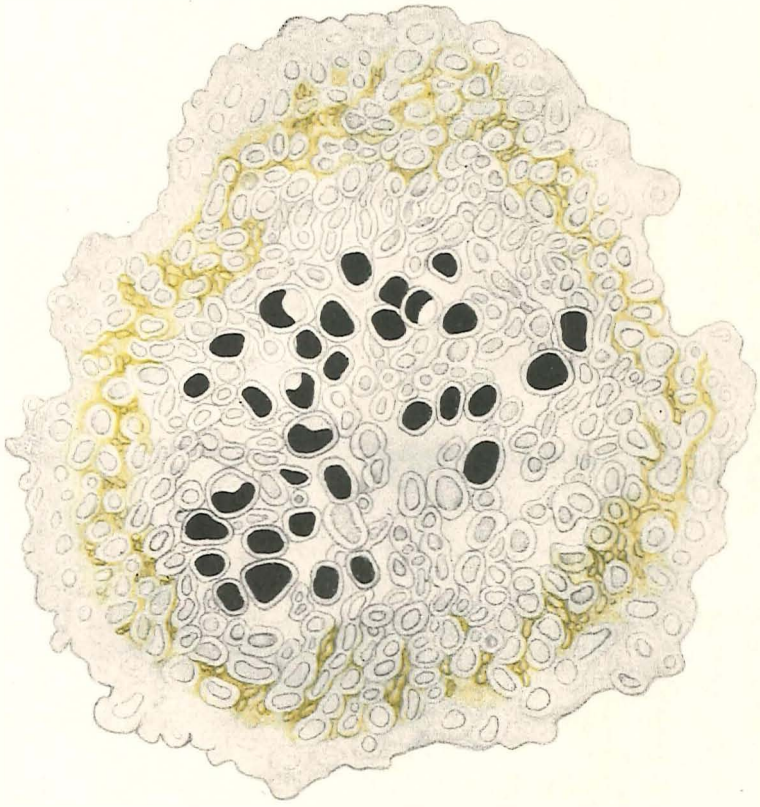


Fig. 358

Fig. 357

Fig. 356

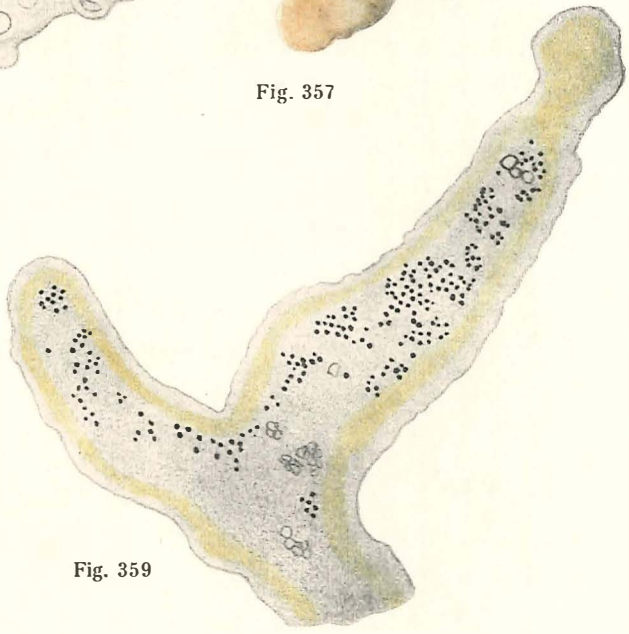


Fig. 359

O. Galløe del.

PERTUSARIA COCCODES Ach.
(Specimen 3).

PLATE 68.

PERTUSARIA GLOBULIFERA.

TURN.

Specimen 1.

Fig. 360. Portion of thallus with soralia of all ages. At *(a)* a small specimen of *Pertusaria communis*. (× 8).

Fig. 361. Portion of thallus. At *(a)* a cecidium of algæ resting on the cortex. A zone of minute granules deposited between the hyphæ is seen under the gonidia, in the upper portions of the medulla. (× 100).

Fig. 362. Cortex and gonidial layer. In the mostly dead cortex several living hyphæ. Above to the right a group of gonidia is embedded in the cortex; it may be considered as a cecidium, probably originated from free algæ having fallen on the surface of the cortex, where they have been taken in by the cortical hyphæ. (× 620).

Fig. 363. Cortex and upper part of gonidial layer. Here a cecidium is likewise formed on the cortex. (× 620).

Fig. 364. Above, the gonidial layer; next follows medulla, in the upper layers of which numerous small, colourless granules are embedded between the hyphæ. (× 620).

Fig. 363

Fig. 360

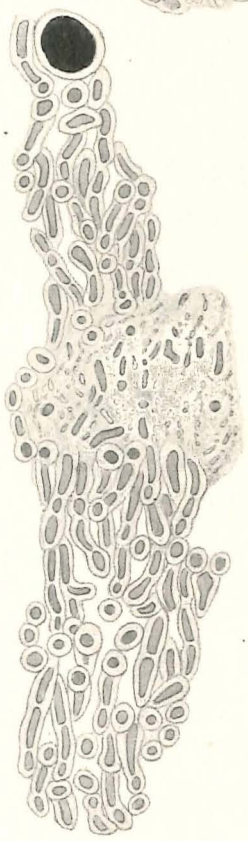


Fig. 364

Fig. 362

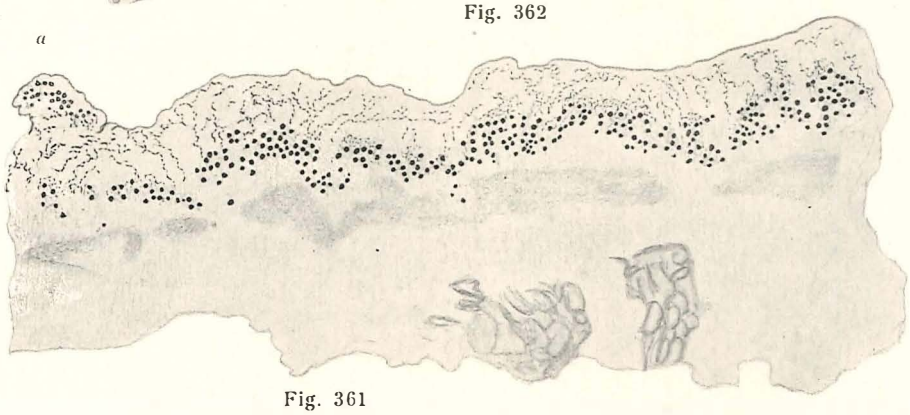


Fig. 361

O. Galloe del.

PERTUSARIA GLOBULIFERA TURN.
(Specimen 1).

PLATE 69.

PERTUSARIA GLOBULIFERA.

TURN.

Specimen 1.

Fig. 365. Isolated hyphæ from medulla; they have minute granules on the outside of their cell-walls. (× 1053).

Fig. 366. Vertical section of a soral with stalked soredia and surrounded by a thalline margin. In the right side of the section endogenous soredia are in formation—surrounded by numerous minute, colourless granules deposited between the hyphæ. (× 80).

Fig. 367. Vertical section of the margin of a soral. The thalline margin is to the right in the section; to the left is seen a soredium. (× 620).

Fig. 368. A single stalked soredium from the centre of the soral, to the surface of which it is still attached. The soredium has a thin cortex at the top. (× 620).

Fig. 369. A small, isolated soredium. (× 620).

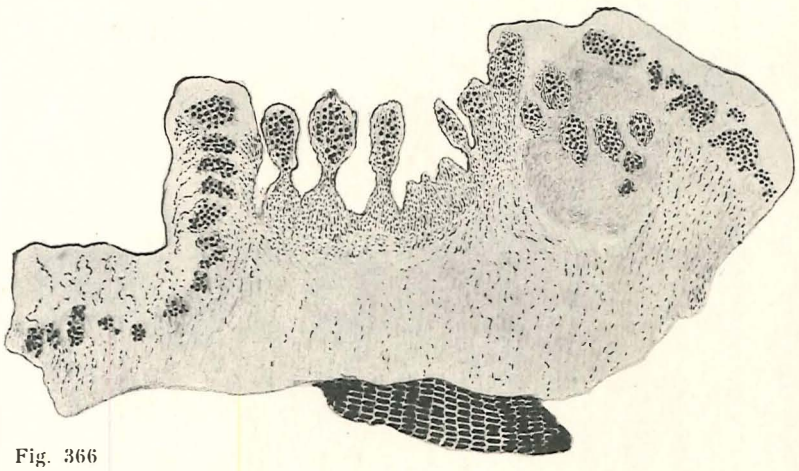


Fig. 366

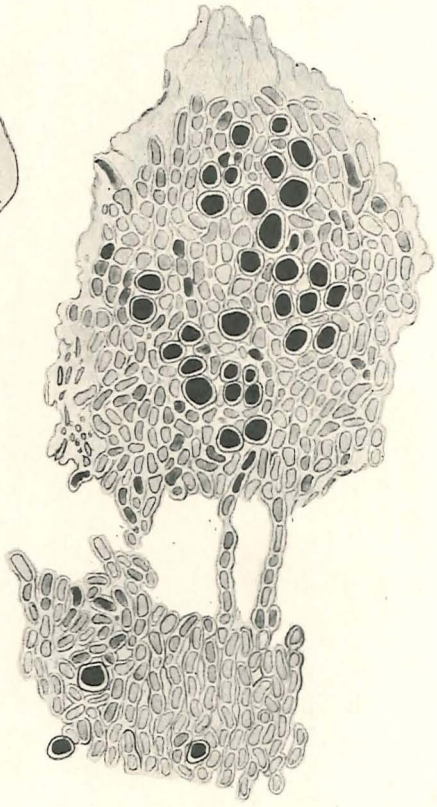


Fig. 368

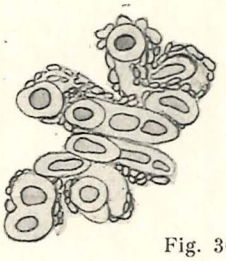


Fig. 365

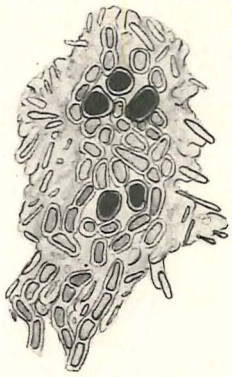


Fig. 369

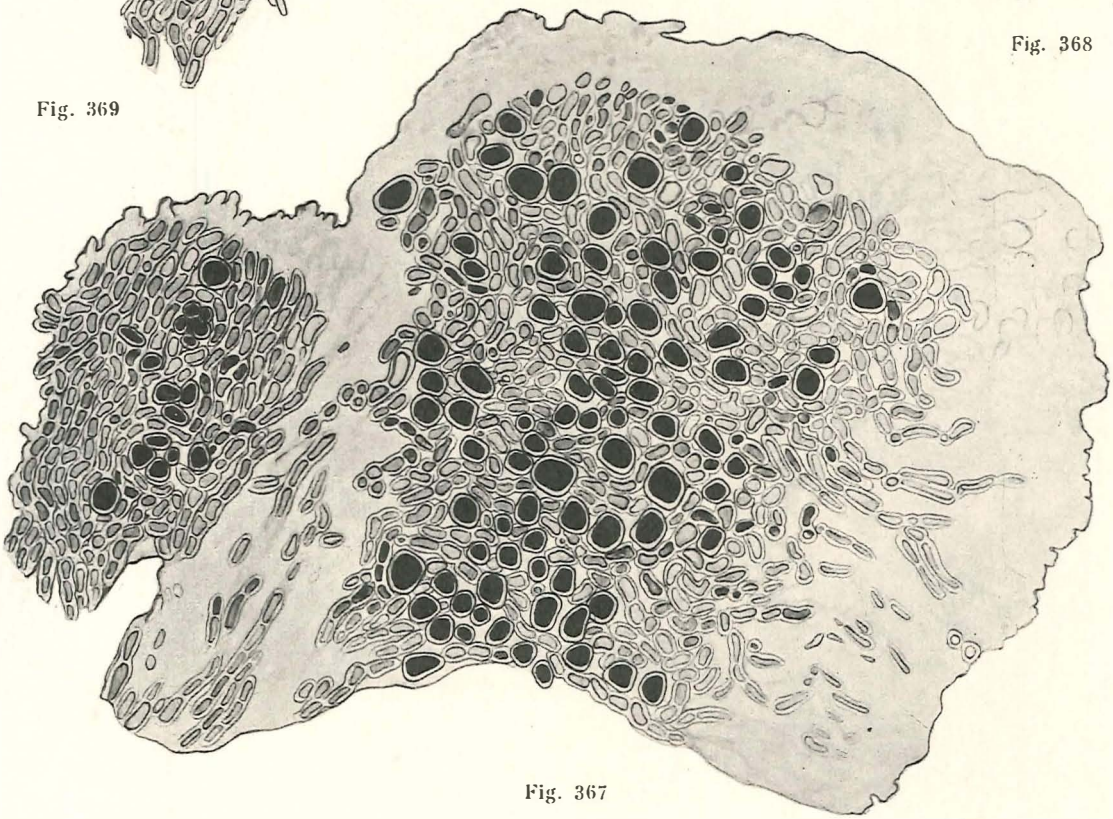


Fig. 367

O. Galløe del.

PERTUSARIA GLOBULIFERA Turn.
(Specimen 1).

V. P 18

PLATE 70.

PERTUSARIA GLOBULIFERA.

TURN.

Specimen 2.

Fig. 370. Margin of thallus spreading over mosses and hepatics, and also meta-thallus with soralia. (× 20).

Fig. 371. Fragment of thallus with young soralia. (× 30).

Fig. 372. Fully developed soralia. (× 30).

Fig. 373. Section of the margin of thallus containing overgrown and dying-off mosses. (× 80).

Fig. 374. Ripe soral. (× 80).

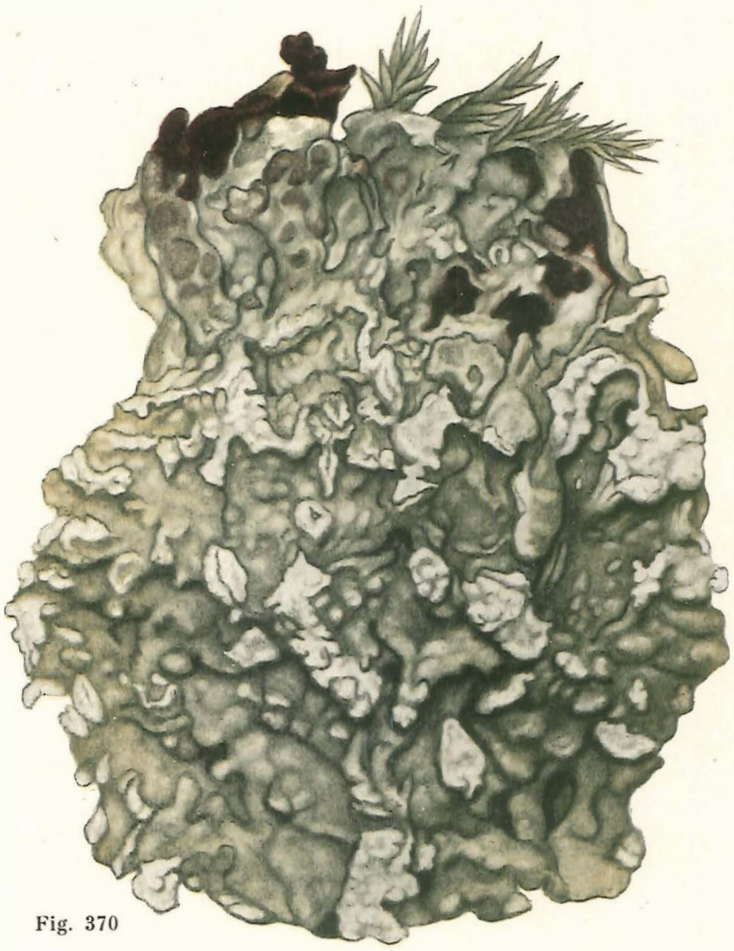


Fig. 370

Fig. 371

Fig. 372

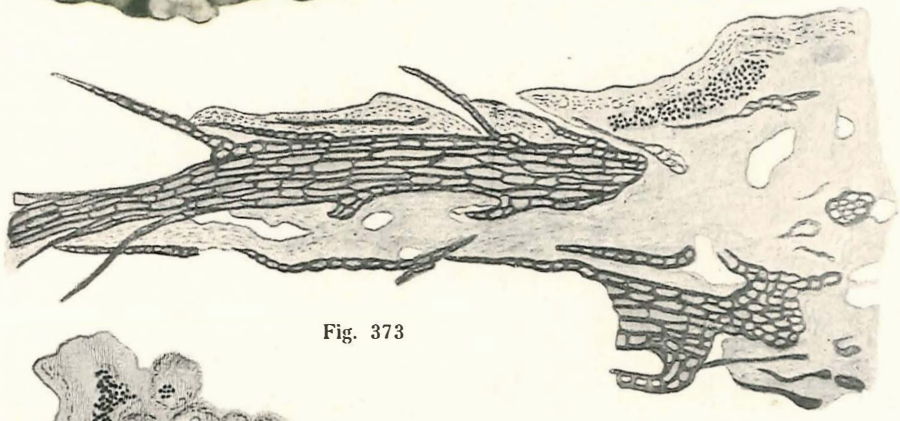


Fig. 373

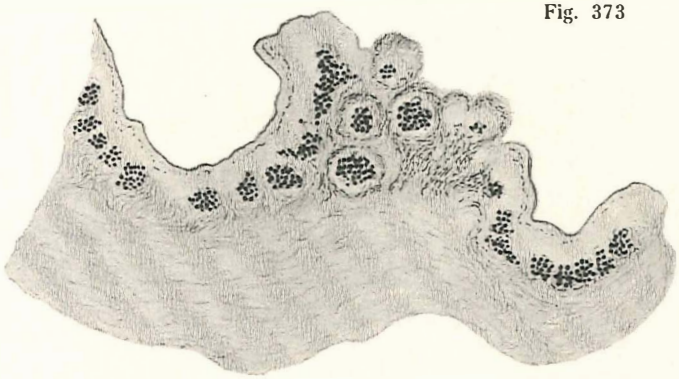


Fig. 374

O. Galløe del.

PERTUSARIA GLOBULIFERA Turn.
(Specimen 2).

V. P18*

PLATE 71.

PERTUSARIA GLOBULIFERA.

TURN.

Specimen 2.

Fig. 375. Ripe soral with dead remains of moss. (× 80).

Fig. 376. Longitudinal section of the living gonidialess margin of the thallus, growing over a leaf of moss. (× 840).

Fig. 377. Cortex, containing several living cells, and also the gonidial layer. (× 840).

Fig. 378. Hyphæ from the medullary layer cut across. (× 840).

Fig. 379. Isolated soredium. (× 620).

Fig. 380. Hyphæ from the soredium, in part covered with a white granular substance. (× 840).

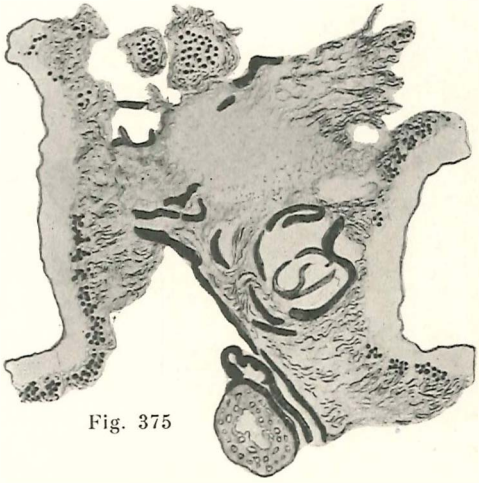


Fig. 375

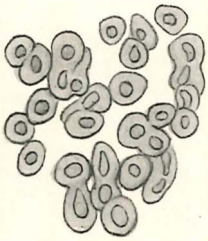


Fig. 378

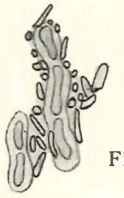


Fig. 380

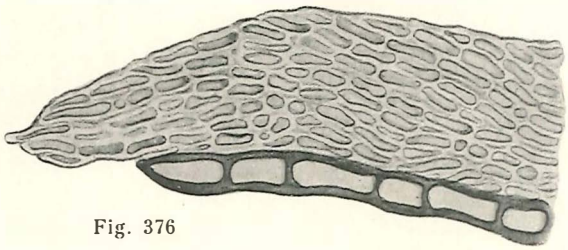


Fig. 376

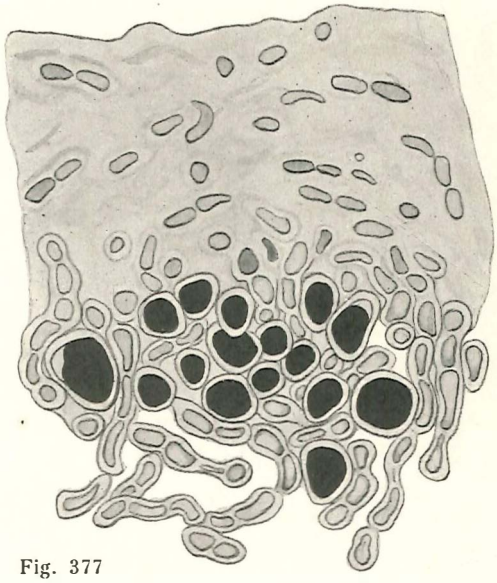


Fig. 377

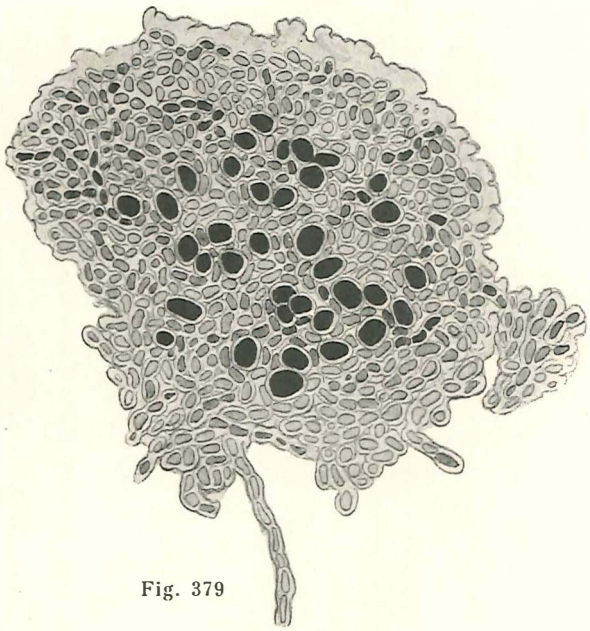


Fig. 379

O. Galløe del.

PERTUSARIA GLOBULIFERA Turn.
(Specimen 2).

PLATE 72.

PERTUSARIA LEIOPLACA.

ACH.

Fig. 381. Thallus consisting of small granules and bigger verrucæ, which latter contain one apothecium or some few apothecia. Above to the left thallus borders on a *Phlyctis argena,* to the right it borders on a *Lecanora subfusca.* (× 20).

Fig. 382. Verruca and adjacent thallus. Detached particles from the periderm of the substratum plant lie upon the thallus and in its interior. One apothecium is seen in the verruca. (× 80).

Fig. 381

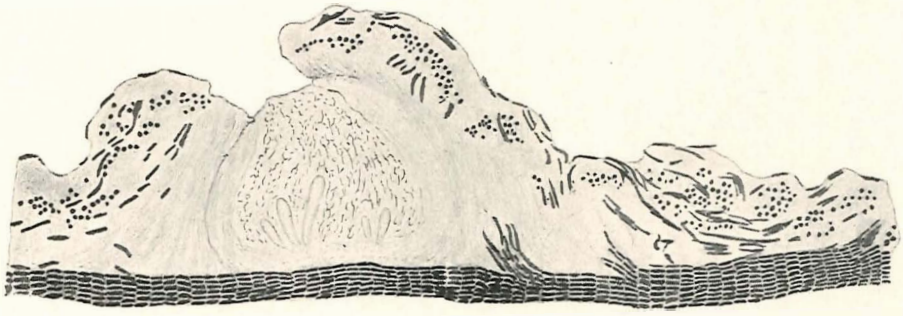


Fig. 382

O. Galloe del.

PERTUSARIA LEIOPLACA Ach.

PLATE 73.

PERTUSARIA LEIOPLACA.

ACH.

Fig. 383. Portion of thallus from the space between the verrucæ, vertical section. Thallus is somewhat homoeomerous. (× 620).

Fig. 384. Portion of thallus from the space between the verrucæ, vertical section. Numerous peeling-off lamellæ of the substratum periderm are seen in the thallus. Three accumulations of colourless granules lie between the hyphæ. (× 620).

Fig. 385. Verruca with one apothecium. In the gonidial layer beneath the transparent cortex there are numerous groups of big, white granules. In the hymenium twelve asci are cut across. (× 33).

Fig. 386. Horizontal section of a verruca with six apothecia, each of which is surrounded by a calyx; between the apothecia there is a medulla. (× 33).

Fig. 387. Portion of a horizontal section through a verruca. Numerous particles of periderm-lamellæ of the substratum plant are seen on its outside. Numerous white granules lie in the gonidial layer; two adjacent apothecia with calyx and with asci in the hymenium are seen in the medulla. (× 80).

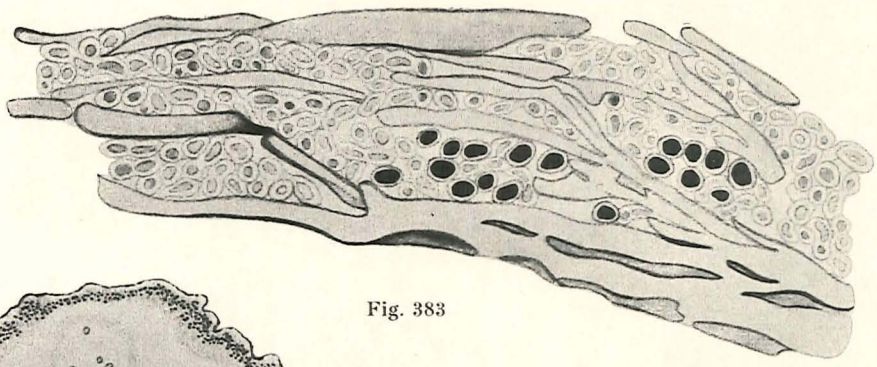


Fig. 383

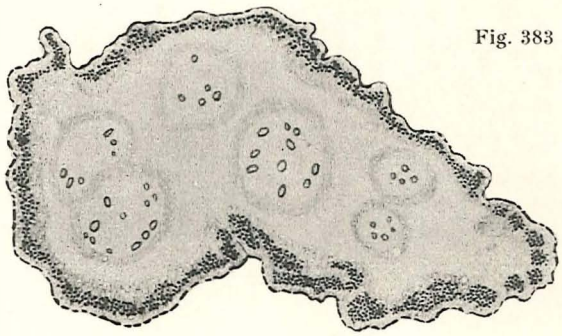


Fig. 386

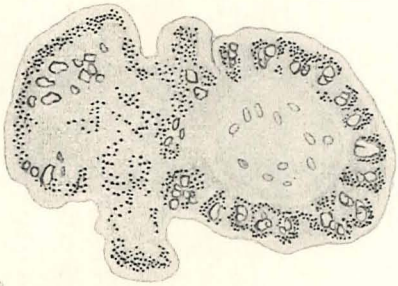


Fig. 385

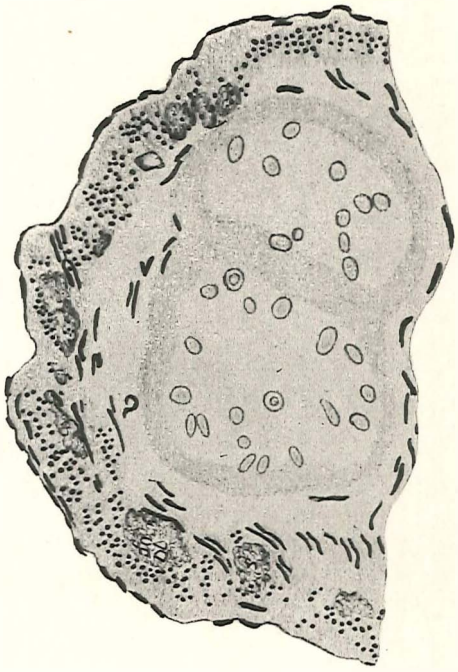


Fig. 387

Fig. 384

O. Galtøe del.

PERTUSARIA LEIOPLACA Ach.

V. P 19

PLATE 74.

PERTUSARIA LEIOPLACA.

ACH.

Fig. 388. Portion of a horizontal section of a verruca; only cortex and gonidial layer are pictured here. Cortex is dead and cuticle-like. (× 840).

Fig. 389. Portion of a horizontal section of a verruca; it is hypophloeodic, and this is probably the reason why its superficial layers are living (i. e. not cuticle-like as in the case pictured in Fig. 388). Periderm-lamellæ are seen in the gonidial layer, too. (× 620).

Fig. 390. Horizontal section of medulla from the space between the apothecia of a verruca. Fragments of periderm are seen in the section. (× 1053).

Fig. 391. Horizontal section of hymenium, with two asci, paraphyses and hymenial gelatine. The hyphæ of calyx, surrounding the hymenium, are seen above. (× 100).

Fig. 392. Paraphyses, anastomosed. Above, apices of paraphyses. (× 620).

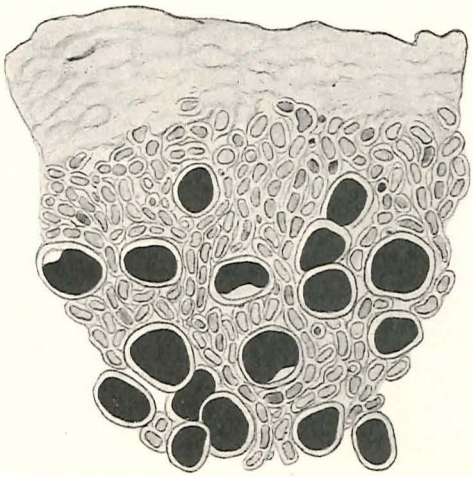


Fig. 388

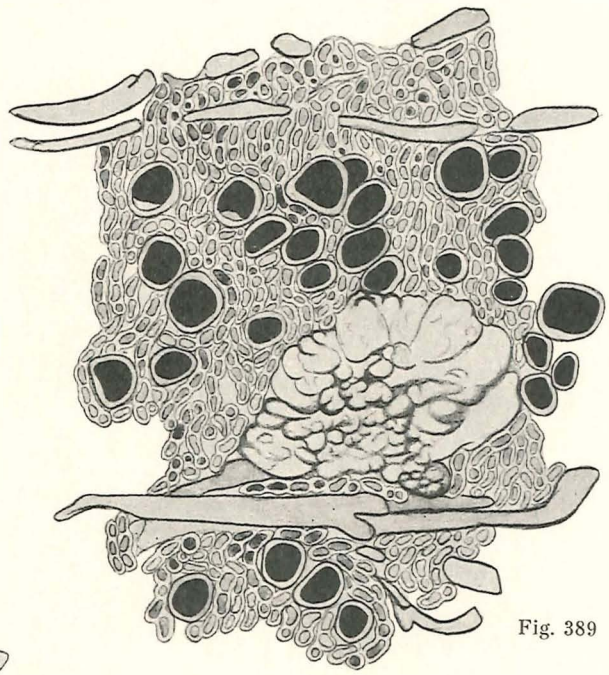


Fig. 389

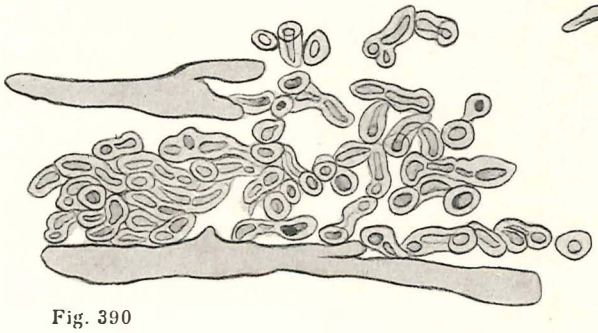


Fig. 390

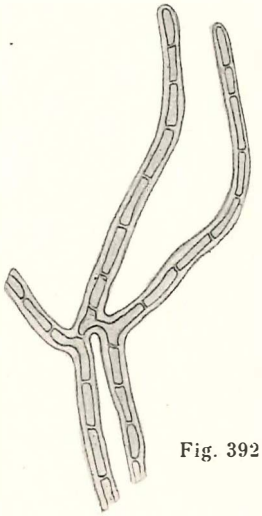


Fig. 392

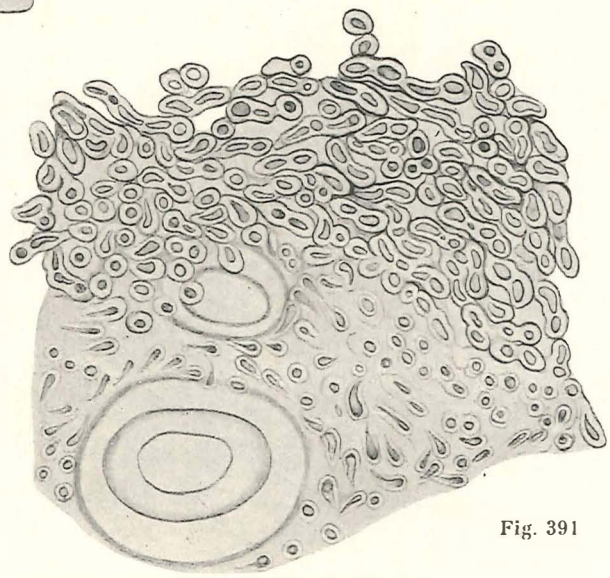


Fig. 391

O. Galløe del.

PERTUSARIA LEIOPLACA Ach.

PLATE 75.

PERTUSARIA LEIOPLACA.

ACH.

Fig. 393. Ascus with two not fully ripe spores with one-layered cell-wall. (× 620).
Fig. 394. Ascus containing two ripe spores with two-layered cell-wall. (× 620).
Fig. 395. Ripe ascus with four spores. (× 620).

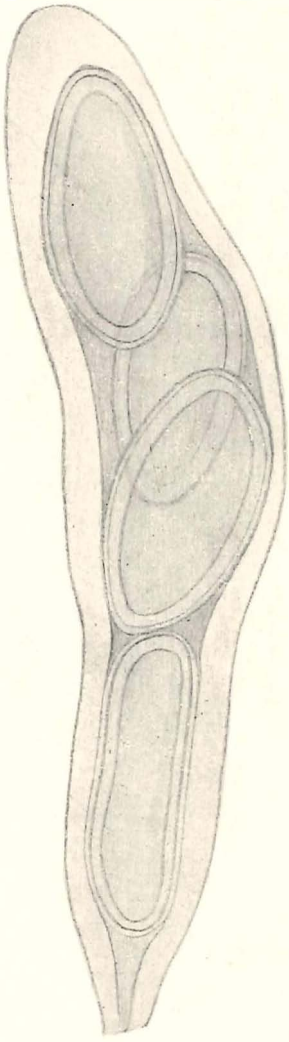


Fig. 395

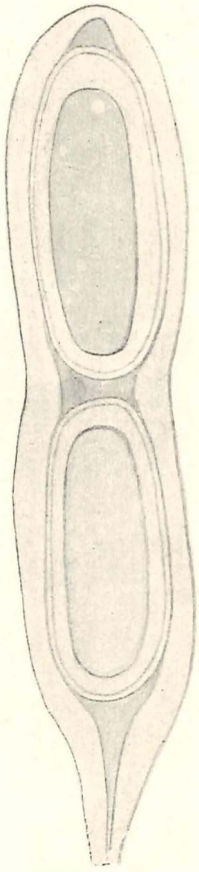


Fig. 394

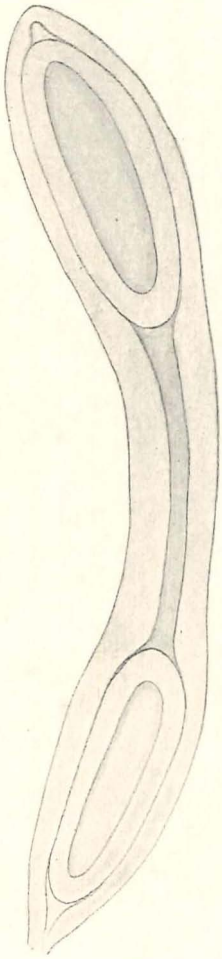


Fig. 393

PLATE 76.

PERTUSARIA COMMUNIS.
D. C.

Fig. 396. Thallus on the periderm of *Fagus silvatica.*

Fig. 397. Margin of thallus. (× 10).

Fig. 398. Portion of central part of thallus. The plurality of the areoles (verrucæ) contain apothecia. (× 10).

Fig. 396

Fig. 397

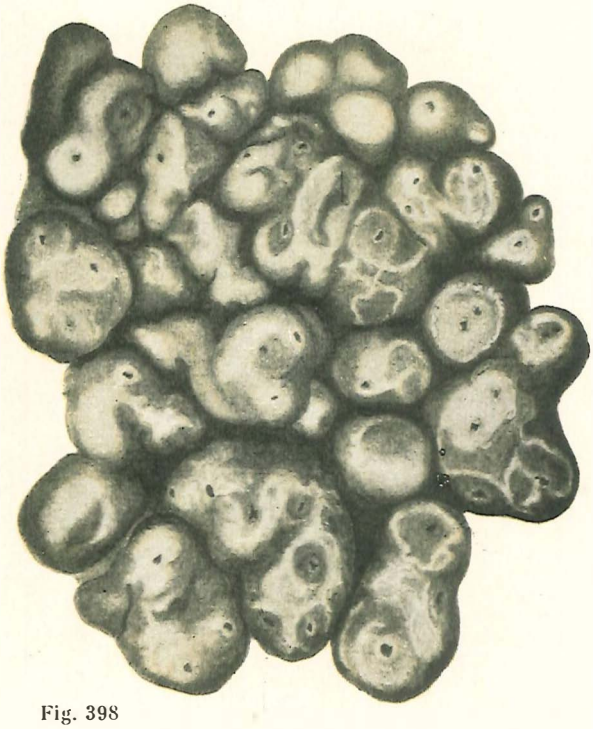


Fig. 398

O. Galløe del.

PERTUSARIA COMMUNIS D. C.

PLATE 77.

PERTUSARIA COMMUNIS.

D. C.

Fig. 399. Vertical section of a verruca, with three apothecia. (× 33).

Fig. 400. Horizontal section of a verruca. Two apothecia are placed in the verruca in such a way that they have been cut nearly in longitudinal section. (× 33).

Fig. 401. Two ripe asci and one unripe ascus. The central one has burst and is about to shed its spores. (× 140).

Fig. 402. Longitudinal section of margin of thallus. In the present case it is membranaceous and detached from the substratum; previously, it must have been in contact with the substratum, which fact is made evident by the presence of particles of the substratum embedded in it. To the extreme left groups of recently taken-in gonidia. Part of the uppermost group of the latter is shown, greatly magnified, in Fig. 403. (× 80).

Fig. 403. Extreme edge of the margin of thallus, with recently captured gonidia. (× 620).

Fig. 404. Apical cells from the margin shown in Fig. 403. (× 1053).

Fig. 405. Portion of margin of thallus, at a short distance from the mycelial edge. Isolated fragments of the substratum lie between the hyphæ. (× 620).

Fig. 406. Portion of the same margin of thallus as shown in Fig. 405, with a cortex of chiefly ascendent hyphæ, of which most are dead but some few living. (× 620).

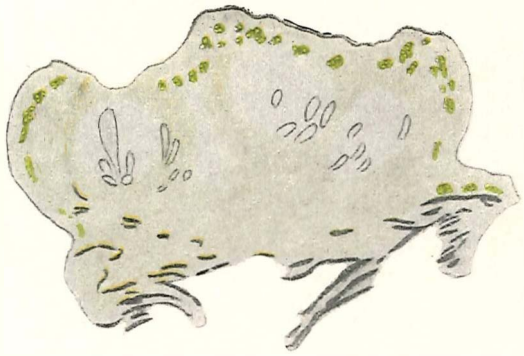


Fig. 399

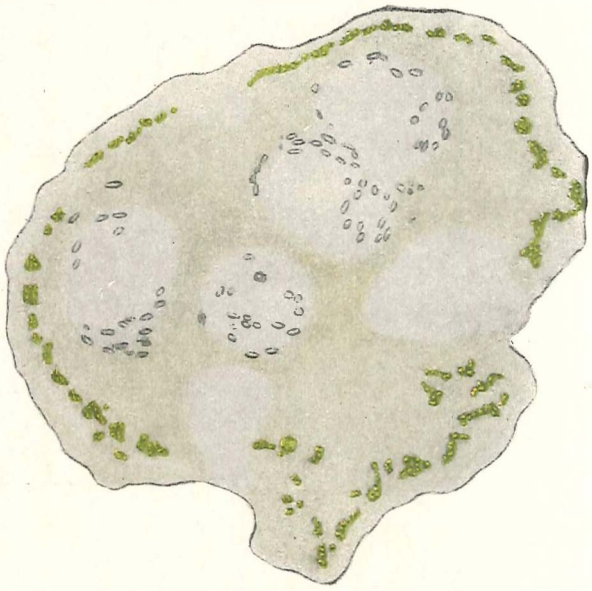


Fig. 400

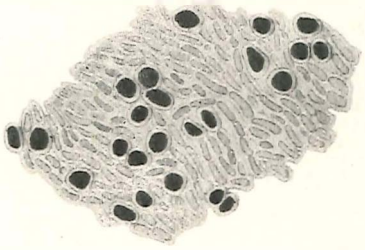


Fig. 403

Fig. 404

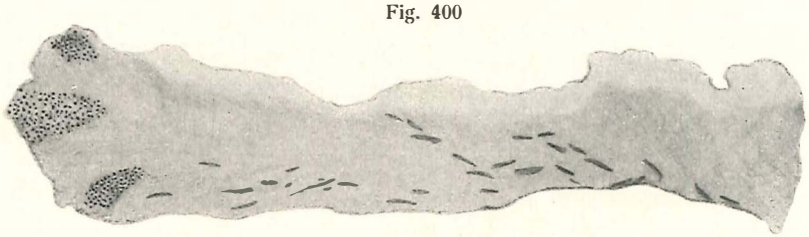


Fig. 402

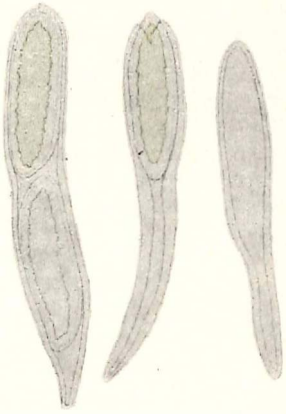


Fig. 401

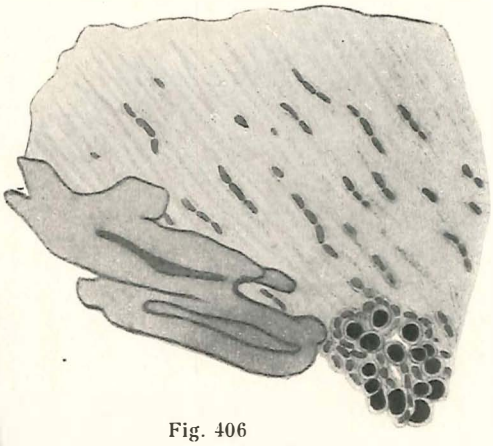


Fig. 406

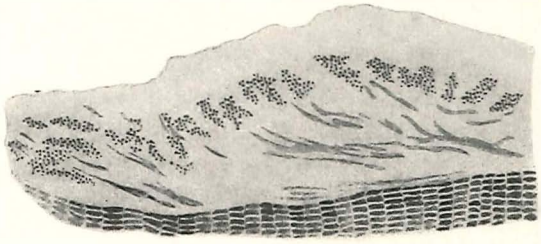


Fig. 405

O. Galloe del.

PERTUSARIA COMMUNIS D. C.

V. P 20

PLATE 78.

PERTUSARIA COMMUNIS.

D. C.

Fig. 407. Portion of verruca, cut horizontally. The section shows the partly concentrical arrangement of the asci both in the genuine, light hymenium and between the medullary hyphæ, which are likewise concentrically arranged. (× 80).

Fig. 408. Horizontal section of cuticle, cortex, and gonidial layer of a verruca. (× 840).

Fig. 409. Ascus with one spore (the wall of which is two-layered); to the left the concentrically arranged medullary hyphæ, cut horizontally. (× 840).

Fig. 410. Hymenium with branched and anastomosed paraphyses. Horizontal section. (× 840).

Fig. 411. Tips of paraphyses; longitudinal section. (× 840).

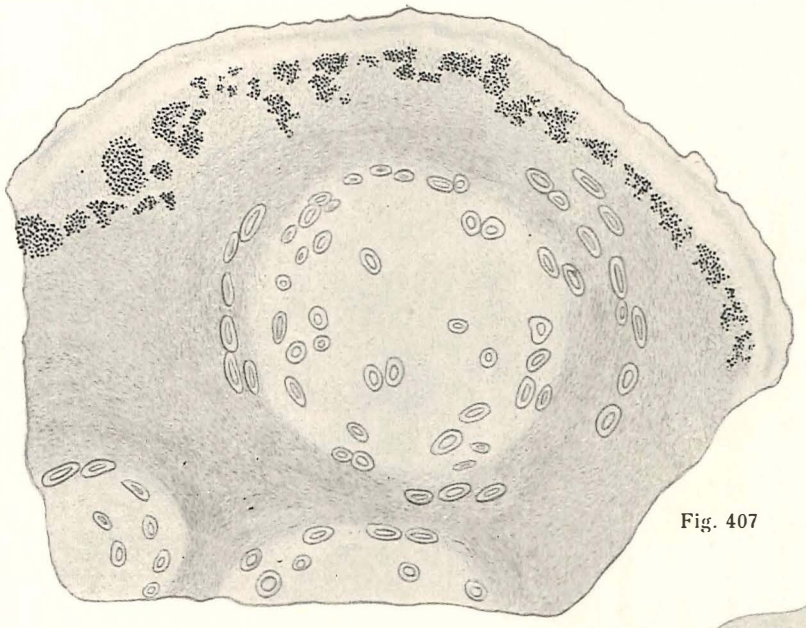


Fig. 407

Fig. 411

Fig. 410

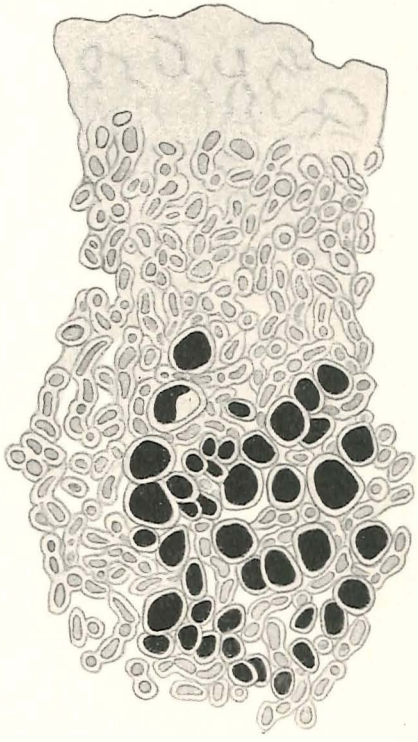


Fig. 408

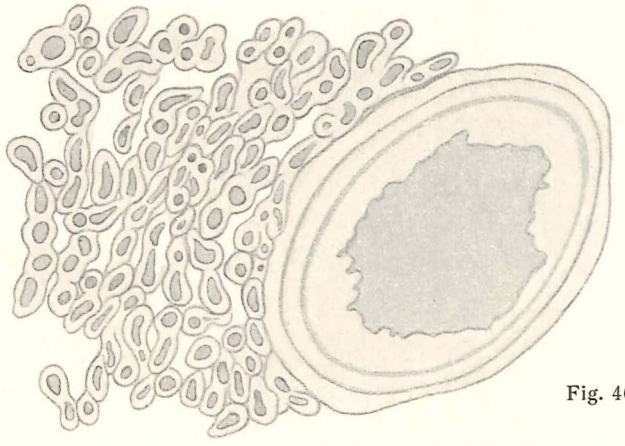


Fig. 409

O. Galløe del.

PERTUSARIA COMMUNIS D. C.

PLATE 79.

PERTUSARIA COMMUNIS.
D. C.

Fig. 412. Cortex of a verruca, vertical section. The hyphæ are to a great extent dead, with minute granules deposited between them. (× 1053).

Fig. 413. Vertical section of medulla between the apothecia. (× 840).

Fig. 414. Rhizoidal hyphæ between periderm-lamellæ of the substratum-bark. (× 840).

Fig. 415. Two unripe asci. (× 620).

Fig. 416. Ripe spore, with double-layered cell-wall. The inner layer has minute depressions, occupied by the cytoplasm. (× 620).

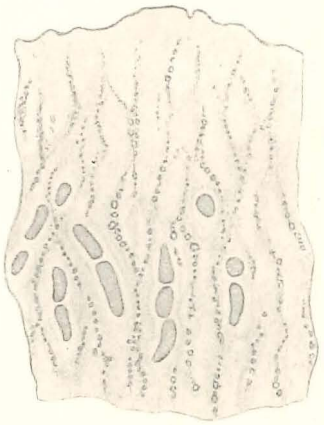


Fig. 412

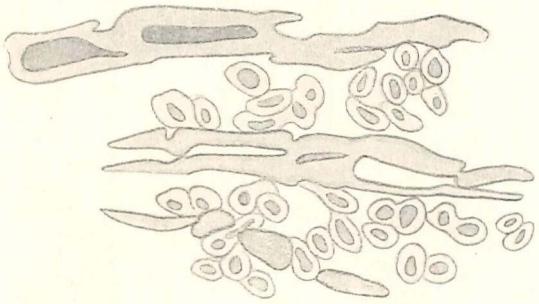


Fig. 414

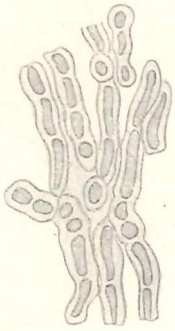


Fig. 413

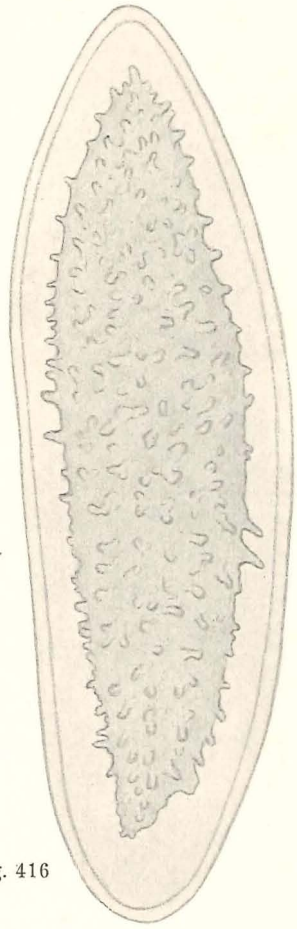


Fig. 416

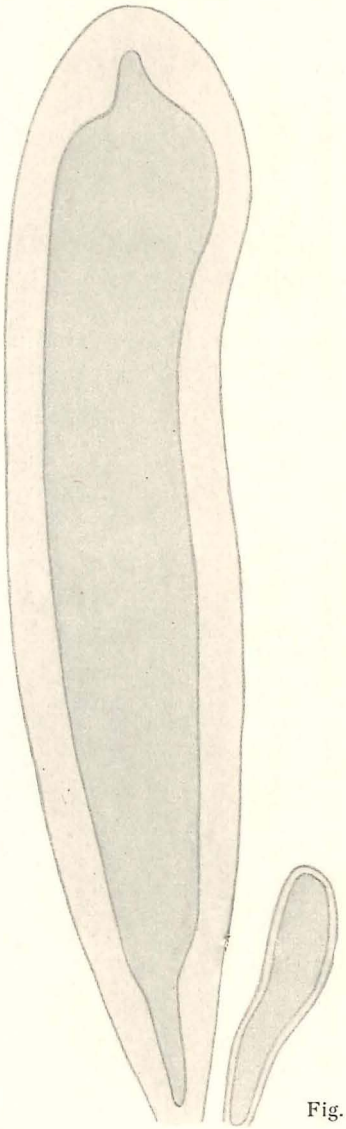


Fig. 415

O. Galloe del.

PERTUSARIA COMMUNIS D. C.

PLATE 80.

PERTUSARIA FAGINEA.

L.

Fig. 417. Margin of thallus with young soralia. (× 10).

Fig. 418. Thallus, at a short distance from the margin, with rather young soralia. (× 10).

Fig. 419. Portion of the central part of thallus, with old, confluent soralia. (× 10).

Fig. 420. Vertical section of thallus, with three soralia at different stages of development. (× 80).

Fig. 417

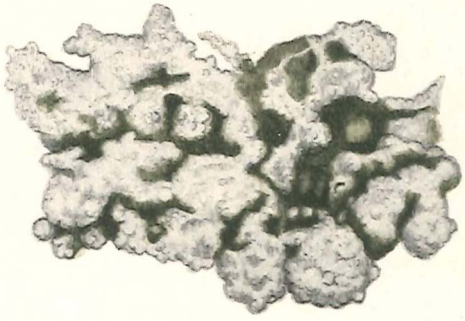


Fig. 419

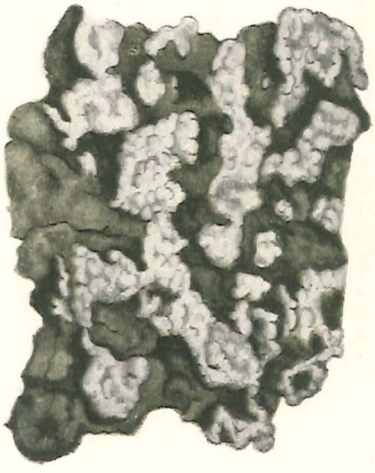


Fig. 418

Fig. 420

O. Galløe del.

PERTUSARIA FAGINEA L.

PLATE 81.

PERTUSARIA FAGINEA.
L.

Fig. 421. Vertical section of margin of thallus. (× 100).
Fig. 422. Young soral on the point of opening, with endogenous soredia. (× 140).
Fig. 423. Two isolated soredia. (× 620).
Fig. 424. Portion of thallus with cortex, gonidial layer, and medulla. (× 840).

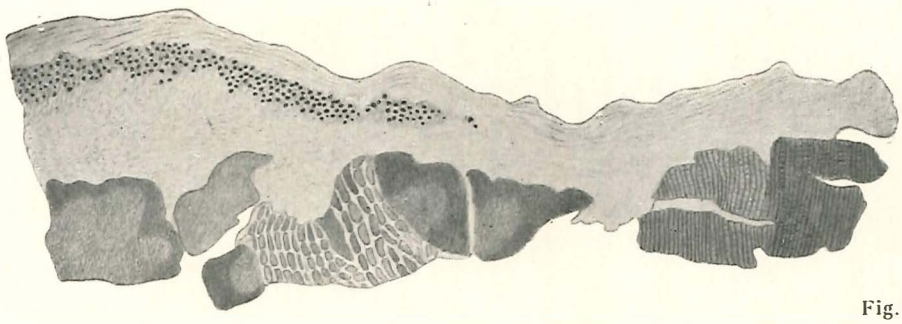


Fig. 421

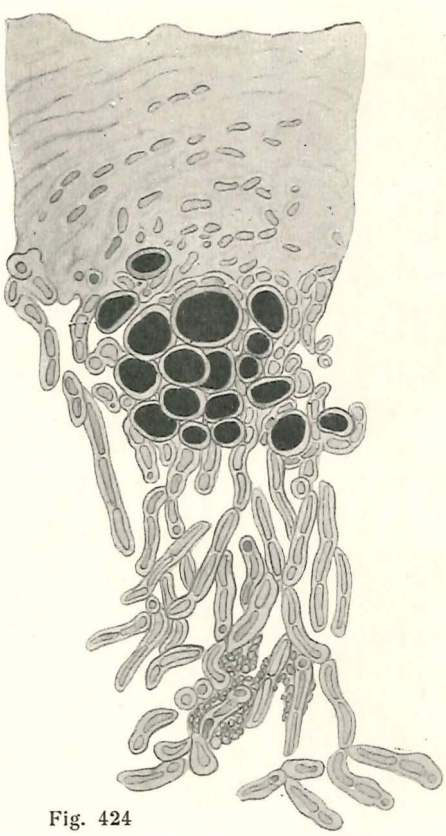


Fig. 424

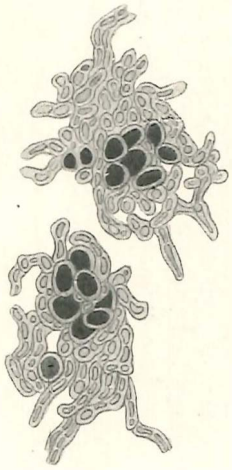


Fig. 423

Fig. 422

PLATE 82.

GYALOLECHIA LUTEOALBA.

TURN.

Fig. 425. Thallus with apothecia of all ages. (× 15).
Fig. 426. Thallus with an apothecium of almost purely lecideine structure. (×140).
Fig. 427. Paraphyses. (× 747).
Fig. 428. Thallus. (× 620).

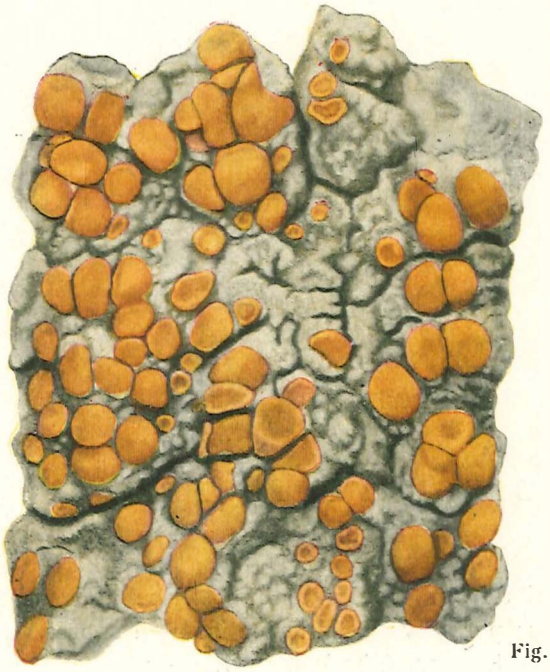


Fig. 425

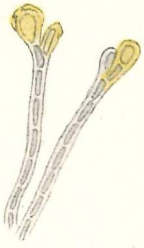


Fig. 427

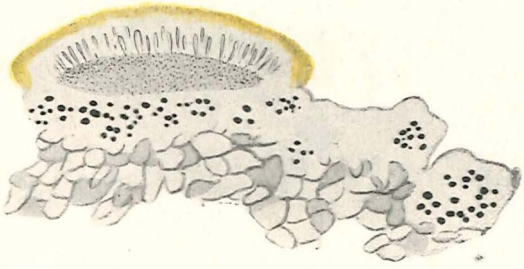


Fig. 426

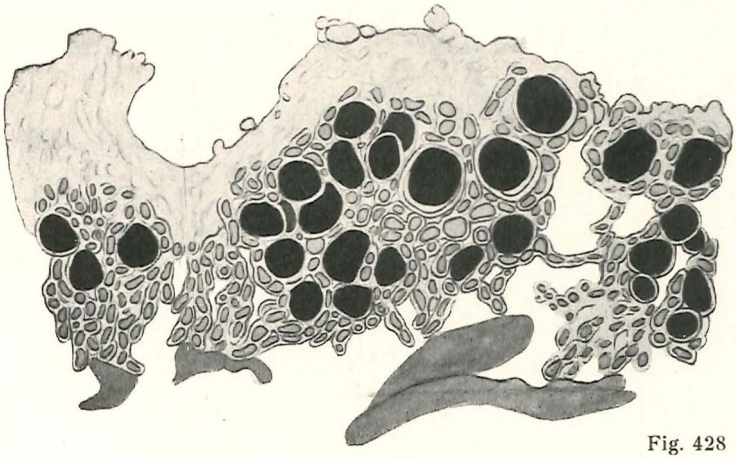


Fig. 428

O. Galløe del.

GYALOLECHIA LUTEOALBA TURN.

PLATE 83.

GYALOLECHIA LUTEOALBA.

TURN.

Fig. 429. Structural details from the hymenium: Ripe and unripe asci, ascogenous hyphæ, young colourless paraphyses, and ripe isolated spores. (× 747).

Fig. 430. Thallus with apothecium. The latter evidently takes up an intermediate position between a lecideine and a lecanorine structure, as the calyx has forced aside the cortex and the gonidial layer of the thallus when it broke out of the thallus. The latter has only to a slight degree participated in the growth of the apothecium more in the left side than in the right side of the section. (× 620).

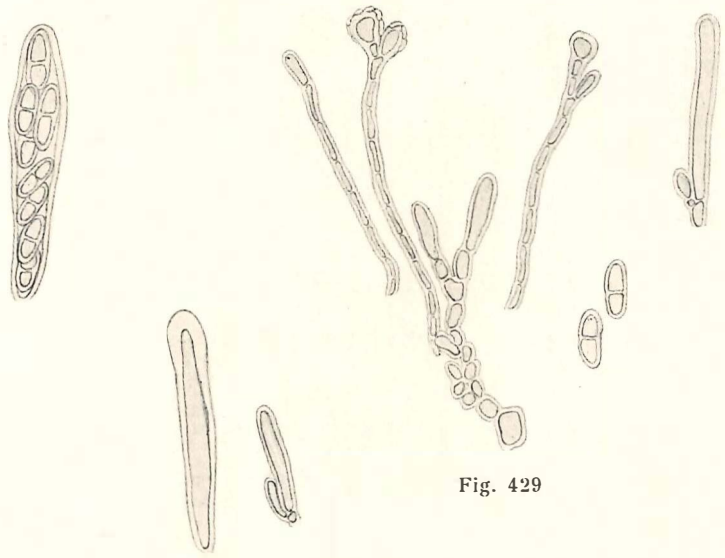


Fig. 429

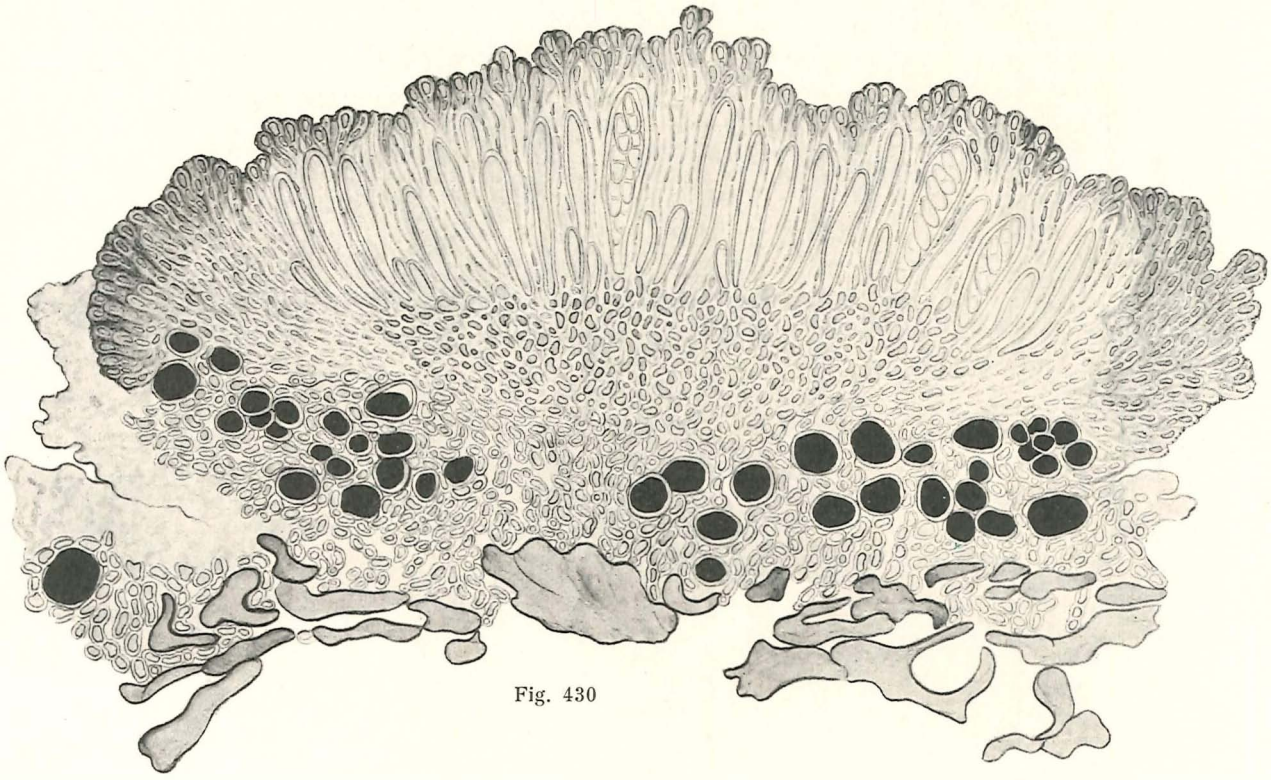


Fig. 430

O. Galløe del.

GYALOLECHIA LUTEOALBA TURN.

PLATE 84.

GYALOLECHIA CALCICOLA.

O. GALLØE nov. sp.

Fig. 431. Fragment of a limestone, with normal apothecia and several dead, discoloured apothecia, and also extremely minute, epilithic granules of thallus. (× 35).

Fig. 432. Fragment of limestone, with three very young, semiglobular apothecia immersed in small depressions of the substratum. The dark dots represent epilithic granules of thallus. The rest of the thallus is endolithic. (× 100).

Fig. 433. Fragment of limestone with orange-yellow normal apothecia, and some apothecia attacked by a parasitic *Pyrenomycete, Tichothecium* which gradually kills and discolours the apothecia. (× 33).

Fig. 434. Margin of a small, epilithic granule of thallus. Above to the left is seen a portion of an apothecium cut in such a way that the hyphæ of a part of the proper margin (with granules of parietine) are cut across. (× 80).

Fig. 435. Apothecium, developed in a gonidiiferous portion of thallus. This apothecium may just as well be considered lecideine as lecanorine (*vide* the text). (× 140).

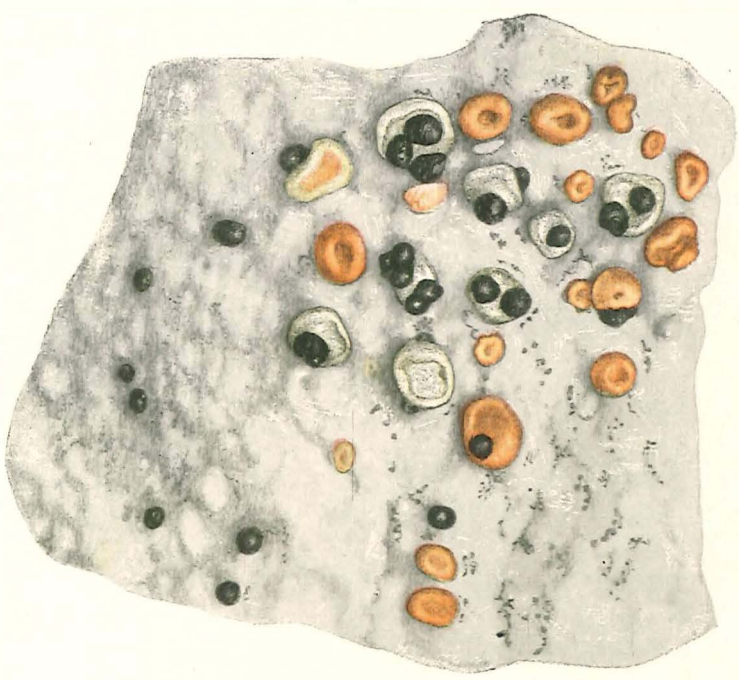


Fig. 433

Fig. 434

Fig. 431

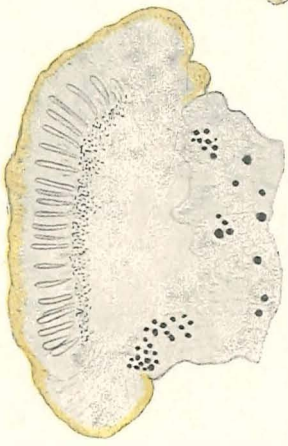


Fig. 435

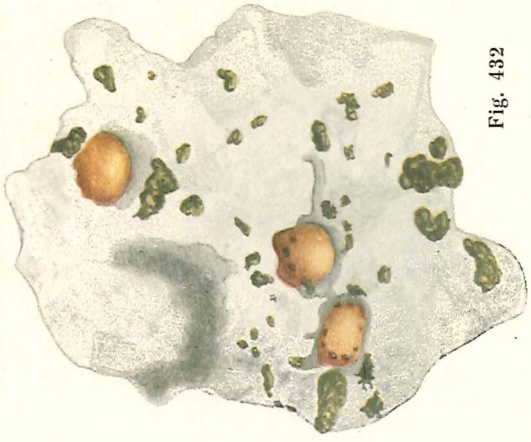


Fig. 432

O. Galløe del.

GYALOLECHIA CALCICOLA O. GALLØE nov. sp.

PLATE 85.

GYALOLECHIA CALCICOLA.

O. GALLØE nov. sp.

Fig. 436. Gonidiiferous, endolithic thallus from the upper layers of the substratum. (× 840).

Fig. 437. Hyphæ with adhering grains of lime, from the interior of the substratum. (× 1053).

Fig. 438. Endolithic hyphæ, and two gonidia. (× 1053).

Fig. 439. Hyphæ from the cortex of an epilithic granule of thallus, isolated by crushing. (× 620).

Fig. 440. Margin of apothecium with adhering thallus. Some apices of hyphæ from the proper margin, suffused by grains of parietine, are seen below to the right. (× 840).

Fig. 441. Hyphæ from a longitudinal section of stipes. (× 840).

Fig. 442. Ascogenous hyphæ with young asci. (× 840).

Fig. 443. Two ripi asci, with four and eight spores respectively, and three isolated spores together with two paraphyses, one branched, the other unbranched, with granules of parietine. (× 747).

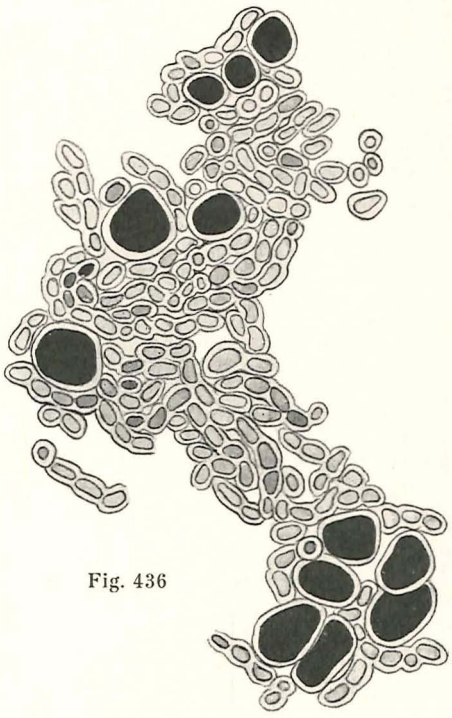


Fig. 436

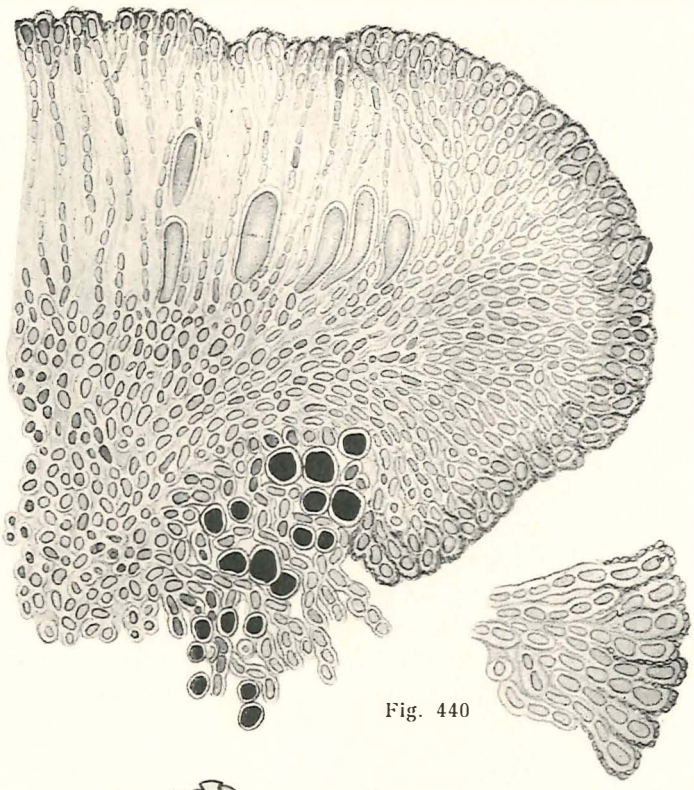


Fig. 440

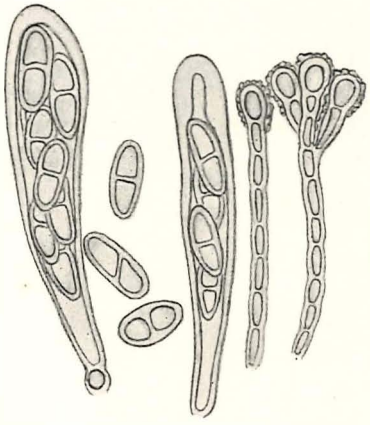


Fig. 443

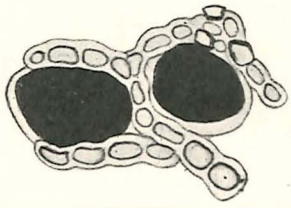


Fig. 438

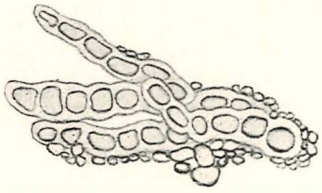


Fig. 437

Fig. 439

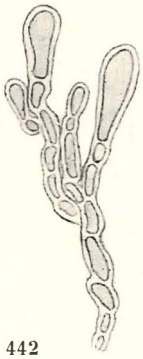


Fig. 442

Fig. 441

O. Galløe del.

GYALOLECHIA CALCICOLA O. GALLOE nov. sp.

PLATE 86.

TICHOTHECIUM PYGMAEUM Koerb.
parasitic on
GYALOLECHIA CALCICOLA.
O. Gallœe nov. sp.

Fig. 444. Piece of limestone with two perithecia, of which the left one is drawn in profile, while the right one is seen from above. None of these had a visible ostiole. They are parasitic on the endolithic (and therefore invisible) thallus of *Gyalolechia calcicola*. (× 140).

Fig. 445. A dead and discoloured apothecium of *Gyalolechia calcicola*, with two perithecia, of which one has a distinct ostiole. (× 140).

Fig. 446. Margin of a discoloured dying-off apothecium of *Gyalolechia calcicola*, with a parasitic perithecium, the brown hyphæ of which are just penetrating into the host-plant. The perithecium has a brown wall of pseudo-parenchymatic hyphæ, inwards passing into colourless hyphæ. The hypothecium has distinct ascogonia, from which asci (unripe in the present case) issue. The paraphyses are gelatinous, rather short-celled. (× 620).

Fig. 447. Dying-off and discoloured apothecium of *Gyalolechia calcicola* with a parasitic perithecium. The host-plant has ceased to develop asci. (× 140).

Fig. 448. Horizontal section through the base of the perithecium, showing how the brown hyphæ make their way between the colourless hyphæ of the stipes of the apothecium of the host-plant. (× 620).

Fig. 449. Horizontal section through the wall of the perithecium of the parasite, showing the transition from the dark outer wall to the light inner wall. (× 840).

Fig. 450. Ripe ascus with olivaceous spores. (× 747).

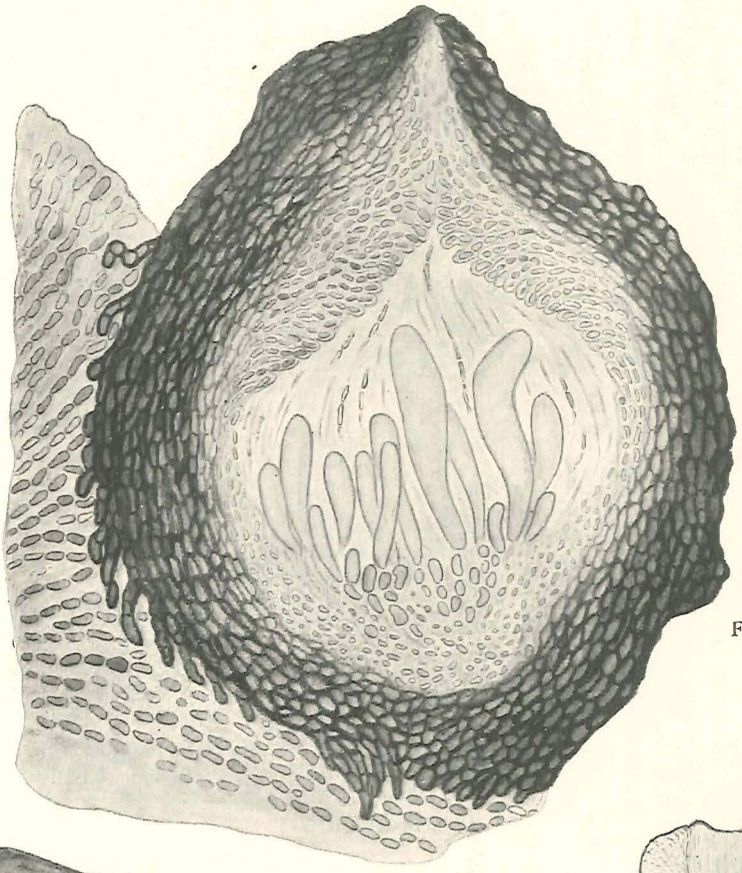


Fig. 446

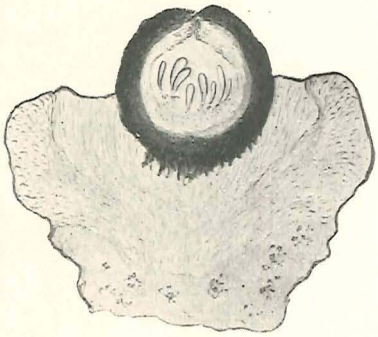


Fig. 447

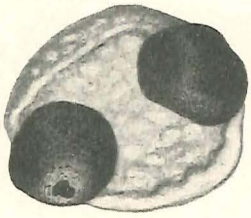


Fig. 445

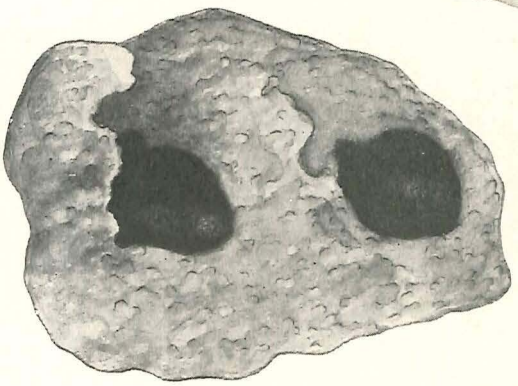


Fig. 444

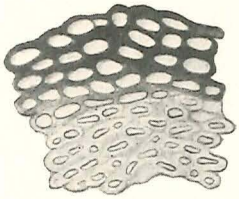


Fig. 449

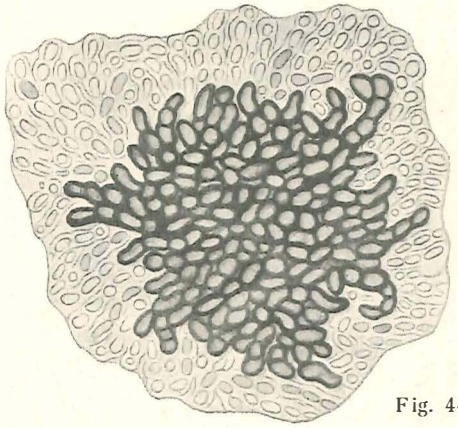


Fig. 448

Fig. 450

O. Galløe del.

TICHOTHECIUM PYGMAEUM KOERB.

PLATE 87.

CALOPLACA CERINA.

EHRH.

Fig. 451. Thallus with distinctly centrifugal arrangement of the apothecia. (×15).

Fig. 452. Thallus; to the left an apothecium, cut extra-axially, so that only the thalline margin has been left; to the right a young, just opened, apothecium, cut axially. (× 140).

Fig. 453. Young apothecium, still embedded in the thallus; it consists of paraphysogenous and ascogenous hyphæ, but has not yet any calyx, nor stipes or distinct paraphyses. (× 140).

Fig. 454. Older, fully developed apothecium, with distinct stipes-calyx and colourless margo proprius inside the thalline margin. (× 80). To the left an unbranched paraphysis (× 747).

Fig. 455. Branched paraphysis. (× 747).

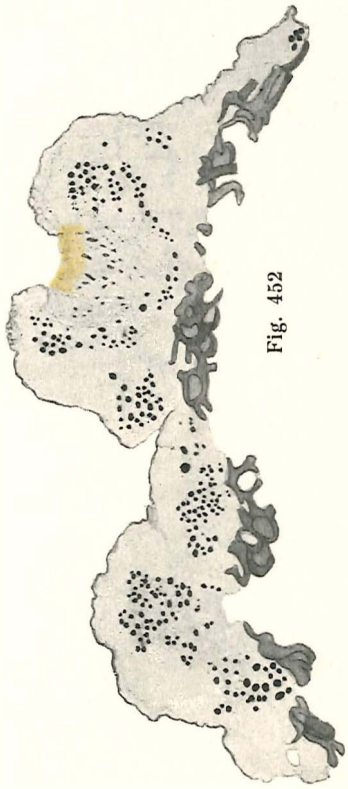


Fig. 452

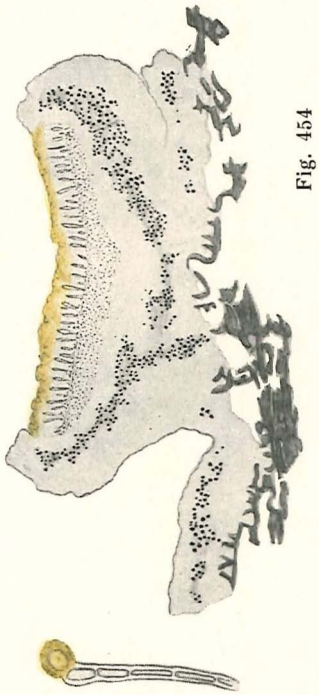


Fig. 454

Fig. 453

Fig. 455

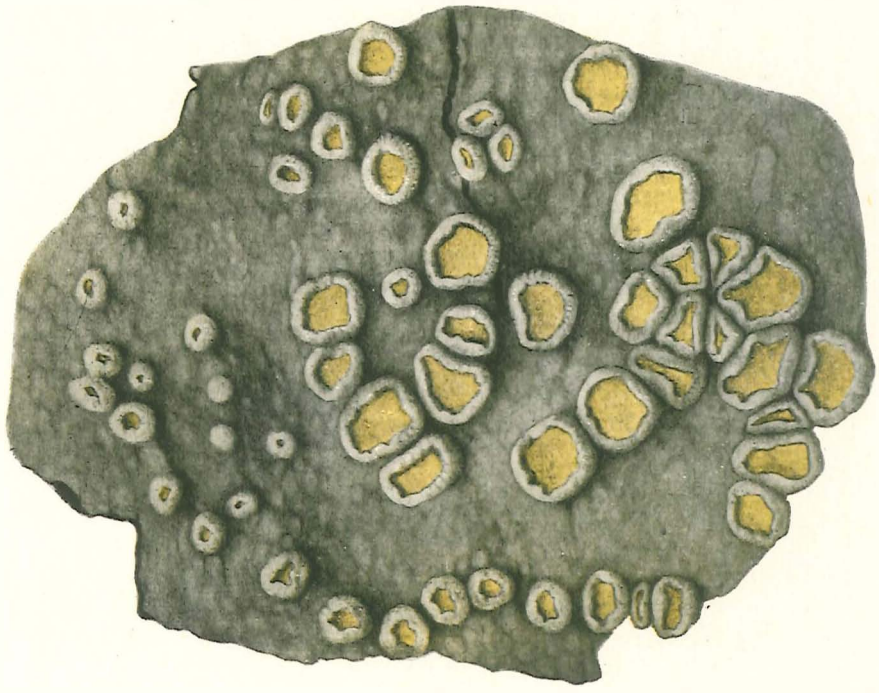


Fig. 451

O. Galløe del.

CALOPLACA CERINA Ehrh.

PLATE 88.

CALOPLACA CERINA.

EHRH.

Fig. 456. Thallus; remains of the periderm of the substratum are situated on its surface. (× 620).

Fig. 457. Cortex with cuticle, and a particle of the periderm. Two gonidia are seen at the bottom of the picture. (× 1053).

Fig. 458. Gonidial layer. (× 1053).

Fig. 459. Medullary-rhizoidal layer in the periderm of the substratum-plant. (× 1053).

Fig. 460. Margin of an apothecium, with hypothecium, hymenium, calyx (and colourless margo proprius), together with the thalline margin. (× 620).

Fig. 461. Above, a branched paraphysis having one yellow tip (to the left) and one young, colourless tip. Below, young colourless paraphyses. (× 747).

Fig. 462. Ripe and unripe asci. The connection between young asci and ascogenous hyphæ is seen below to the right. (× 620).

Fig. 463. Gonidia. (× 747).

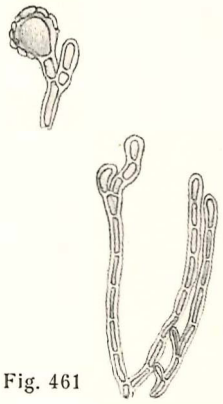


Fig. 461

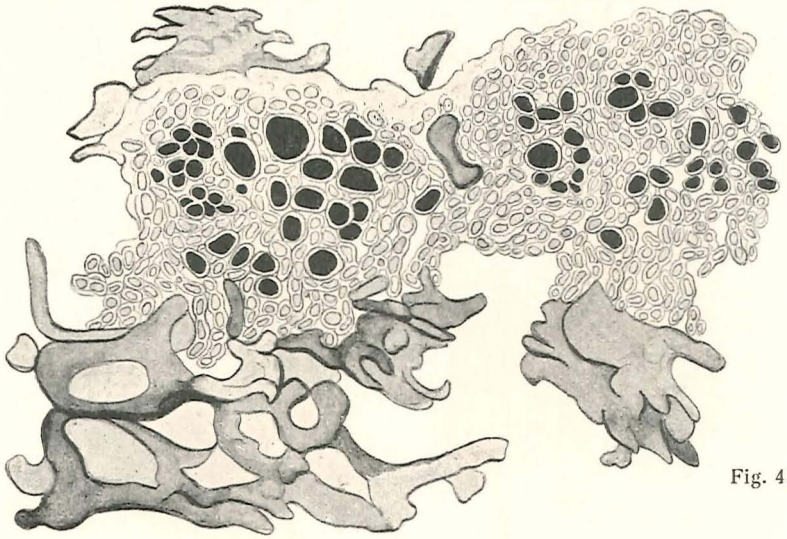


Fig. 456

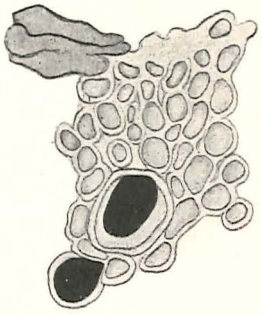


Fig. 457

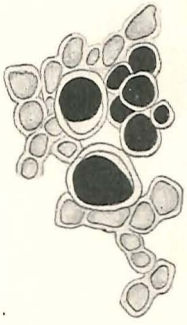


Fig. 458

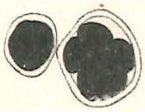


Fig. 463

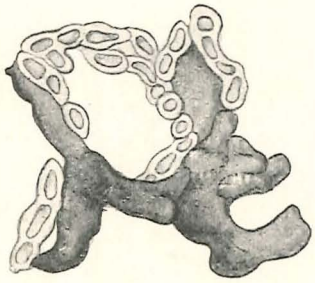


Fig. 459

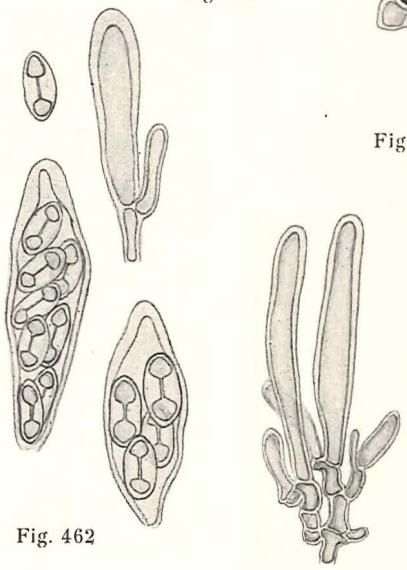


Fig. 462

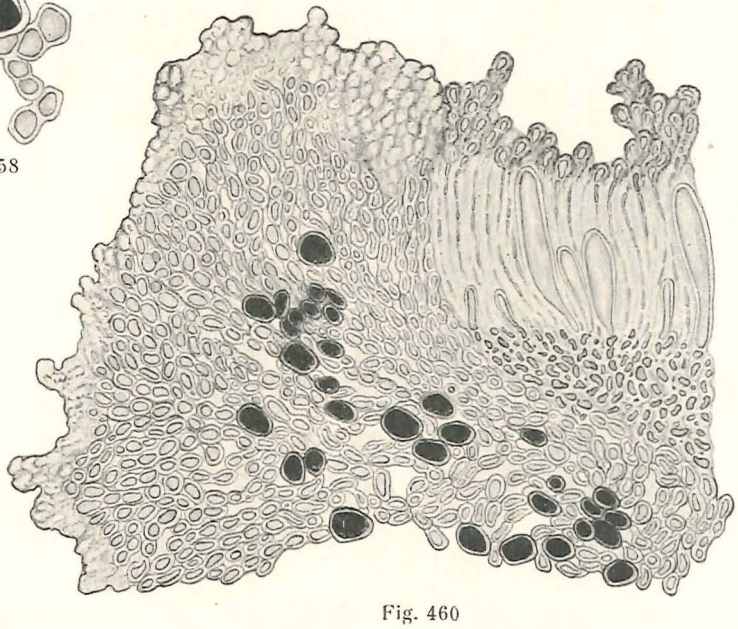


Fig. 460

O. Galløe del.

CALOPLACA CERINA Ehrh.

PLATE 89.

CALOPLACA CHLORINA.

FLOT.

Specimen 1.

Fig. 464. Thallus with apothecia of all ages. (× 15).

Fig. 465. Group of very young apothecia. Note the distinct margo proprius inside the thalline margin. (× 30).

Fig. 466. Thallus with one apothecium. (× 100).

Fig. 465

Fig. 464

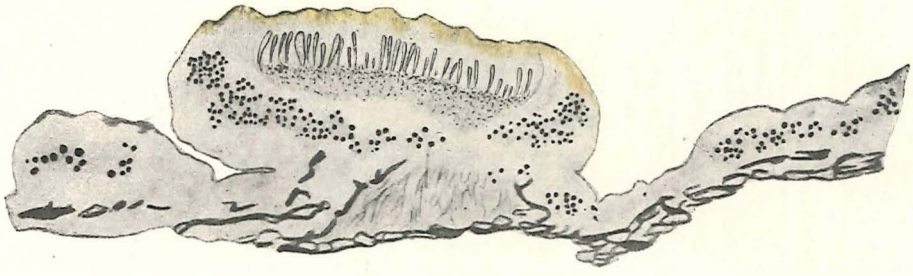


Fig. 466

O. Gallœe del.

CALOPLACA CHLORINA FLOT.
(Specimen 1).

V. P 23

PLATE 90.

CALOPLACA CHLORINA.

FLOT.

Specimen 1.

Fig. 467. Thallus; hyphæ of a parasitic fungus are seen in the cortex. (× 840).

Fig. 468. Margin of apothecium, with margo proprius and margo thallinus. There are only six spores in the ripe ascus. (× 620).

Fig. 469. To the left two unripe asci with ascogenous hyphæ. In the middle an unripe ascus, and paraphyses, of which some have colourless apices. To the right a ripe ascus. (× 747).

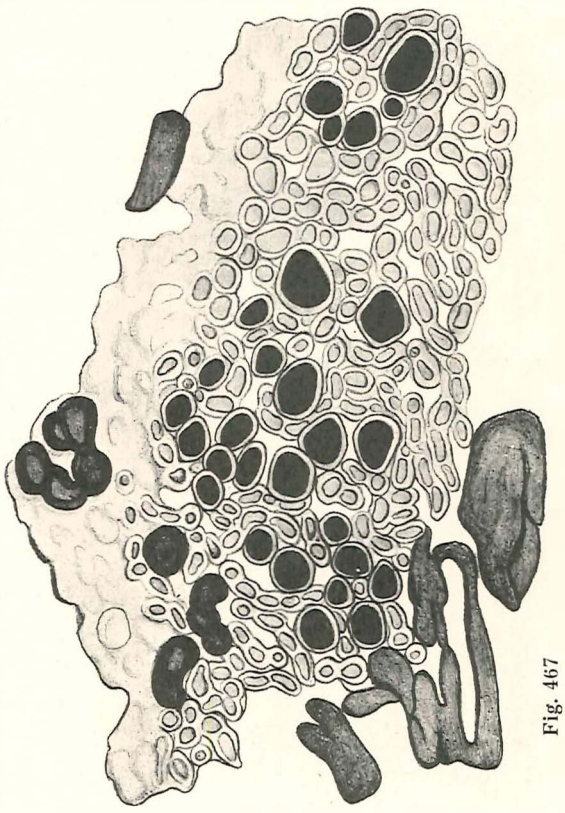


Fig. 467

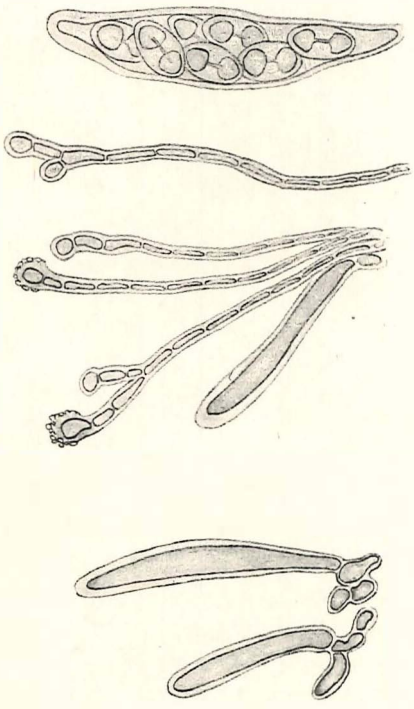


Fig. 469

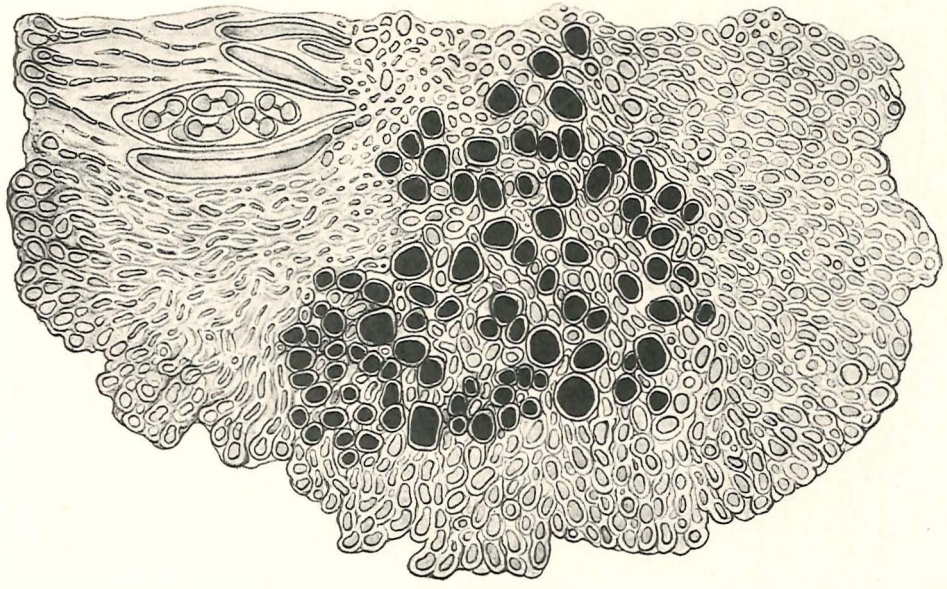


Fig. 468

O. Galløe del.

CALOPLACA CHLORINA FLOT.
(Specimen 1).

PLATE 91.

CALOPLACA CHLORINA.

FLOT.

Specimen 2.

Fig. 470. Thallus with apothecia. Scanty, free mycelial hyphæ are seen along the free margin of thallus. (× 15).

Fig. 471. Young apothecium. Margo proprius is yellow like the tips of the paraphyses (× 140).

Fig. 472. Ripe apothecium, with distinct stipes. (× 100).

Fig. 473. Tips of paraphyses, seen from above. (× 747).

Fig. 474. Thallus. To the right the margin of an areole. (× 620).

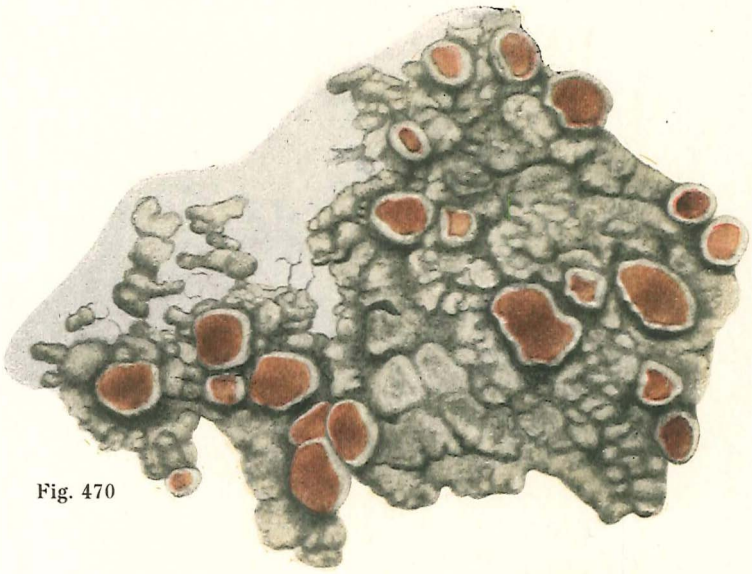


Fig. 470

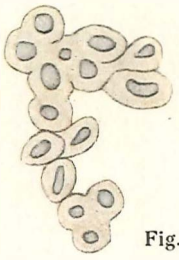


Fig. 473

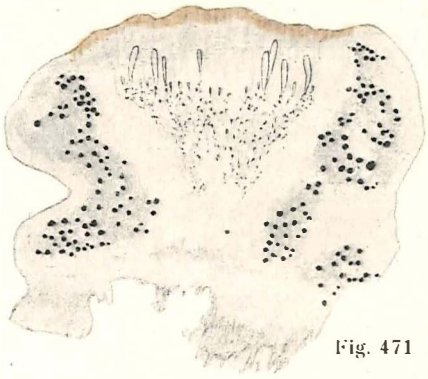


Fig. 471

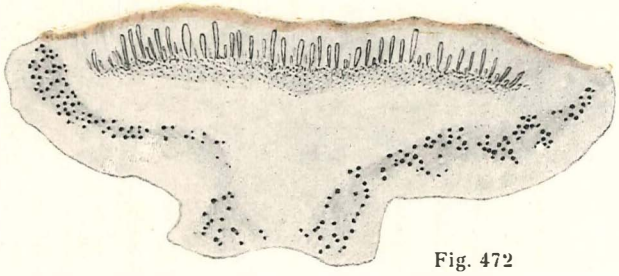


Fig. 472

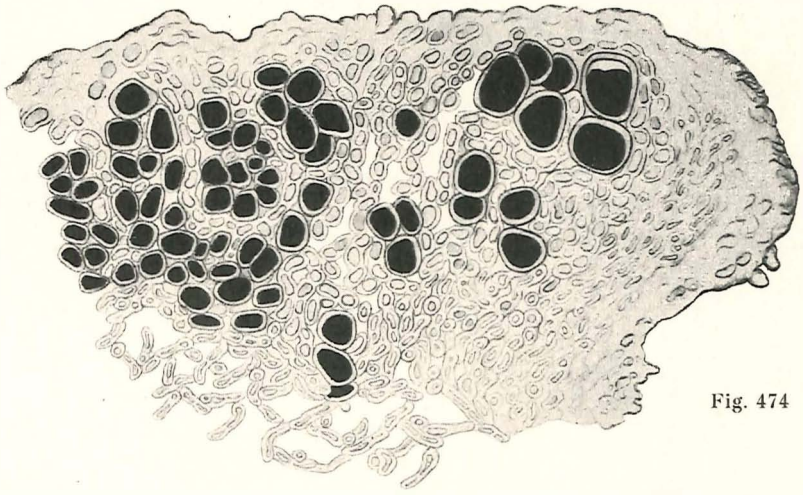


Fig. 474

O. Galløe del.

CALOPLACA CHLORINA FLOT.
(Specimen 2).

PLATE 92.

CALOPLACA CHLORINA.

FLOT.

Specimen 2.

Fig. 475. Margin of an apothecium. (× 620).

Fig. 476. Hyphæ from stipes, from the region just beneath the hypothecium. (× 1053).

Fig. 477. Ascogenous hyphæ and young asci. (× 747).

Fig. 478. Ripe ascus, with four spores, together with paraphyses, which are partly diffusely coloured, partly coloured by a granular parietine. (× 747).

Fig. 479. Ripe ascus with eight spores. (× 747).

Fig. 475

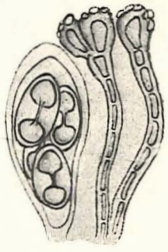


Fig. 478

Fig. 479

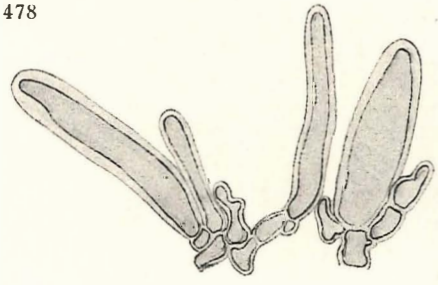


Fig. 477

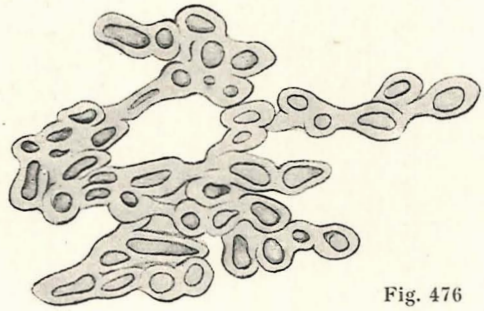


Fig. 476

O. Galløe del.

CALOPLACA CHLORINA FLOT.
(Specimen 2.)

PLATE 93.

CALOPLACA PYRACEA.

ACH.

Fig. 480. Thallus with apothecia, on wood. (× 23).

Fig. 481. Apothecium with margo thallinus and margo proprius. (× 100).

Fig. 482. Thallus with a young apothecium, on wood. Margo thallinus is entirely hidden under the proper margin when the apothecium is seen from above. (× 93).

Fig. 483. Granule of thallus. (× 840).

Fig. 484. Hyphæ from the medulla just beneath the gonidial layer (a gonidial alga is seen above in the figure); a colony of *Chroococcaceæ* with gelatinous cell-walls is seen between the hyphæ. (× 840).

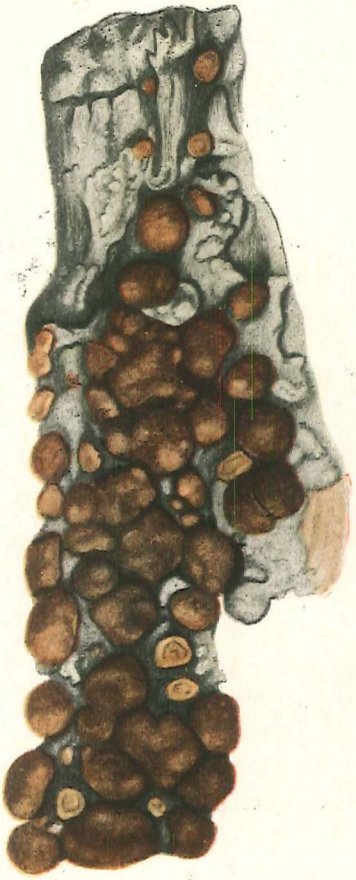


Fig. 480

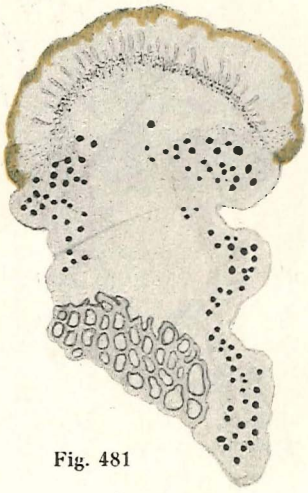


Fig. 481

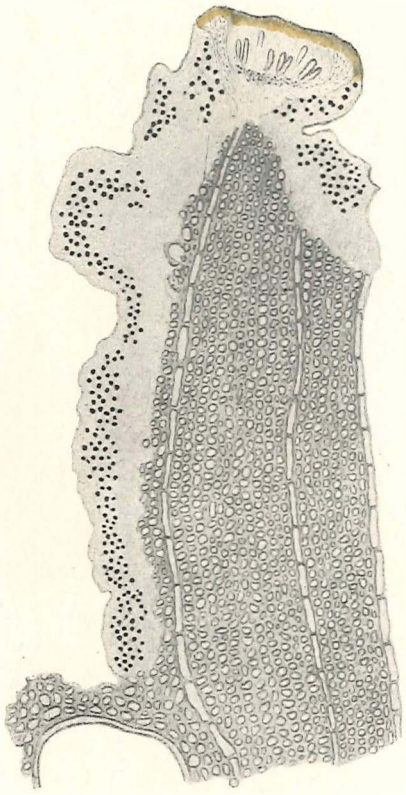


Fig. 482

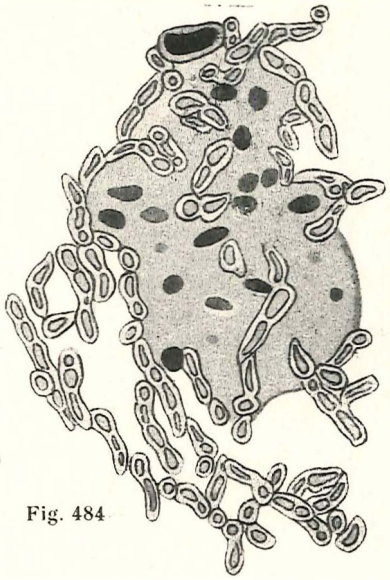


Fig. 484

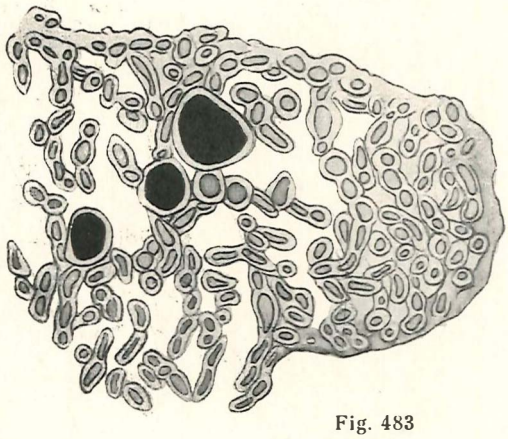


Fig. 483

O. Galloe del.

CALOPLACA PYRACEA Ach.

V. P 24

PLATE 94.

CALOPLACA PYRACEA.

ACH.

Fig. 485. Cells of the woody substratum, with rhizoidal hyphæ. (× 840).

Fig. 486. Margin of apothecium, with very thick (and yellow) margo proprius, which abruptly is replaced by a colourless margo thallinus. (× 620).

Fig. 487. Apices of hyphæ, with granules of parietine, from margo proprius. (× 840).

Fig. 488. Hyphæ from stipes-calyx; longitudinal section. (× 1053).

Fig. 489. Paraphyses and young asci. (× 747).

Fig. 490. Ripe ascus. (× 747).

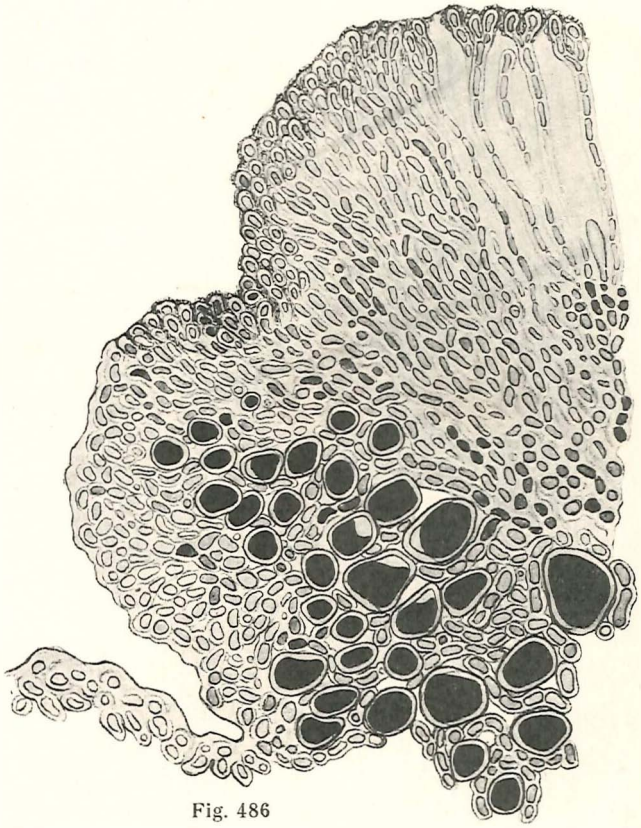


Fig. 486

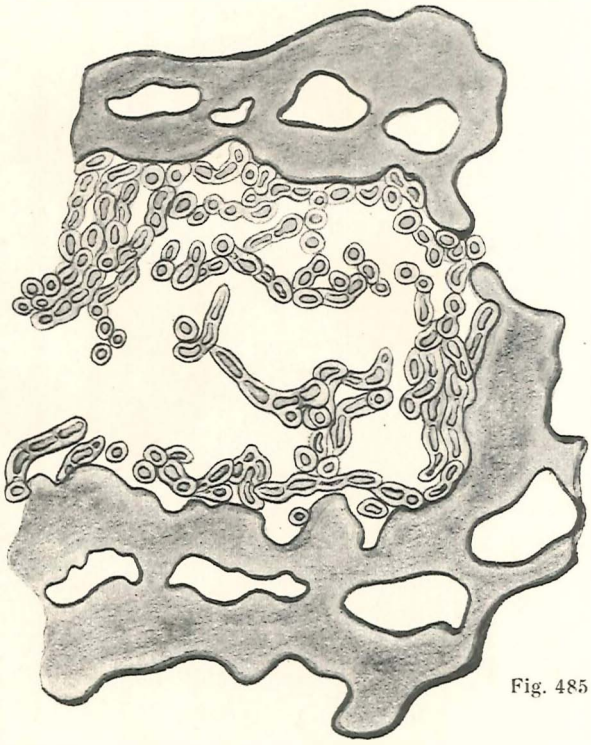


Fig. 485

Fig. 490

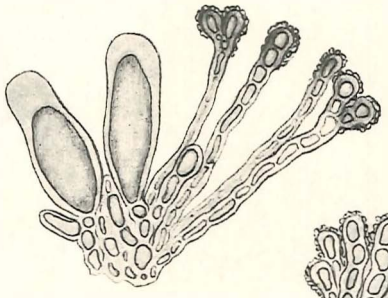


Fig. 489

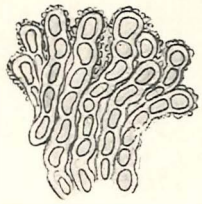


Fig. 487

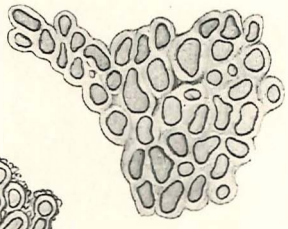


Fig. 488

O. Galløe del

CALOPLACA PYRACEA Ach.

PLATE 95.

CALOPLACA AURANTIACA.

LIGHTF.

Specimen 1.

Fig. 491. Thallus with apothecia of all ages. Part of the inequalities of the thallus is due to its spreading over a *Frullania,* which it has nearly grown over and covered (only a single branch of *Frullania* is still intact). At *(a)* an apothecium, which has issued two fresh apothecia as prolifications of its disc. (Similar prolifications are pictured and described in Part IV of this work). (× 15).

Fig. 492. Thallus with a very young, lecanorine apothecium, with distinct calyx-stipes and with ascogenous hyphæ in the hypothecium. Note the yellow pigment distributed in spots in the thallus. (× 140).

Fig. 493. Two neighbouring apothecia with common margo thallinus. At *(a)* the margin is exclusively lecideine, without gonidia. A common hypothecium connects the apothecia; it has the same oil-like substance between the hyphæ as found in the two functioning hypothecia, but has no ascogenous hyphæ. (× 80).

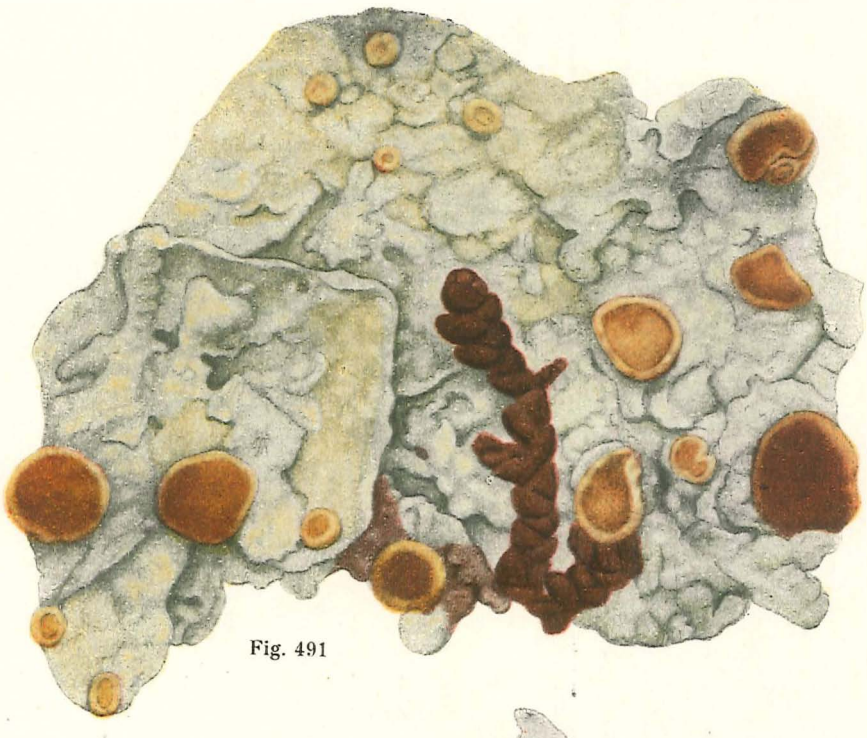
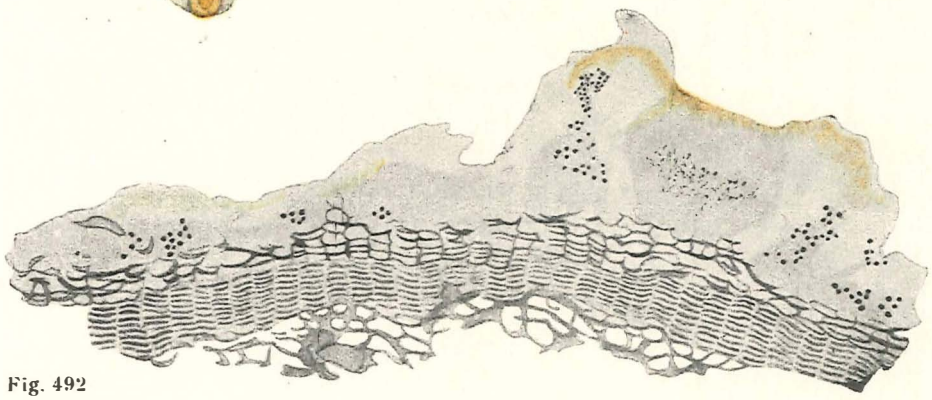


Fig. 491



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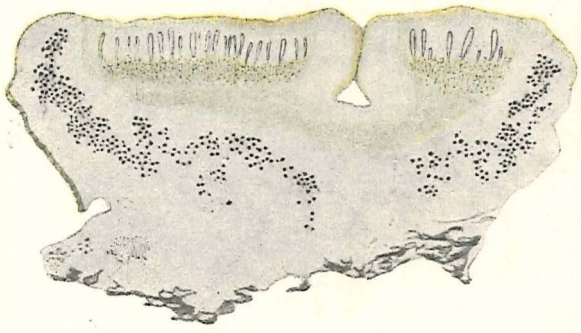


Fig. 493

O. Gallœe del.

CALOPLACA AURANTIACA LIGHTF.
(Specimen 1).

PLATE 96.

CALOPLACA AURANTIACA.

LIGHTF.

Specimen 1.

Fig. 494. Rather old apothecium. (× 80).

Fig. 495

Fig. 496. Margin of apothecium. The whole of the upper layers of paraphyses, margo proprius, and margo thallinus is yellow (here represented by a dark shade). (× 620).

Fig. 497. Hypothecium (with a droplike substance, which makes the course of the hyphæ indistinguishable). Moreover, numerous ascogenous hyphæ together with young asci and paraphyses. (× 747).

Fig. 498. Paraphyses, an unripe ascus and a ripe ascus. (× 747).

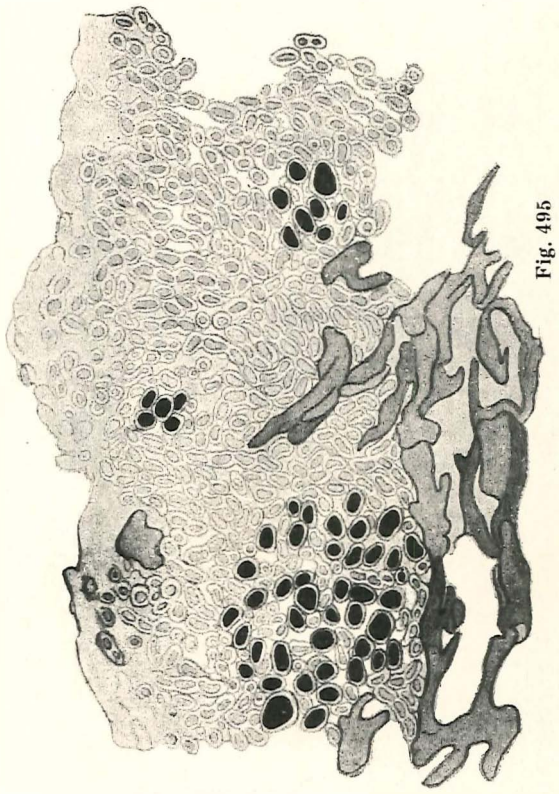


Fig. 495

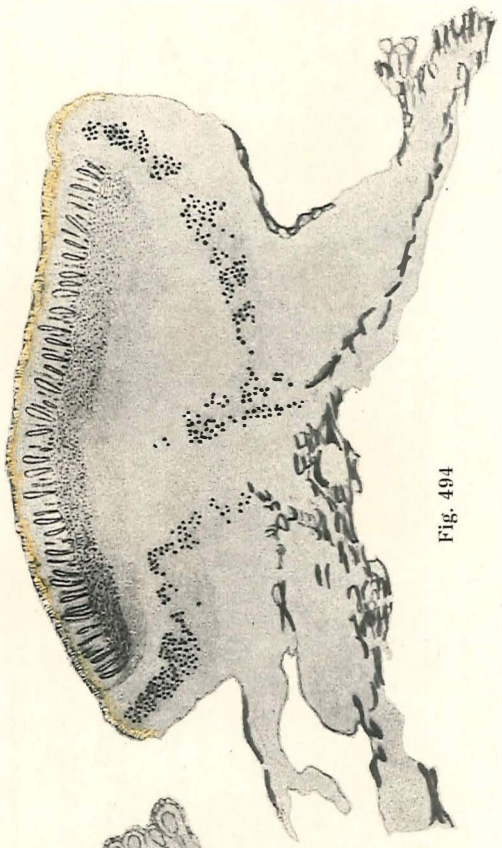


Fig. 494

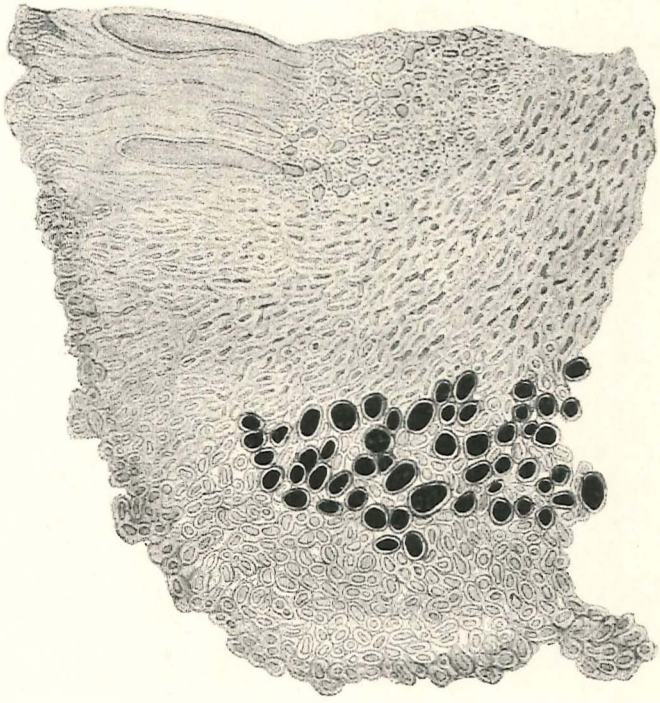


Fig. 496

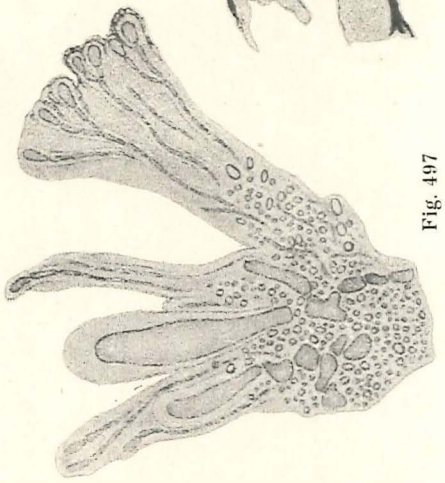


Fig. 497

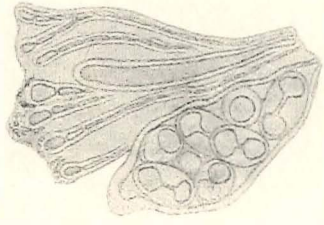


Fig. 498

O. Galløe del.

CALOPLACA AURANTIACA LIGHTF.
(Specimen 1).

PLATE 97.

CALOPLACA AURANTIACA.

LIGHTF.

Specimen 2.

Fig. 499. Thallus with apothecia. (× 23).
Fig. 500. Two apothecia. (× 100).
Fig. 501. Cortex and gonidial layer. (× 840).
Fig. 502. Medulla. (× 840).
Fig. 503. Apices of hyphæ, with granules of parietine, from margo proprius. (× 747).
Fig. 504. Hymenium with unripe asci. (× 747).
Fig. 505. A ripe ascus and some unripe asci. (× 747).

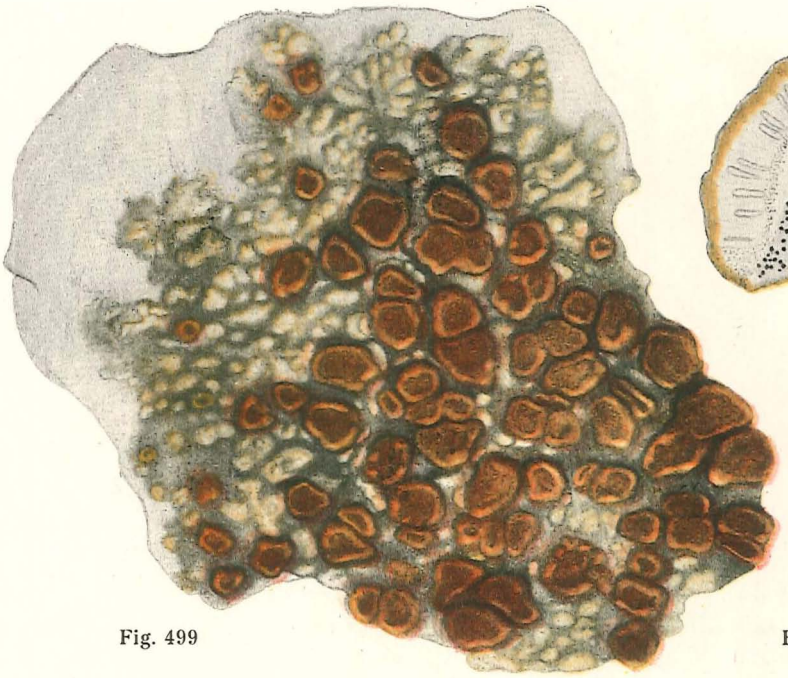


Fig. 499

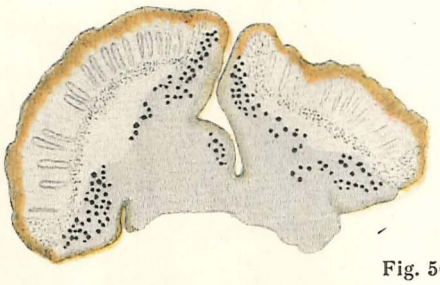
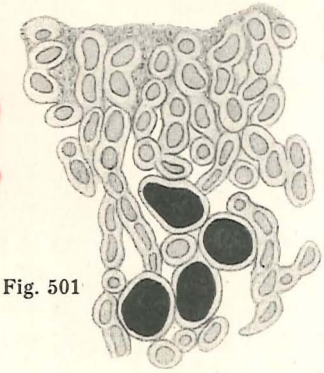


Fig. 500



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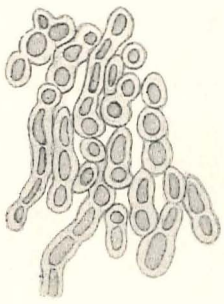


Fig. 502

Fig. 505

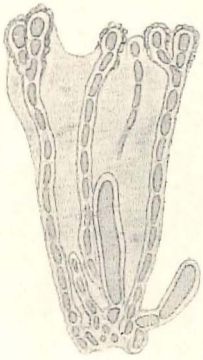


Fig. 504

Fig. 503

O. Gallœe del.

CALOPLACA AURANTIACA LIGHTF.
(Specimen 2.)

V. P 25

PLATE 98.

CALOPLACA PHLOGINA.

ACH.

Fig. 506. Greyish thallus, with ripe, yellow soredia, together with apothecia of all ages. (× 20).

Fig. 507. Very young apothecium in the thallus. The yellow margin of the apothecium is, anatomically seen, at the same time a proper and a thalline margin. The surface of the thallus is finely granular from young soredia. (× 80).

Fig. 508. Older apothecium. It has a thick yellow margin, which, structurally seen, is at the same time a proper and a thalline margin; on one of the sides the yellow margin passes into a grey thalline margin. (× 80).

Fig. 509. Vertical section of apothecium with distinct calyx-stipes. The picture shows how the yellow margin is a proper and a thalline margin at the same time. (× 140).

Fig. 510. To the left two young asci issuing from ascogenous hyphæ. In the middle paraphyses; to the right a ripe ascus. (×

Fig. 511. Thallus with soredia on its surface. (× 140).

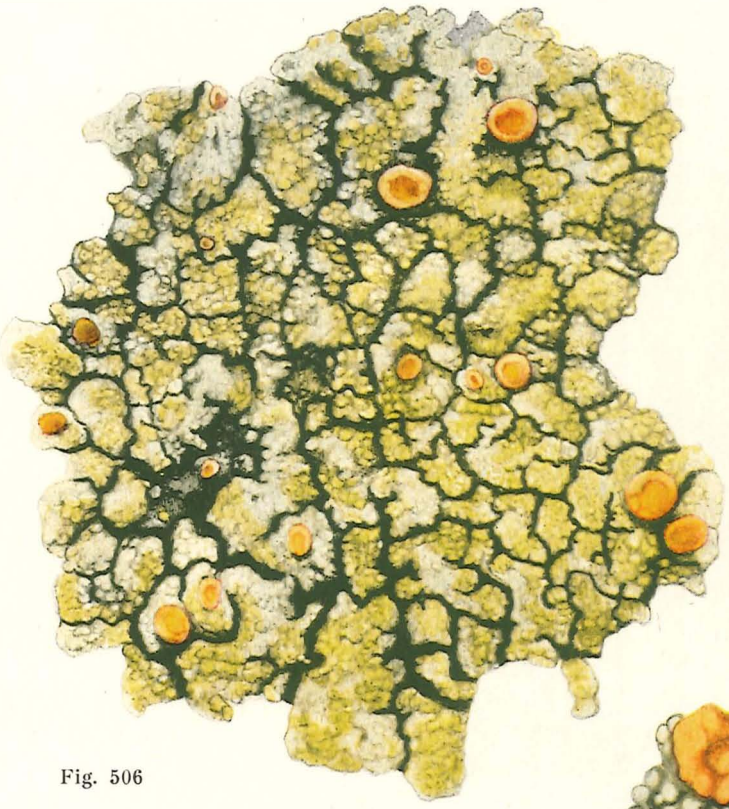


Fig. 506

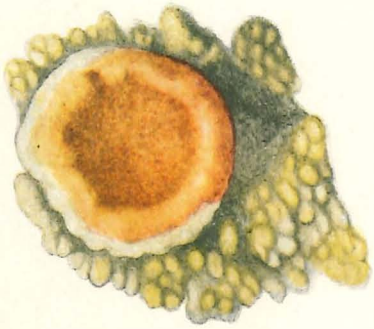


Fig. 508

Fig. 507

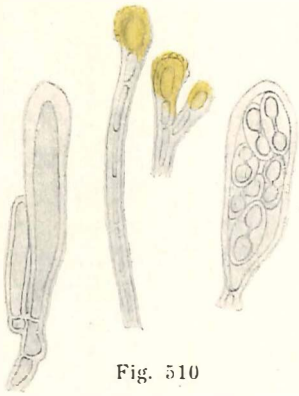


Fig. 510

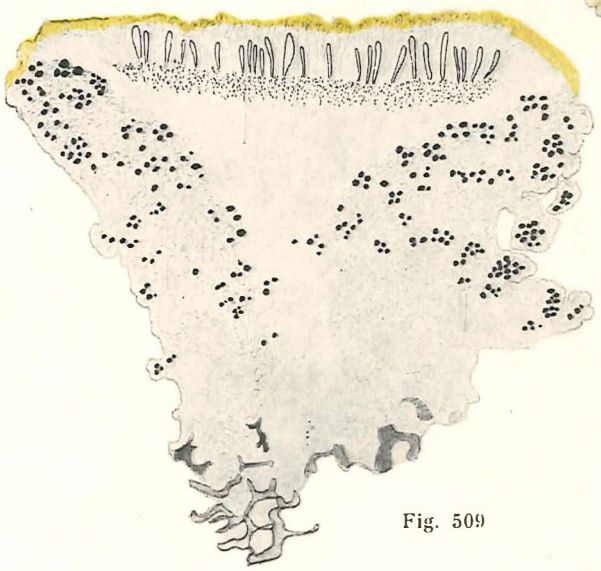


Fig. 509

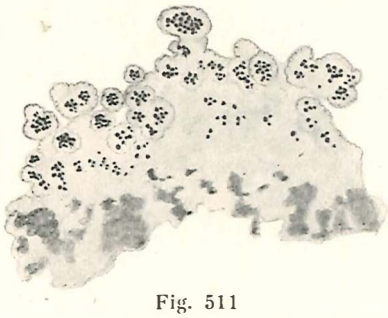


Fig. 511

O. Galløe del.

CALOPLACA PHLOGINA Ach.

V. P 25

PLATE 99.

CALOPLACA PHLOGINA.

ACH.

Fig. 512. Vertical section of thallus. Above to the left a soredium on the point of loosening. (× 620).

Fig. 513. Margin of an apothecium. Note the broad proper margin. The dark shades seen in the paraphyses, the proper margin, and in some portions of the thalline margin represent the yellow-pigmentated portions. (× 620).

Fig. 514. Cells from a longitudinal section of stipes. (× 840).

Fig. 515. Two ripe asci. (× 747).

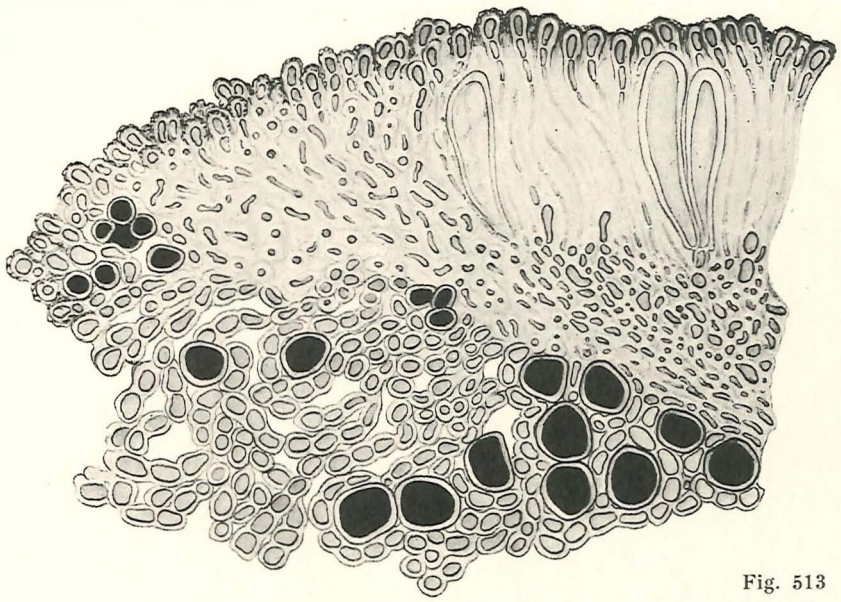


Fig. 513

Fig. 512

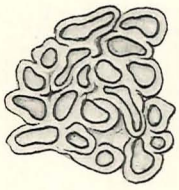


Fig. 514

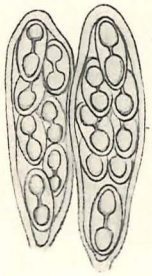


Fig. 515

O. Galløe del.

CALOPLACA PHLOGINA Ach.

PLATE 100.

CALOPLACA CITRINA.

HOFFM.

Specimen 1.

Fig. 516. Thallus with apothecia arranged in a fairy-ring. (× 20).

Fig. 517. Margin of thallus; it is granular and partly grey, partly citrine. (× 80).

Fig. 518. Vertical section of apothecium and thallus. There is a thick and distinct margo proprius and beneath it a thin margo thallinus. In several places soredia are on the point of loosening from the surface of the thallus. (× 140).

Fig. 519. Paraphyses. (× 747).

Specimen 2.

Fig. 520. Very young individual. The thallus is grey, developing soredia, which at first are grey but gradually turn yellow as they ripen. (× 80).

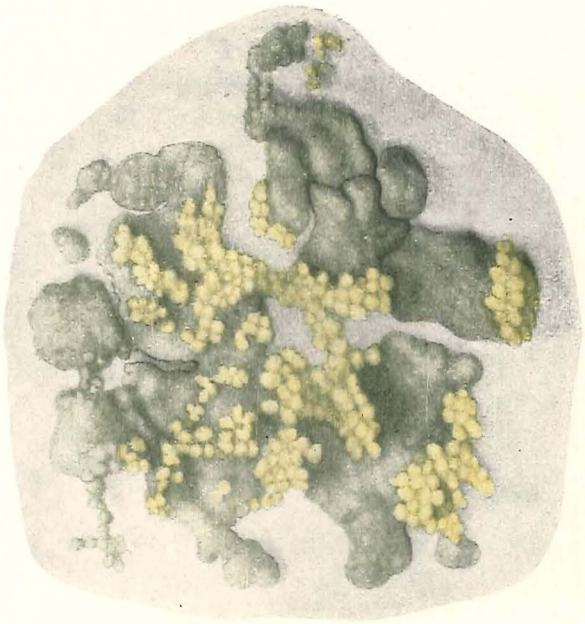


Fig. 520

Fig. 517

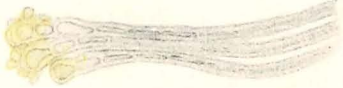


Fig. 519

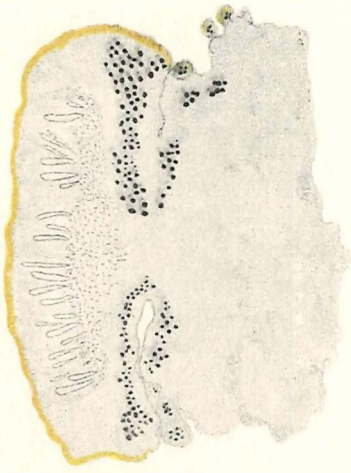


Fig. 518

Fig. 516

O. Galloe del.

CALOPLACA CITRINA HOFFM.
(Specimen 1, 2).

PLATE 101.

CALOPLACA CITRINA.

HOFFM.

Specimen 1.

Fig. 521. Vertical section of thallus. To the left two yellow soredia (here shaded dark). (× 620).

Fig. 522. Soredia. The two to the left were yellow while the three others were greyish. (× 840).

Fig. 523. Margin of apothecium. Note the thick proper margin. Below to the left a soredium is on the point of loosening from the thalline margin. (× 620).

Fig. 524. Ascogenous cells, with two very young asci. (× 747).

Fig. 525. Ascogenous cells, with four somewhat older but still unripe asci. (× 747).

Fig. 526. Ripe ascus. To the left an abnormal two-celled spore. (× 747).

Fig. 527. Hyphæ from a longitudinal section of stipes. (× 1053).

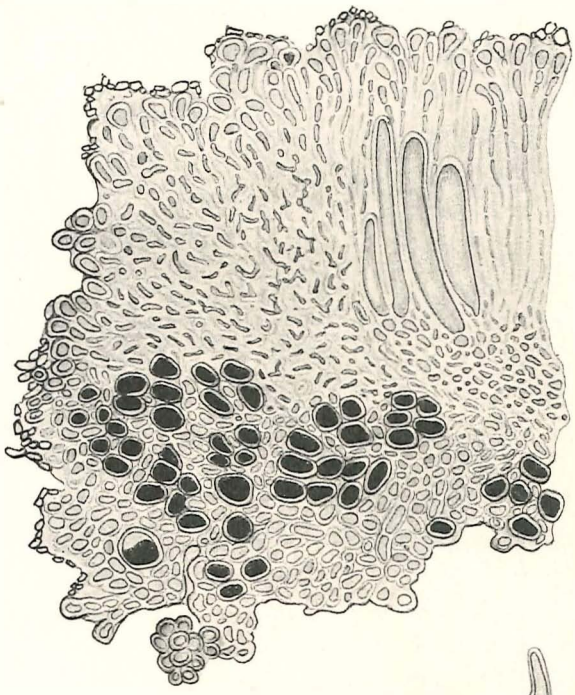


Fig. 523

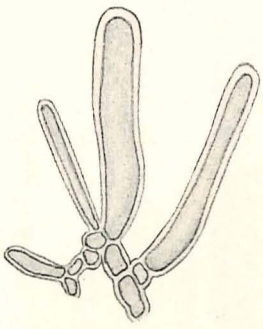


Fig. 525

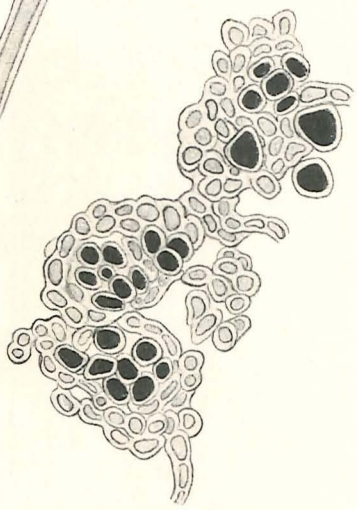
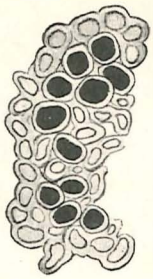


Fig. 522



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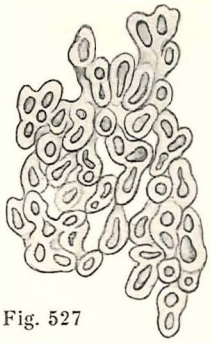


Fig. 527

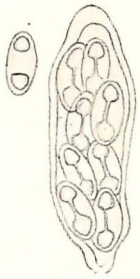


Fig. 526

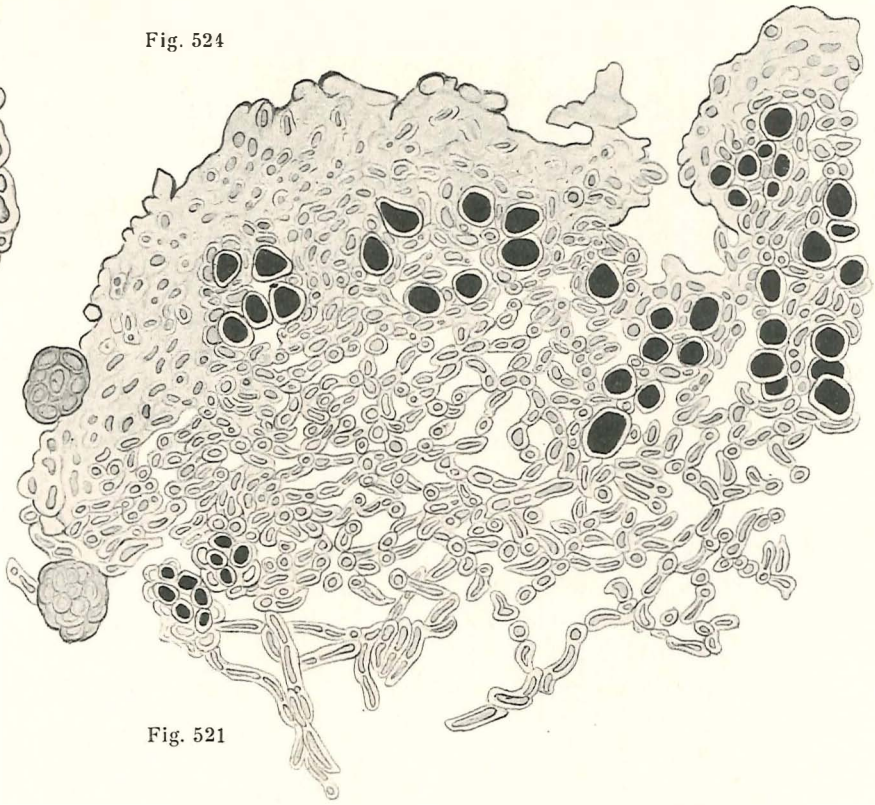


Fig. 521

O. Galløe del.

CALOPLACA CITRINA HOFFM.
(Specimen 1).

PLATE 102.

CALOPLACA MURORUM

HOFFM.

Specimen 1.

Fig. 528. About one quadrant of the whole of the orbicular thallus (*vide* the text). (× 20).

Specimen 2.

Fig. 529. Young, sterile thallus, a seedling with yellow margin and grey centre. (× 20).

Specimen 3.

Fig. 530. About one quadrant of the whole of the orbicular thallus. (× 20).

Fig. 531. Longitudinal section through thallus, with an apothecium. (× 80).

Fig. 532. Apical cells of hyphæ from margo proprius, with parietine on the surface of the cell-walls. (× 840).

Fig. 533. Cells from tre surface of margo thallinus, with parietine between the hyphæ. (× 840).

Fig. 534. Paraphyses and a ripe ascus. (× 747).

Fig. 528

Fig. 530

Fig. 529

Fig. 533

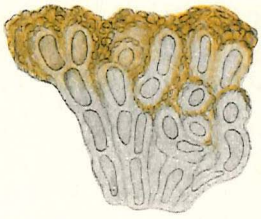


Fig. 532

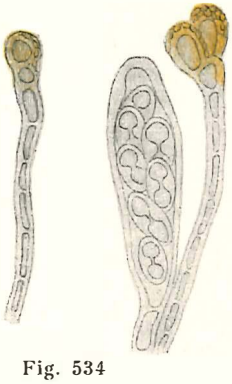


Fig. 534

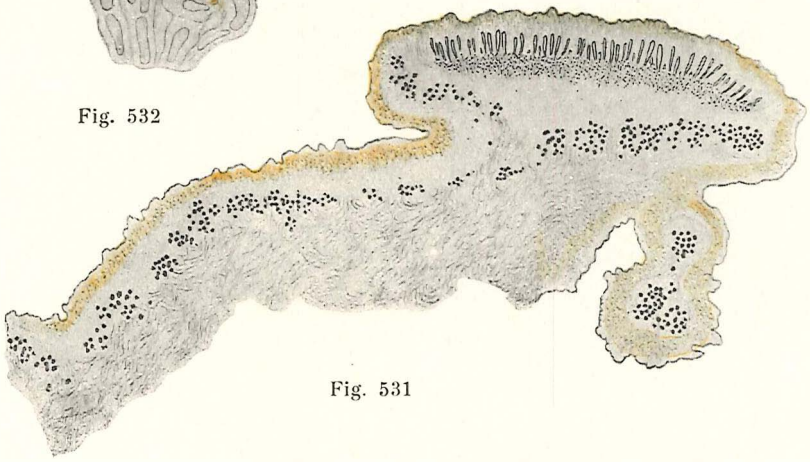


Fig. 531

O. Galløe del.

CALOPLACA MURORUM HOFFM.
(Specimen 1, 2, 3).

PLATE 103.

CALOPLACA MURORUM

HOFFM.

Specimen 3.

Fig. 535. Longitudinal section of margin of thallus. Note how the cortex of the upper surface is abruptly replaced by the rhizoidal hyphæ of the margin and of the lower surface of the thallus (the rhizoids are probably able to take in gonidial algæ). (× 620).

Fig. 536. Cortex, with cuticle, granules of parietine in the cortex (here shaded dark), and the gonidial layer beneath the cortex. (× 840).

Fig. 537. Above, two gonidia. Below, the medulla. (× 840).

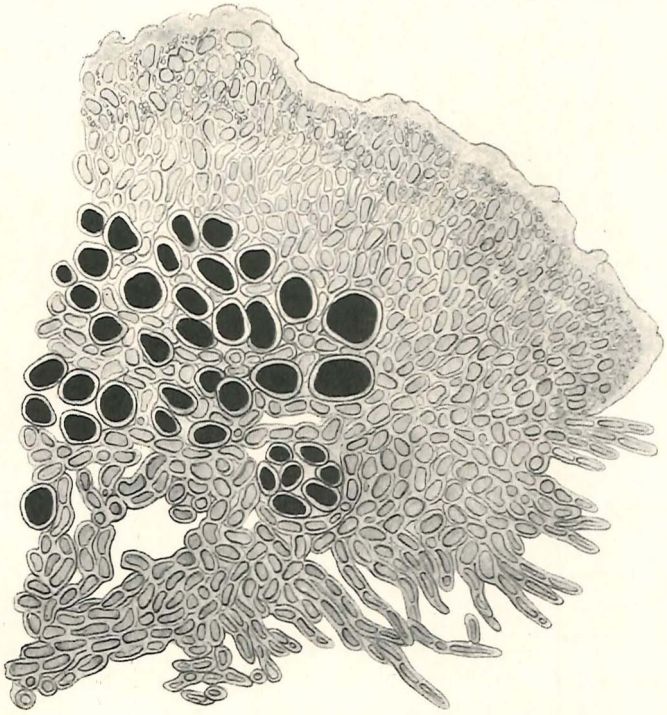


Fig. 535

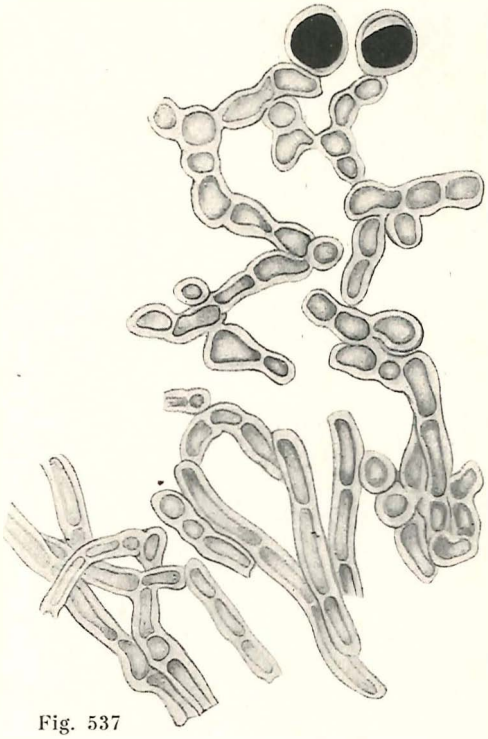


Fig. 537

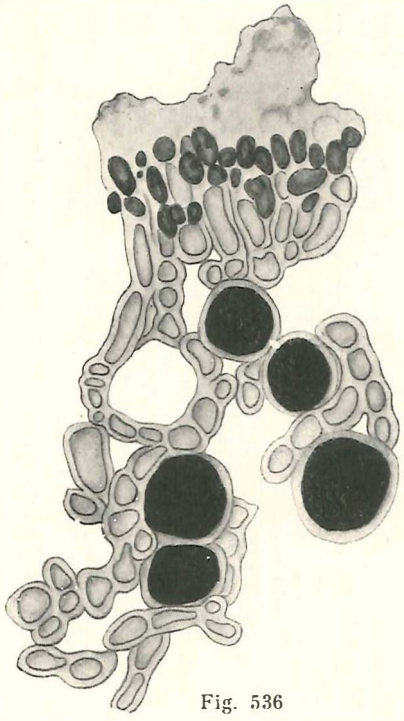


Fig. 536

O. Galløe del.

CALOPLACA MURORUM HOFFM.
(Specimen 3).

PLATE 104.

CALOPLACA MURORUM

HOFFM.

Specimen 3.

Fig. 538. Margin of apothecium, with margo proprius and margo thallinus; the latter has granules of parietine between the hyphæ. (× 620).

Fig. 539. Vertical section of the bottom of calyx (the dense tissue above in the figure); below this gonidia, and further down the medullary layer. (× 840).

Fig. 540. Young ascus and primordia of two other asci issuing from an ascogenous hypha. (× 840).

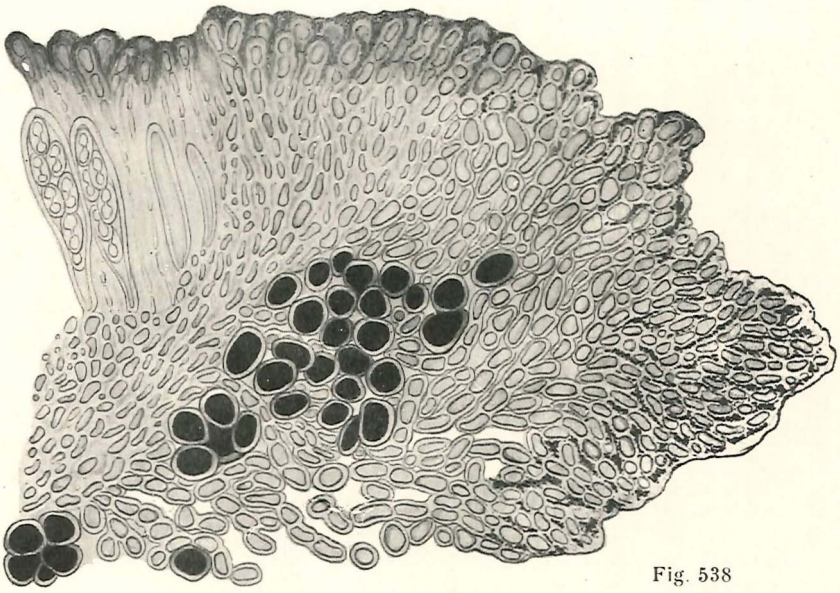


Fig. 538

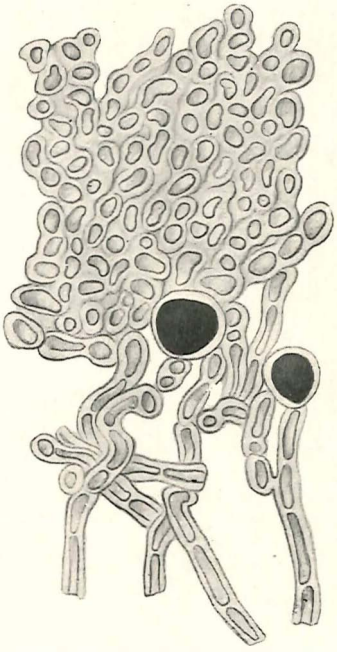


Fig. 539

Fig. 540

O. Galløe del.

CALOPLACA MURORUM HOFFM.
(Specimen 3).

PLATE 105.

CALOPLACA LOBULATA

FLK.

Fig. 541. Thallus with apothecia. (× 20).

Fig. 542. Thallus with apothecia. The margin of thallus is to the right in the picture; it is in part effigurate and micro-lobulate. Numerous areoles have radiating dark hyphæ (*vide* the text). (× 33).

Fig. 543. Areoles and two apothecia. (× 80).

Fig. 544. Partially confluent areoles connected with grey interareolar thallus. (× 80).

Fig. 545. Thallus, with yellow cortex. (× 140).

Fig. 546. Areole with apothecium. (× 100).

Fig. 541

Fig. 542

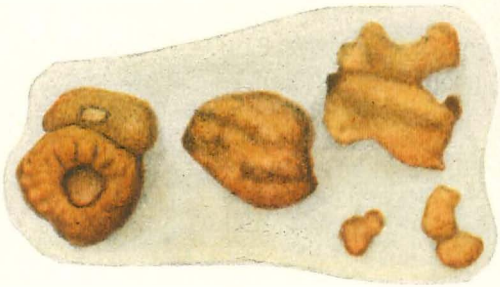


Fig. 543

Fig. 545

Fig. 544

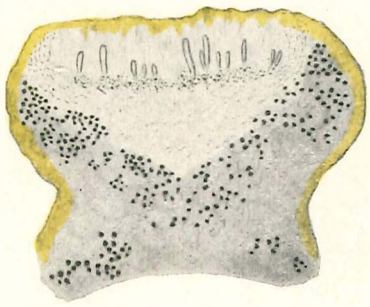


Fig. 546

O. Galløe del.

CALOPLACA LOBULATA Flk.

V. P 27

PLATE 106.

CALOPLACA LOBULATA

FLK.

Fig. 547. Thallus. The dark granules in the cortex are parietine. (× 620).
Fig. 548. Cortex and gonidial layer. (× 840).
Fig. 549. Hymenium with unripe ascus, and hypothecium. (× 840).
Fig. 550. Hyphæ with parietine, from margo proprius. (× 840).
Fig. 551. Ascus with spores. (× 747).

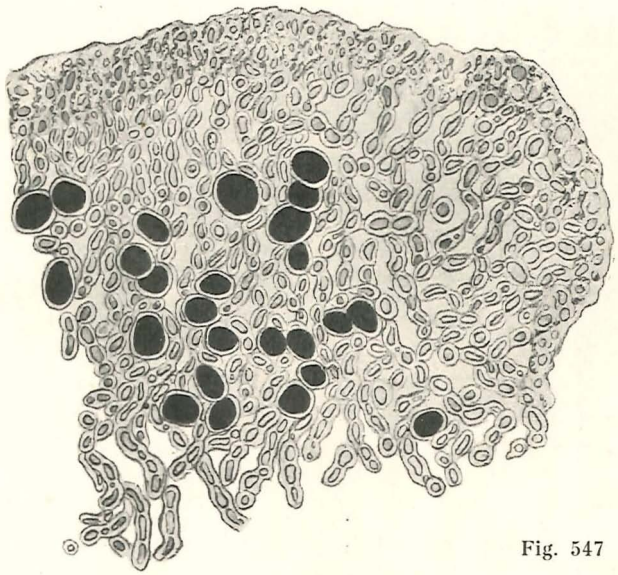
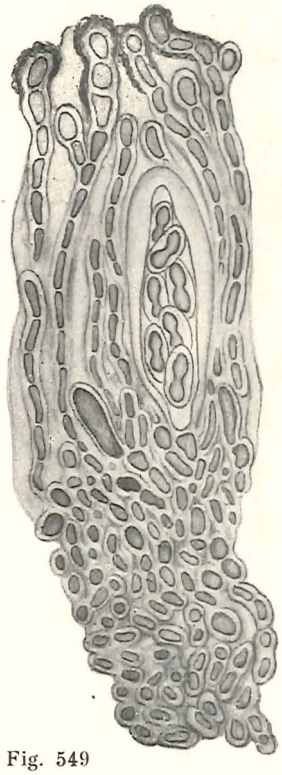


Fig. 547



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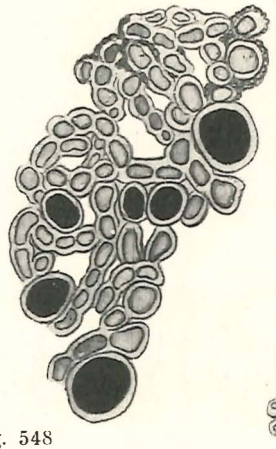

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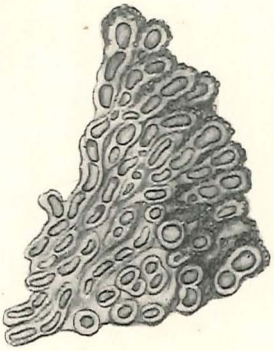


Fig. 550

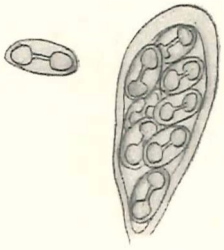


Fig. 551

O. Galløe del.

CALOPLACA LOBULATA Flk.

PLATE 107.

GYALECTA ULMI

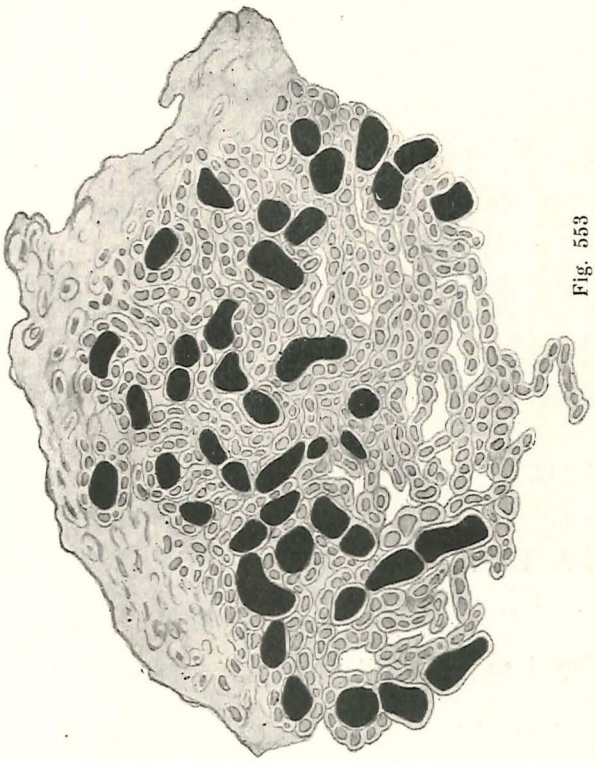
Sw.

Fig. 552. Thallus spreading over moss. In several places the moss protrudes through the thallus. The margin of thallus is above in the picture. (× 20).

Fig. 553. Vertical section of thallus, with *Trentepohlia*—gonidia. (× 620).

Fig. 554. Portion of a moss-leaf (at the bottom of the figure), with rhizoidal hyphæ from the thallus of the lichen. (× 840).

Fig. 555. Three isolated gonidia, with surrounding hyphæ. (× 840).



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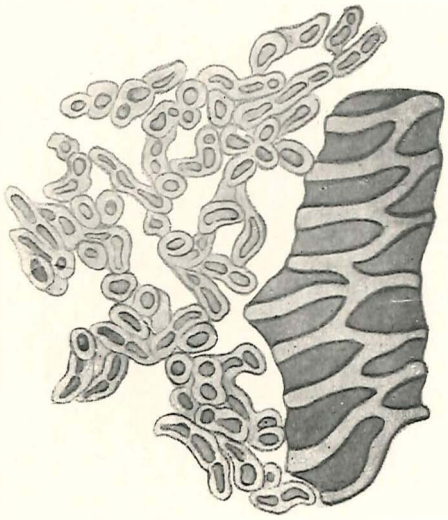

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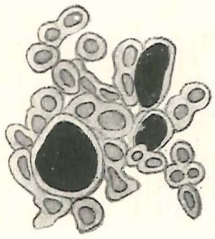


Fig. 555

Fig. 552

O. Galløe del.

GYALECTA ULMI Sw.

PLATE 108.

GYALECTA ULMI
Sw.

Fig. 556. Apothecium, with well-developed calyx. Part of a moss-leaf is seen at the bottom of the picture. (× 620).

Fig. 557. Portion of margin of apothecium. The thalline margin is drawn to the full only at the top of the picture. Note the greatly developed calyx. (× 620).

Fig. 558. Young ascus issuing from an ascogenous hypha, together with five paraphyses, the tips of which are surrounded by 'sockets' of a red pigment. (× 747).

Fig. 559. Vertical section of hypothecium with ascogenous cells and a very young ascus. Below, some nearly horizontal hyphæ from the bottom of calyx. (× 747).

Fig. 560. Ripe ascus. (× 747).

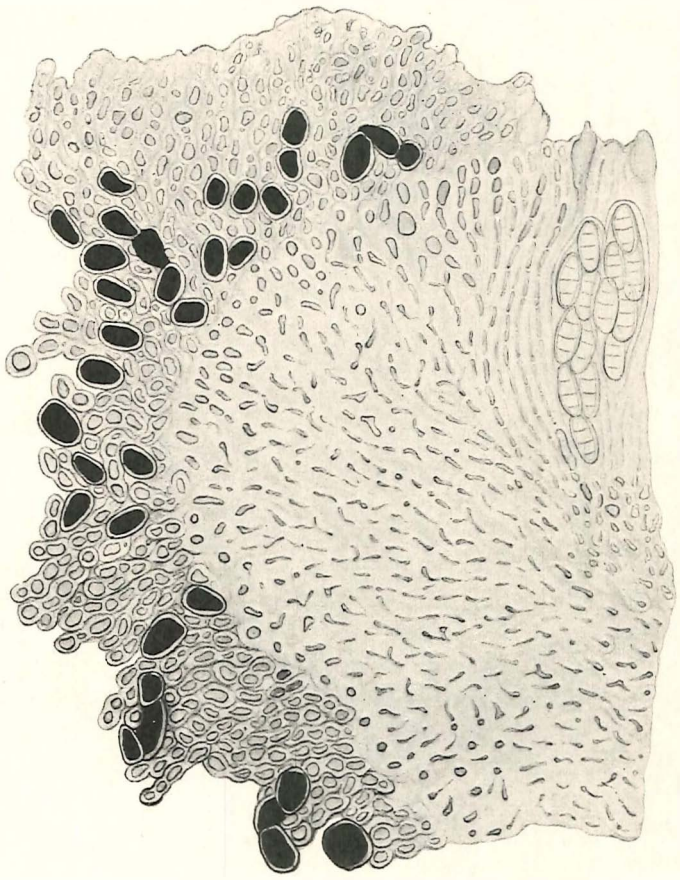


Fig. 557

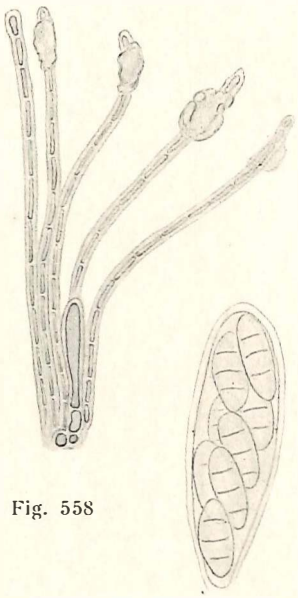
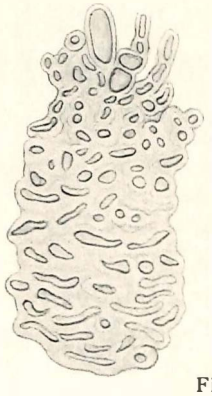


Fig. 558

Fig. 560



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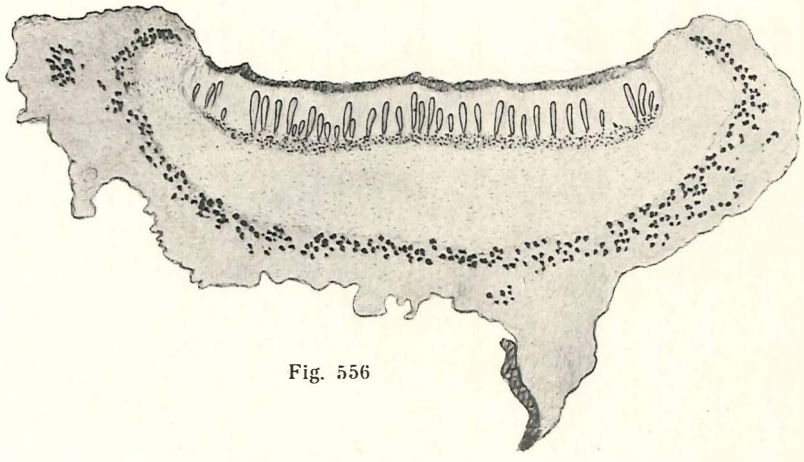

Fig. 556

O. Galløe del.

GYALECTA ULMI Sw.

PLATE 109.

DIPLOSCHISTES SCRUPOSUS
L.

Fig. 561. Margin of thallus growing on moss. (× 20).

Fig. 562. Older portion of thallus, with young apothecia provided with a double margin.

Fig. 563. Older apothecia. Below to the right an old apothecium, on the margin of which some few young apothecia (prolifications) of second order have been developed. (× 20).

Fig. 564. Thallus, with an old apothecium. Note the greatly developed, high proper margin. (× 33).

Fig. 565. Two ripe spores, and the apex of a paraphysis. (× 620).

Fig. 566. Cortex and gonidial layer. (× 840).

Fig. 561

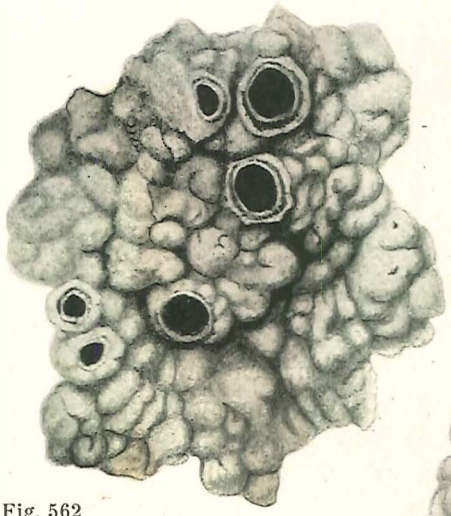

Fig. 562

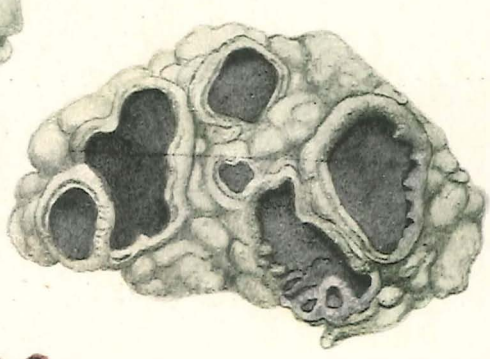

Fig. 563

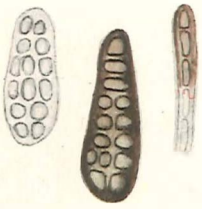

Fig. 565

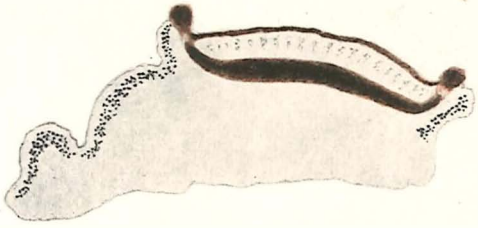

Fig. 564

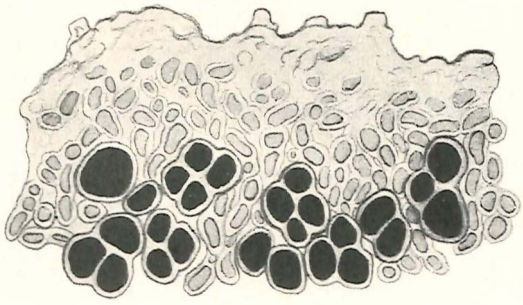

Fig. 566

O. Galløe del.

DIPLOSCHISTES SCRUPOSUS L.

PLATE 110.

DIPLOSCHISTES SCRUPOSUS
L.

Fig. 567. Margin of apothecium. The greatly developed proper margin, the cells of which are partly colourless, partly brown, is seen inside the thalline margin. (× 140).

Fig. 568. Brown hyphæ from the inner parts of margo proprius. The brown colour is chiefly found in the outer layers of the cell-walls. (× 840).

Fig. 569. Hymenium, below passing into a colourless hypothecium with ascogenous hyphæ. Beneath this the dark-brown calyx. (× 840).

Fig. 570. Hyphæ from the medulla of thallus. (× 840).

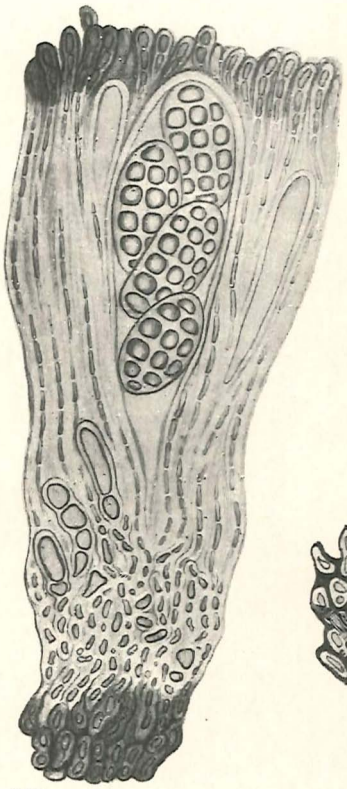

Fig. 569

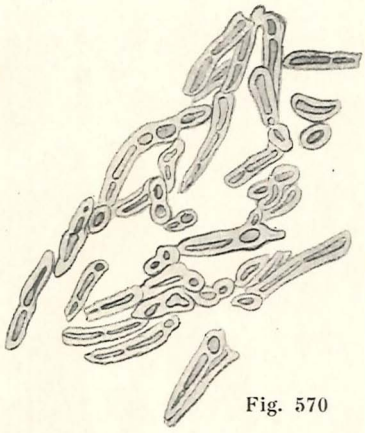

Fig. 570

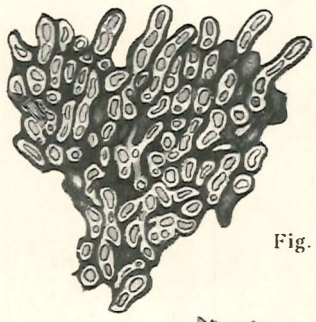

Fig. 568

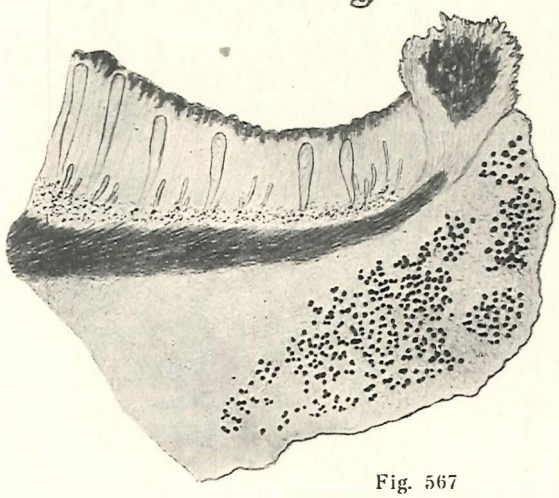

Fig. 567

O. Galløe del.

DIPLOSCHISTES SCRUPOSUS L.

PLATE 111.

THELOTREMA LEPADINUM

ACH.

Fig. 571. Thallus on the periderm of *Fagus silvatica*. The big, dark spots to the right in the figure represent a fungus. The centre of the thallus is to the left. (× 6).

Fig. 572. Thallus with apothecium. Note the mighty, high margo proprius. (× 80).

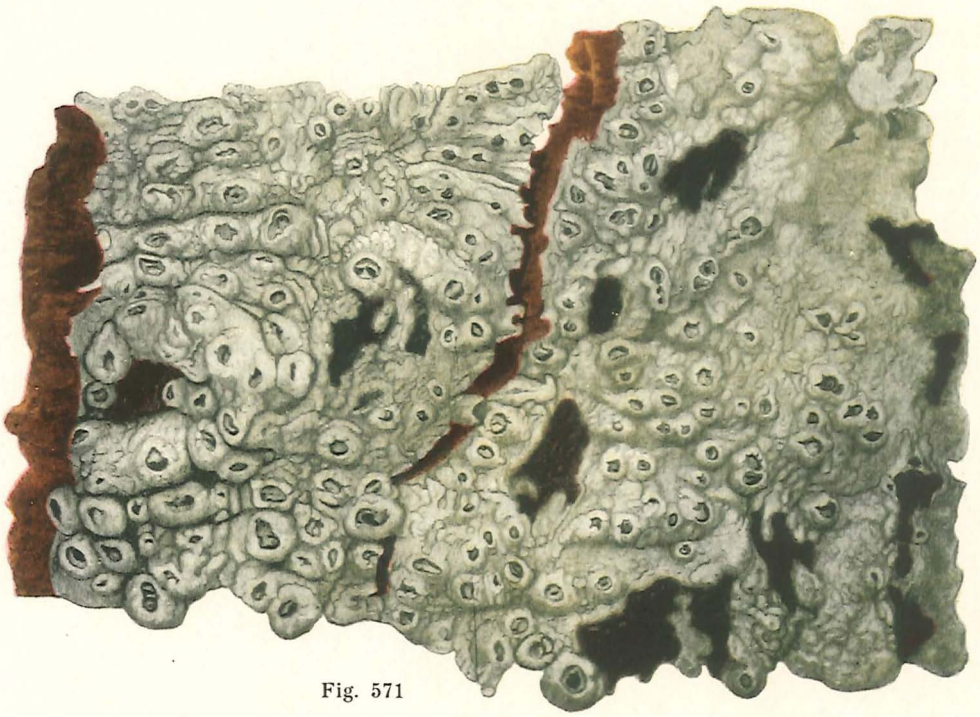

Fig. 571

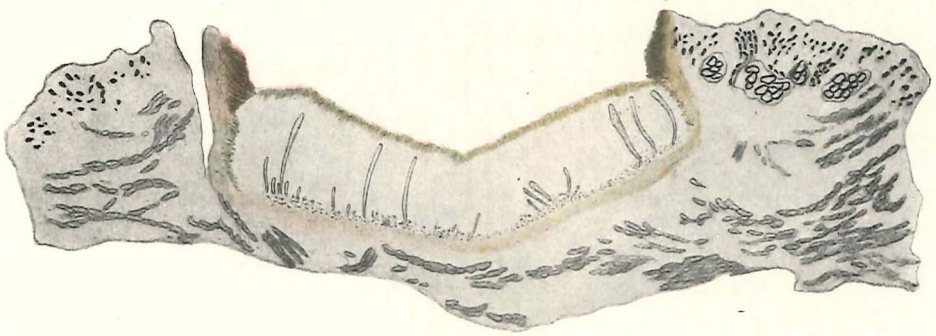

Fig. 572

O. Galløe del.

THELOTREMA LEPADINUM Ach.

PLATE 112.

THELOTREMA LEPADINUM

ACH.

Fig. 573. Young, smooth portions of thallus with young apothecia. (× 10).

Fig. 574. Older portions of thallus with old apothecia. Margo proprius is seen inside the thalline margin. (× 10).

Fig. 575. Surface of thallus. There is no genuine cortex. (× 840).

Fig. 576. Group of white granules (of oxalate of calcium?) between the *Trentepohlia*-gonidia. Particles of the periderm of the substratum-plant are seen on the surface of thallus. (× 840).

Fig. 577. Medullary hyphæ between the lamellæ of the substratum-bark. (× 840).

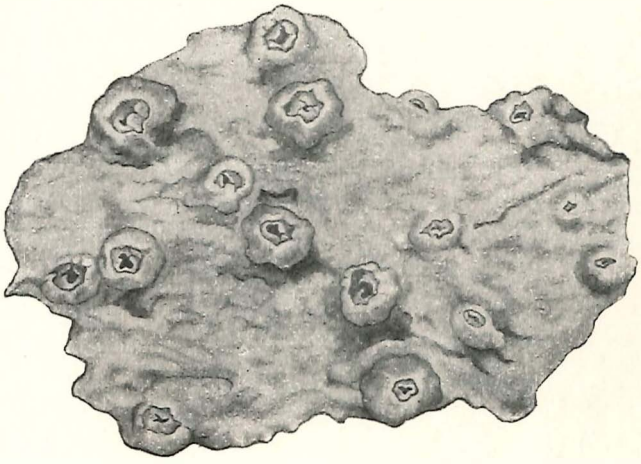

Fig. 573

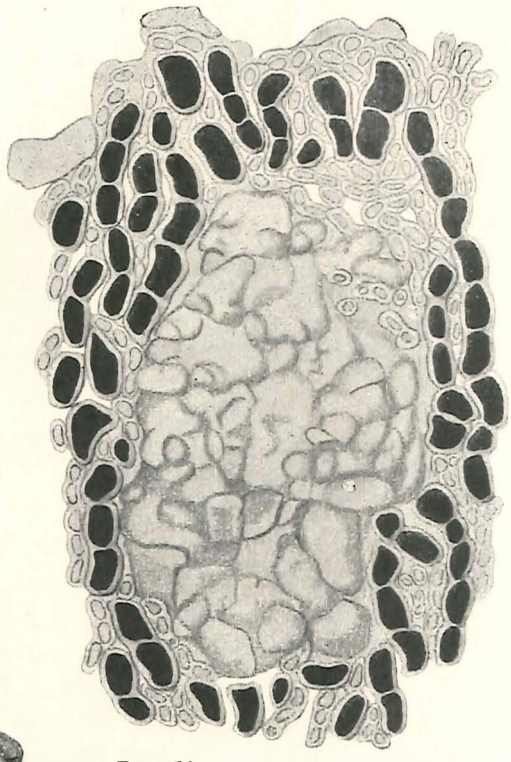

Fig. 576

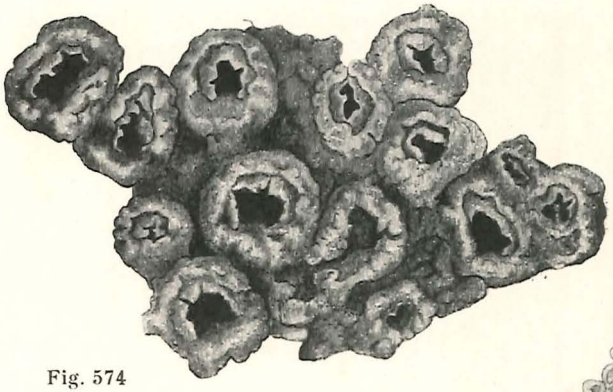

Fig. 574

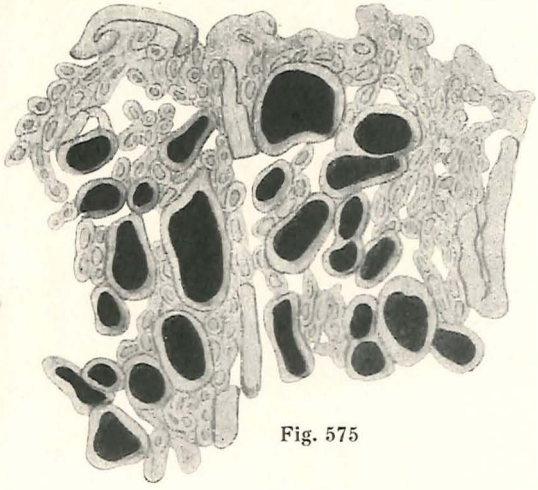

Fig. 575

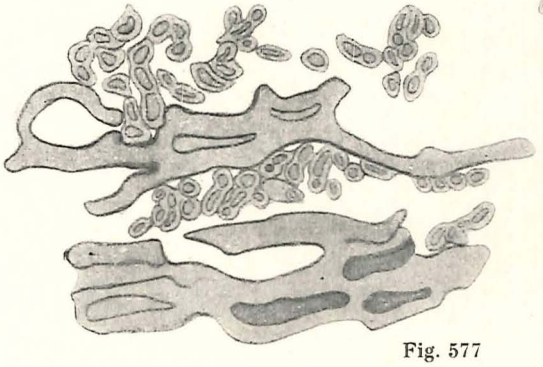

Fig. 577

O. Galløe del.

THELOTREMA LEPADINUM Ach.

PLATE 113.

THELOTREMA LEPADINUM

ACH.

Fig. 578. Margin of apothecium (the thalline margin is omitted in the figure). Note the horizontal hyphæ at the inside of margo proprius, which otherwise is composed of erect hyphæ. Calyx beneath the hypothecium is faintly brownish. (× 620).

Fig. 579. Two ripe spores. (× 747).

Fig. 580. Two ripe spores. (× 747).

Fig. 581. Horizontal section of paraphyses in hymenial gelatine. (× 747).

Fig. 582. Unripe ascus. (× 747).

Fig. 583. Ripe ascus. (× 747).

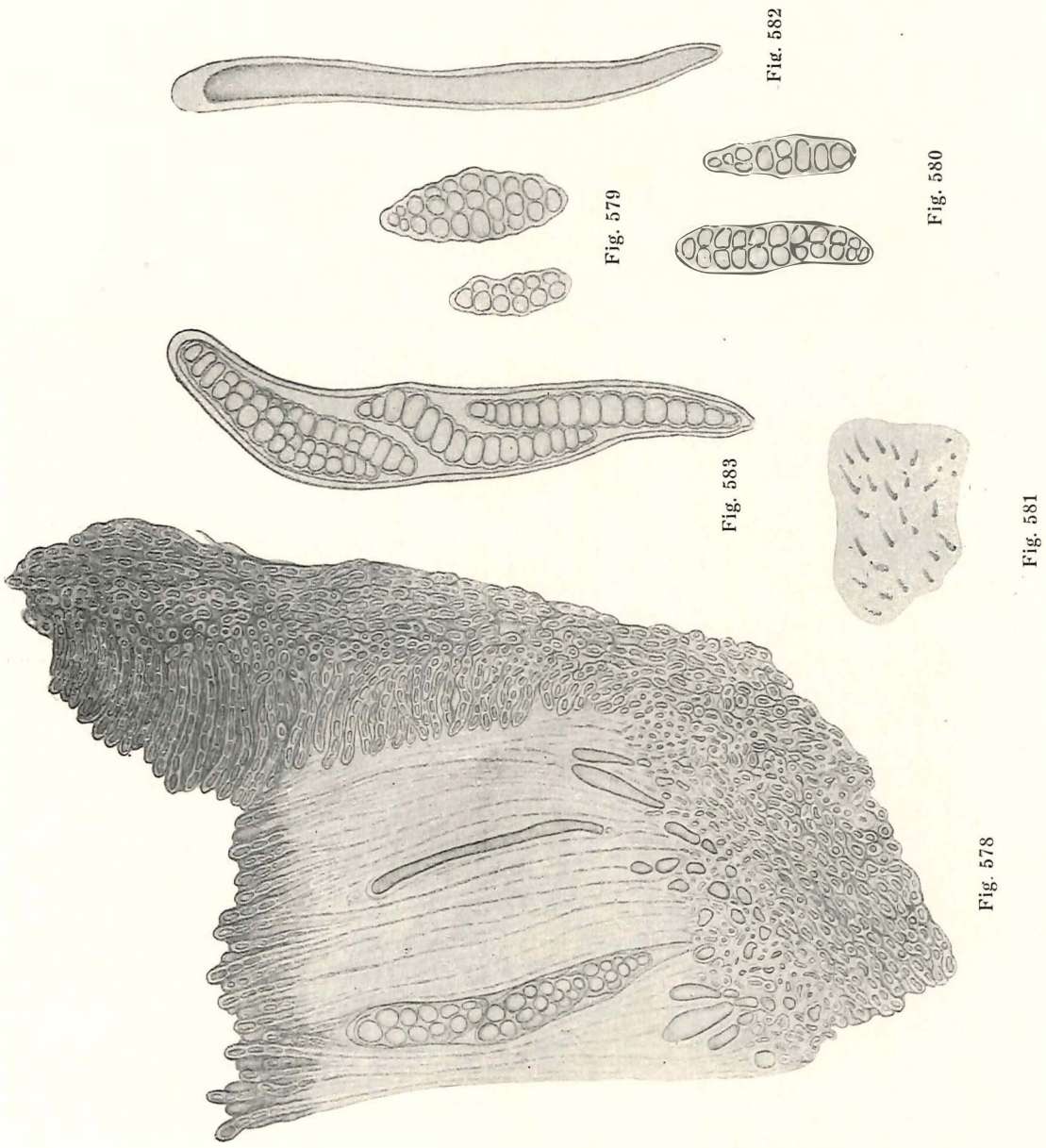

Fig. 582

Fig. 579

Fig. 580

Fig. 583

Fig. 581

Fig. 578

O. Galløe del.

THELOTREMA LEPADINUM Ach.

PLATE 114.

PHLYCTIS ARGENA

ACH.

Fig. 584. Thallus with soralia. A single apothecium is seen on a level with *a*. A special picture is drawn of this soral, including the apothecium. The thallus is wholly hemmed in by other lichens *(Lecanora subfusca* at *a, Lecanora intumescens, Lecanora carpinea, Lecidea elœvchroma).* (× 5).

Fig. 585. Portion of thallus (greyish) with a small soral, in which there is one apothecium. (× 80).

Fig. 585

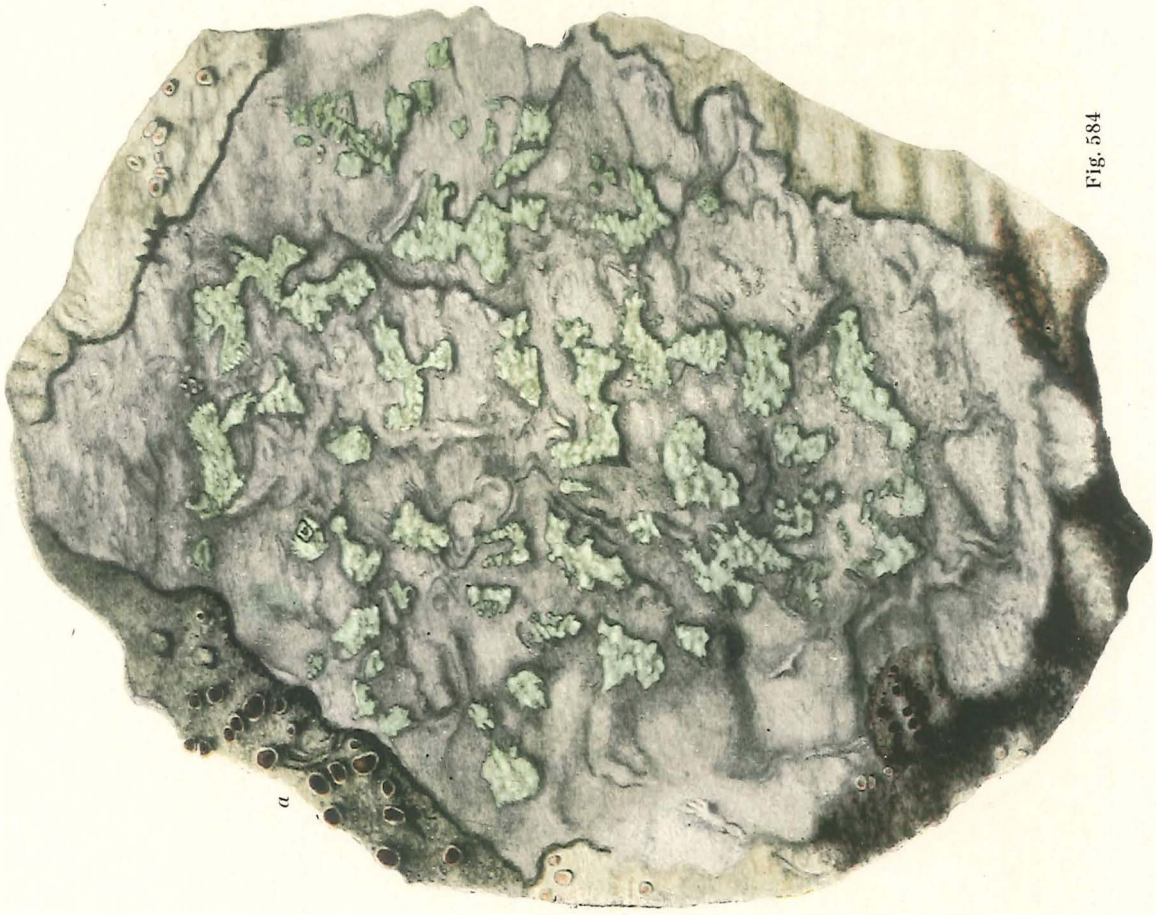

Fig. 584

O. Galløe del.

PHLYCTIS ARGENA Ach.

PLATE 115.

PHLYCTIS ARGENA

ACH.

Fig. 586. Vertical section of thallus. To the left in the section a soral, to the right the smooth thallus. (× 100).

Fig. 587. Thallus, with lamellæ of the periderm of *Fagus*. (× 840).

Fig. 588. Apothecium. The surrounding soredia have fallen off in the section. Note a single group of gonidia in the right side of margo proprius. (× 140).

Fig. 589. Margin of apothecium. Just to the left of the paraphyses is seen the calyx (the parathecium), which merges into the ordinary tissue of the thallus at the very top of the picture. In this section there were no gonidia in the tissues of the thallus to the left of the calyx. (× 620).

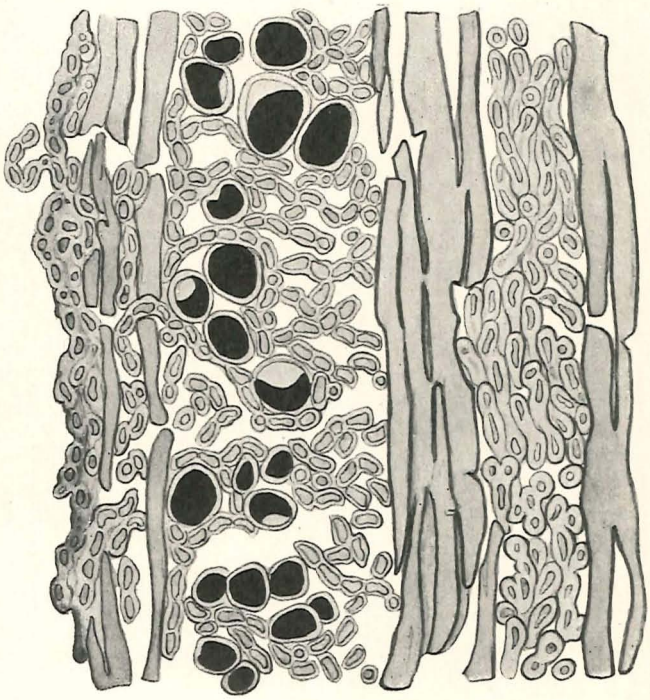

Fig. 587

Fig. 588

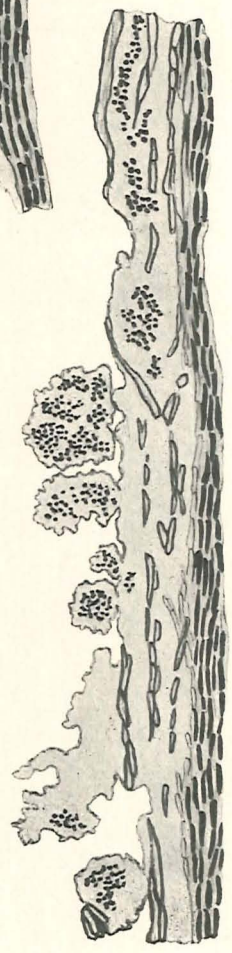

Fig. 586

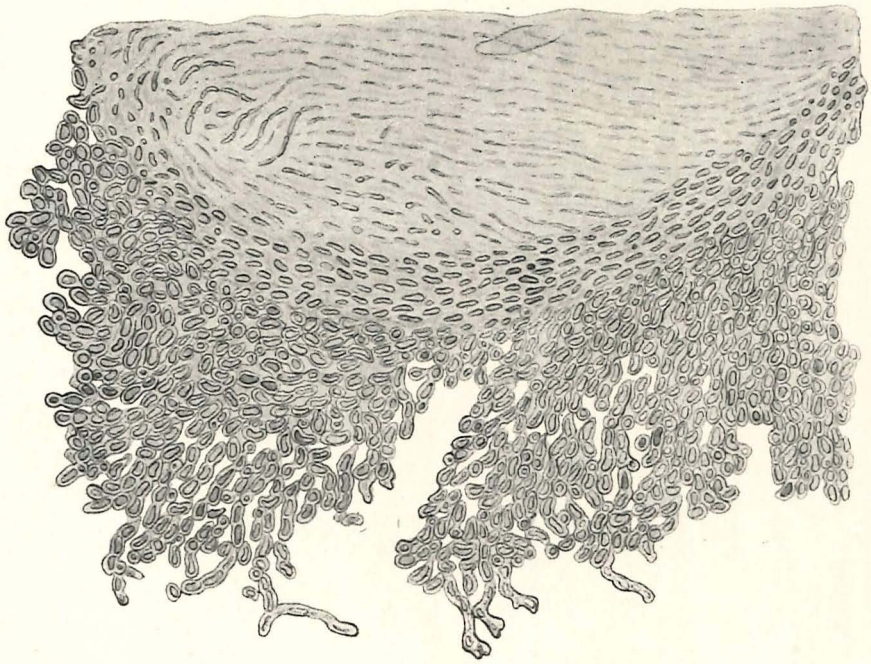

Fig. 589

PHLYCTIS ARGENA Ach.

O. Galløe del.

PLATE 116.

PHLYCTIS ARGENA

ACH.

Fig. 590. Faintly brownish hypothecium with ascogenous hyphæ, bases of paraphyses, and one unripe ascus. (× 620).

Fig. 591. Hypothecium and hymenium, with one ripe ascus. (× 620).

Fig. 592. Ripe spore. (× 747).

Fig. 593. Ripe, germinating spore. (× 620).

Fig. 594. Paraphyses and hymenial gelatine, cut across. (× 747).

Fig. 595. Transverse section of spore. (× 747).

Fig. 596. Soredium. (× 620).

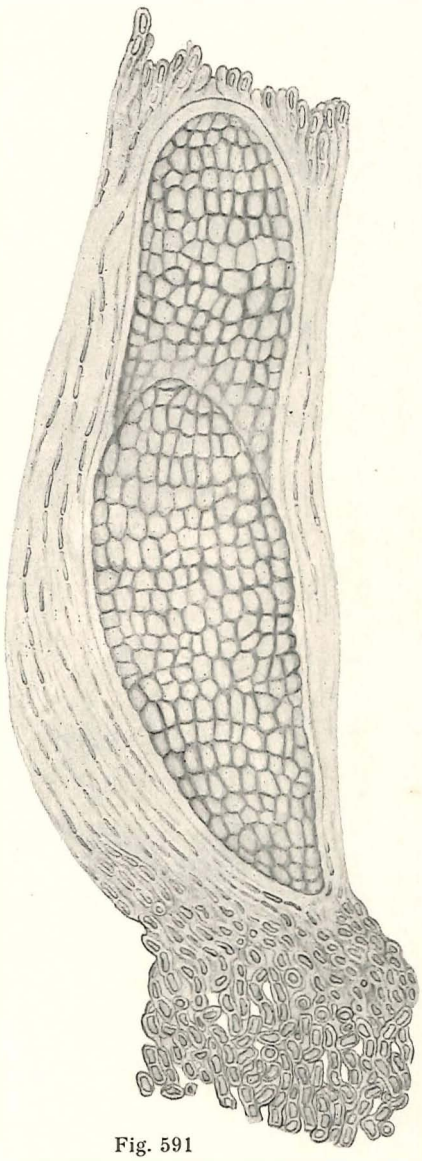

Fig. 591

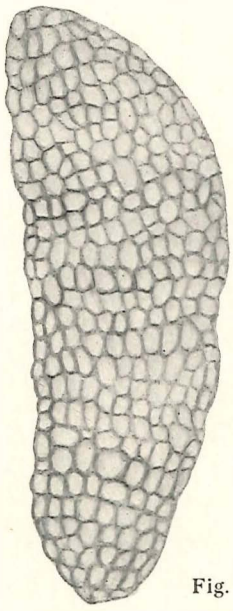

Fig. 592

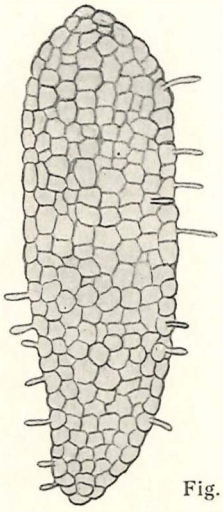

Fig. 593

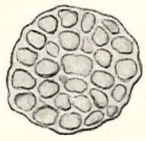

Fig. 595

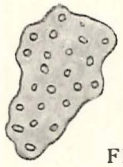

Fig. 594

Fig. 590

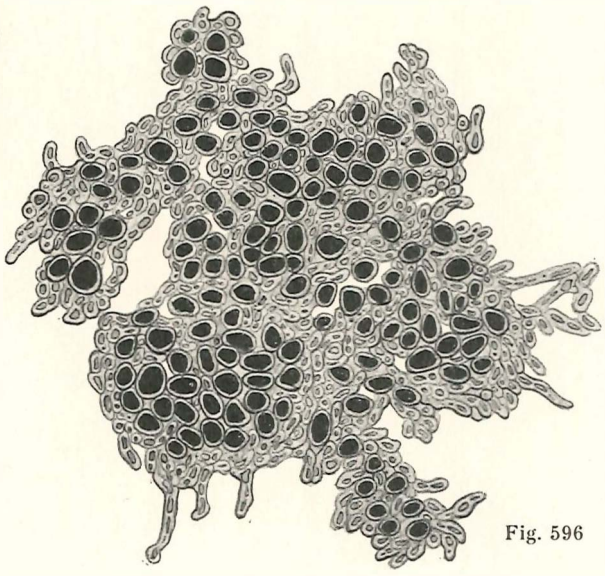

Fig. 596

O. Galløe del.

PHLYCTIS ARGENA Ach.

PLATE 117.

PHLYCTIS AGELÆA

ACH.

Fig. 597. Thallus on periderm. Unfortunately, the present picture is in some respects rather confusing, because it shows two species of lichens growing promiscually in a confounding mixture: The big, black apothecia belong to a *Lecidea elæochroma,* interspersed between the small, irregular apothecia of *Phlyctis agelæa.* The whole of the examined specimen (together with several others) was of such a peculiar mixture. Above to the left the picture shows a pure collection of apothecia of *Phlyctis* in a verruca; to the right of this is seen a thin, pure thallus of *Phlyctis agelæa.* (× 20).

Fig. 598. Verruca with one apothecium. (× 80).

Fig. 599. Verruca with several apothecia. (× 80).

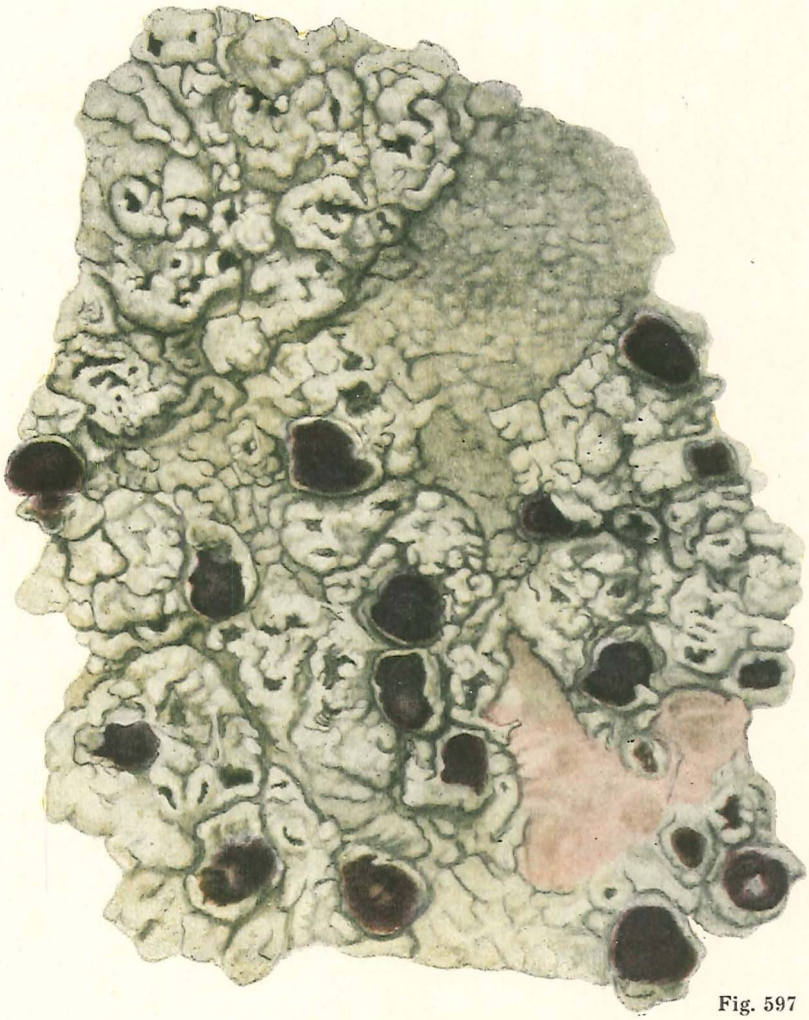

Fig. 597

Fig. 599

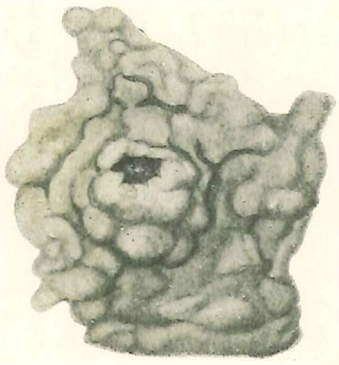

Fig. 598

O. Galløe del.

PHLYCTIS AGELÆA. Ach.

PLATE 118.

PHLYCTIS AGELÆA

ACH.

Fig. 600. Thallus with apothecia. An apothecium with calyx is seen at the extreme left of the figure; at the extreme right an old apothecium, consisting of an old hymenium of paraphyses only, but no asci. In the hypothecium a fresh, young apothecium is about to be developed through a regeneration; of this apothecium a special picture is given in Fig. 601. (× 100).

Fig. 601. Primordium of an apothecium, consisting of paraphyses and ascogenous hyphæ, but not yet any asci. This primordium has been developed in the old, functionless apothecium mentioned above and pictured in Fig. 600. (× 620).

Fig. 602. Thallus. (× 100).

Fig. 603. Portion of the uneven surface of a verruca. To the left it is in part corticate. A periderm-lamella protrudes through the surface of the verruca. (× 620).

Fig. 604. Portion of smooth thallus from the thallus connecting the verrucæ. This picture shows the cortex and the gonidial layer. (× 1053).

Fig. 605. Rhizoidal hyphæ between the substratum-cells. (× 1053).

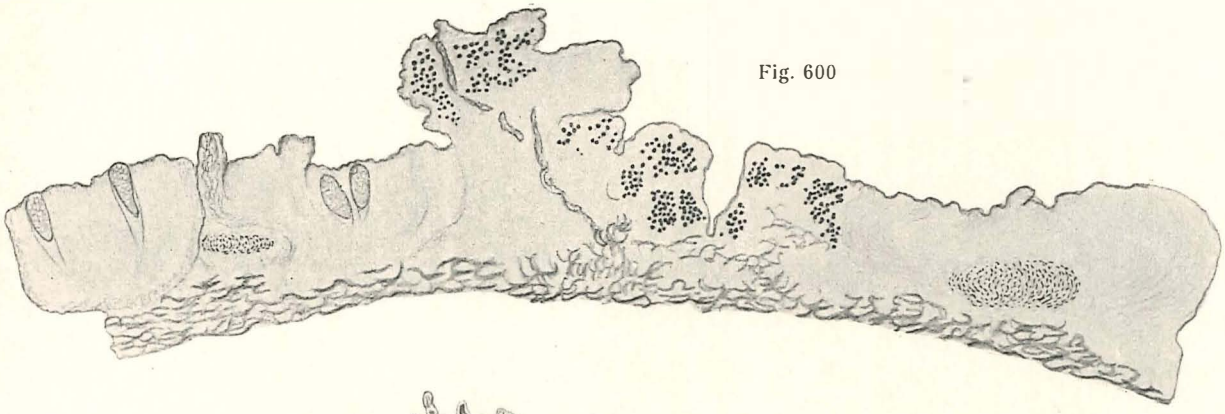

Fig. 600

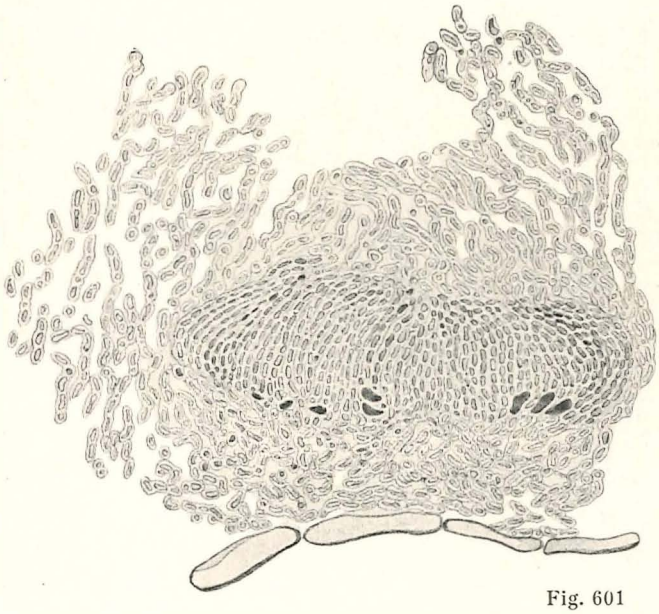

Fig. 601

Fig. 603

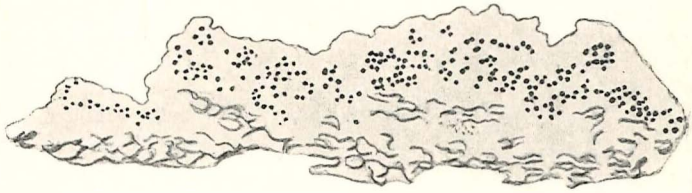

Fig. 602

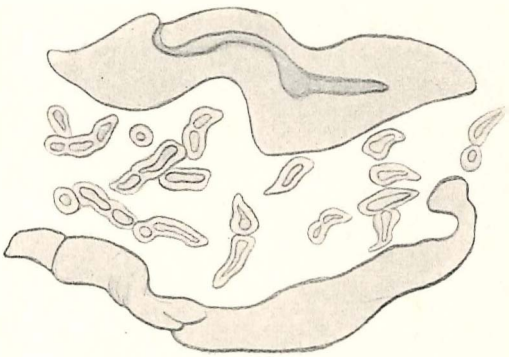

Fig. 605

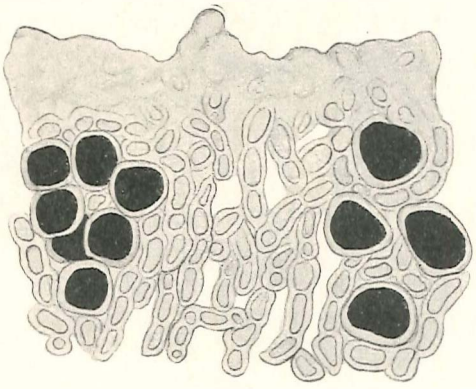

Fig. 604

O. Galløe del.

PHLYCTIS AGELÆA Ach.

PLATE 119.

PHLYCTIS AGELÆA

ACH.

Fig. 606. Young primordium of apothecium, with young asci. The hymenium is surrounded by a thin parathecium. Distinct, ascogenous cells are seen in the hypothecium.

Fig. 607. Ripe ascus. (× 747).

Fig. 608. Ripe spore with papillæ. (× 747).

Fig. 609. Horizontal section of paraphyses embedded in hymenial gelatine. (× 747).

Fig. 610. Tips of paraphyses, faintly brown. (× 1053).

Fig. 611. Anastomosed paraphyses. (× 1053).

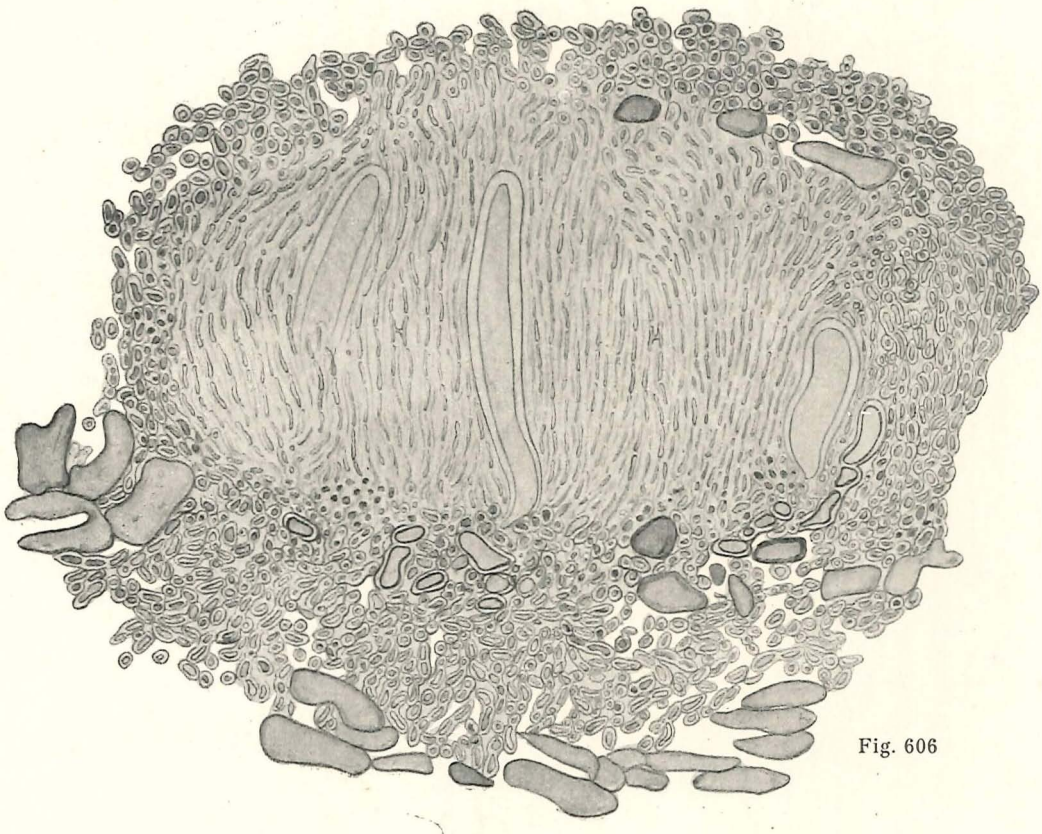

Fig. 606

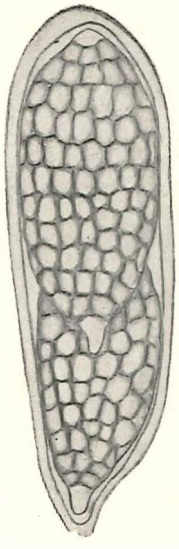

Fig. 607

Fig. 608

Fig. 611

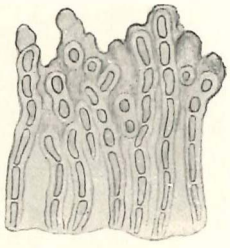

Fig. 610

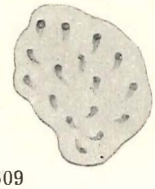

Fig. 609

O. Galløe del.

PHLYCTIS AGELÆA Ach.

PLATE 120.

RINODINA PYRINA

ACH.

Fig. 612. Bark with thallus and apothecia at all ages. To the left in the picture young seedlings of a *Xanthoria*. (× 20).

Fig. 613. Three young apothecia. The left one has a thalline margin; in the other two the margin is still invisible. Thallus is very thin. (× 80).

Fig. 614. Top series: To the left an unripe ascus; next, a preparation showing paraphyses, an unripe ascus, a ripe ascus, and ascogenous hyphæ; to the right a nearly ripe ascus. Lower series: To the left two *Cystococcus*-gonidia containing aplanospores; next, three ripe spores with dark outer cell-walls and lighter inner walls; to the right an unripe ascus connected with its ascogenous cells. (× 747).

Fig. 615. Thallus, cut vertically. (× 620).

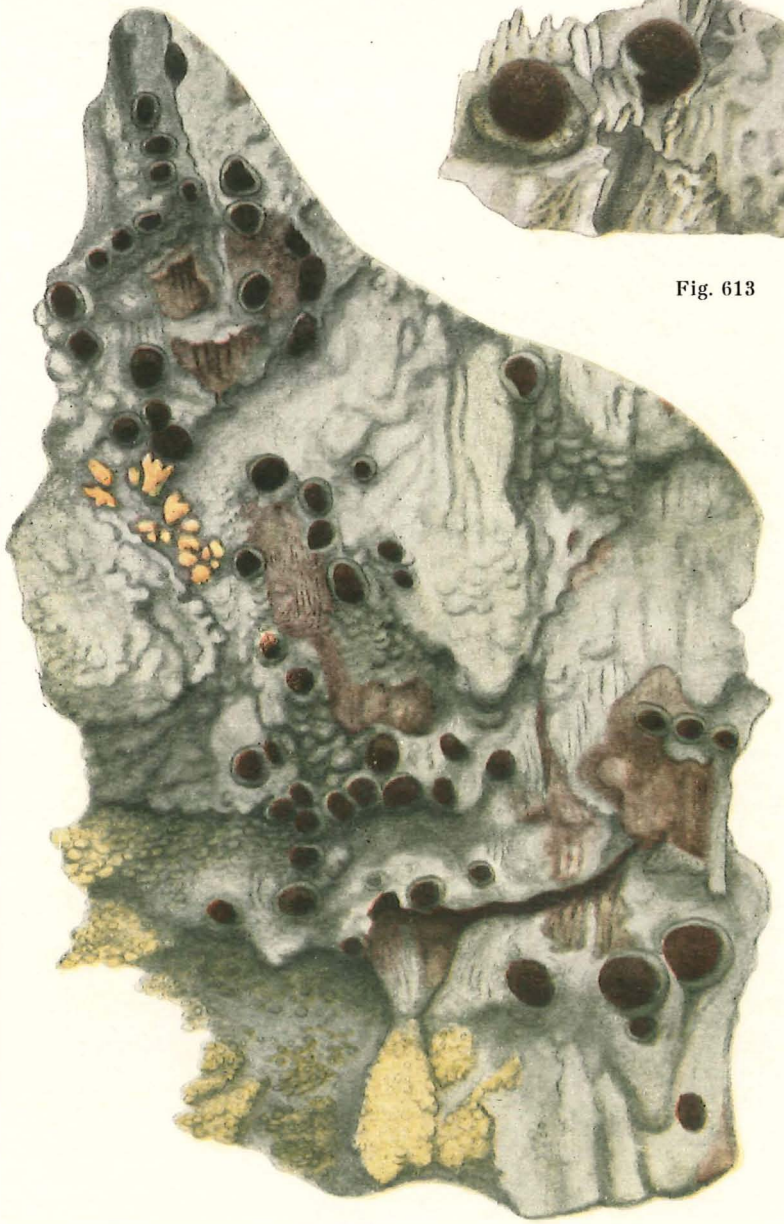

Fig. 612

Fig. 613

Fig. 614

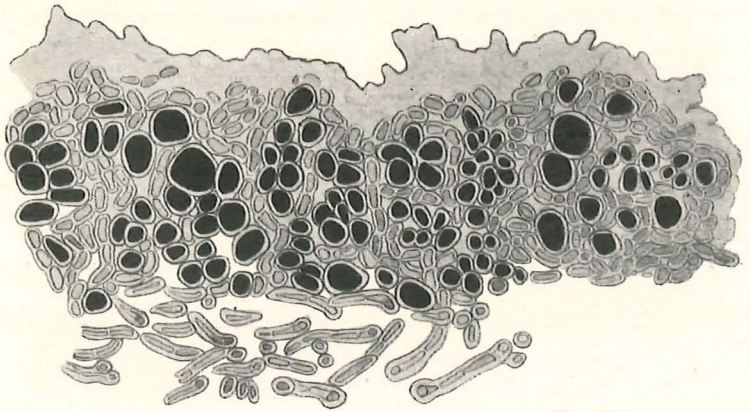

Fig. 615

RINODINA PYRINA Ach.

O. Gallœ del.

PLATE 121.

RINODINA PYRINA

ACH.

Fig. 616. Vertical section of thallus and apothecium with thalline margin. The sides of the calyx and the proper margin are rather poorly developed. (× 620).

Fig. 617. Hyphæ from a vertical section of the hyphæ of the calyx just beneath the hypothecium. (× 1053).

Fig. 618. Above, a *Trentepohlia*-gonidium isolated from the thallus. Below, a *Cystococcus*-gonidium. (× 620).

Fig. 619. Vertical section of a pycnide. Above to the left in the section there are loosely interwoven hyphæ, which were placed between the pycnide pictured here and another pycnide, cut off in the section. (× 620).

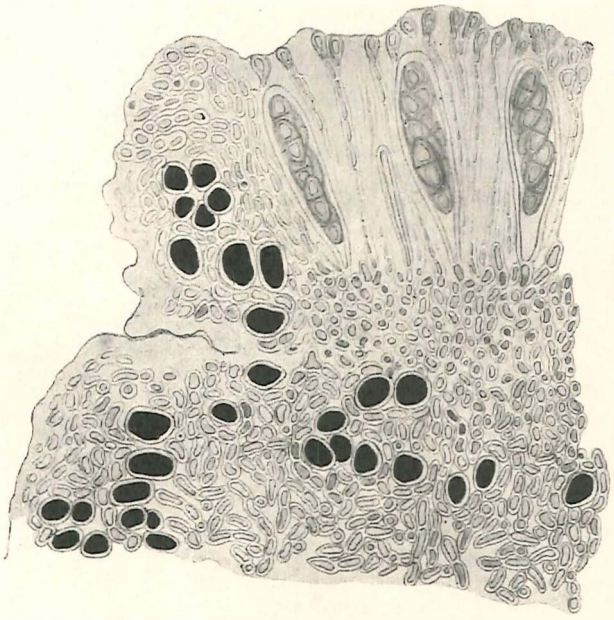

Fig. 616

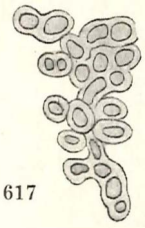

Fig. 617

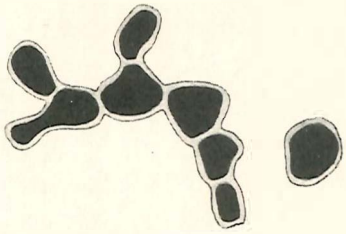

Fig. 618

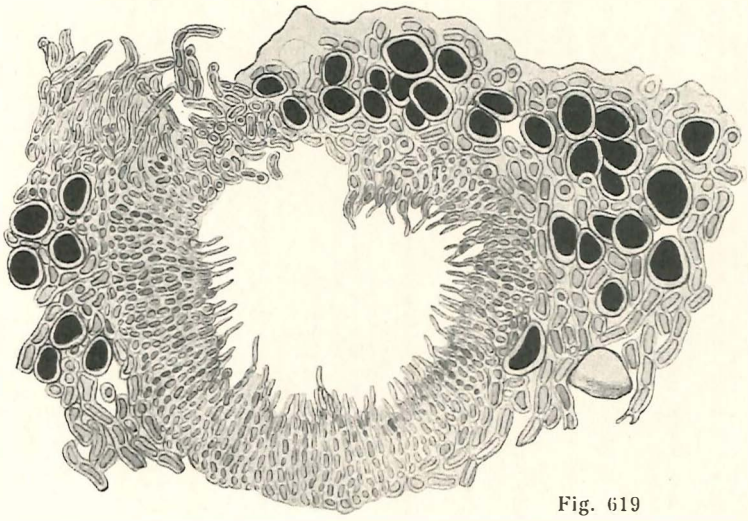

Fig. 619

O. Galløe del.

RINODINA PYRINA Ach.

V. P 31

PLATE 122.

RINODINA EXIGUA

ACH.

Fig. 620. Thallus on dead wood. The margin is seen above in the figure. On either side of *Rinodina* there are apothecia of a *Caloplaca*. (× 20).

Fig. 621. Margin of thallus, at the extreme edge passing into the dead wood of the substratum, the fibres of which are rather easily distinguished. The four apothecia are very young. (× 80).

Fig. 622. Hymenium and hypothecium with ascogenous hyphæ, together with an unripe ascus and a single ripe ascus; the basal cells of the paraphyses (in the hypothecium) are rather short-celled. (× 747).

Fig. 623. Vertical section of thallus. (× 840).

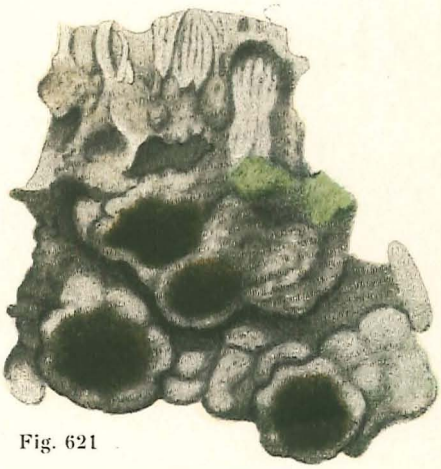

Fig. 621

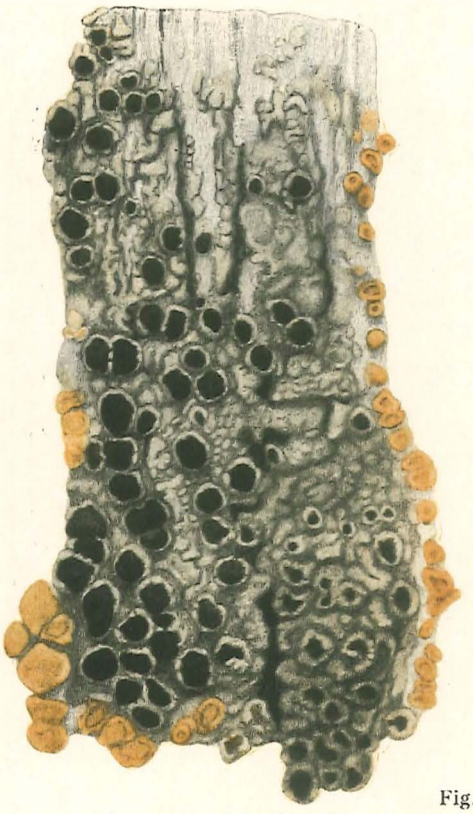

Fig. 620

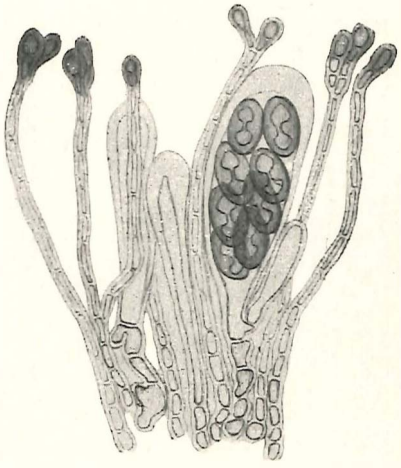

Fig. 622

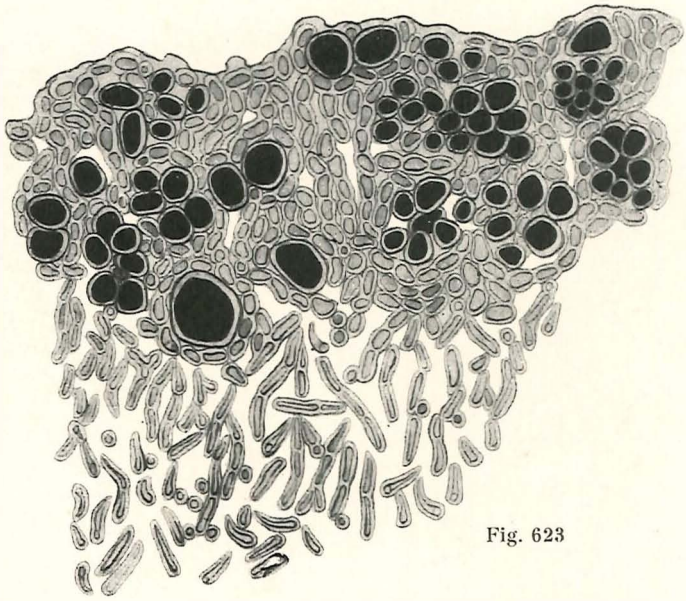

Fig. 623

O. Galløe del.

RINODINA EXIGUA Ach.

PLATE 123.

RINODINA EXIGUA

ACH.

Fig. 624. Medulla, below passing into the utterly destroyed cells of the substratum. (× 840).

Fig. 625. Thallus with apothecium. (× 100).

Fig. 626. Gonidia, isolated from thallus. The one situated farthest to the right is cystococcoid and contains aplanospores the other ones belong to other types of algæ. (× 840).

Fig. 627. Margin of apothecium (× 620). An isolated hypha (with top-cell) from margo thallinus is pictured above (× 840); a transverse section of the hyphæ of the sides of the calyx (parathecium) is seen beneath the section. (× 840).

Fig. 628. Hyphæ from a vertical section of stipes, from below the hypothecium. (× 747).

Fig. 624

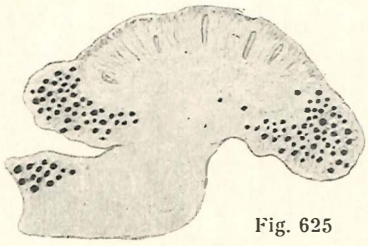

Fig. 625

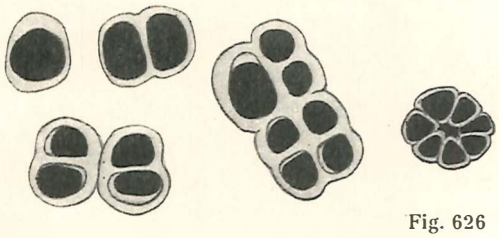

Fig. 626

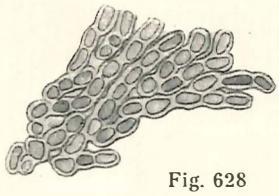

Fig. 628

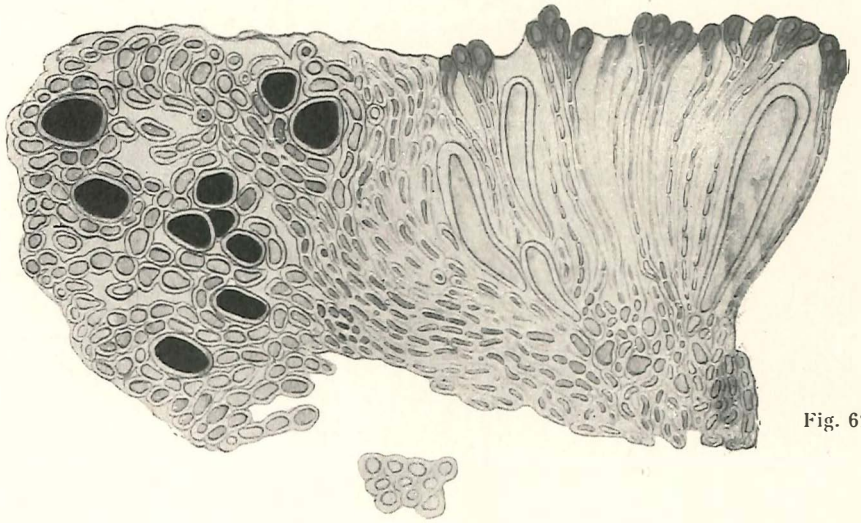

Fig. 627

O. Galløe del.

RINODINA EXIGUA Ach.

PLATE 124.

RINODINA CONRADI

KOERB.

Fig. 629. Thallus with apothecia of all ages, on moss. (× 20).

Fig. 630. Portion of a dead moss-stem with a leaf, on which some few confluent, small granules of thallus from the margin of *Rinodina Conradi* are growing. (× 80).

Fig. 631. Moss-stem with young thallus and three very young apothecia, the discs of which are still nearly colourless. In the lowest of the apothecia the paraphyses are beginning to turn dark (the minute dark dots). (× 80).

Fig. 632. Group of apothecia. (× 80).

Fig. 633. Asci at various stages of development. In the centre a young ascus with still undivided, almost colourless spores. To the left a somewhat older, but still unripe ascus with two-celled spores; beside the ascus two isolated spores, the uppermost of which has a complete septum. To the right in the picture a fully ripe ascus with four-celled spores and with isthmi connecting the lumina of the cells. Farthest to the right a spore with thin septa. (× 747).

Fig. 631

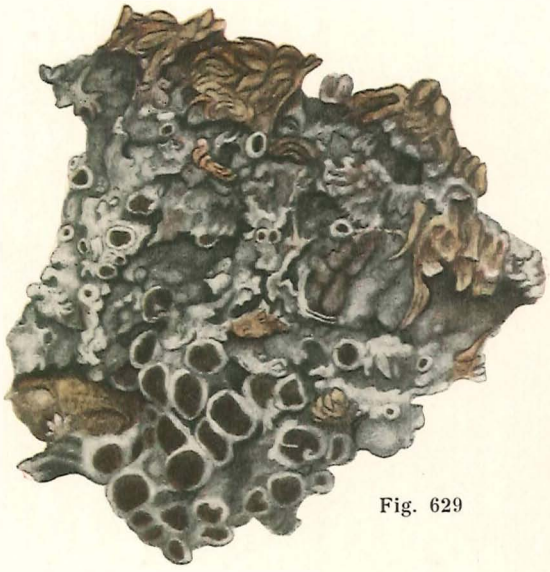

Fig. 629

Fig. 630

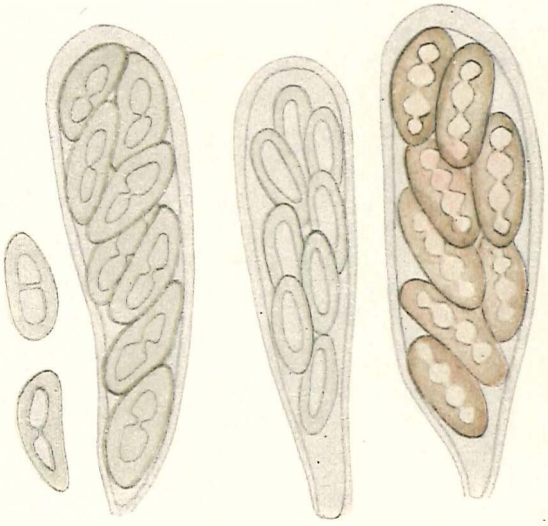

Fig. 633

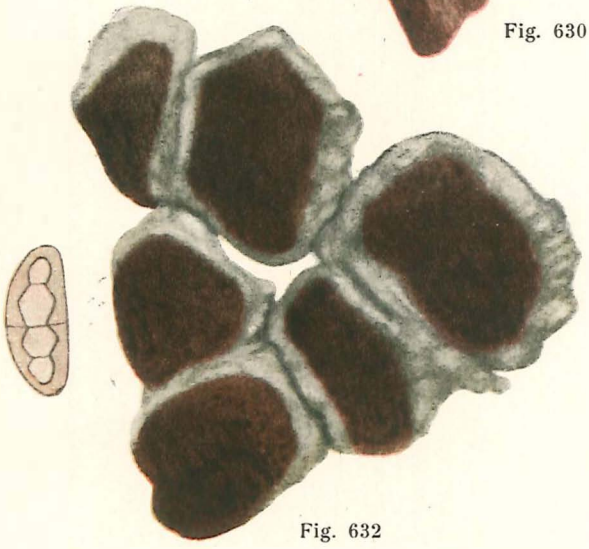

Fig. 632

O. Galløe del.

RINODINA CONRADI KOERB.

PLATE 125.

RINODINA CONRADI

KOERB.

Fig. 634. Thallus with two apothecia. Transverse section of moss-leaf at the bottom of the section. (× 100).

Fig. 635. Section of thallus, with transverse section of moss-leaves. (× 140).

Fig. 636. Thallus. Above, three empty cell-walls of a *Cystococcus*. (× 840).

Fig. 637. Margin of apothecium, with colourless margo thallinus, colourless margo proprius, and brown tips of paraphyses. (× 620).

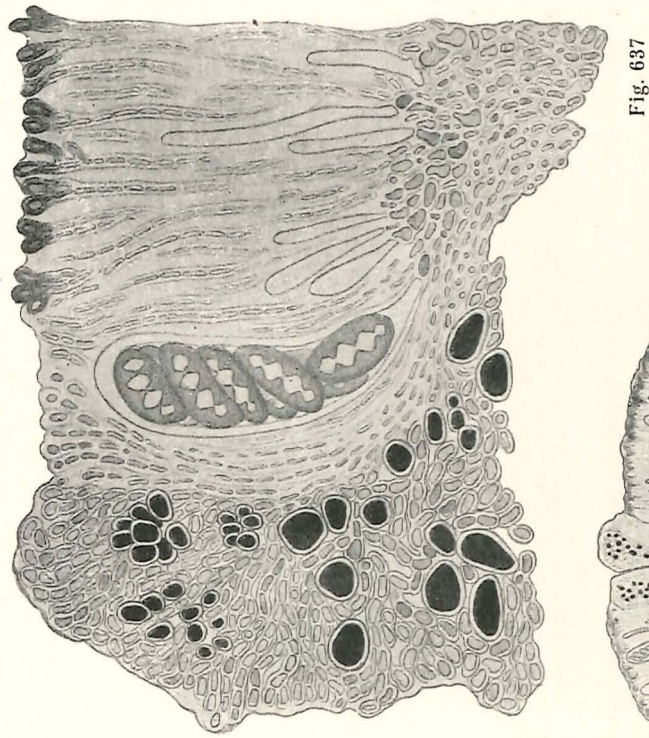

Fig. 637

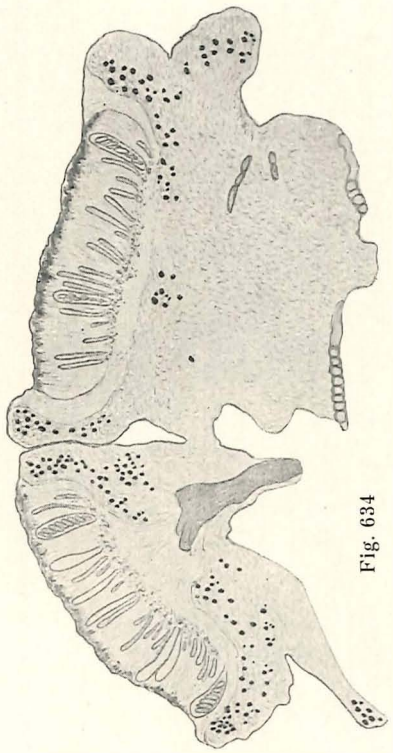

Fig. 634

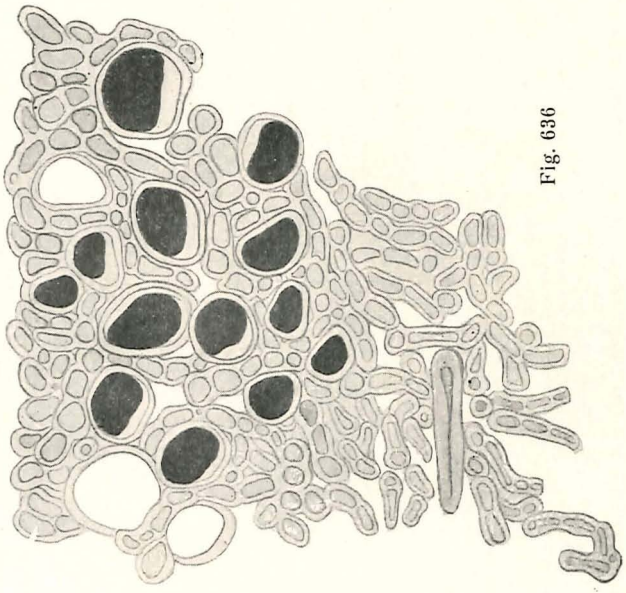

Fig. 636

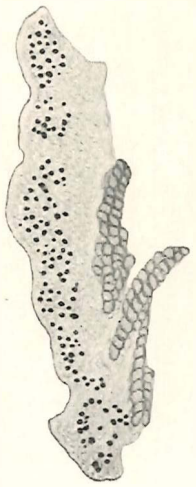

Fig. 635

O. Galløe del.

RINODINA CONRADI KOERB.

PLATE 126.

RINODINA SOPHODES

ACH.

Fig. 638. Thallus with apothecia of all ages. (× 23).

Fig. 639. Section of thallus with apothecia. (× 80).

Fig. 640. Granules of thallus. (× 840).

Fig. 641. Hyphæ from the medullary-rhizoidal layer. (× 840).

Fig. 642. Margin of apothecium. (× 620).

Fig. 643. Hyphæ from the calyx, cut across. (× 1053).

Fig. 644. Hymenium and colourless hypothecium, with paraphysogenous and ascogenous hyphæ. (× 747).

Fig. 645. Ripe ascus and three isolated spores, of which one has an isthmus. (× 747).

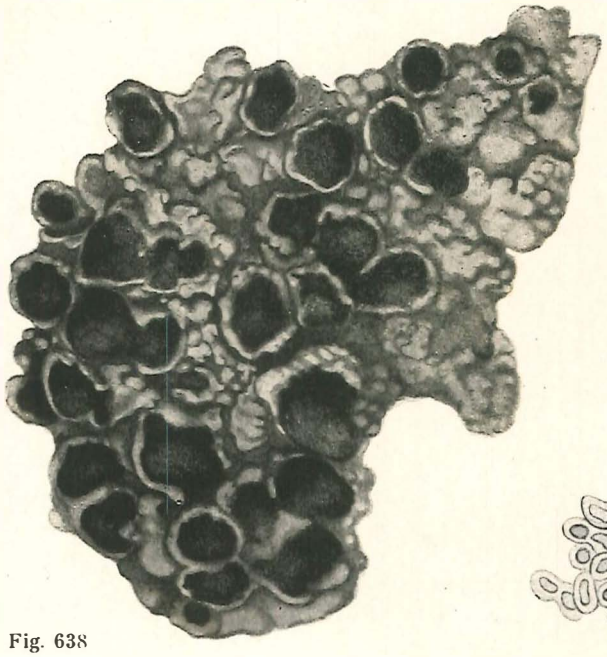

Fig. 638

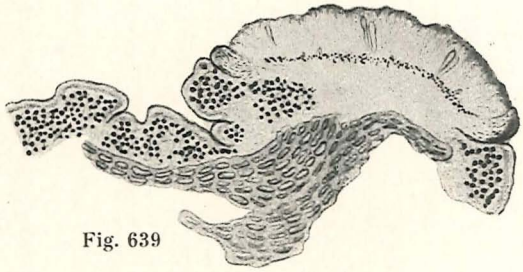

Fig. 639

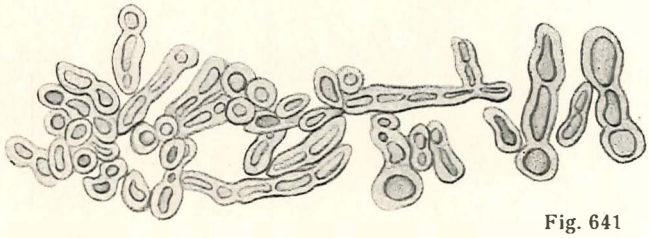

Fig. 641

Fig. 643

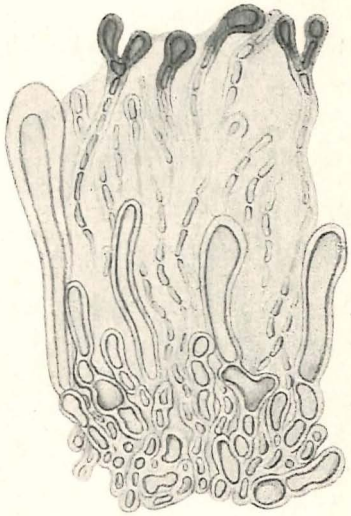

Fig. 644

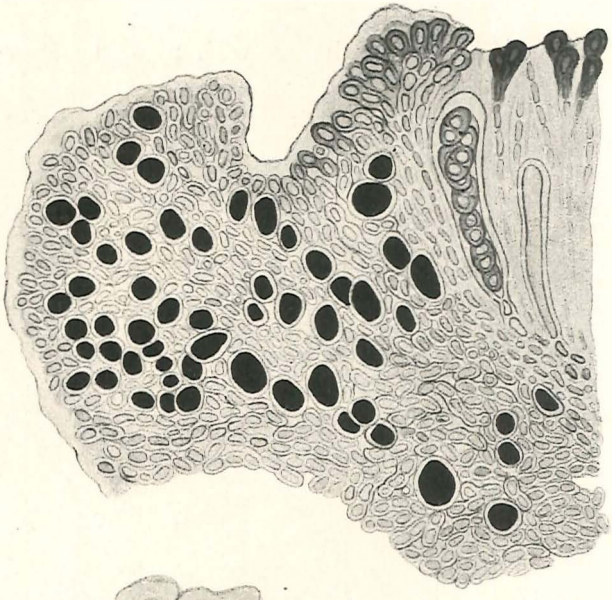

Fig. 642

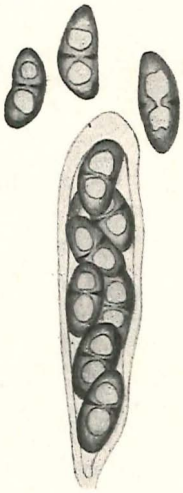

Fig. 645

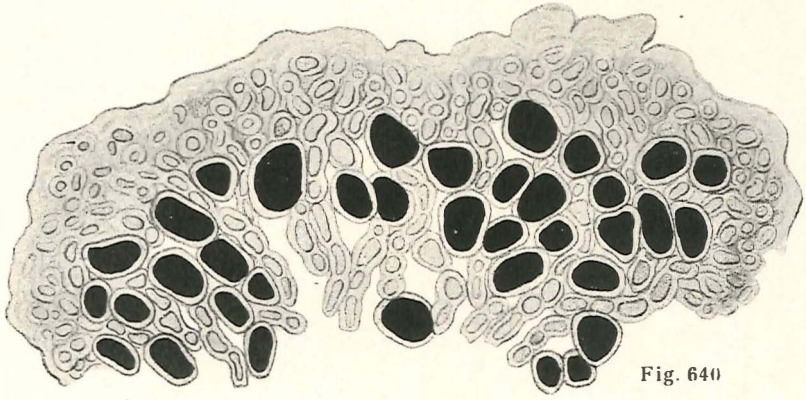

Fig. 640

O. Gallœe del.

RINODINA SOPHODES Ach.

PLATE 127.

RINODINA MILVINA

WAHLENBG.

Specimen 1

Fig. 646. Thallus with margin of free mycelial hyphæ, and with apothecia at all ages. (× 20).

Fig. 647. Portion of margin of thallus, with young areoles. (× 80).

Specimen 2.

Fig. 648. Thallus with apothecia. (× 20).

Fig. 649. Two young areoles, and (at the centre) a young apothecium, all three connected by a basal inter-areolar thallus. (× 90).

Fig. 650. Ripe apothecium. (× 90).

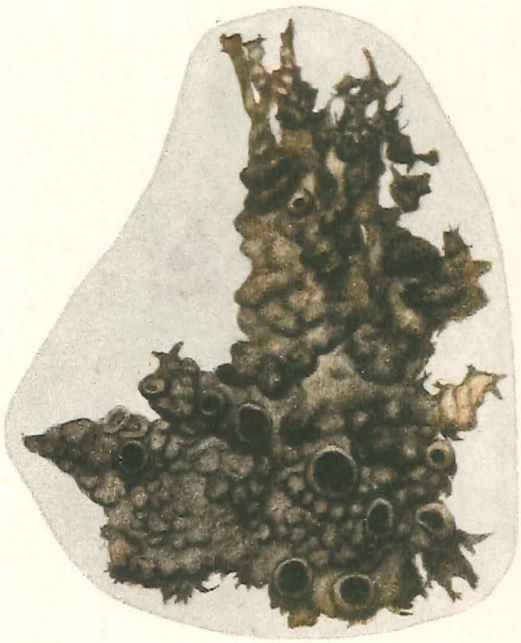

Fig. 648

Fig. 646

Fig. 649

Fig. 650

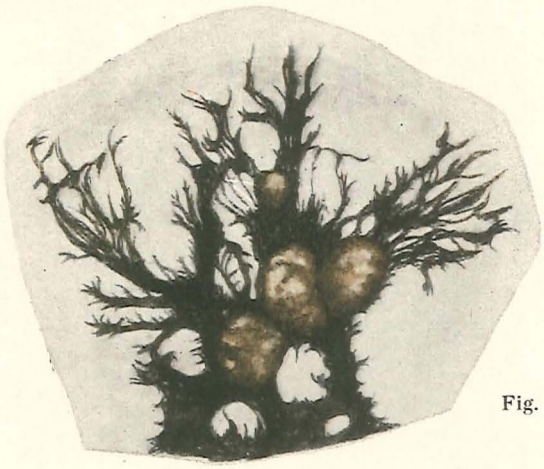

Fig. 647

O. Galløe del.

RINODINA MILVINA Wahlenbg.
(Specimen 1, 2.)

PLATE 128.

RINODINA MILVINA

WAHLENBG.

Specimen 1.

Fig. 651. Thallus with apothecia. (× 100).

Fig. 652. Cortex with cuticle; below, gonidia. (× 840).

Fig. 653. Gonidial layer. (× 840).

Fig. 654. Medulla. (× 840).

Fig. 655. Gonidia. (× 747).

Fig. 656. Paraphyses, unripe ascus, ascogenous cells and paraphysogenous hyphæ from the hypothecium, at the base passing into the calyx. (× 747).

Fig. 657. To the left an almost ripe ascus; at the centre three spores; to the right a ripe ascus. (× 747).

Fig. 658. Margin of apothecium with thalline margin and proper margin. (× 620).

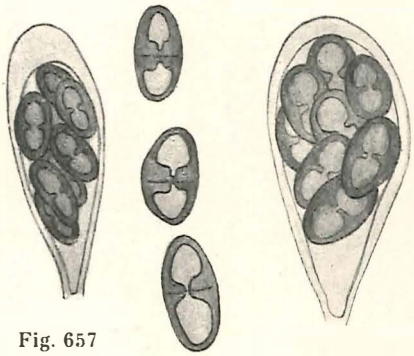

Fig. 657

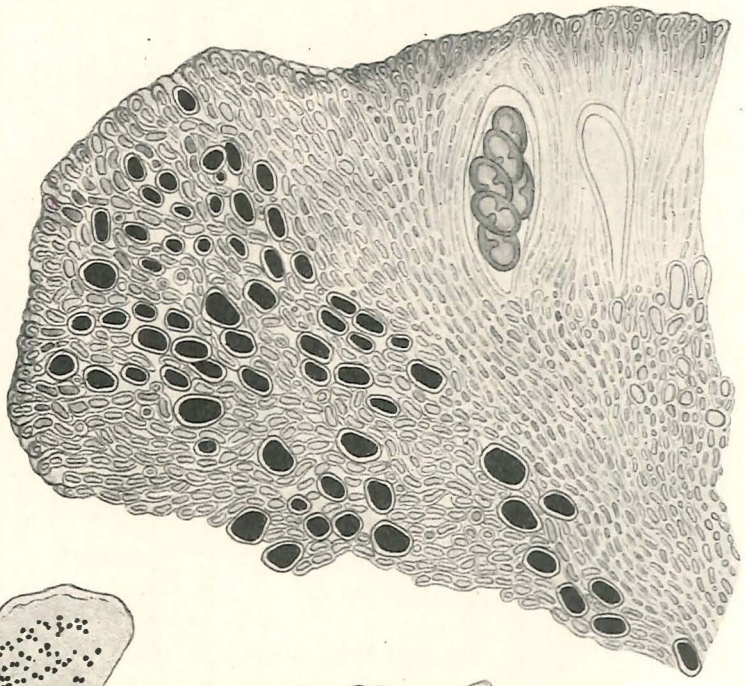

Fig. 658

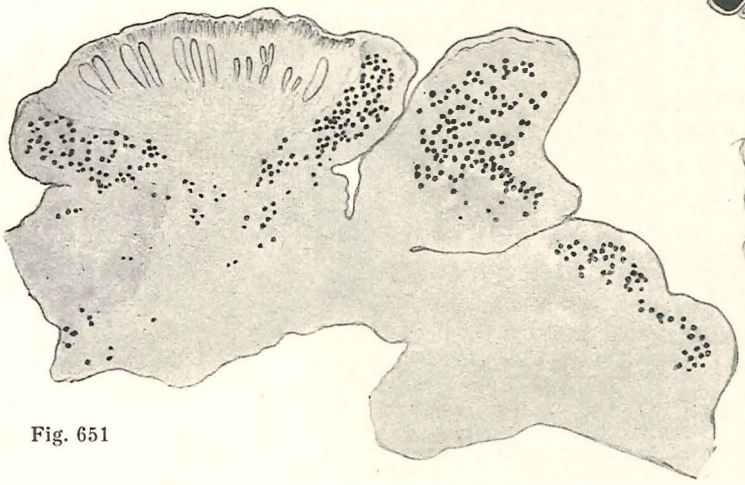

Fig. 651

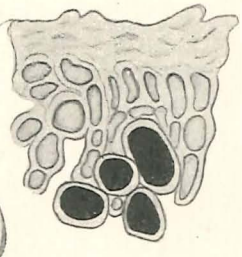

Fig. 652

Fig. 655

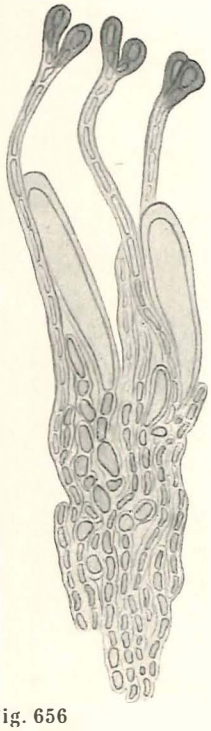

Fig. 656

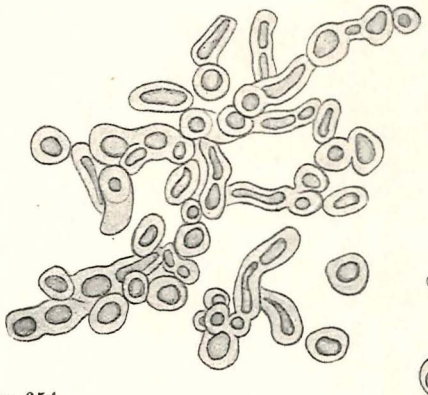

Fig. 654

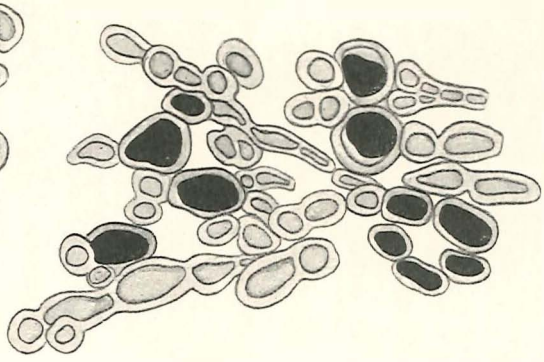

Fig. 653

O. Gallœ del.

RINODINA MILVINA Wahlenbg.
(Specimen 1).

PLATE 129.

RINODINA ASTROIDES

FL. DAN.

Fig. 659. A very young specimen, consisting of some few areoles placed on an astroid, radiating thallus. In the biggest of the areoles an apothecium is in formation. Anatomically this specimen has the same structure as the next specimen, which is the one described in the text. (× 80).

Fig. 660. Group of several (4 or 5) specimens. The biggest one (to the right in the figure) is the one described in the text. (× 33).

Fig. 661. Ripe ascus. (× 747).

Fig. 662. Thallus with two adjacent apothecia. (× 100).

Fig. 663. Granule of thallus, to the left passing into radiating marginal hyphæ. (× 840).

Fig. 664. Thallus. Note the primitive cortex above in the figure. (× 1053).

Fig. 665. Margin of apothecium. (× 620).

Fig. 666. Hymenium. (× 747).

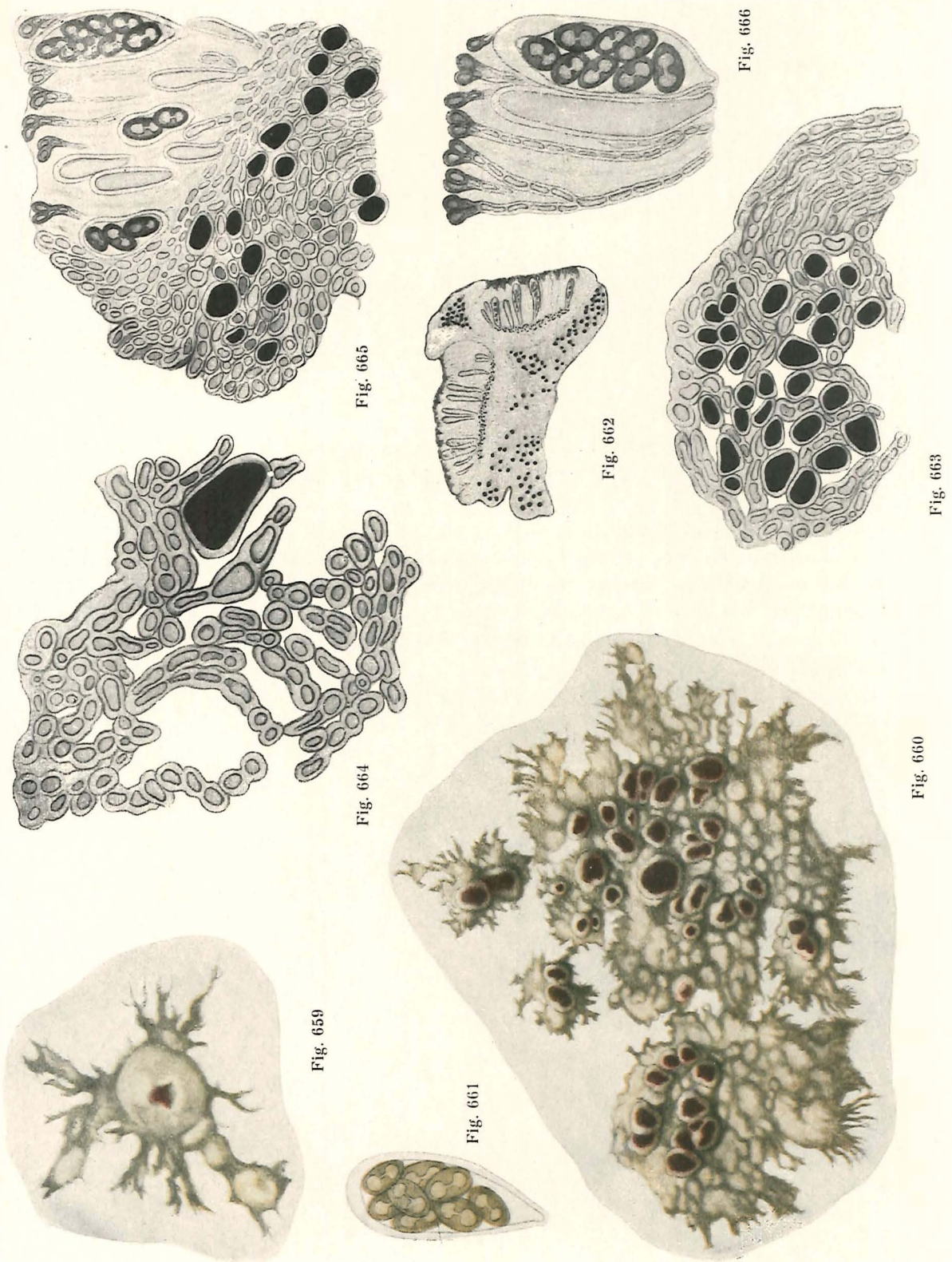

Fig. 659

Fig. 660

Fig. 661

Fig. 662

Fig. 663

Fig. 664

Fig. 665

Fig. 666

O. Galløe del.

RINODINA ASTROIDES Fl. Dan.

PLATE 130.

RINODINA DEMISSA

LAUR.

Fig. 667. Small granules of thallus, connected by an inter-areolar thallus, which is so thin that the colour of the substratum can be distinguished through it. (× 80).

Fig. 668. Vertical section of thallus, with one apothecium. (× 100).

Fig. 669. Margin of thallus, with radiating marginal hyphæ. (× 10).

Fig. 670. Margin of thallus, with mycelial, marginal hyphæ and two quite young apothecia. (× 40).

Fig. 671. Centre of thallus, with apothecia. (× 40).

Fig. 672. Two areoles, vertical section. (× 840).

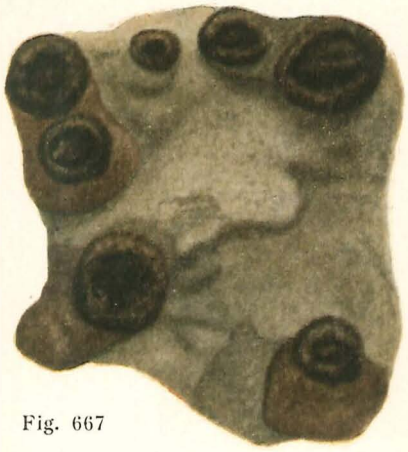

Fig. 667

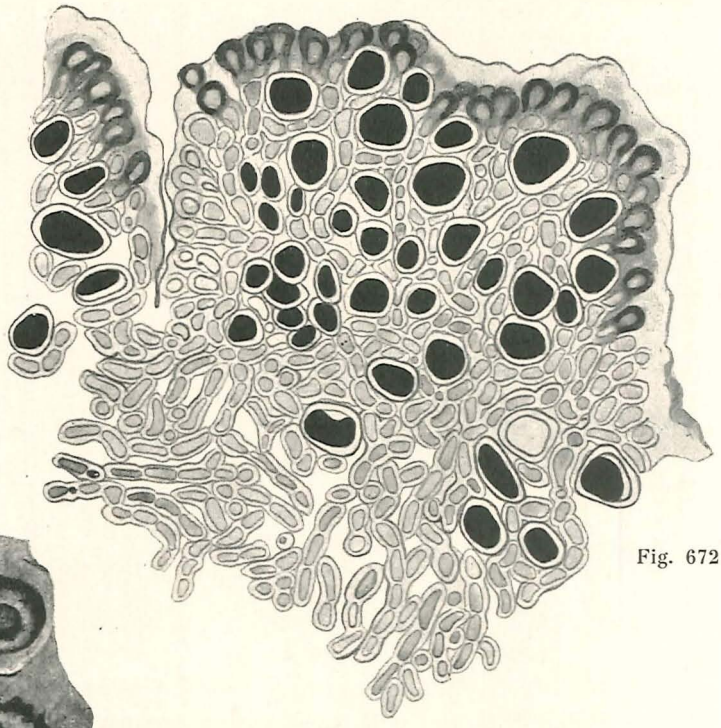

Fig. 672

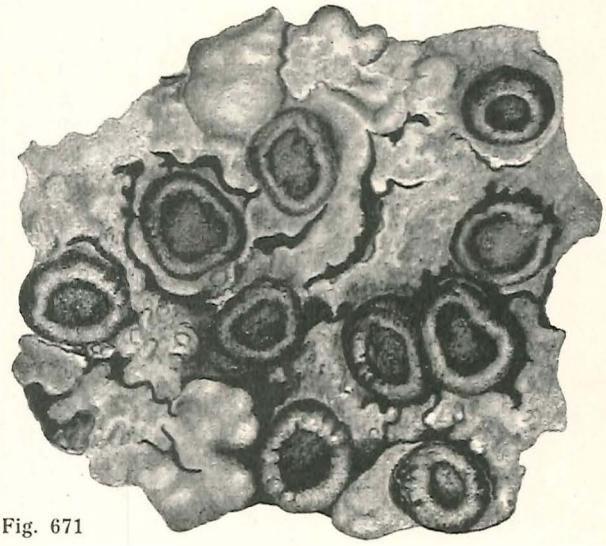

Fig. 671

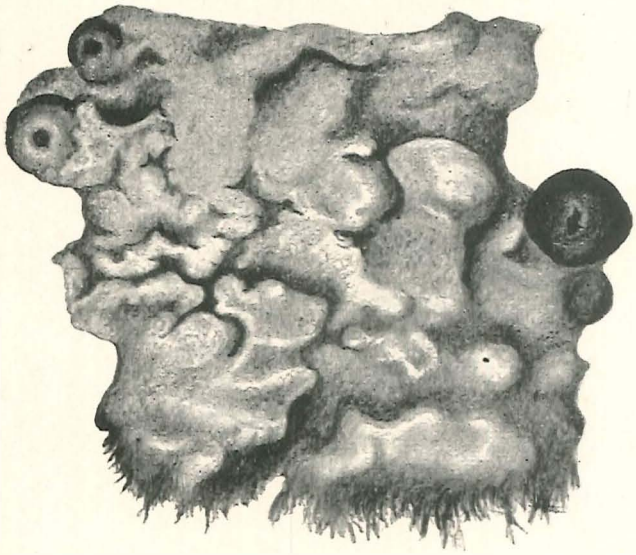

Fig. 670

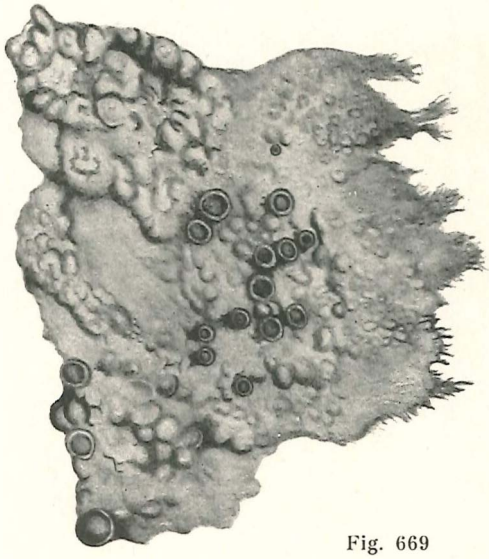

Fig. 669

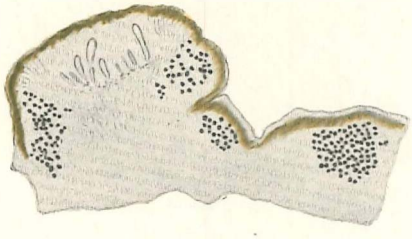

Fig. 668

O. Galløe del.

RINODINA DEMISSA Laur.

PLATE 131.

RINODINA DEMISSA

LAUR.

Fig. 673. Margin of apothecium (with margo thallinus and margo proprius). (× 620).

Fig. 674. Hyphæ from vertical section of stipes. (× 840).

Fig. 675. Top-cells of hyphæ from margo proprius. (× 840).

Fig. 676. Horizontal section of hymenium, with hymenial gelatine, paraphyses, and asci. (× 840).

Fig. 677. To the left an unripe ascus, in the middle a ripe ascus with four spores, to the right a ripe ascus with eight spores. (× 747).

Fig. 678. Three ripe spores. (× 747).

Fig. 679. Paraphyses and two unripe asci issuing from ascogenous hyphæ. (× 747).

Fig. 680. Gonidia. (× 747).

Fig. 681. Upper half of a pycnide, embedded in the thallus. (× 620).

Fig. 682. Isolated conidia. (× 840).

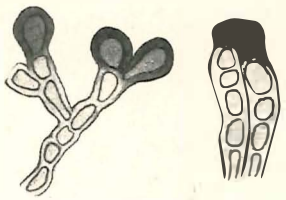

Fig. 675

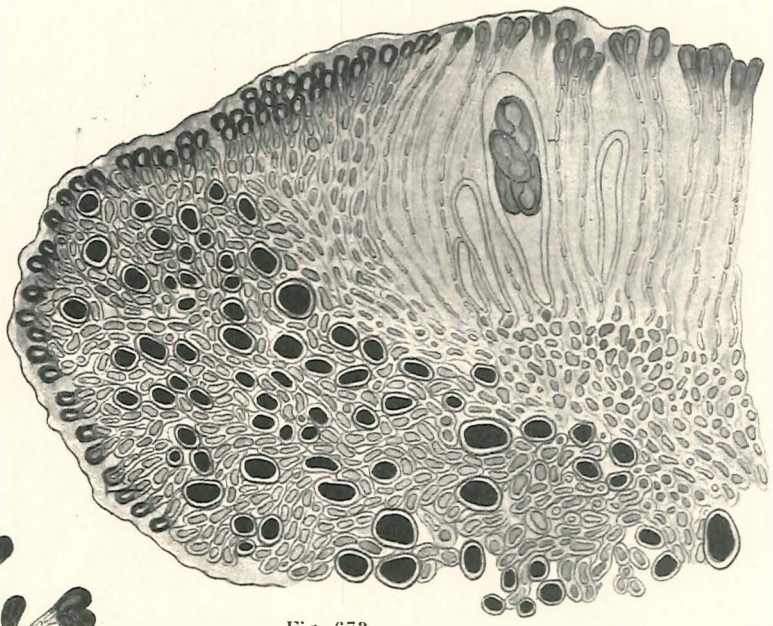

Fig. 673

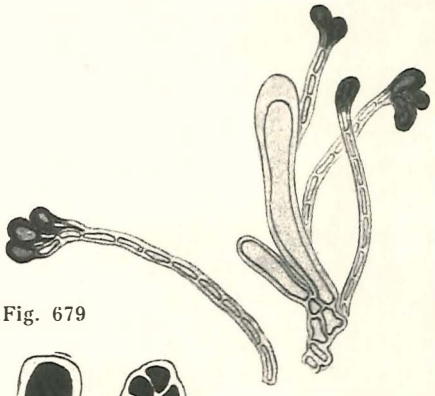

Fig. 679

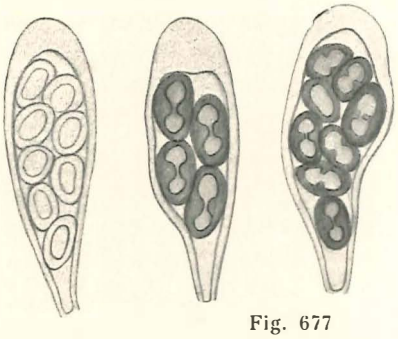

Fig. 677

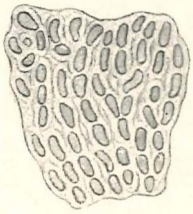

Fig. 674

Fig. 680

Fig. 678

Fig. 682

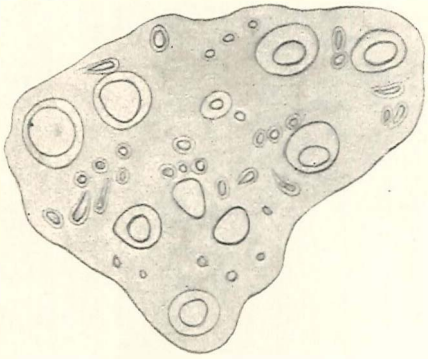

Fig. 676

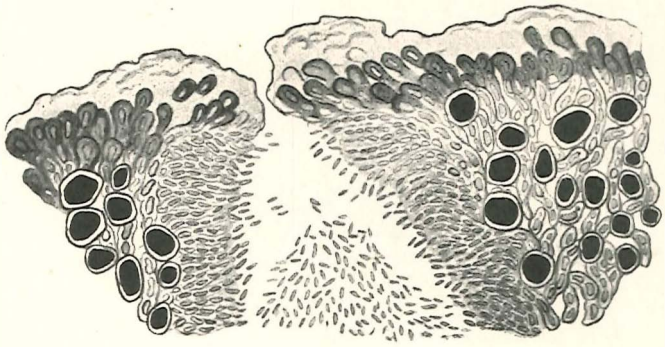

Fig. 681

O. Galløe del.

RINODINA DEMISSA Laur.

PLATE 132.

RINODINA BISCHOFFII

HEPP.

Fig. 683. Thallus with apothecia. The free margin is to the left and cannot easily be distinguished from the substratum. (× 20).

Fig. 684. Group of apothecia on thallus, drawn in dry condition. (× 80).

Fig. 685. The same group of apothecia as in Fig. 684, in moistened condition. (× 80).

Fig. 686. Thallus, with numerous *Trentepohlia*-gonidia. (× 840).

Fig. 687. Gonidia, of which the three at the bottom of the figure seem to be cystococcoid, while the others belong to *Trentepohlia*. In the two gonidia to the right algæ are seen to adhere to the cell-walls of the algæ. (× 840).

Fig. 688. *Trentepohlia*-gonidium with adhering hyphæ, which in part are dark. (× 840).

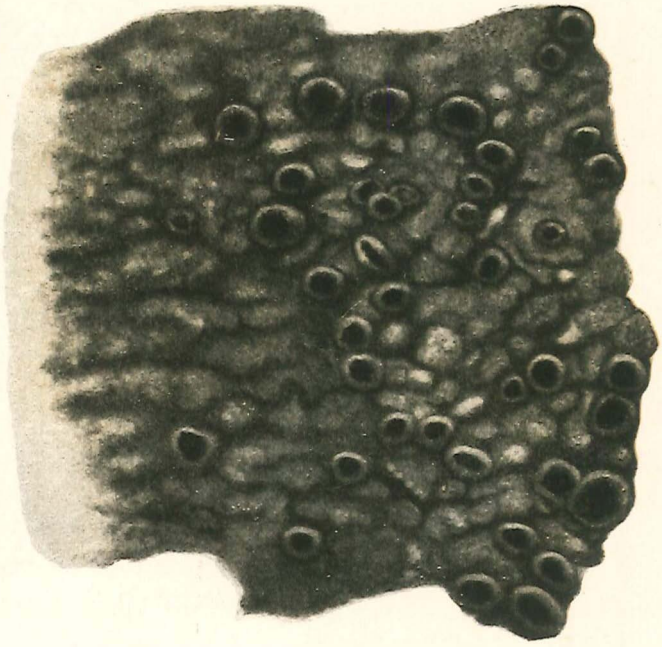

Fig. 683

Fig. 684

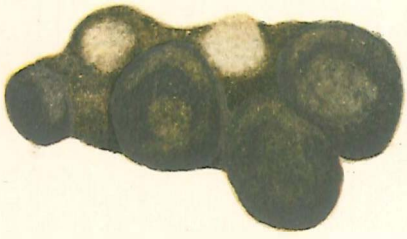

Fig. 685

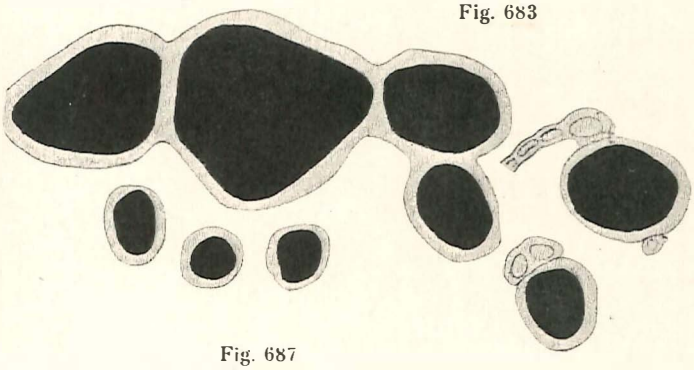

Fig. 687

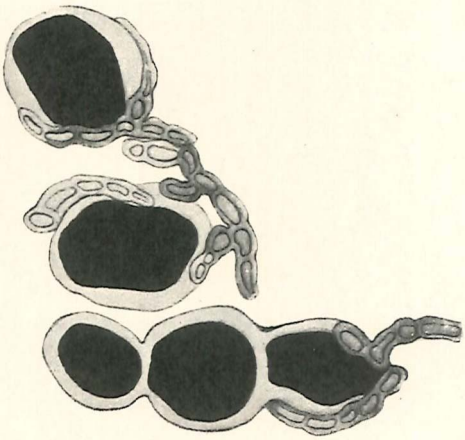

Fig. 688

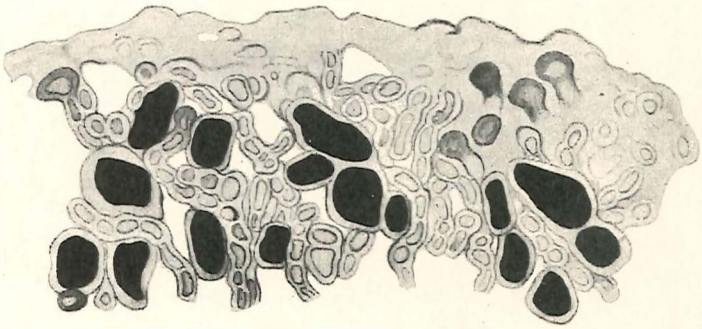

Fig. 686

O. Galløe del.

RINODINA BISCHOFFII Hepp.

PLATE 133.

RINODINA BISCHOFFII

HEPP.

Fig. 689. Apothecium. Some few empty gonidia are seen at the base of stipes. (× 620).

Fig. 690. Portion of the thick bottom of the calyx, from which the thin side (the parathecium) is seen to ascend upwards, ending at the top of the fignre in a dark, brown proper margin. (× 620).

Fig. 691. Top-cells from the proper margin. (× 840).

Fig. 692. Paraphyses, a ripe ascus, and an unripe ascus together with ascogenous hyphæ. (× 747).

Fig. 693. Three ripe spores; they have no isthmi. (× 840).

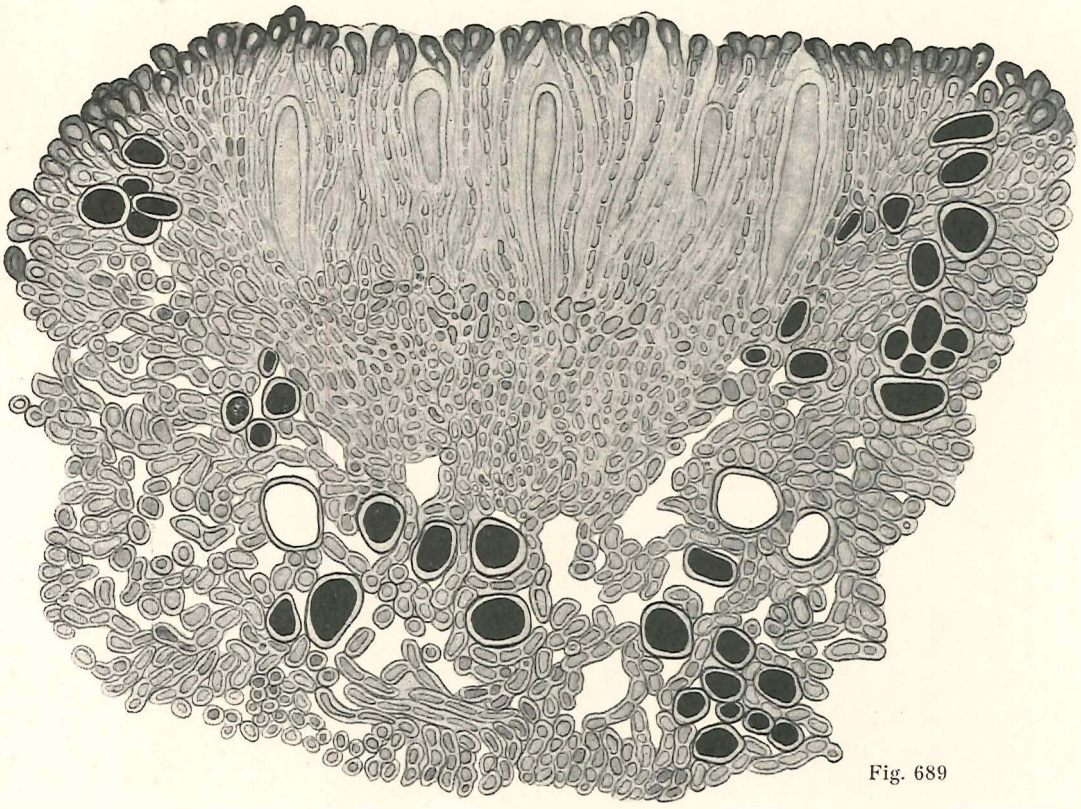

Fig. 689

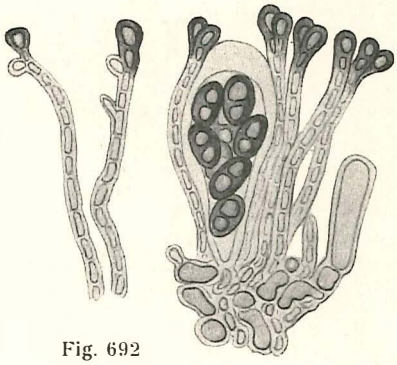

Fig. 692

Fig. 693

Fig. 691

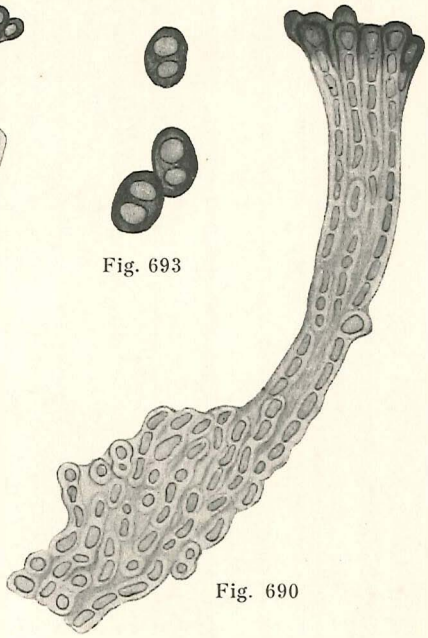

Fig. 690

O. Galløe del.

RINODINA BISCHOFFII Hepp.

V. P 34

PLATE 134.

RINODINA ATROCINEREA

DICKS.

Specimen 1.

Fig. 694. Margin of thallus, with black borderline and with scanty, slender hyphæ spreading over the white grains of quartz of the substratum. To the right the *Rinodina* borders on an *Ochrolechia parella*. (× 20).

Fig. 695. Metathallus with apothecia and pycnidia. (× 20).

Fig. 696. An areole with a few ostioles of pycnidia. (× 20).

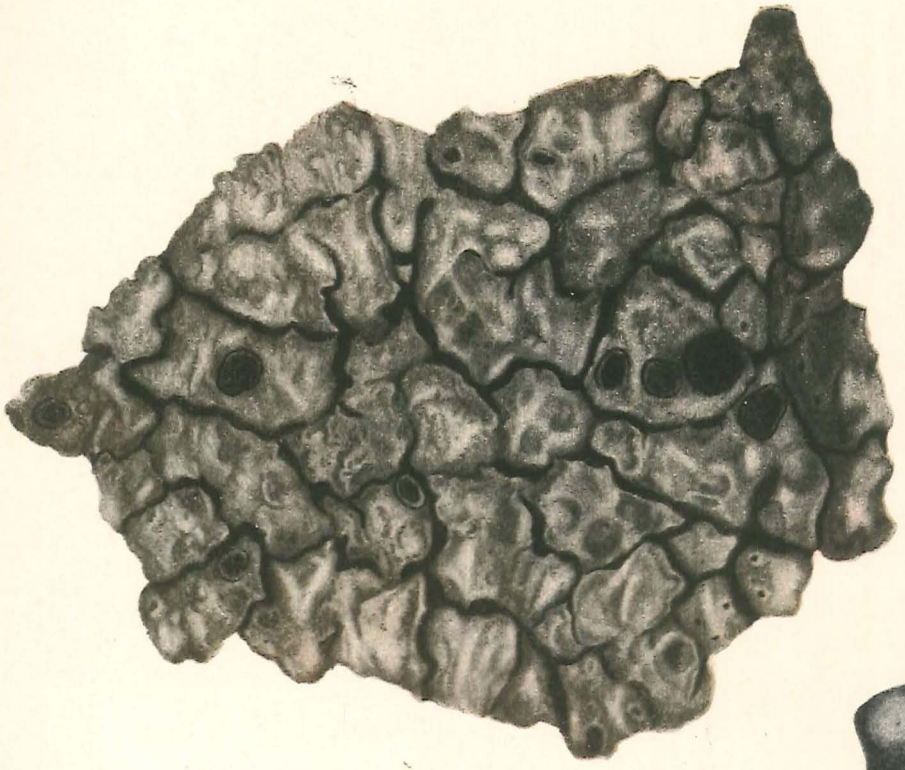

Fig. 695

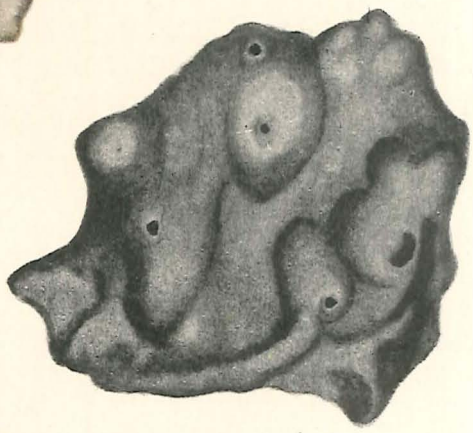

Fig. 696

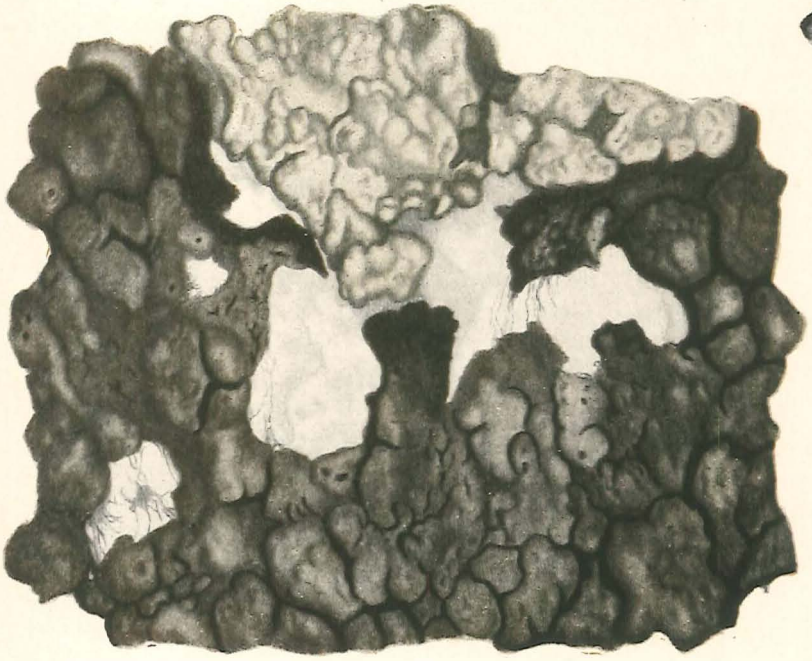

Fig. 694

O. Galløe del.

RINODINA ATROCINEREA DICKS.
(Specimen 1).

PLATE 135.

RINODINA ATROCINEREA

DICKS.

Specimen 1.

Fig. 697. Two areoles with young apothecia; the lower one is on the point of breaking through the thallus; the upper one has already broken through. (× 93).

Fig. 698. Vertical section of three areoles, with brown medulla and inter-areolar thallus. (× 93).

Fig. 699. Thallus with two purely lecideine apothecia. (× 93).

Fig. 700. Thallus with one apothecium, the right side of which is purely lecideine, while the left side displays traces of a thalline margin. (× 93).

Fig. 701. Margin of an areole, the free surface of which is to the left in the figure. It is provided with a cuticle, a brown cortex, a colourless gonidial layer, and a brown (though in part colourless) medulla; at the bottom of the section medulla is colourless (quite an exception!) and has a sharp and plane lower surface without rhizoids, resting on the substratum, which in this case is a grain of quartz. (× 747).

Fig. 702. Margin of apothecium, which is purely lecideine, with brown surface. (× 747).

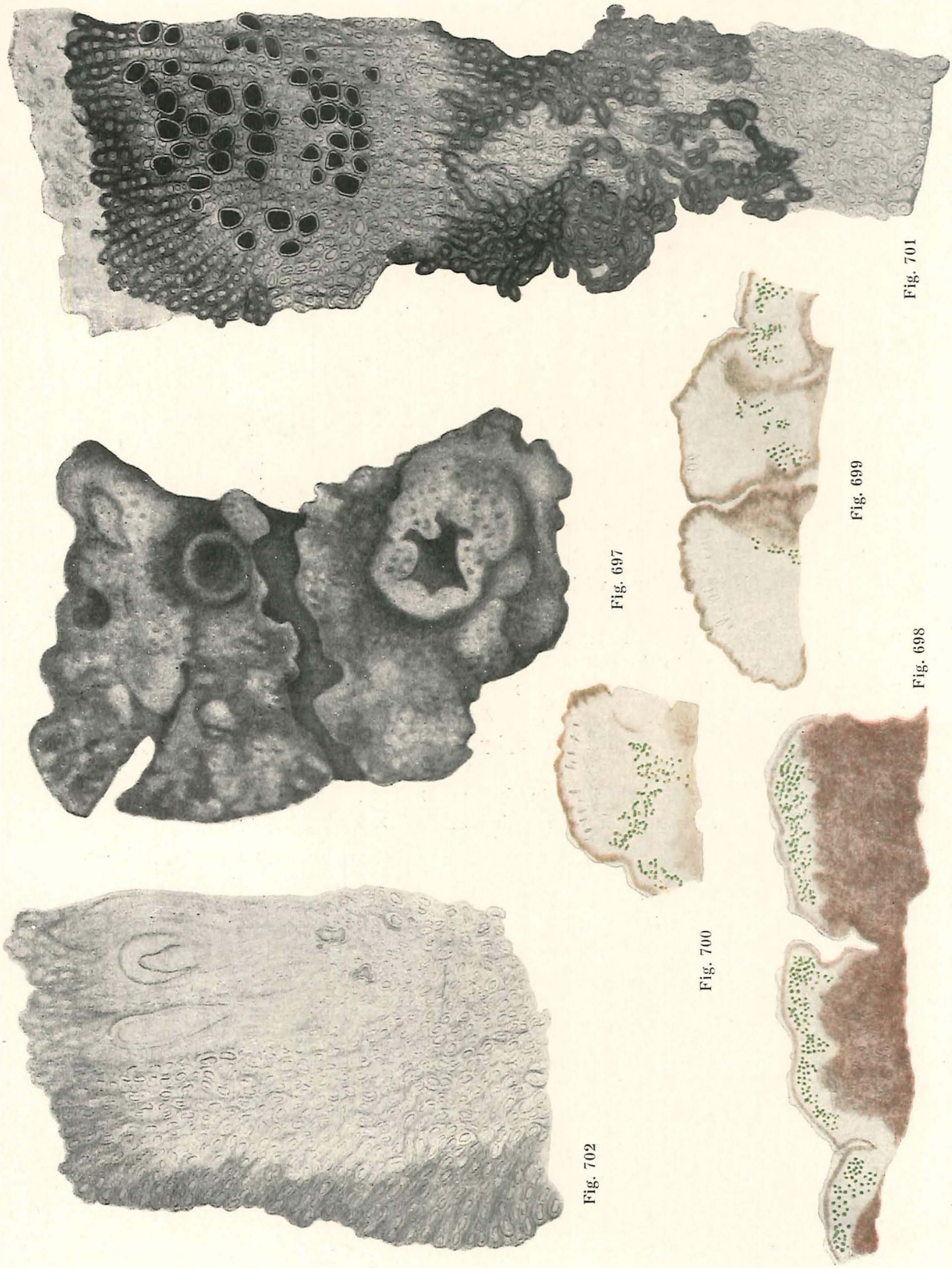

Fig. 701

Fig. 699

Fig. 697

Fig. 698

Fig. 700

Fig. 702

O. Galløe del.

RINODINA ATROCINEREA Dicks.
(Specimen 1).

PLATE 136.

RINODINA ATROCINEREA

DICKS.

Specimen 1.

Fig. 703. Details from the thallus: Above to the left brown, living cortical cells; in the middle three gonidia; at the bottom hyphæ from the gonidial layer. (× 747).

Fig. 704. Hypothecium with ascogenous and paraphysogenous hyphæ, and hymenium with a very young ascus and a somewhat older, though unripe ascus. The paraphyses are brown at the tips. (× 747).

Fig. 705. Above to the left two ripe spores. To the right two unripe asci. Below, two unripe asci with greyish spores. (× 747).

Fig. 706. Three ripe spores. Very few of this type were present. (× 747).

Fig. 707. To the left three paraphyses. To the right ascogenous hyphæ and young asci. (× 747).

Fig. 708. Pycnide, embedded in thallus. (× 620).

Fig. 709. Conidiiferous hyphæ with conidia. (× 1053).

Fig. 703

Fig. 704

Fig. 705

Fig. 706

Fig. 707

Fig. 708

Fig. 709

O. Galløe del.

RINODINA ATROCINEREA DICKS.
(Specimen 1).

PLATE 137.

RINODINA ATROCINEREA

DICKS.

Specimen 2.

Fig. 710. Margin of thallus with black edge and with pycnidia in some of the areoles. (× 23).

Fig. 711. Metathallus, with four apothecia at various stages of development. The biggest one has a somewhat indistinct thalline margin; the others have scarcely yet been raised above the level of the thallus. In numerous areoles ostioles of pycnidia can be seen. (× 23).

Fig. 712. Entire areole containing an apothecium, the thalline margin of which is identical with the whole of the thallus of the areole. (× 93).

Fig. 713. An areole, above which an apothecium with distinct thalline margin rises. (× 93).

Fig. 714. Areole with an apothecium. A pycnide has been developed to the left in the thalline margin of the apothecium. (× 93).

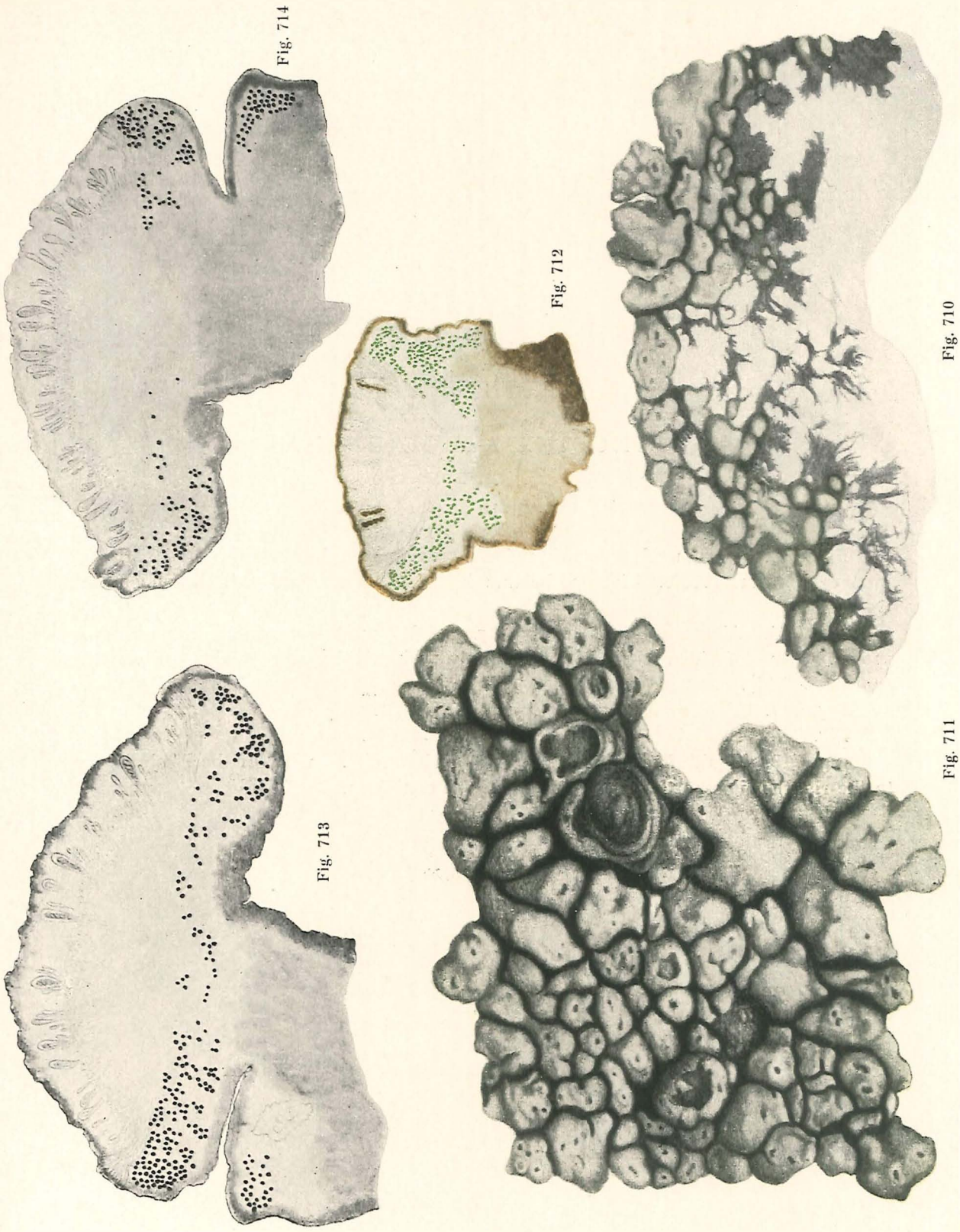

Fig. 714

Fig. 712

Fig. 710

Fig. 713

Fig. 711

O. Galloe del.

RINODINA ATROCINEREA DICKS.
(Specimen 2).

PLATE 138.

RINODINA ATROCINEREA

DICKS.

Specimen 2.

Fig. 715. Margin of areole functioning as margo thallinus of the apothecium immersed in the areole. The apothecium has a distinct calyx with thalline margin. (× 747).

Fig. 716. Above, a series of ripe spores; below, two unripe asci with unripe spores. Some of them have still an isthmus, while others are ordinary two-celled spores. (× 747).

Fig. 717. Two areoles, with a pycnide. (× 93).

Fig. 718. Pycnide, immersed in thallus. (× 620).

Fig. 719. Conidiiferous hyphæ and isolated conidia. In one of the hyphæ (below to the right) it is seen that each cell cuts off a conidium. (× 1053).

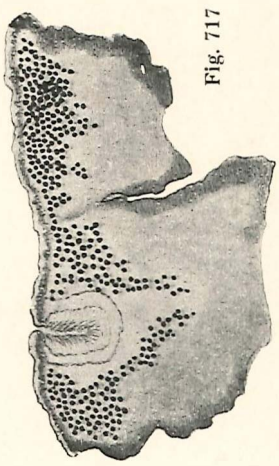

Fig. 717

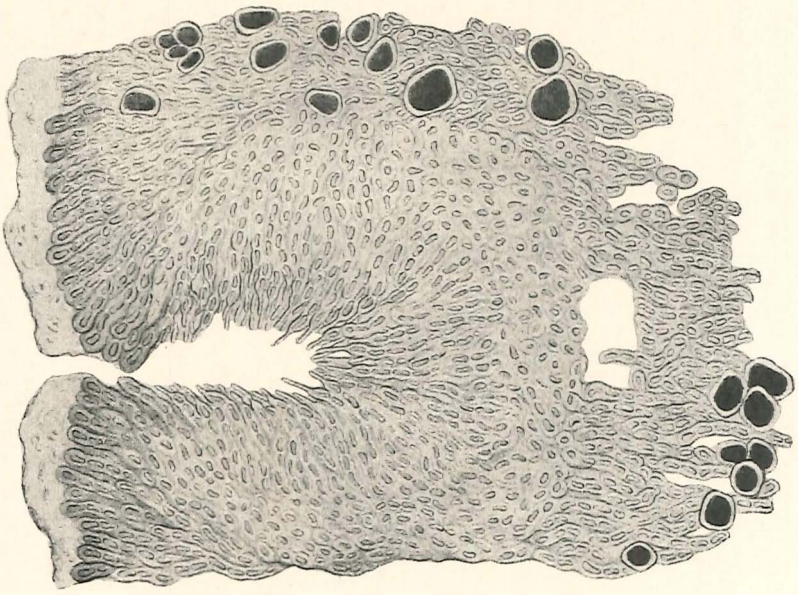

Fig. 718

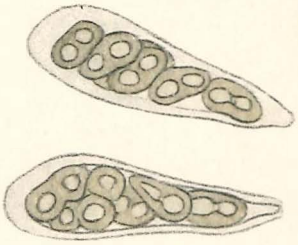

Fig. 716

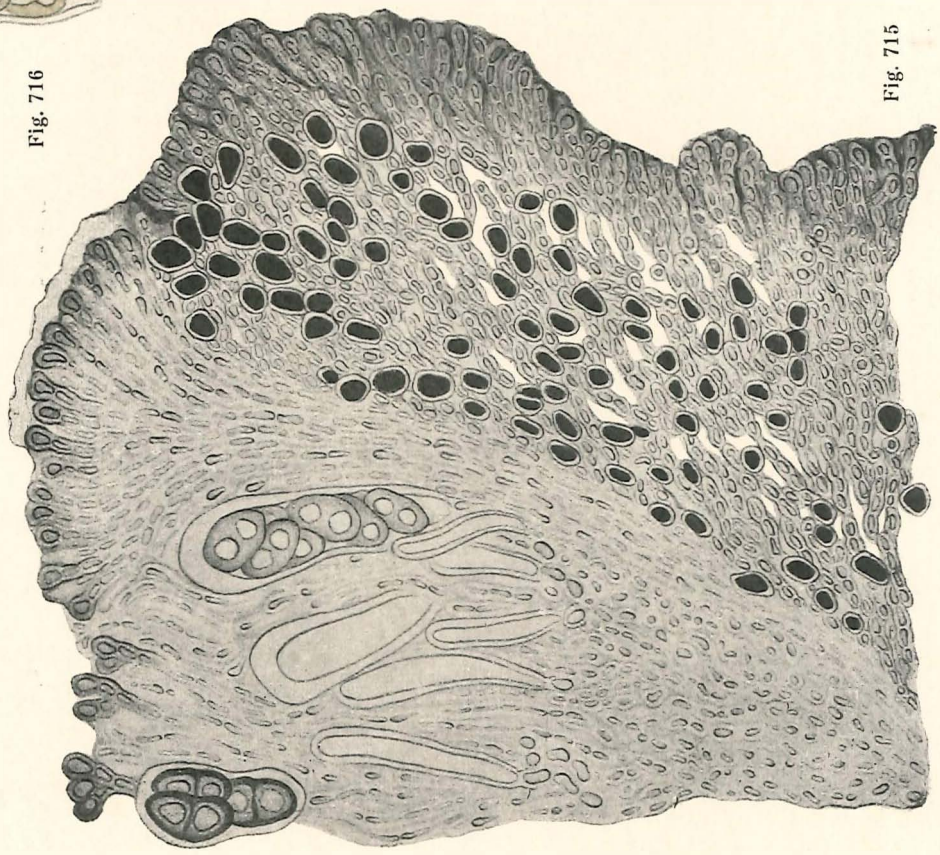

Fig. 715

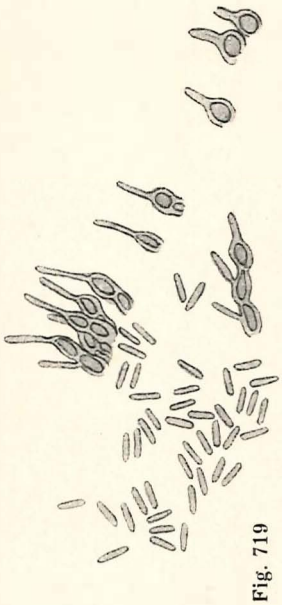

Fig. 719

O. Galløe del.

RINODINA ATROCINEREA DICKS.
(Specimen 2).

V. P 35*

PLATE 139.

RINODINA CONFRAGOSA

ACH.

Fig. 720. Thallus with pycnidia and with apothecia of all ages. (× 20).

Fig. 721. Four apothecia just broken out from the thallus and provided with a thalline margin. (× 33).

Fig. 722. Thallus with very young, purely lecideine apothecia. (× 33).

Fig. 723. Three apothecia, one lecanorine and the two others with faint traces of the colour of thallus left on the otherwise lecideine margin. (× 33).

Fig. 724. Three pycnidia. (× 80).

Fig. 725. Thallus with three apothecia, one immersed and two raised; the latter are almost purely lecideine. (× 100).

Fig. 726. Thallus with three apothecia; two of these are lecanorine, with some few gonidia enclosed in the margin. (× 100).

Fig. 727. Thallus with a purely lecideine apothecium without gonidia. (× 100).

Fig. 720

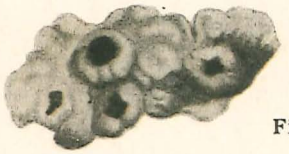

Fig. 721

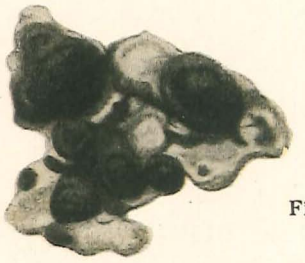

Fig. 722

Fig. 724

Fig. 723

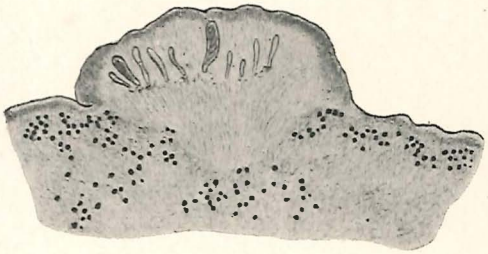

Fig. 727

Fig. 726

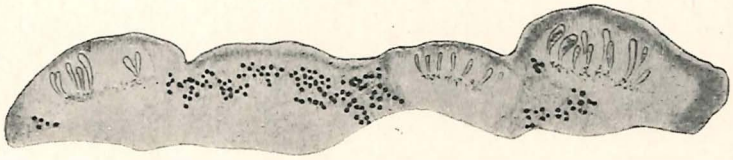

Fig. 725

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PLATE 140.

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Fig. 728. Margin of areole; the free, vertical side is to the left in the figure. Note the cuticle and the brown cortex on the surface of the areole. (× 620).

Fig. 729. Margin of a lecideine apothecium, the interior of which is colourless, while the peripheral hyphæ are brown. (× 620).

Fig. 730. Unripe ascus, paraphyses, ascogenous and paraphysogenous hyphæ from the hypothecium. (× 747).

Fig. 731. To the left an unripe ascus, to the right a ripe ascus with polaridyblast spores. (× 747).

Fig. 732. Two ripe, brown spores. (× 747).

Fig. 733. Thallus with a pycnide. (× 140).

Fig. 734. Conidiiferous hyphæ. (× 1053).

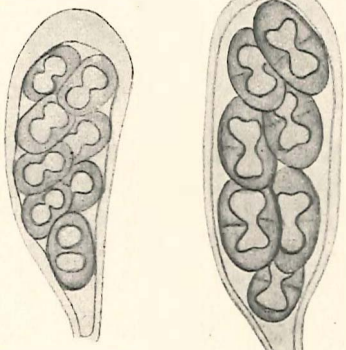

Fig. 731

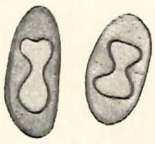

Fig. 732

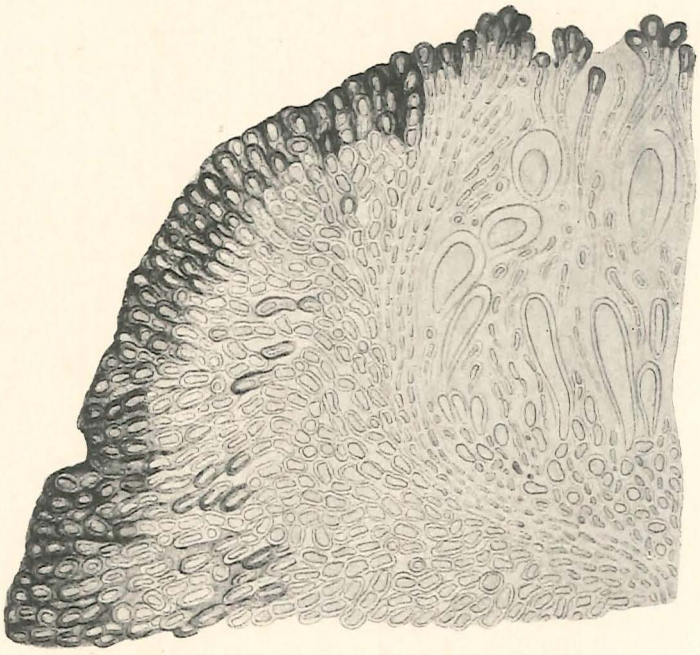

Fig. 729

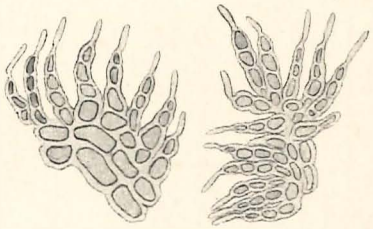

Fig. 734

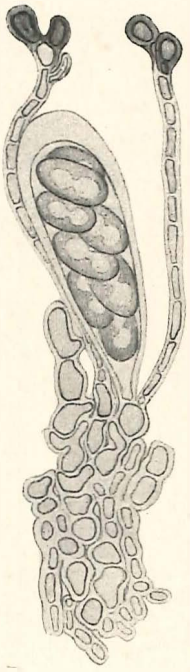

Fig. 730

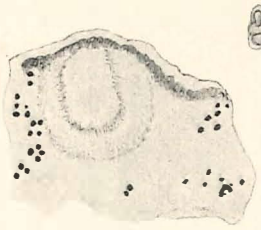

Fig. 733

Fig. 728

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