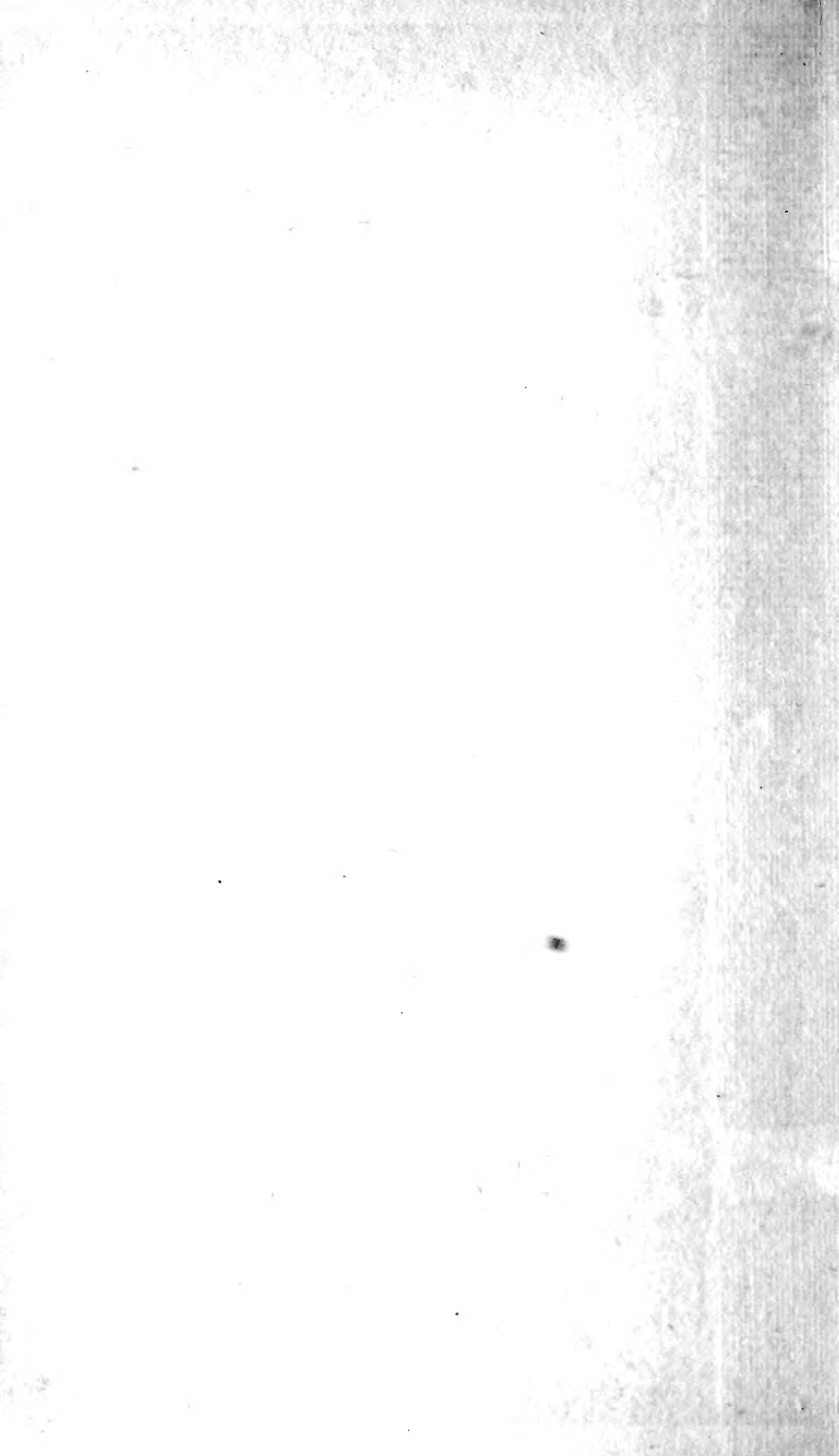


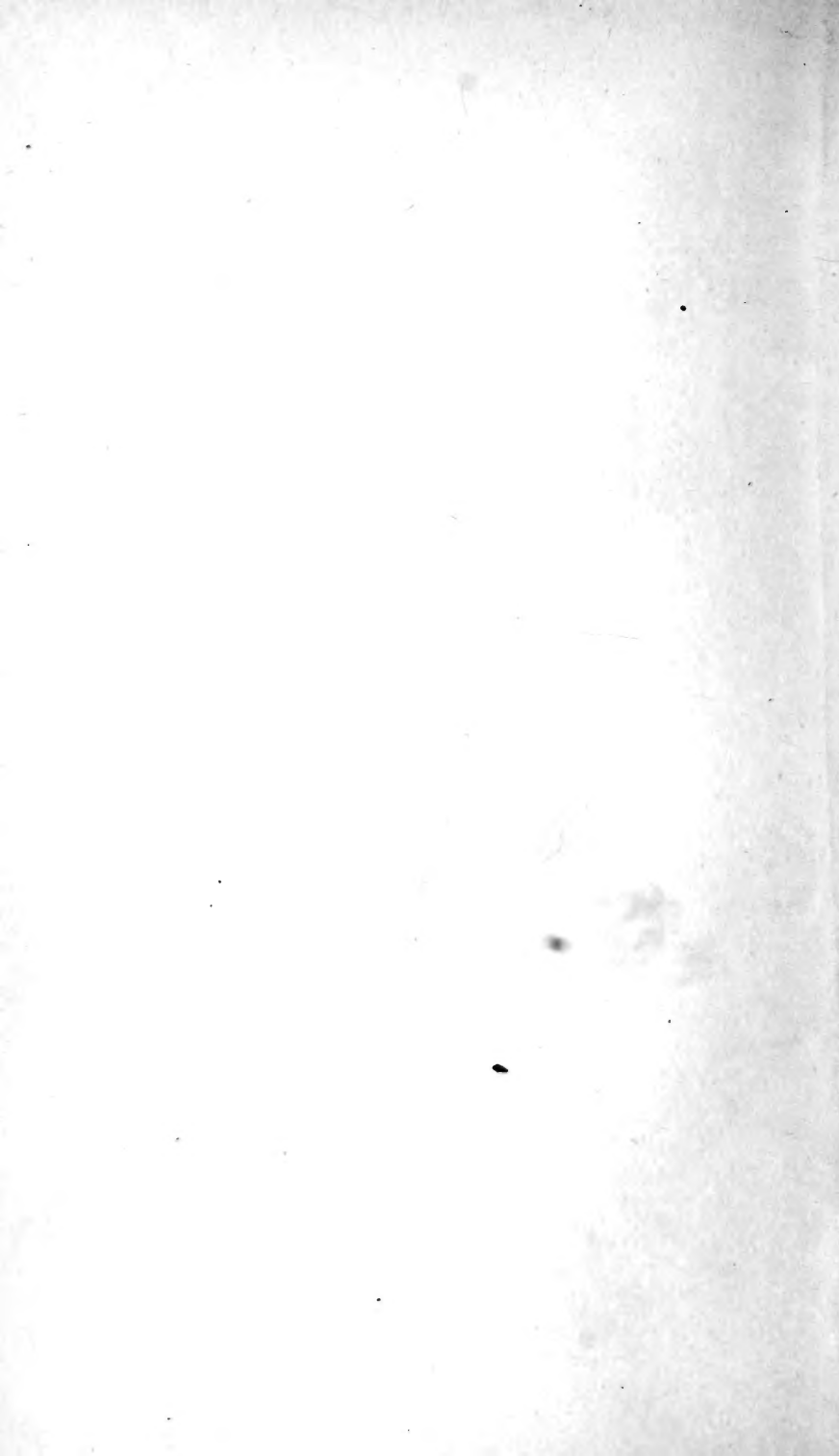


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BRITISH LICHENS



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A MONOGRAPH
OF THE
BRITISH LICHENS

A DESCRIPTIVE CATALOGUE
OF THE SPECIES IN THE
DEPARTMENT OF BOTANY, BRITISH MUSEUM

PART I.
SECOND EDITION

BY
ANNIE LORRAIN SMITH, F.L.S.
Acting Assistant, Department of Botany

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LONDON
PRINTED BY ORDER OF THE TRUSTEES OF THE
BRITISH MUSEUM

AND SOLD BY
LONGMANS, GREEN & CO., 39, PATERNOSTER ROW, E.C. 4;
B. QUARITCH, LTD., 11, GRAFTON STREET, NEW BOND STREET, W. 1;
DULAU & CO., LTD., 37, SOHO SQUARE, W. 1;
AND AT THE
BRITISH MUSEUM (NATURAL HISTORY), CROMWELL ROAD, S.W. 7.

1918

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LONDON:
PRINTED BY WILLIAM CLOWES AND SONS, LIMITED,
DUKE STREET, STAMFORD STREET, S.E. 1, AND GREAT WINDMILL STREET, W. 1.

PREFACE TO SECOND EDITION

THE long interval of time between the publication of the two Parts of the Monograph of British Lichens rendered necessary the preparation of a new edition of Part I. as soon as possible after the completion of Part II., and fortunately Miss Lorrain Smith was able to undertake the work.

The present volume covers the same ground as the first edition of Part I. by the Rev. J. M. Crombie, but has been completely re-written; much new material has been incorporated, and considerable alterations in arrangement and classification have been made. It thus forms an independent work companion to Part II., by the same author, issued in 1911.

By the addition of an Appendix, in which are contained those Orders that under the accepted scheme of arrangement would have been included in Part II., the two Parts are correlated; together they form a complete modern presentment of the British Lichens. Miss Smith has also added, in the form of an Introduction, a general account of the Lichens.

The small blocks in the text illustrating the genera have been replaced by a series of plates similar to those issued with Part II.

A. B. RENDLE.

DEPARTMENT OF BOTANY,
BRITISH MUSEUM (NATURAL HISTORY),
CROMWELL ROAD, S.W.

July 1918.

PREFACE TO FIRST EDITION

THE re-arrangement of the British Lichens in the Herbarium of the British Museum and the incorporation of a great series of specimens made a revised Catalogue of these plants a necessity.

The large number of authentic specimens from Dillenius, Hudson, Sowerby, Dawson Turner, T. Taylor, Salwey, Mudd and Leighton contained in the Herbarium supplied material for determining the species of these lichenologists which does not exist elsewhere ; while the extensive series of British Lichens, including the collections of Buddle, E. Forster, R. Brown, Carroll, Piggot, Holl, Crombie and Larbalestier, made it possible to determine with certainty the geographical distribution of the species within the British Islands.

The Rev. J. M. Crombie, M.A., undertook the preparation of a Monograph based on these materials. This volume contains descriptions of half the known British species. The remainder (consisting of the Lecidei, Graphidei, Pyrenocarpei, Peridiei and Myriangiacei) is so advanced that it may be expected to appear in 1895, and will contain a complete index to the genera and species of the whole work.

WILLIAM CARRUTHERS.

March 1894.

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INTRODUCTION

THE LICHEN-PLANT.

LICHENS are a class of thallophytes of lowly organization that inhabit soil, rock, wood, trees, etc. The vegetative thallus is of varying form and colour; the reproductive organs are akin to those of fungi. They differ from all other members of the vegetable kingdom in their composite structure, being formed from the union in intimate symbiotic relationship of two separate plants, a fungus and an alga. This can easily be demonstrated in any part of the thallus or vegetative structure; a thin section, examined under the microscope, shows a ground structure of colourless cells or hyphæ, the fungal elements; and a series of green cells which are the alga. If the latter are confined to a narrow zone near the upper surface, the thallus is termed heteromerous (see figs. 5, 6), but if they are scattered more or less evenly through the thallus it is then described as homoimerous (fig. 1).

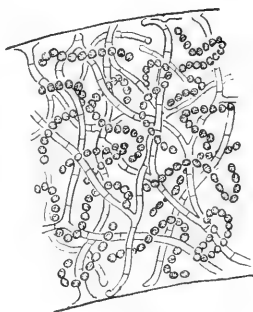


FIG. 1.—Section of homoimerous thallus of *Collema*.
× 250.

12 This old division of lichens into heteromerous and homoimerous does not entirely correspond with the modern more exact system of classification based on the reproductive organs; but the type of structure thus indicated is generally well marked, and a valuable character in identification.

Fungal elements of the thallus.—These have undergone considerable modification as lichen constituents, and cannot as a rule be traced back to any particular species or genus of fungi. The British lichens, however, are all associated with Ascomycetes, and approximate to certain groups within that class of fungi.

In the tropics there are lichens in which the fungus belongs to the Hymenomycetes.

Lichen-hyphæ, as they issue from the germinating spore and lay hold on the algæ, are thin-walled, and similar to those of fungi (fig. 2). The various tissues are formed by the branching

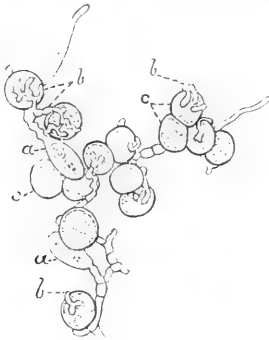


FIG. 2.—*a*, Germinating spores ; *b*, clasping filaments ; *c*, algal cells. (After Bonnier $\times 350$.)

and septation of these hyphæ. In the growing regions, at the apex or edges of the thallus, or in the gonidial region, the cells remain comparatively thin-walled ; but in the other parts of the thallus, especially in the medulla, the walls become very thick, with the exception of the gelatinous lichens, in which the thickening is less marked. In the cortex of the foliose and other species, there is frequently a formation of pseudo-parenchyma (plectenchyma). It arises from the vertical, multiseptate tips of the hyphæ which lie closely packed together and present the ap-

pearance of cellular structure. In many cortices, more especially of crustaceous lichens, the walls are so swollen that the cell-lumen practically disappears and the tissue becomes an amorphous gelatinized mass.

Strengthening elements are provided by the coherent parallel growth of thick-walled hyphæ which form fibre-like bundles or chondroid strands that give support to the thallus.

Lichen-hyphæ retain many of the characteristics of those of the higher fungi. Pure cellulose has not been found, the cell-walls being formed of various hemi-celluloses, and nearly all the cell-membranes contain more or less chitin. The cells enclose a nucleus, protoplasm, glucoses and sometimes oil-drops ; glycogen occurs in the cells of the reproductive system. Sphæroid cells filled with greenish oil are a constant feature of the lower rhizoidal layer of calcicolous lichens ; oil cells also occur occasionally in other lichens.

Algal elements of the thallus.—The algal constituents of the composite thallus belong to the two classes—(1) Myxophyceæ, generally termed blue-green algæ, and (2) Chlorophyceæ, which are referred to as bright-green. Most of them are aerial forms and, in a free condition, they inhabit moist shady situations. They multiply by division within the thallus ; zoospores are

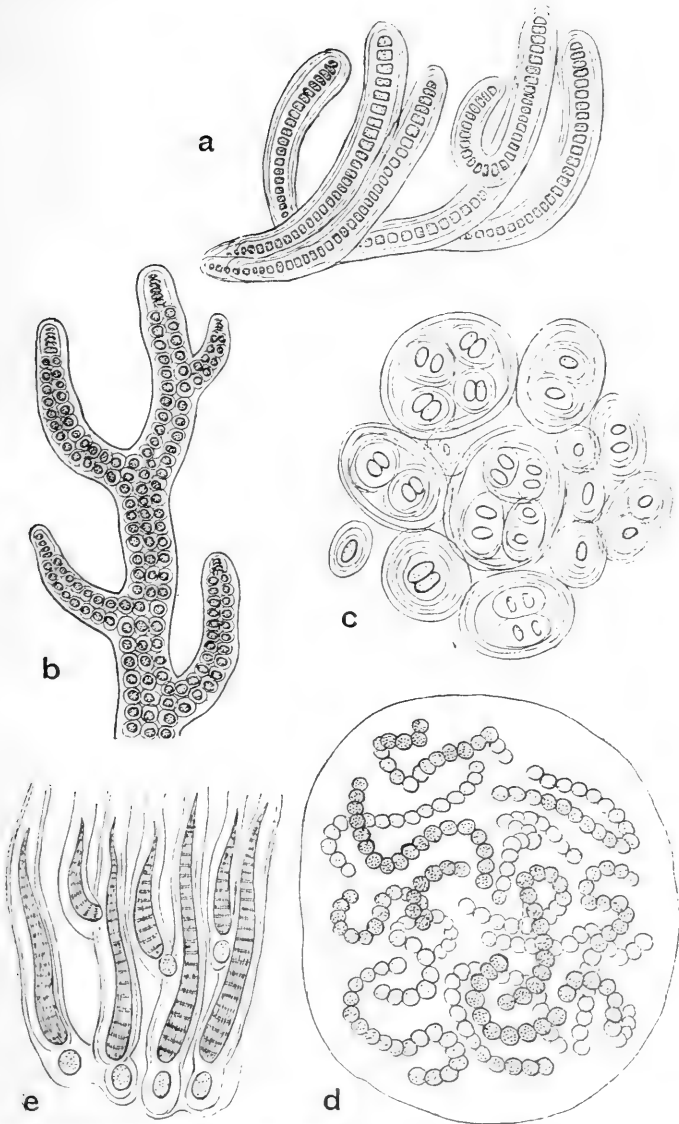


FIG. 3.—Blue-green algae that form gonidia. a, *Scytonema*; b, *Stigonema*; c, *Gloeocapsa*; d, *Nostoc*; e, *Rivularia*. (a, b, e, after Kützing, $\times 350$; c, after Cooke, $\times 400$; d, $\times 450$.)

never produced except in cultivation outside the thallus. The determination of the genera and species to which they severally belong is often uncertain, but their distribution in British lichens is somewhat as follows :—

1. Myxophyceæ associated with Phycolichenes, many of them gelatinous lichens (fig. 3). They are :—

Scytonema occurring in *Thermutis*, *Spilonema*, *Leptogidium*, *Gyalecta* (in part), *Placynthium*, *Polychidium*, *Porocyphus* and *Coccocarpia*.

Stigonema in *Ephebe* and *Ephebeia*.

Glæocapsa in *Euopsis*, *Pyrenopsis*, *Synalissa* and *Psorotichia*.

Nostoc in *Collema*, *Leptogium*, *Peltigera*, *Pannaria* and *Parmeliella*.

Rivularia in *Lichina* and *Pterygium*.

Nylander gave the name gonimia to the blue-green algæ of the thallus, retaining the term gonidia for the bright-green species. The distinction is not generally maintained.

2. Chlorophyceæ associated with Archilichenes (fig. 4), as follows :—

Protococcus (*Cystococcus*, *Pleurococcus*) and *Palmella* in the greater number of the larger lichens and in many crustaceous genera, such as *Lecanora*, *Lecidea*, *Pertusaria*, *Verrucaria*, etc.

Trentepohlia in *Cænogonium*, *Dirina*, *Rocella*, *Graphidaceæ*, *Pyrenulaceæ*, and also in *Thelotrema* and *Gyalecta*, rarely in *Lecanora* and *Lecidea*.

Cladophora in *Racodium*.

Though as a general rule the alga is less affected than the fungus by the symbiotic life, it also may become modified in appearance. The blue-green forms may lose their colour, as in *Glæocapsa*; or the strings of cells may be broken up, as occasionally in *Nostoc*, *Scytonema*, etc. Among the Chlorophyceæ, there is occasional change of form both in *Protococcus* and in *Trentepohlia*; they revert to their original appearance in free cultivation.

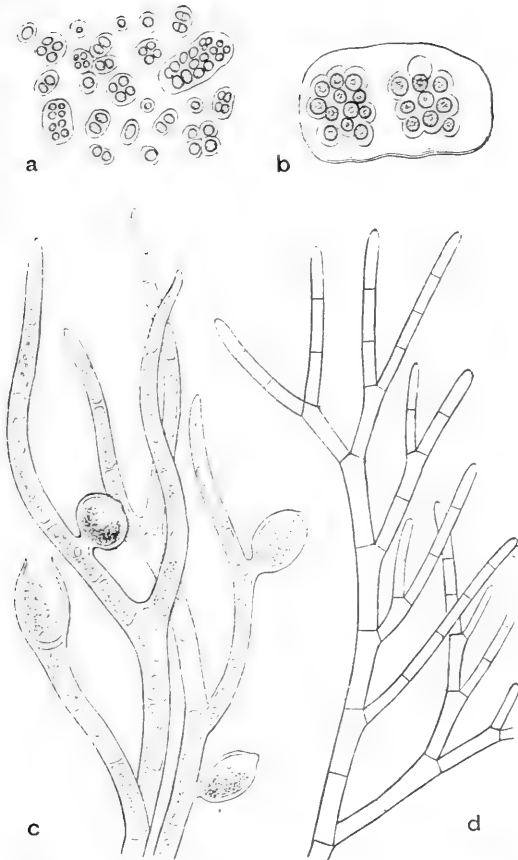


FIG. 4.—Bright-green algae that form gonidia. a, *Protococcus*; b, *Palmella*; c, *Trentepohlia*; d, *Cladophora*. (a, b, $\times 250$, after Hassal; c, after Cooke, $\times 250$; d, after West, $\times 60$.)

MORPHOLOGY.

There are three principal types of development in the vegetative body or thallus of lichens:—

1. *Crustaceous*, or encrusting lichens which spread over trees, rocks or soil, with a more or less well-developed crust varying in thickness, form and colour. The thallus consists generally of an upper cortical layer of hyphæ; beneath the cortex a zone of algal cells and lower still a medulla of fungal filaments, the latter resting directly on the substratum; sometimes the crust is only

a thin structureless mixture of hyphæ and algæ. Though mostly superficial the crustaceous thallus is, in certain genera or species, partly or wholly embedded in the bark or rock on which it grows. It is thus often difficult to recognize the different tissues. The lower hyphæ in many of the superficial species form a thin spreading layer called the hypothallus; it is usually dark in colour and often appears as a black border to the thallus, either as a firm limiting line or as dendritic filaments. A patch of crustaceous lichen on tree or rock may belong to one species and yet be composed of many individuals which have started from different centres, each growing centrifugally. The dark lines chiefly occur where the different individuals encounter each other. A striking instance of such intersecting lines occurs in the thallus of the well-known *Rhizocarpon geographicum*. Strong boundary lines also frequently divide different species inhabiting the same substratum.

2. *Foliose, foliaceous or leafy lichens*; as the name implies, these are spreading leaf-like expansions of one or many lobes, which adhere more or less firmly to the support on which they grow. Like the crustaceous forms, they are dorsiventral in structure; the upper surface is provided with a distinct hyphal cortex, beneath which lies the gonidial zone and the medulla. There is also a lower cortex which is frequently of a darker colour and which is mostly provided with hairs or with rhizoids formed of strands of hyphæ that are chiefly organs of attachment.

3. *Fruticose or shrubby lichens*: these are upright branching forms rising from a basal point, and they are either cylindrical or strap-shaped. The structure is radial, with a central pith of fungal hyphæ, a surrounding band of algæ and an outer cortex of fungal elements. There is considerable variety of form in this group from the short, stiff, strap-shaped lobes of some *Ramalinæ* to the long pendulous thread-like strands of *Alectoria* or *Usnea*. Intermediate forms connect these different groups. In the *Cladoniaceæ* there is a basal thallus, either crustaceous or of small lobes, and there is also an upright stalk called a "podetium," which in many cases opens out into a cup-like structure called a "scyphus." The podetia may be simple or branched, and as the reproductive bodies in this family are borne on the tips of the branches or on the edges of the scyphi, the upright thallus has been frequently regarded as a modified fruit-stalk.

VEGETATIVE STRUCTURES PECULIAR TO THE LICHEN-THALLUS.

Soredia.—These are small powdery bodies that consist of one or several algal cells closely surrounded by lichen-hyphæ. They occur as grayish powder on trees, or on the ground, representing the first stage of thallus formation; as white or greyish granules on the squamules and podetia of many *Cladonia*, or they are massed on the surface of the thallus into well-defined pustules called soralia. The soralium is formed by an increased growth of soredial gonidia and hyphæ at certain points within the thallus, the overlying tissue finally bursting and allowing the escape of the soredia. Soralia are generally constant in form and in position on the thallus. Each soredium can give rise to a new lichen-plant. It is a method of vegetative reproduction that secures a ready and wide dispersal of species.

Isidia.—The isidium is a small outgrowth from the surface of the thallus which contains both the algal and fungal constituents, but differs from the soralium in being covered by a cortex. Usually the isidia are like minute cones on a narrow stalk; occasionally they are branched.

Cephalodia.—On the thallus of various lichens there are developed abnormal, and generally darker-coloured swellings,

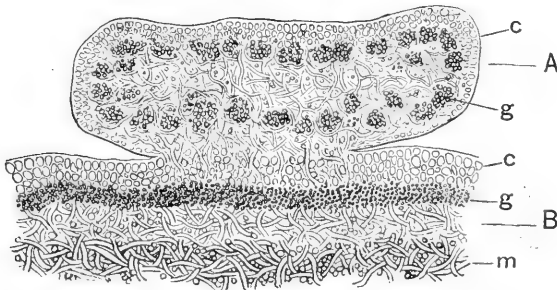


FIG. 5.—Vertical section of thallus and cephalodium of *Peltigera aphthosa*. A, Cephalodium; B, Thallus; c, cortex; g, gonidia; m, medulla. (Greatly magnified.)

tubercles or warts, composed of the normal lichen hyphæ, but containing a different algal constituent, which is almost invariably one of the Myxophyceæ (*Nostoc*, *Stigonema*, etc.). Cephalodia are constant in form and occur as flat orbicular light-coloured expansions (*Lecanora gelida*), groups of dark branchlets (*Lobaria*

laciniata), or irregular warts (*Peltigera*, *Stereocaulon*). They also form internal packets in certain species which are termed endotrophic cephalodia. They are probably of value in retaining moisture (fig. 5).

Cyphellæ and Pseudo-cyphellæ.—These are small roundish bodies scattered over the lower surface, mostly in the genus *Sticta*. They are of definite form with a distinct rim (cyphellæ),

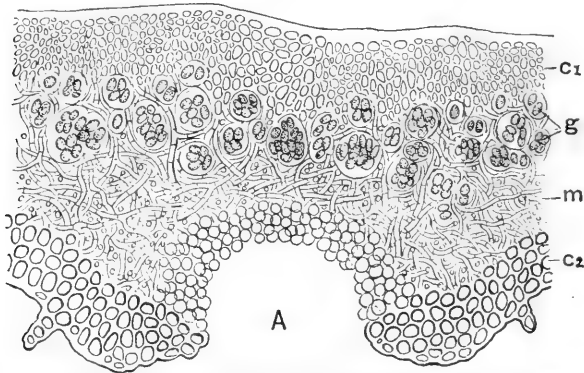


FIG. 6.—Vertical section of thallus and cyphella of *Sticta* sp. A, Cyphella; c₁, upper cortex; c₂, lower cortex; g, gonidia; m, medulla. (Greatly magnified.)

or they are mere openings in the cortex through which hyphae project (pseudocyphellæ). They serve most probably as aerating organs as do the bare areas on the under surface of *Lobaria pulmonaria*, etc. (fig. 6).

Definite breathing pores have been demonstrated in only one lichen, *Parmelia exasperata*; but openings and breaks occur frequently and allow ready communication between the internal tissues and the outer air.

REPRODUCTIVE ORGANS.

Apothecia and Perithecia.—With the exception of a few tropical genera of Hymenolichenes, all known lichens belong to the subclass Ascolichenes and produce their spores in fruits—apothecia or perithecia—somewhat similar to those of the Ascomycetes.

Apothecium.—An open fruit with a more or less exposed disc, comparable to that of the Discomycetes among fungi. The

simplest type of apothecium is formed solely from the fungal constituent as in the Lecideaceæ, usually a round button-like disc, which is either soft and often brightly coloured (biatorine)

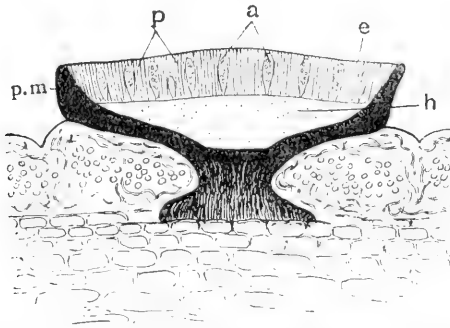


FIG. 7.—Vertical section of lecideine apothecium. a, asci; p, paraphyses; e, epithecium; h, hypothecium; p.m, proper margin. (Greatly magnified.)

(fig. 8), or dark and mostly hard and carbonaceous (lecideine) (fig. 7). The disc is formed of compact upright rows of asci or thecæ (a) which contain the spores, and of sterile threads, the paraphyses (p) of which the tips generally project beyond the

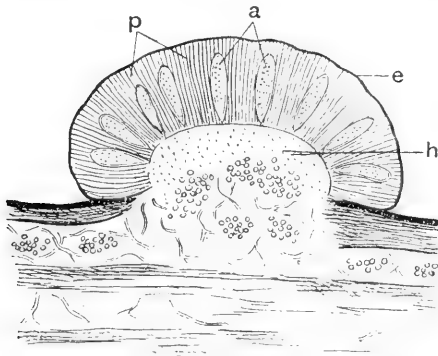


FIG. 8.—Vertical section of biatorine apothecium. a, asci; p, paraphyses; e, epithecium; h, hypothecium. (Greatly magnified.)

asci and form the epithecium (e). The combined asci and paraphyses are the hymenium. The tissue of the fruit immediately below the hymenium is the hypothecium (h), and as continued up and round the fruit is called the parathecium or “proper margin” (p.m). It may be formed of loosely interwoven light-

coloured hyphae, or it may be dark and carbonaceous. Frequently it is excluded by the growth of the disc (fig. 8).

In the more highly developed lecanorine apothecium (fig. 9) the thalline tissue containing gonidia develops along with the

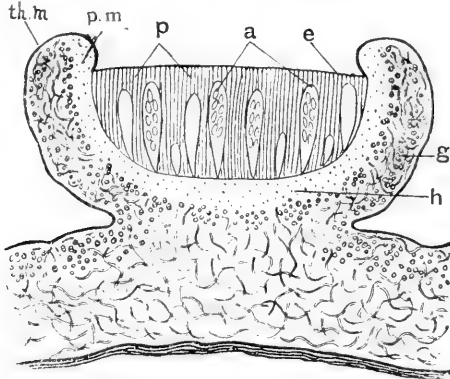


FIG. 9.—Vertical section of lecanorine apothecium. a, asci; p, paraphyses; e, epithecium; g, gonidia; h, hypothecium; p.m, proper margin; th.m, thalline margin. (Greatly magnified.)

other apothecial tissues. This outer protective wall or amphithecium is generally called the “thalline margin” (th.m); it closely surrounds and forms an integral part of the apothecium. Apothecia vary greatly in size from about 0.25 to 10 mm. or more in diameter.

Perithecium.—When the fruit is a closed body with only a narrow opening or ostiole it is called a perithecium (fig. 10). Generally it is surrounded by a wall and the perithecium is then entire (a), or the wall is absent or reduced to a thin line below the base and it is then described as dimidiate (b). Perithecia are always small bodies and usually they are partly immersed in the thallus or substratum.

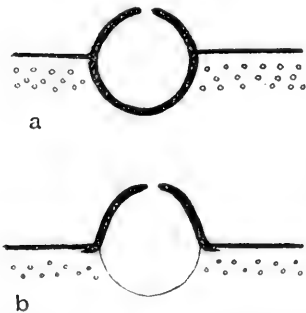


FIG. 10.—Vertical section of perithecia. a, entire; b, dimidiate. (Greatly enlarged, diagramatic.)

As a rule lichen-fruits grow slowly. Spores may be produced almost any time in the year, but for a number of species there is a double spore-bearing season, in spring and again in autumn. The same fruits often persist for several years, new asci being

continually formed. It is therefore no unusual experience to find the spores shed in seemingly well-fruited lichens.

Lichen spores vary considerably in size, form, septation and colour. Usually there are 8 in the ascus, but in some genera or species the ascus contains only one large spore, in others they are innumerable and of small dimensions. The largest spores are found in *Pertusaria* and in *Varicellaria*, the 1-septate spore of the latter measuring up to $350 \mu \times 115 \mu$. In the family, Physiaceæ, the cross wall of the septate spore is so thickened that the lumen of each cell is reduced to a small area at the ends; hence the term polari-bilocular. This is a type of spore without any parallel among fungi. Each cell of a septate spore may give rise to a hyphal filament on germination. The large one-celled spores of *Pertusaria* and other lichens contain many nuclei and produce germinating tubes all over the surface (fig. 11). The newly formed hyphal filaments become associated with an algal cell, and development proceeds (fig. 2), or, if no alga is encountered, the hyphæ in time die off. In some genera of Pyrenocarpaceæ (*Endocarpon* and *Staurothele*) gonidia occur in the hymenium alongside of the asci. They escape from the perithecia with the spores and together they build up a new plant.

Spermogones or *Pycnidia*.—These are small perithecia-like bodies which occur on many lichens, generally scattered over the thallus, but occasionally confined to definite areas: to the periphery of the lobes (*Parmelia physodes*), the margins (*Cetraria islandica*) or the tips of the podetia (*Cladonia*). They vary in form, being ovoid, globose, etc., and sometimes irregular with folds of tissue projecting inwards, thus subdividing the interior. The inner wall is lined by simple or branched hyphæ, the sterigmata or by a cellular tissue on which spermatia are borne. The spermatia are usually minute, and more or less cylindrical, and are provided with a cell-wall and contain a nucleus, etc. Many lichenologists have looked on these bodies as the male organs of the plant bearing non-motile spermatia. They are largely functionless, and as germination of the "spermatia" has been observed in a number of forms, it seems probable that they should rank as secondary fruit forms or pycnidia, their contents would then be more properly described as sporophores and pycnidiospores.

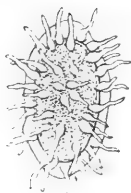


FIG. 11. — Multi-nucleate spore of *Lecidea sanguinaria* var. *affinis*, with germinating tubes. (After de Bary. \times about 250.)

The form of the sterigmata (or sporophores) varies, and the differences have been made use of in classification. Nylander divided the spermatogones into two groups: those with simple "sterigmata" and those with "arthrosterigmata." In the former, the more usual type, the sterigmata are more or less upright, variously branched, and sometimes anastomosing; they are usually sparingly septate, and the spermatia are acrogenous on the tips of a secondary branch. The arthrosterigmata are divided up into short cells, each cell directly giving rise to a pleurogenous spermatium (or spore). This type of sterigma is found in *Physcia* and *Sticta*. In *Endocarpon* the arthrosterigmata form a tissue lining the wall.

The spermatia also show great variation in form. Usually they are extremely minute, or if elongate, extremely narrow and thread-like. Some undoubted pycnidia contain larger stouter spores which do not differ from the others except in size, though the term "pycnides" was wholly reserved for these by Lindsay.

PHYSIOLOGY.

Nutrition.—In the higher plants there are green cells containing chlorophyll and colourless cells forming tissues with different functions. We find the same distinctions between the tissues in lichens, but with this great difference, that whereas, in the higher plants, all the cells have the same initial starting point, in lichens, the two kinds of cells have a widely separate origin. In lichens, as in the higher plants, the green cells—the lichen gonidia—do the work of assimilation and by photosynthesis prepare carbohydrates for the whole plant. The colourless cells or hyphæ are the organs of absorption, and, in return for the algal carbohydrates in the form of sugars or glucoses, they supply water, nitrogenous substances and salts, which they have absorbed from the substratum or from the environment and converted into a state in which they can be used by the protoplasm of the green cell.

Symbiosis.—The relationship between the two organisms was at first regarded as that of algal host and fungal parasite, but further consideration showed that this view was not entirely satisfactory, and Reinke pointed out that each member of the joint thallus might be regarded as the "consort" of the other. This view was further elaborated by De Bary, who brought forward a similar theory of "*symbiosis*," or conjoint life with more

or less advantage to each member or *symbiont* of the dual organism. The alga undoubtedly grows with great vigour in the lichen-thallus, being excited to increased vitality by contact with the fungus, or by conditions, such as increased moisture, supply of inorganic salts, shelter, etc., that are specially favourable to its growth. On the other hand, the fungus withdraws from the alga the necessary carbohydrates. The presence of hyphæ within the algal cells observed in certain lichens, and of empty algal membranes in others, testify to the occasional harmful ravages of the fungus; but any theory of lichens as merely parasitic fungi is incompatible with the continuous healthy development of the lichen plant.

Excretory products.—In many lichens there is an abundant formation of oxalate of lime; it is laid down in crystals on the outside of the hyphæ, medullary or cortical. In *Lecanora esculenta*, a limestone desert lichen, it has been proved that the crystals form sixty per cent. or more of the dry substance of the thallus.

There is also an enormous production of lichen acids, organic products of varying chemical formulæ found only in lichens, and due undoubtedly to the peculiar symbiotic relationship of fungus and alga. Among the best known are parietin (chrysophanic acid), which gives the brilliant yellow colour to several lichens, and the valuable series of acids that produce the orchill of commerce, called also cudbear and litmus. Orchill provides a beautiful purple dye, and though it can be extracted from a number of lichens, the chief commercial source is *Rocella tinctoria*, which grows in great abundance on the rocky coasts of southern Europe. The crustaceous lichen *Lecanora tartarea* also yields a purple dye.

ECOLOGY AND DISTRIBUTION.

Lichens are xerophytic in structure and well-adapted by their composite nature to withstand extreme drought and extreme weather conditions. In some cases water may be absorbed from the soil, but in most lichens the habitat precludes that possibility: they live nearly always in xerophytic conditions—on the bark of trees, on the bare rock, on acid moorland soil, on sandy wastes or by the seashore. The hyphæ swell up and retain for a long time the moisture they receive mostly from mist or rain. There is no regular provision for transpiration except in a few

cases. Growth is extremely slow, and there is in consequence little demand on the metabolic activity of the cells. A plant of *Parmelia saxatilis* kept under observation for a considerable period was observed to increase about 1 cm. in diameter in a year. The gonidial layer is usually several cell-rows below the surface and is often obscured by pigments in the cortical cells; they require therefore abundant light and pure air, and are always most luxuriant in well-lighted situations, such as the sunny side of a wall, and on the outskirts of a wood rather than in its shady glades. They soon die out or lead an impoverished existence in the near precincts of a large town, owing to the smoke. They are the most cosmopolitan of all plants and the pioneers of vegetation, occupying great tracts of mountain and arctic regions where no other plants can live. Distribution in the case of some genera and species is limited by climate or by the nature of the substratum. On the other hand, there are species, like the mountain-loving *Rhizocarpon geographicum*, that spread almost from pole to pole.

ECONOMIC USES OF LICHENS.

In addition to their use as dye-plants, lichens are to a very limited extent valuable as a food supply. The lichenin stored in the cell-walls of *Cetraria islandica*, the Iceland Moss, can be so prepared as to be both nutritious and appetising and has been often utilised by northern peoples. Species of *Gyrophora*, "tripe de roche," have been eaten by travellers when no other food was available, but though they contain some nourishment they are too bitter for consumption. Reindeer pasture largely on *Cladonia rangiferina*, and snails, slugs, mites, etc., devour eagerly many different kinds of lichens.

In the economy of Nature a considerable part is played by crustaceous saxicolous lichens in breaking up the rock and preparing it for plants more dependent on loose soil. Calcareous and granite rocks are thus slowly but gradually disintegrated. Volcanic rocks with their smoother harder surface are less affected. Topographically as well as geographically, lichens are indispensable pioneers. Many lichens grow on trees, where they are epiphytic, though occasionally their root-bases penetrate the living tissue; only one species, a leaf-lichen in the tropics, has been recorded as constantly parasitic. Sometimes the growth of leafy and shrubby forms is so luxuriant as to cover the entire

bark and thus impede the aeration of the tree. On the other hand, it is suggested that they probably protect the tree from extreme cold. They do, however, indirect harm by providing harbourage for insect pests.

PHYLOGENY AND CLASSIFICATION.

Lichens as regards both their symbionts are polyphyletic in origin, the algæ which form gonidia belonging to widely separated groups, and the fungi which form lichen-hyphæ being derived from the two great subclasses Basidiomycetes and Ascomycetes.

All the British lichens are derived from the Ascomycetes, and they are again polyphyletic within the subclass. They fall into two great series :—

- I. Gymnocarpeæ, in which the fruits have more or less open discs.
- II. Pyrenocarpeæ, with closed fruits.

The Gymnocarpeæ are divided into three subseries :—

1. Coniocarpineæ, characterized by a "mazædium" type of fruit, and, in most of the families, by a primitive thallus. The derivation is doubtful.
2. Cyclocarpineæ, with open fruits corresponding to those of the Discomycetes. Their fungal ancestors are to be sought for among the Pezizineæ and most probably in the family Patellariaceæ.
3. Graphidineæ. The fruits are characterized by a narrow generally elongate disc. The nearest allies among fungi are the Hysteriaceæ.

In the arrangement of the various Orders or families, special attention has been given to the development of the lichen-plant as a whole within each series.

The Coniocarpineæ are a subseries apart, intimately connected with fungi and have been placed first. The almost closed form of the fruit suggests, however, affinity with the Pyrenocarpeæ.

In the Cyclocarpineæ, the first group includes those families in which the fruit is highly developed, the apothecia with few exceptions having a thalline margin (lecanorine). It was

impossible to place the less highly developed lecideine families first as they are already described in Part II. The lichens containing blue-green algæ (*Myxophyceæ*) have been considered first; those with a simple homoimerous thallus being followed by those with a heteromerous thallus, reaching the highest development in the *Peltigeraceæ* and *Stictaceæ*, which include genera with both types of gonidia, blue-green and bright-green.

To avoid any break in the arrangement, the *Parmeliaceæ*, which are allied to the *Stictaceæ*, are placed next. The gonidia in this and the following families are bright-green. Then follow the *Usneaceæ*, and after that family the *Physciaceæ*, marked by the peculiar polarilocular spores. The genera of *Physciaceæ* range from fruticose to crustaceous forms. The *Lecanoraceæ* and other crustaceous families close the first group.

The second great group of *Cyclocarpineæ* includes those families in which the apothecia are without a thalline margin (biatorine or lecideine), the gonidia taking no part in the formation of the fruit: they are thus more primitive phylogenetically than the preceding. Beginning with the highest families of the group, we place first the *Gyrophoraceæ* with a well-developed foliose thallus, followed by the *Cladoniaceæ*, the filamentous *Cœnogoniaceæ*—very poorly represented in northern countries—and finally the great family of *Lecideaceæ* with a crustaceous or, at most, minutely squamulose thallus.

In subseries *Graphidineæ*, the families have a crustaceous thallus, with the exception of *Rocellaceæ*, which is fruticose and highly developed, the gonidia are all *Chlorophyceæ* and mostly from the genus *Trentepohlia*. The arrangement depends on the character of the fruit.

Series II., *Pyrenocarpeæ*, includes a small family of *Pyrenidiaceæ* with blue-green gonidia (*Myscophyceaceæ*), the others all contain *Chlorophyceæ*. There is one family, *Dermatocarpaceæ*, which is foliose, the other families are all crustaceous and are arranged according to perithecial characters. They are derived from the *Pyrenomycetes*.

The arrangement adopted has been partly necessitated by the order of publication. In the previous Monograph (by Crombie), the thallus rather than the fruit formed the basis of classification. If it had been possible to republish the whole work simultaneously, a better scientific grouping would have been to begin with the *Pyrenocarpeæ*, in which the fruit form is more

primitive, to be followed by the Gymnocarpeæ, with the three subseries in order of development:—1. Coniocarpeæ; 2. Graphidineæ; 3. Cyclocarpeæ. In Cyclocarpeæ the more simple lecideine families should precede the great lecanorine group, which includes the most highly evolved lichens.

The term "Order" has been retained in place of the now generally accepted term "Family" to maintain conformity with Part II. The Orders that should have been included in the latter work are printed in the Appendix to the present volume. The sequence of arrangement adopted will be found at pp. 1-2, 25-6 and 387-8.

In preparing the Monograph it has been found necessary to depart in many instances from the scheme of classification and method of description adhered to by the Rev. J. M. Crombie in 1894, but I desire to record my very great indebtedness to the work done by him both in his publications and in the herbarium of the British Museum. I wish to thank those who have generously sent me rare or new specimens:—Mr. Hebden, Rev. W. Johnson (especially for *Sarcopyrenia gibba*), Miss Knowles, Mr. Paulson, Mr. Travis, Mr. Watson and Mr. Wheldon. I have also to thank Dr. Rendle for his ready advice, my colleagues in the Cryptogamic herbarium, Mr. A. Gepp and Mr. J. Ramsbottom, for their unfailing assistance in all doubtful points, and Mr. P. Highley for his careful drawings.

The metric system has been used for measurement; the Greek letter μ indicates the one-thousandth part of a millimeter. Other abbreviations refer to chemical reagents: + signifies a colour-reaction, f + a faint reaction, — no reaction. Iodine solution—(I), iodine 1 grain, potassium iodide 3 grains, water $\frac{1}{2}$ oz., is used as a test for starch or glycogen; potassium hydrate (K),—equal parts of caustic potash and water; calcium hypochlorite or bleaching-powder (CaCl), —1 part in half its weight of water; and nitric acid (NO₃), indicate by colour-reactions the presence of lichen-acids in the thallus. K + yellow indicates a general yellow reaction; K ^{+yellow}, a reaction in the upper portion or cortex. K followed by CaCl frequently gives a reaction and is expressed thus:—K(CaCl) + yellow. The meaning of these varying reactions is that the colour of the acids is liberated by the application of an alkali alone, by bleaching-powder alone or after previous treatment with an alkali. Reactions cannot always be relied on, as the production of acids may have been inhibited by absence of light, etc.

NOTE TO STUDENTS

To the Lichen Floras recommended to students in Part II. should be added Harmand's "Lichens de France, Paris, 1905-13," still unfortunately incomplete, only five fascicles having been issued. Various groups of lichens—Orders, Genera, etc.—have been revised by modern lichenologists, and the results, when touching on British Lichens, have been freely used. The following are the more important:—

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CATALOGUE
OF
BRITISH LICHENS.

PART I.

SUBCLASS ASCOLICHENES.

Series I. GYMNOCARPEÆ.—Fruit a more or less open apothecium.

Series II. PYRENOCARPEÆ.—Fruit closed, a perithecium.

SERIES I. GYMNOCARPEÆ.

Subseries I. CONIOCARPINEÆ. — Apothecium partially closed, retaining the spores when mature in a powdery mass (*mazædium*).

Subseries II. CYCLOCARPINEÆ.—Apothecium with open disc ; spores ejected when mature.

Subseries III. GRAPHIDINEÆ.—Apothecium with elongate narrow disc (*lirella*) or roundish (*ardella*) ; spores ejected when mature.

Subseries I. CONIOCARPINEÆ.

Thallus crustaceous (or wanting), or fruticose (foliose in some foreign genera). Algal cells *Protococcus*, *Pleurococcus*, *Stichococcus*, or *Trentepohlia*. Fruit a stalked or sessile apothecium, usually hyphal in origin, with a capitulum open or partially closed ; asci usually cylindrical, dissolving early, so that the spores as they

mature lie loose in the apothecium, like powder or dust, forming a *mazædium*.

The Coniocarpineæ are distinguished from all other lichens by the peculiar form of the mature fruit. Some of the genera and species are parasitic on other lichens; others have no recognizable thallus. Such forms are closely connected with fungi and have been classified as such by some mycologists (see Rehm in Rabenhorst's *Krypt. Fl.* i. 3 (1887-96), p. 382). The British species have all been included among lichens. There are two British Natural Orders:—

- Thallus crustaceous..... i. CALICIACEÆ.
Thallus foliose or fruticose..... ii. SPHEROPHORACEÆ.

ORDER I. CALICIACEÆ.

Thallus effuse, thin, granular-crustaceous, often obsolete. Algal cells Chlorophyceæ (*Protococcus*, *Pleurococcus*, or *Stichococcus*). Fruit usually a stalked, top-shaped or globose apothecium (capitulum), the stalk, when present, simple or sometimes branched, without gonidia; asci dissolving early, the spores forming a powdery mass (*mazædium*), mostly dark-coloured.

The Caliciaceæ, as here understood, include genera and species with stalked and sessile apothecia. In most cases, the algal constituents of the thallus take no part in fruit-formation; in one genus only (*Cyphelium*), a thalline margin is present in some of the species. The following genera are British:

- Thallus wanting or doubtful, mostly parasitic on
Pertusaria..... 1. *Sphinctrina*.
Thallus granular, crustaceous, sometimes obsolete.
Apothecia stalked.
Spores spherical, simple.
Spores dark in the mass 2. *Chænotheca*.
Spores yellow in the mass..... 3. *Coniocybe*.
Spores oblong, septate, dark-coloured.
Spores 1-septate..... 4. *Calicium*.
Spores 3- or more-septate 5. *Stenocybe*.
Apothecia sessile.
Spores oblong, septate.
Spores 1- or more-septate, dark-
coloured 6. *Cyphelium*.

1. *SPHINCTRINA* Fr. Syst. Orb. p. 120 (1825) (as a genus of Fungi); De Not. in Giorn. Bot. Ital. ii. p. 314 (1846). (Pl. 1.)

Thallus doubtful or none proper. Apothecia small, globose-turbinate, sessile or shortly stalked, somewhat shining, black, with a thick connivent proper margin; asci subpersistent; spores black in the mass, simple (rarely 1-septate), blackish. Spermogones immersed; spermatia long, acicular, bent.

The species of this genus are mostly parasitic on the thallus of *Pertusaria* or other lichens. The entire genus has been included by Rehm (in Rabenhorst's *Krypt. Fl.* i. 3, p. 389 (1887-96)) in Pezizaceæ, suborder Dermateaceæ.

1. *S. turbinata* Fr. l. c. & Summ. Veg. p. 366 (1849) (as a fungus); De Not. l. c.—Thallus wanting. Apothecia small, globose or somewhat top-shaped, shortly stalked or almost sessile; spores protruding in a mass from the narrowed disc, globose or subglobose, small, 3–8 μ in diam.; hymenial gelatine pale bluish then sordid dark-coloured with iodine.—Nyl. Syn. Lich. i. p. 142, t. 5, f. 1; Mudd Man. p. 255, t. 4, f. 102; Cromb. Lich. Brit. p. 11; Leight. Lich. Fl. p. 38; ed. 3, p. 38. *Lichen gelasinatus* With. Arr. ed. 3, iv. p. 8, t. 31, f. 1 (1796)? *Calicium turbinatum* Pers. Tent. Disp. Meth. Fung. Suppl. p. 59 (1797). *C. sessile* Pers. l. c.; Engl. Bot. t. 2520; Turn. & Borr. Lich. Brit. p. 128; Hook. in Sm. Engl. Fl. v. p. 138. *C. stigonellum* Ach. Meth. p. 88 (1803). *Sphæria sphincterica* Sowerb. Engl. Bot. iii. t. 386, fig. 1 (1803). *Acolium stigonellum* S. F. Gray Nat. Arr. i. p. 482 (1821).

Easicc. Leight. n. 132; Mudd n. 241. Carroll Lich. Hib. n. 26; Johns. n. 168.

The apothecia are usually numerous on the host, though scarcely visible without a lens. The spermogones are scattered among the apothecia and are not infrequent with spermatia 12–15 $\mu \times 1 \mu$. *Lichen gelasinatus* With. is somewhat doubtful, both in description and in figure.

Hab. Parasitic on the thallus of *Pertusaria communis* and sometimes of *P. fallax*, on the trunks of trees, chiefly oaks.—*Distr.* General and not uncommon in England and in S. and Central Scotland, rare in Ireland.—*B. M.* Rozel, Jersey; Guernsey; near Withiel, Cornwall; Ventnor, Isle of Wight; New Forest, Hants; Balcombe Hurst, Wakehurst, Danny, Henfield and St. Leonard's Forest, Sussex; Sibertswold, Kent; Shiere, Surrey; Great Totham and Gosfield Hall, Essex; Chedworth Woods and Oakley Park, near Cirencester, Gloucestershire; near Worcester; Shrewsbury, Shropshire; Llanbryn-mair, Montgomeryshire; Hay Wood, Herefordshire; Leven's Park, Westmoreland; near Ayton, Cleveland, Yorkshire; New Galloway, Kircudbrightshire; Roseneath, Dumbartonshire; Pitfour, Carse of Gowrie, Perthshire; Blarney and Andrum, Cork; Curraghmore near Waterford; Glenstale, Tipperary.

2. *S. tubæformis* Massal. Mem. Lich. p. 155, f. 190 (1855); Jatta Syll. Lich. Ital. p. 477 (1900).—Thallus none. Apothecia minute, sessile or shortly stalked, globose or somewhat top-shaped; spores fusiform-ellipsoid, large, 11–16 μ long, 7–8 μ thick; hymenial gelatine faintly bluish with iodine.—*S. microcephala* Nyl. in Act. Soc. Linn. Bord. sér. 3, i. p. 280 (1856); Cromb. Lich. Brit. p. 11 & Monogr. i. p. 84; Leight. Lich. Fl. p. 39; ed. 3, p. 38. *S. turbinata* var. *microcephala* Mudd Man. p. 256 (1861). *Calicium microcephalum* Tul. in Ann. Sci. Nat. sér. 3, xvii. p. 78, t. 15, f. 20 (1852) (non Ach.).

Closely allied to the preceding but with rather smaller more scattered apothecia, and larger differently shaped spores. Lahm (Jahresb. Westf. Prov. Ver. xii. p. 138 (1886)) states that he found growing on the same *Pertusaria* (*P. leioplaca*) spermogones which

he associates with this species. They have short stout sterigmata and somewhat ellipsoid spermatia measuring 4-5 μ long, 3-4 μ thick.

Hab. Parasitic on the thallus of several species of corticolous *Pertusariæ* (*P. melaleuca*, *P. fallax*, *P. leioplaca* and *P. Wulfenii*).—*Distr.* Rare in the Channel Islands and S. England, probably overlooked elsewhere.—*B. M.* Near Brockenhurst, New Forest, Hants.

3. *S. kylemoriensis* Cromb. in Journ. Bot. xx. p. 274 (1882).—Thallus none proper. Apothecia minute with a short pale slender stalk or almost sessile; spores small, globose, dark-brown, 4-6 μ in diam.; hymenial gelatine pale bluish and then sordid with iodine.—*Calicium kylemoriense* Larb. ex Leight. in Trans. Linn. Soc. ser. 2, i. p. 242, t. 33, ff. 12-14 (1878) & Lich. Fl. ed. 3, p. 42.

Differs from *S. turbinata* in the smaller apothecia, the light stalk and in the habitat on saxicolous lichens.

Hab. Parasitic on the thalli of *Lecanora pavela* and of *L. nitens* on maritime rocks.—*Distr.* Local and rare in the Channel Islands and in W. Ireland.—*B. M.* Island of Sark; Kylemore, Connemara, Galway.

4. *S. microcephala* Koerb. Parerg. Lich. p. 288 (1861).—Thallus (if proper) effuse, thin, granular, unequal, greyish-brown or olive-green, sometimes evanescent. Apothecia small, scattered, sessile or shortly stalked, globose or top-shaped, about $\frac{1}{2}$ mm. in height; spores globose, 7-9 μ in diam. or sometimes ellipsoid or oblong, 8-13 μ long, 6-9 μ thick; hymenial gelatine bluish with iodine.—*S. anglica* Nyl. Syn. Lich. i. p. 143, t. 5, f. 3 (1860); Mudd Man. p. 255; Carroll in Journ. Bot. iii. p. 287 (1865); Cromb. Lich. Brit. p. 11; Leight. Lich. Fl. p. 38; ed. 3, p. 38. *Lichen microcephalus* Sm. Engl. Bot. t. 1865 (1808). *Calicium microcephalum* Ach. Syn. Lich. p. 57 (1814); Turn. & Borr. Lich. Brit. 130; Hook. in Sm. Engl. Fl. v. p. 138. *Phacotium* (errore *Phacotrum*) *microcephalum* S. F. Gray Nat. Arr. i. p. 482 (1821).

Rehm (tom. cit. p. 392) describes this species as parasitic on other Lichen crusts, growing on bark of pine trees as well as on rails. The British specimens are all on old rails, especially oak.

Hab. On bark of pines, &c., also on old rails, in shady situations.—*Distr.* Only sparingly in a few localities in S. and Central England.—*B. M.* Ardingly and Albourne, Sussex; Twycross, Leicestershire; Caister, near Yarmouth, Norfolk.

2. **CHÆNOTHECA** Th. Fr. Lich. Arct. p. 250 (1860). *Calicium* Pers. in Ust. Ann. Bot. vii. p. 20 (1794); Cromb. Monogr. i. p. 85 pro parte. *Phacotrum* (*Phacotium*) S. F. Gray Nat. Arr. i. p. 482 pro parte. *Strougyllium* S. F. Gray tom. cit. p. 485. *Cyphelium* Mudd Man. p. 259 (1861) (non Ach.). (Pl. 2.)

Thallus thin, granular or powdery, sometimes evanescent, very rarely squamulose, or none proper. Apothecia stalked, the capitulum top-shaped or subglobose, small, blackish-brown, often

finely powdered with a white-grey or yellow pruina; paraphyses slender, thread-like; spores uniseriate in the ascus, usually globose, one-celled, dark-coloured. Spermogones punctiform, black, with simple or sparingly branched sterigmata and short ellipsoid spermatia.

Distinguished by the dark-coloured simple spores which form a mazædium as in the other Coniocarpineæ, and are often protruded in a dark mass. No gonidia take part in the formation of the fruiting body. The thallus is usually well-developed, though by some botanists it is considered to be distinct from the apothecia, the latter being described as fungi parasitic on various lichen thalli.

Apothecia yellow- or yellowish-green-pruinose.

1. *Ch. chrysocephala* Th. Fr. l. c.—Thallus citrine or bright greenish-yellow, thickly granular, the granules rounded, scattered or conglomerate. Apothecia scattered, black or blackish-brown, on a short slender stalk, the capitulum somewhat turbinate-lentiform, citrine-pruinose at the margin; spores dark umber-brown, globose, small, 3–6 μ in diameter.—*Calicium chrysocephalum* Ach. Meth. Suppl. p. 15 (1803); Engl. Bot. t. 2501; Hook. in Sm. Engl. Fl. v. p. 140; Cromb. Lich. Brit. p. 11 & Monogr. i. p. 87; Leight. Lich. Fl. p. 39; ed. 3, p. 39. *Lichen chrysocephalus* Turn. ex Ach. l. c. & in Trans. Linn. Soc. vii. p. 88, t. 8, f. 1 (1804). *Phacotrum* (*Phacotium*) *chrysocephalum* S. F. Gray Nat. Arr. i. p. 484 (1821). *Cyphelium chrysocephalum* De Not. in Giorn. Bot. Ital. ii. p. 318 (1846); Mudd Man. p. 261.

Esicc. Mudd n. 251; Leight. n. 134.

Easily recognized by the greenish-yellow thallus and by the bright yellow pruina on the margin and underside of the capitulum; the pruina disappears in old plants. The apothecia are more or less scattered, and the stalks are occasionally branched.

Hab. On bark of old trees and on worked wood in maritime and upland tracts.—*Distr.* Local and scarce in a few localities throughout England; very rare in S. and Central Scotland, not recorded from Ireland.—*B. M.* Cadnam and Lyndhurst, New Forest, Hants; Hawkhurst and Bolney, Sussex; Penshurst, Kent; Walthamstow, Essex; Hatfield, near Worcester; Downton Castle, Herefordshire; Hay Park, near Ludlow, Shropshire; Rosedale, Cleveland, Yorkshire.

Var. filaris Dalla Torre & Sarnth. Flecht. Tirol, p. 500 (1902).—Thallus somewhat scattered. Apothecia with more elongate slender stalks and smaller capitula.—*Calicium chrysocephalum* var. *filaris* Ach. Lich. Univ. p. 239 (1810); f. *filaris* Cromb. Monogr. i. p. 88 (1894).

A seemingly distinct variety, though possibly, as Crombie suggests, the characters may be due to the habitat.

Hab. On the bark of old firs in moist upland situations.—*Distr.* Local and rare among the S. Grampians, Scotland.—*B. M.* Aberfeldy and Ben Lawers, Perthshire.

Var. *melanocephala* A. L. Sm.—Thallus as in the species. Apothecia fasciculately branched, pruinose only at the margin; spores globose or ellipsoid, pale brown, 4–16 μ long, 4–8 μ thick.—*Calicium chrysocephalum* f. *melanocephalum* Nyl. Syn. i. p. 147, t. v. f. 19 (1860); Leight. Lich. Fl. p. 40; ed. 3, p. 39; Cromb. in Grevillea xv. p. 14 (1886) & Monogr. i. p. 87.

Easicc. Leight. n. 134 pro parte.

Differs from the species in the constantly dark epithecium, and especially in the colour and form of the spores, which vary from being globose and small to considerably large and ellipsoid. I have been unable to verify this from Leighton's specimen.

Hab. On old palings (associated with the species).—B. M. Downton Castle, Herefordshire (the only locality).

2. *Ch. trabinella* A. L. Sm.—Thallus ashy-grey or olive-brown, thickish, granular, composed of minute congested sub-squamulose crenate granules. Apothecia small, the stalks rather short, slender, pale brown or blackish, the capitulum top-shaped-lentiform, greenish-yellow-pruinose, the sporal mass dark-brown and somewhat plane; spores minute, globose, 3–5 μ in diameter.—*Ch. phæocephala* Th. Fr. Lich. Arct. p. 251 (1860); *Lichen trabinellus* Sm. Engl. Bot. t. 1540 (1805); *L. phæocephalus* Turn. in Trans. Linn. Soc. viii. p. 260, t. 6, f. 1 (1807). *Calicium phæocephalum* Turn. & Borr. Lich. Brit. p. 145 (1839); Hook. in Sm. Engl. Fl. p. 140; Cromb. Lich. Brit. p. 11 & Monogr. i. p. 88; Leight. Lich. Fl. p. 40; ed. 3, p. 39. *Phacotrium (Phacotium) trabinellum* S. F. Gray Nat. Arr. i. p. 484 (1821). *Cyphellium phæocephalum* Koerb. Syst. Lich. Germ. p. 317 (1855); Mudd Man. p. 261.

Not to be confused with *Calicium xylozellum* var. *trabinellum* Wahlenb. ex Ach. Meth. p. 93 (1803). The granular squamulose thallus, by which the species is characterized, varies in thickness and colour, according to the habitat. The British forms are typical, though the plant varies in other countries. The apothecia are numerous, and almost sessile on thicker thalli.

Hab. On old boarded buildings, rarely on palings in wooded districts.—*Distr.* Local and scarce in S.E. and W. England.—B. M. Albourne, Hurstpierpoint and Woodmancote, Sussex; Hay Park near Ludlow, Shropshire; Bruisyard, Suffolk; Lakenham near Norwich, Norfolk.

3. *Ch. acicularis* Zwackh in Flora xlv. p. 535 (1862).—Thallus greyish, very thin, powdery, sometimes obsolete. Apothecia numerous, minute with a short slender dark-brown stalk, the capitulum somewhat narrow, top-shaped, and obconical, more or less citrine-pruinose, the dark-brown sporal mass usually much protruded; spores minute, 3–4 μ in diameter.—*Lichen acicularis* Sm. Engl. Bot. t. 2385 (1812). *Phacotrium (Phacotium) hispidulum* S. F. Gray Nat. Arr. i. p. 483 (1821). *Calicium chlorellum* Turn. & Borr. Lich. Brit. p. 146 (1839) (non Ach.); Hook. in Sm.

Engl. Fl. v. p. 140. *C. aciculare* Fr. Summ. Veg. p. 119 (1846); Leight. Lich. Fl. p. 40; ed. 3, p. 40; Cromb. Monogr. i. p. 88. *C. phæocephalum* var. *aciculare* Cromb. Lich. Brit. p. 12 (1870). *Cyphelium chlorellum* Koerb. Syst. Lich. Germ. p. 317 (1855); Mudd Man. p. 262.

Æsicc. Leight. n. 170; Mudd n. 252; Larb. Lich. Hib. n. 81; Bohl. n. 98

Allied to the preceding, but differing in the thin powdery thallus, the longer and narrower head, and the frequent protrusion of the spirial mass by which the citrine pruina is pushed to the margin.

Hab. On trunks of old trees.—*Distr.* Very local and scarce in S.E. and N.W. England, not recorded for Scotland or Ireland.—*B. M.* New Forest, Hants; Danny and Bolney, Sussex; Boxley, Kent; Wheatfield Park, Oxfordshire; Kempsey, Worcestershire; Bury, Suffolk; Brantsdale and Bousdale Gill, Yorkshire; Levens Park, Westmoreland.

Apothecia whitish- or greyish-pruinose.

4. *Ch. trichialis* Th. Fr. Lich. Arct. p. 251 (1860).—Thallus thinnish, granular-squamulose, greyish-yellow or greyish-glaucous-green. Apothecia small, scattered or crowded, with a slender black stalk, the capitulum globose-lenticular, black, greyish-pruinose, at length naked; spores small, $2.5-4.5 \mu$ in diameter.—*Calicium trichiale* Ach. Lich. Univ. p. 243 (1810); Cromb. Lich. Brit. p. 12 & Monogr. i. p. 85; Leight. Lich. Fl. p. 41; ed. 3, p. 40. *C. æruginosum* var. *cærulescens* Turn. & Borr. Lich. Brit. p. 156 (1839); Hook. in Sm. Engl. Fl. p. 141. *Cyphelium trichiale* De Not. in Giorn. Bot. Ital. ii. p. 318 (1846); Mudd Man. p. 259.

Crombie placed this species in the subgenus *Allodium* Nyl. (Flora lxiii. p. 392), on account of the cylindrical shortly septate alga (*Stichococcus*), a growth form only, which forms the gonidia. The scale-like granules are scattered and minute, or crowded, and then somewhat larger.

Hab. On the trunk of old trees and on old palings (fir) in shady regions.—*Distr.* Rare in S. and N. England, S. Scotland and S.W. Ireland.—*B. M.* Menstrie, New Forest, Hants; Church Stretton, Shropshire; Ingleby Park, Cleveland, Yorkshire; Binnie Woods, Haddingtonshire; Tervoe, Limerick.

Subsp. *cinerea* A. L. Sm.—Thallus finely granular, greyish or whitish. Apothecia with the stalk often brownish and partly greyish-pruinose, the capitulum greyish or whitish pruinose beneath; spores $3-5 \mu$ in diameter.—*Calicium cinereum* Pers. Icones, p. 58, t. 14, ff. 4 & 5 (1798-1800). *C. trichiale* var. *cinereum* Carroll in Journ. Bot. iv. p. 22 (1866); Leight. Lich. Fl. p. 41; ed. 3, p. 40; subsp. *cinereum* Nyl. ex Norrl. in Medd. Sällsk. Faun. & Fl. Fenn. i. p. 10 (1876); Cromb. Monogr. i. p. 86.

Differs from the species in the full granulations of the thallus and in the browner partly pruinose stalks.

Hab. On the bark of old oaks in wooded tracts.—*Distr.* S. Ireland.—*B. M.* Deer Park, Castlemartyr, Cork; Tervoe, near Limerick.

5. *Ch. æruginosa* A. L. Sm.—Thallus thinnish, powdery, greyish-glaucous or greenish-yellow. Apothecia black or brownish-black, the stalk varying in length, dark-brown, the capitulum grey-pruinose beneath or nearly naked; sporal mass amber or reddish-brown; spores small, $2\cdot5$ – $4\cdot5\ \mu$ in diameter.—*Calicium æruginosum* Sm. Engl. Bot. t. 2502 (1813); Turn. & Borr. Lich. Brit. p. 156. *Phacotrum* (*Phacotium*) *æruginosum* S. F. Gray Nat. Arr. i. p. 484 (1821). *Calicium trichiale* var. *stemoneum* Ach. Lich. Univ. p. 243 (1810); Cromb. Lich. Brit. p. 12; Leight. Lich. Fl. p. 41; ed. 3, p. 40; subsp. *stemoneum* Nyl. ex Norrl. in Medd. Sällsk. Faun. & Fl. Fenn. i. p. 10 (1876); Cromb. Monogr. i. p. 86. *Cyphelium trichiale* var. *stemoneum* Mudd Man. p. 260 (1861).

Exsicc. Leight. n. 227; Mudd n. 248.

Closely allied to the preceding, differing chiefly in the finely powdered greener thallus.

Hab. On the branches of old trees, stumps, and palings in shady situations.—*Distr.* Local and scarce in S.W. and N. England.—*B. M.* Lyndhurst, New Forest, Hants; Danny and Cuckfield, Sussex; Hadleigh, Essex; Leith Hill, Surrey; near Henwick, Worcestershire; Brantsdale and Bousdale Gill, Yorkshire.

6. *Ch. brunneola* Muell. Arg. in Mem. Soc. Phys. Hist. Nat. Genève xvi. 2, p. 360 (1862).—Thallus effuse, very thin, occurring in spots, greenish- or greyish-white (K + red), often evanescent. Apothecia small, numerous, the stalk slender, elongate, dark-brown or blackish, the capitulum small, globose-lenticular, brown; spores $2\cdot5$ – $4\ \mu$ in diameter, the sporal mass reddish-brown or ferruginous. *Calicium brunneolum* Ach. in Vet. Acad. Handl. 1816, p. 279, t. 8, f. 12. *C. trichiale* var. *brunneolum* Cromb. Lich. Brit. p. 12 (1870); Leight. Lich. Fl. p. 42; ed. 3, p. 41. *C. melanophæum* subsp. *brunneolum* Nyl. ex Norrl. in Medd. Sällsk. Faun. & Fl. Fenn. i. p. 10 (1876); Cromb. in Grevillea xv. p. 14 & Monogr. i. p. 90. *Cyphelium trichiale* var. *brunneolum* Mudd Man. p. 260 (1861).

Exsicc. Leight. n. 252; Mudd n. 250.

Allied to the preceding, but differing in the character of the thallus, which is often entirely evanescent, and in the more slender apothecia.

Hab. On bark and on old decorticated trees and stumps in shady districts.—*Distr.* Very local and scarce in S. and N. England.—*B. M.* New Forest, Hants; Penshurst, Kent; Redland Woods, near Leith Hill, Surrey; Crowle, near Worcester; Baysdale, Brantsdale,

near Stokesley, and Ingleby Park, Cleveland, Yorkshire; Hexham, Northumberland.

Var. *elassosporum* A. L. Sm.—Thallus thinnish, glaucous or glaucous-greenish, or almost obsolete. Apothecia numerous, similar to the species; spores minute, 2.5μ in diameter or even smaller, the sporal mass umbrose.—*Calicium elassosporum* Nyl. in Flora lviii. p. 441 (1875); Cromb. in Grevillea iv. p. 180 (1876) & Monogr. i. p. 90; Leight. Lich. Fl. ed. 3, p. 41.

Exsicc. Cromb. n. 111.

Differs from the species in the scantier thallus and in the smaller spores. Nylander states also that the gonidia are smaller, a character difficult to be sure of in specimens with very scanty thallus. The apothecial stalks are sometimes branched.

Hab. On decorticated trunks of elders in mountainous districts.—*B. M.* Glen Lochay, Perthshire (the only locality).

Apothecia not pruinose.

7. *Ch. melanophæa* Zwackh in Flora xlv. p. 535 (1862).—Thallus thickish, granular, greenish, whitish or cream-coloured (K + red), sometimes nearly obsolete. Apothecia scattered, the stalk short and stoutish, or long (up to 2.5 mm. and more), slender, black, the capitulum top-shaped, black; sporal mass occasionally protruded; spores spherical, 2.5 – 8μ in diameter.—*Calicium melanophæum* Ach. in Vet. Acad. Handl. 1816, p. 276, t. 8, f. 8; Cromb. Lich. Brit. p. 12 & Monogr. i. p. 89; Leight. Lich. Fl. p. 42; ed. 3, p. 41. *Cyphelium melanophæum* Mudd Man. p. 259 (1861).

Exsicc. Leight. n. 315.

The thallus somewhat resembles that of *Ch. trichialis*, but has more rounded granules. The apothecia are irregularly scattered and rather rare in British specimens.

Hab. On the trunks of old firs and decorticated oaks, rarely on decaying posts in wooded tracts.—*Distr.* Local and scarce in S.E. and N. England and in Central Scotland.—*B. M.* Ardingly, Sussex; Epping Forest, Essex; Oakley Park and Hailey Wood, near Cirencester, Gloucestershire; Shropshire; Lounsdale, Cleveland, Yorkshire; Eglestone, Durham; New Galloway, Kireudbrightshire; Braes of Doune, Blairdrummond, and Aberfeldy, Perthshire.

Var. *ferruginea* A. L. Sm.—Thallus crowded, granular or nearly powdery and often sprinkled with irregular rusty spots. Apothecia almost sessile, the stalk immersed in the thallus, the capitulum rather large; spores 4 – 11μ in diameter.—*Calicium ferrugineum* Sm. Eng. Bot. t. 2473 (1812); Turn. & Borr. Lich. Brit. p. 136; Hook. in Sm. Engl. Fl. v. p. 139. *C. melanophæum* var. *ferrugineum* Schær. Enum. p. 172 (1850); Cromb. in Grevillea xv. p. 14 & Monogr. i. p. 89. *C. trichiale* var. *ferrugineum* Cromb. Lich. Brit. p. 12 (1870); Leight. Lich. Fl. p. 41; ed. 3, p. 41. *Phacotrum (Phacotium) ferrugineum* S. F.

Gray Nat. Arr. i. p. 484 (1821). *Cyphelium trichiale* var. *ferrugineum* Mudd Man. p. 260, t. 4, f. 106 (1861).

Exsicc. Johns. n. 45; Mudd n. 249.

Differs from the species in the character of the thallus and in the sessile apothecia. It is often sterile, but when fertile the apothecia are numerous, and sometimes two or more become confluent.

Hab. On old palings, rarely on decorticated oaks in shady lowland and upland tracts.—*Distr.* Pretty general, and common where it occurs, throughout England, chiefly in the south.—*B. M.* Horsham, Sussex; near Reigate, and Redland Woods, near Dorking, Surrey; near Millhill, Middlesex; Hadleigh Wood, Danbury, Gosfield Hall, and Walthamstow, Essex; Oakley Park, Cirencester, Gloucestershire; Gopsall Wood and Twycross, Leicestershire; Packington Park and Bagley Park, Worcestershire; Moor Park and Hay Park, near Ludlow, Shropshire; Suffolk; Framlingham, near Norwich, Norfolk; Brantsdale and Hoggarts Wood, Ingleby, Cleveland, Yorkshire.

3. **CONIOCYBE** Ach. in Vet. Acad. Handl. 1816, p. 283; emend. Nyl. in Mém. Soc. Sci. Nat. Cherb. iii. p. 168 (1855). (Pl. 3.)

Thallus effuse, thin, crustaceous or pulverulent or almost obsolete. Apothecia usually with a rather long slender stalk, the capitulum globose, pulverulent with the protruded sporal mass; paraphyses slender; spores spherical, simple, colourless, yellowish or pale-brownish. Spermogones with simple sterigmata and oblong or ellipsoid spermatia.

The genus is characterized by the pale- or brightly-coloured apothecia and spores.

1. **C. furfuracea** Ach. in Vet. Acad. Handl. 1816, p. 288.—Thallus powdery, pulverulent, yellowish-green or sulphur-coloured. Apothecia small or moderate in size, similar in colour to the thallus or rarely greyish-pruinose; the stalk elongate, slender, pulverulent; capitulum globose, the sporal mass yellow or pale brownish; paraphyses becoming branched, spores colourless or pale yellow, minute, $2\cdot5$ – $3\ \mu$ in diameter.—Mudd Man. p. 262, t. 4, f. 108 (excl. var. *sulphurella*); Cromb. Lich. Brit. p. 14 (excl. var. *sulphurella*); Leight. Lich. Fl. p. 46; ed. 3, p. 45. *Mucor furfuraceus* L. Sp. Pl. ed. 2, p. 1655 (1763). *Clathrus virescens* Huds. Fl. Angl. ed. 2, p. 632 (1778). *Trichia furfuracea* With. Arr. ed. 3, iv. p. 398 (1796). *Calicium furfuraceum* Pers. Tent. Disp. Meth. Fung. p. 60 (1797); Turn. & Borr. Lich. Brit. p. 159; Hook. in Sm. Engl. Fl. v. p. 142. *C. capitellatum* Ach. Meth. p. 98 (1803). *Lichen capitatus* Ach. Lich. Suec. Prodr. p. 86 (1798); Sm. Engl. Bot. t. 1539. *Strongyllum capitellatum* S. F. Gray Nat. Arr. i. p. 485 (1821). *Bæomyces furfuraceus* Tayl. in Mackay Fl. Hib. ii. p. 78 (1836).

Exsicc. Bohl. n. 62; Cromb. n. 10; Johns. n. 207; Leight. n. 225.

The thallus is more or less effuse, and frequently infertile. The apothecia, when present, are numerous, and scattered or crowded; the stalks long and more or less flexuose.

Hab. On the roots of decayed trees and on dead twigs, occasionally on the ground and on decayed mosses, rarely on rocks in shady places.—*Distr.* General throughout England, rare in Wales, in S. and Central Scotland, and in E. Ireland.—*B. M.* Near Shanklin, I. of Wight; Lyndhurst, and near Menstrie, New Forest, and Blackwater, Hants; Esher, Surrey; Langford, near Shalford Common, and Walthamstow, Essex; Bury, Suffolk; near Alfrick, Malvern Wells, and Little Malvern, Worcestershire; Oswestry and Church Stretton, Shropshire; near Barmouth, Merionethshire; Forden, Montgomeryshire; Peel, I. of Man; South Wingfield, Derbyshire; Brantsdale, Yorkshire; Bassenthwaite Lake, Cumberland; near Gateshead, Durham; Calderbank, near Glasgow; Falls of Moness, near Aberfeldy, and Blair Athole, Perthshire.

Form *fulva* Fr. Lich. Eur. p. 382 (1831).—Stalk short and rather stout; capitulum hemispherical; otherwise similar to the species.—Mudd Man. p. 262; Cromb. in Grevillea xv. p. 14. Var. *fulva* Schær. Enum. p. 175 (1850); Leight. Lich. Fl. ed. 3, p. 100. *Mucor fulvus* L. Sp. Pl. ed. 2, p. 1658 (1763).

Only a form of the species; transition states have been observed on the same specimen.

Hab. On dead stems and mosses on walls, and on the ground in upland tracts.—*Distr.* Somewhat rare in W. England and Central Scotland.—*B. M.* Garryside, Blair Athole, Perthshire.

2. *C. sulphurea* Nyl. ex Cromb. in Grevillea xv. p. 14 (1886).—Thallus effuse, powdery, very thin, greyish or greyish-white, often obsolete. Apothecia small, sulphur-pulverulent; stalk short and slender; capitulum minute, globose, the sporal mass sulphur-yellow; spores minute, $2.5-3 \mu$ in diameter.—*C. furfuracea* f. *sulphurella* Fr. Lich. Eur. p. 382 (1831); Mudd Man. p. 262; var. *sulphurella* Schær. Enum. p. 175 (1850); Cromb. Lich. Brit. p. 14; Leight. Lich. Fl. p. 47; ed. 3, p. 46. *Lichen sulphureus* Retz. in Vet. Acad. Handl. 1769, p. 249.

Differs from the preceding in the more scanty, lighter-coloured thallus, and in the brightly-coloured apothecia.

Hab. On decaying trunks of old oaks in wooded upland tracts.—*B. M.* New Forest, Hants; Brantsdale, Yorkshire; Teesdale, Durham.

3. *C. pallida* Fr. Sched. Crit. i. p. 3 (1824).—Thallus very thin, powdery, white, often obsolete. Apothecia small; stalk moderate in size, stoutish, whitish or yellow, rarely brownish above; capitulum globose or hemispherical, the sporal mass white or pale-brownish; spores rather large, $4-10 \mu$ in diameter.—Mudd Man. p. 262; Cromb. Lich. Brit. p. 14; Leight. Lich. Fl. p. 47; ed. 3, p. 46. *Calicium pallidum* Pers. in Ust. Ann. Bot. vii. p. 20, t. 3, figs. 1-2 (1794). *C. peronellum* Ach. Meth.

p. 96 (1803); Winch Bot. Guide ii. p. 42; Turn. & Borr. Lich. Brit. p. 158; Hook. in Sm. Engl. Fl. v. p. 141. *C. cantherellum* Ach. Lich. Suec. Prodr. p. 85 (1798); Engl. Bot. t. 2557. *Phacotrum* (*Phacotium*) *cantherellum* S. F. Gray Nat. Arr. i. p. 484 (1821).

Similar to *C. sulphurea* in the colour of the thallus, but differing in the apothecia, which are very pale yellow, often with a tinge of cinnamon on the upper side of the capitulum.

Hab. On stumps and trunks of old decayed trees in shady places.—*Distr.* Very rare in Central and N. England, probably overlooked elsewhere.—*B. M.* Mundon, Essex; Teesdale, Durham; near Hexham, Northumberland.

4. *C. hyalinella* Nyl. in Act. Soc. Linn. Bord. sér. 3, i. p. 279 (1856–8).—Thallus obsolete. Apothecia small; stalk slender, whitish, brownish above; capitulum globose, the sporal mass white or pale-reddish; spores minute, $2\cdot5$ – $4\ \mu$ in diameter.—Cromb. Lich. Brit. p. 14; Leight. Lich. Fl. p. 47; ed. 3, p. 46.

Closely allied to *C. pallida*, but differing in the smaller apothecia and spores. Occasionally there are doubtful traces of a thin whitish thallus.

Hab. On decayed trunks of trees.—*B. M.* Brantsdale, Yorkshire.

4. **CALICIUM** Pers. in Ust. Ann. Bot. vii. p. 20 (1794); emend. De Not. in Giorn. Bot. Ital. ii. p. 309 (1846). *Phacotrum* (errore *Phacotium*) S. F. Gray Nat. Arr. i. p. 482 pro parte. *Strongyllum* S. F. Gray tom. cit. p. 485 pro parte. (Pl. 4.)

Thallus thin, granular or pulverulent, rarely squamulose, sometimes obsolete or none proper. Apothecia stalked, the capitulum top-shaped or subglobose, blackish-brown, often finely powdered with a white, yellow or reddish pruina; paraphyses slender; spores elongate or ovate, 1-septate, dark-coloured. Spermogones similar to those of *Chænotheca*.

Similar in outward appearance to *Chænotheca*, differing chiefly in the spore characters. Some of the species have been classified by Continental botanists as fungi.

Capitulum yellow-pruinose.

1. *C. arenarium* Nyl. ex Lamy in Bull. Soc. Bot. Fr. xxv. p. 345 (1878).—Thallus none proper. Apothecia congregate or scattered, rather small, the stalk stoutish, elongate, rusty-brown, sometimes with a yellowish pruina; capitulum globose-lentiform; spores oblong, becoming 1-septate, rarely with a slight constriction in the middle, pale-brown, 6 – $11\ \mu$ long, $2\cdot5$ – $3\cdot5\ \mu$ thick, paraphyses slender, scanty.—Cromb. in Grevillea xv. p. 14 (1886). *C. citrinum* Cromb. Lich. Brit. p. 12 (1870); Leight. Lich. Fl. p. 45; ed. 3, p. 44. *Cypbellium arenarium* Hampe ex Massal.

Misc. Lich. p. 50 (1856). *Coniocybe citrina* Leight. in Ann. Mag. Nat. Hist. ser. 2, xix. p. 130, t. 8, figs. 7-9 (1857).

Exsicc. Leight. n. 269.

Somewhat resembling *Coniocybe furfuracea* in the general appearance of the fructification. It grows frequently in shady places, where the spores do not develop fully.

Hab. Parasitic on the powdery yellowish-green thallus of *Lecidea lucida*, a saxicolous lichen.—*Distr.* Rather local and scarce in Wales, N. England, and the Central Highlands, Scotland.—*B. M.* Crossfaen, Monmouthshire; Llanymawddy, Llandyssil, near Bala, and between Bala and Corwen, Merioneth; Dent, Yorkshire; Glen Fender, Blair Athole, Perthshire.

2. *C. roscidum* Floerke Deutsche Lich. 3, p. 1 (1815); Nyl. Syn. Lich. i. p. 153 (1860).—Thallus ashy-grey, thin or almost obsolete. Apothecia moderate in size, blackish; stalk black, rather short and stout; capitulum lentiform, the margin or the entire head greenish-yellow-pruinose; spores brown or blackish, fusiform-ellipsoid, 1-septate, slightly constricted at the septum, brownish or blackish, 9-18 μ long, 4-8 μ thick.—Mart. ex A. L. Sm. Monogr. ii. p. 351. *C. hyperellum* var. *roscidum* Ach. Lich. Univ. p. 238 (1810).

Easily distinguished by the colour of the pruina and by the spore characters.

Hab. On oak bark.—*Distr.* Rare in N. England.—*B. M.* Ingleby, Cleveland, Yorkshire; Lowther Park, Westmoreland.

Capitulum reddish-pruinose.

3. *C. hyperellum* Ach. Meth. p. 93 (1803).—Thallus granular or pulverulent, bright greenish-yellow. Apothecia black, moderate in size with an elongate firm stalk; the capitulum globose-lentiform, reddish beneath; spores ellipsoid or slightly narrower at each end, 1-septate, dark-brown or blackish in the mass, 9-16 μ long, 4-6 μ thick.—Hook. in Sm. Engl. Fl. v. p. 139; Tayl. in Mackay Fl. Hib. ii. p. 77; Turn. & Borr. Lich. Brit. p. 140; Mudd Man. p. 258, t. 4, fig. 105; Cromb, Lich. Brit. p. 12; Leight. Lich. Fl. p. 42; ed. 3, p. 42. *Coralloides fungiforme arboreum nigrum, vix crustosum* Dill. Hist. Musc. p. 78, t. 14, fig. 3 B. (1740). *Lichen hyperellus* Ach. Lich. Suec. Prodr. p. 85 (1798); Engl. Bot. t. 1832. *Phacotrum* (*Phacotium*) *hyperellum* S. F. Gray Nat. Arr. i. p. 483 (1821).

Exsicc. Bohl. n. 61; Johns. n. 8; Leight. n. 23; Mudd n. 245.

Resembling *Chænotheca chrysocephala* in the brightly-coloured thallus. It usually spreads over large areas, though also to be found in small patches. The apothecia are rather rarely developed, but, when present, they are numerous and prominent.

Hab. On the trunks of old trees, in wooded districts.—*Distr.* Pretty general and common in England, rare in Wales, S. and Central Scotland, and in Ireland.—*B. M.* New Forest, Hants;

Hurstpierpoint, Woodmancote, St. Leonard's Forest and Angmering Park, Sussex; Penshurst Park, Kent; Epping Forest, Stanstead, Mountfitchet Park, Gosfield Hall and Ulting, Essex; Stapleton and Sapperton, Gloucestershire; Hindlip, Worcestershire; Packington Park, Warwickshire; Bala, Merioneth; Builth, Brecknockshire; Hay Park, near Ludlow, and Almond Park, near Shrewsbury, Shropshire; Bettws-y-Coed, Carnarvonshire; Welshpool, Montgomeryshire; Gopsall Park, Leicestershire; Derbyshire; Bury, Suffolk; Earsham, Norfolk; Ingleby, Brantsdale and Kildale, Cleveland, Yorkshire; Leven's Park, Westmoreland; Catterlin, Cumberland; Wark-on-Tyne, Northumberland; Kirkconnel, Springkell, Dumfriesshire; Glenlee, New Galloway, Kirkcudbrightshire; Falls of Clyde, Lanarkshire; Aberfeldy, Perthshire; Killarney, Kerry.

Form *viride* Cromb. in *Grevillea* xv. p. 14 (1886) & *Monogr.* i. p. 91.—Thallus thin, pulverulent or somewhat granular, greenish-yellow. Stalk of apothecium occasionally very short, the capitulum often greenish- or greyish-pulverulent, black beneath.—Var. *viride* Nyl. *Syn.* i. p. 153 (1860). *C. viride* Pers. *Ust. Ann. Bot.* vii. p. 20 (1794).

Distinguished from the species by the more pulverulent thallus and by the colour of the apothecium, a character not always constant. The stalk is sometimes very short, a condition referred to by Turner and Borrer in *Lich. Brit.* p. 142.

Hab. On trunks of old trees and on palings in wooded situations.—*Distr.* Local and scarce in E., S. and W. England and among the S. Grampians, Scotland.—*B. M.* New Forest, Hants; Sapperton, Gloucestershire; Malvern, Worcestershire; Ickworth, Suffolk; Ben Lawers, Perthshire.

Form *baliolum* Cromb. *ll. c.*—Apothecia larger, the stalk thicker and compressed at the base.—*C. baliolum* Ach. *Meth.* p. 94, t. 2, fig. 4 (1803).

Differs from the species in the form of the stalk. In the only British specimen the apothecia are numerous and some are nearly sessile.

Hab. On old palings in wooded regions.—*B. M.* Near Lyndhurst, New Forest, Hants.

4. *C. sphærocephalum* Wahlenb. *Fl. Lapp.* p. 486 (1812).—Thallus finely granular, very thin, greyish-white or often obsolete. Apothecia moderate in size, usually numerous, scattered or crowded, black, the stalk short and stout or elongate and slender, the capitulum top-shaped-globose, reddish beneath; spores dark-coloured, 1-septate, slightly constricted in the middle, 8–13 μ long, 4–7 μ thick.—Hook. *Fl. Scot.* ii. p. 41 (1821) & in *Sm. Engl. Fl.* v. p. 141; Tayl. in Mackay *Fl. Hib.* ii. p. 77; Turn. & Borr. *Lich. Brit.* p. 153. *C. trachelinum* Ach. in *Vet. Acad. Handl.* 1816, p. 272, t. 8, figs. 7 A & B; Mudd *Man.* p. 258; Cromb. *Lich. Brit.* p. 12 & *Monogr.* i. p. 94; Leight. *Lich. Fl.* p. 43; ed. 3, p. 42; var. *hemiphodium* Nyl. ex Leight. *Lich. Fl.* ed. 3, p. 43 (1879); form *hemiphæum* Nyl. ex Cromb. in

Grevillea xv. p. 14 (1886). *C. clavicularare* var. *trachelinum* Ach. Meth. p. 91 (1803). *Coralloides fungiforme arboreum nigrum, vix crustosum* Dill. Hist. Musc. p. 78, t. 14, fig. 3 A (1740). *Mucor sphærocephalus* L. Sp. Pl. p. 1655 (1753)? Lightf. Fl. Scot. p. 1071? *Lichen sphærocephalus* Web. Spicil. Goett. p. 198 (1778)? Sm. Engl. Bot. t. 414 (1797). *Phacotrum* (*Phacotium*) *sphærocephalum* S. F. Gray Nat. Arr. i. p. 483 (1821).

Exsicc. Cromb. n. 112 pro parte; Leight. n. 270; Mudd n. 246.

Resembles the preceding in the reddish tinge of the apothecium (visible under the microscope as minute red granules), but easily distinguished by the difference in the thallus. As in other species it is often more or less suffused by a yellowish *Lepraria*, which remains when the proper thallus has disappeared. In form *hemiphæum* (errore *hemiplodium*), the whole stalk is more or less suffused with red, an unusual state. There has been much confusion over the identity of *Mucor sphærocephalus* Linn., of which no specimen exists in the herbarium at the Linnean Society. Smith's specimen described in 1797 certainly represents this plant.

Hab. On the trunks of old trees and on palings in maritime and upland districts.—*Distr.* Not very general nor common throughout the British Isles.—*B. M.* New Forest, Hants; Lewes, Danny and Henfield, Sussex; Ulting, Thorndon Hall and Lea Bridge Road, Essex; Chedworth Woods, Gloucestershire; near Cricklade, Wiltshire; near Worcester; Pophills, Warwickshire; Earsham, Norfolk; Pen-y-law, near Oswestry, Shropshire; Ingleby Park and Kildale, Cleveland, Yorkshire; Egglestone, Durham; Leven's Park, Westmoreland; Ben Lawers and Den of Dupplin, Perthshire; Mar Lodge, Braemar, Aberdeenshire; Castlebernard Park, Bandon, Cork.

Var. *xylonellum* A. L. Sm.—Thallus very thin. Apothecia with a blackish, usually more globose capitulum, the margin inflexed, sometimes brownish. *Calicium xylonellum* Ach. Meth. p. 92; Suppl. p. 14 (1803). *C. sphærocephalum* var. *crustosum* Turn. & Borr. Lich. Brit. p. 153 (1839). *C. trachelinum* var. *xylonellum* Nyl. Syn. i. p. 155 (1860); Cromb. Monogr. i. p. 95.

Hab. On old palings in wooded tracts.—*Distr.* Very local and scarce in E. and S. England and (*vide* Nyl. l. c.) in Ireland.—*B. M.* Stoney Cross, New Forest, Hants; Penshurst, Kent; Bury St. Edmund's, Suffolk.

Capitulum whitish-pruinose.

5. *C. quercinum* Pers. Tent. Fung. p. 59 (1797).—Thallus thin, granular, pulverulent or nearly smooth, greyish-white, or nearly evanescent. Apothecia moderate in size, the stalk stoutish, black, the capitulum top-shaped-lentiform, at first white-pruinose, then naked, beneath grey-pruinose; spores dark-coloured, small, 1-septate, slightly constricted in the middle, 5–9 μ long, 3–5 μ thick.—Nyl. Syn. i. p. 155, t. 5, fig. 25; Mudd Man. p. 257; Cromb. Lich. Brit. p. 13 (excl. subsp. *curtum*); Leight. Lich. Fl. p. 43; ed. 3, p. 43. *C. clavellum*

Turn. & Borr. Lich. Brit. p. 138 (1839); Hook. in Sm. Engl. Fl. v. p. 139; *C. clavulare* Ach. Meth. p. 90 (1803). *Lichen clavellus* Ach. Lich. Suec. Prodr. p. 83 (1798); Engl. Bot. t. 1465. *Phacotrum* (*Phacotium*) *clavulare* S. F. Gray Nat. Arr. i. p. 413 (1821).

Exsicc. Bohl. n. 95; Mudd n. 244.

Frequently the thallus is but little visible; but the species may always be recognized by the grey pruina on the under side of the capitulum. The apothecia are frequent, and the spermatogones usually abundant and crowded.

Hab. On old palings and decayed trunks of trees.—*Distr.* Local and scarce throughout England and S. Scotland; not recorded for Ireland.—*B. M.* Lyndhurst, New Forest, Hants; Hurst, Ardingly, Heathfield Park, Yaptan and Henfield, Sussex; Hay Park, Ludlow, Shropshire; Birkland, Nottinghamshire; Lakenham, Norfolk; Brantsdale and Baysdale, Cleveland, Yorkshire; Hexham, Northumberland; Falls of Clyde, Lanarkshire.

Var. *lenticulare* Nyl. Syn. i. p. 156 (1860).—Thallus thin, granular-pulverulent, whitish, scarcely any, sometimes obsolete. Apothecia moderate in size, numerous, the stalk stoutish, black, the head dilated and rather flat or lens-shaped above, sometimes entirely naked; spores as in the species or narrower, about 5–9 μ long, 3–4 μ thick.—Subsp. *lenticulare* Cromb. Lich. Brit. p. 13. *Calicium lenticulare* Ach. in Vet. Acad. Handl. 1816, p. 262, t. 8, fig. 4.

Exsicc. Cromb. n. 112 pro parte; Johns. n. 9.

Distinguished from the species by the more lentiform head and less distinct pruina.

Hab. On old oak palings.—*Dist.* Local and scarce in S. and W. England and in N. Wales.—*B. M.* Near Bovey Tracey, S. Devon; Lewes, Sussex; Brockenhurst, New Forest, Hants; Balcombe and Shiere, Surrey; Barmouth, Merioneth; Ennerdale, Cumberland.

Subsp. *curtiusculum* Cromb. in Grevillea viii. p. 114 (1880), emend.—Thallus effuse, granulate, whitish or greenish-yellow. Apothecia black, the stalk very short, the capitulum lentiform, white pruinose at the margin; spores 6–10 μ long, 3.5–4.5 μ thick. *C. curtiusculum* Nyl. in Flora lxii. p. 360 (1879). *C. quercinum* var. *lenticulare* f. *chlorodes* Nyl. ex Cromb. in Grevillea xv. p. 14 (1886) and Monogr. i. p. 93.

Exsicc. Larb. Lich. Hb. n. 82.

Differs from the species in the almost sessile apothecia. The form *chlorodes* has similar apothecia with a somewhat brighter coloured thallus.

Hab. On palings and bark of old firs.—*Distr.* Found only sparingly in S. and E. England.—*B. M.* Near Bovey Tracey, S. Devon; near Lewes, Sussex; Shiere, Surrey; Epping Forest, Essex; Oakington, Cambridgeshire.

6. *C. curtum* Turn. & Borr. ex Sm. Engl. Bot. t. 2503 (1813) & Lich. Brit. p. 148 (1839).—Thallus very thin, wide-spreading,

granulose, greyish, sometimes obsolete. Apothecia small, black, the stalk short and stoutish, the capitulum somewhat top-shaped-cylindrical, white-pruinose at the margin, with the sporal mass generally much protruded; spores ellipsoid, 1-septate, 7-14 μ long, 4-7 μ thick; hymenial gelatine frequently bluish with iodine.—Hook. in Sm. Engl. Fl. v. p. 140; Mudd Man. p. 257; Leight. Lich. Fl. p. 44; ed. 3, p. 43. *C. quercinum* subsp. *curtum* Nyl. Syn. p. 156 (1860); Cromb. Lich. Brit. p. 13. *Phacotrum* (*Phacotium*) *curtum* S. F. Gray Nat. Arr. i. p. 485 (1821).

Exsicc. Bohl. n. 99; Cromb. n. 113; Johns. n. 169; Larb. Lich. Hb. nos. 83, 321; Leight. n. 133; Mudd n. 99.

Differs from the preceding in having the capitulum pruinose at the margin only, and in the protruded sporal mass which gives the apothecium "a miniature resemblance to a painter's brush" (Turn. & Borr. l. c.). The apothecia vary considerably in size even on the same specimen; they are usually numerous and crowded. The prominent black spermogones are frequent and often congregate.

Hab. On old palings and decayed branches of trees, chiefly oaks in wooded districts.—*Distr.* General and plentiful in most parts of Great Britain, but local and scarce in the Channel Islands and Ireland.—*B. M.* Guernsey; Lyndhurst, New Forest, Hants; Bolney, Washington and Tilgate, Sussex; near Hythe, Kent; Shiere, Surrey; Braydon Forest, Wilts; Tetsworth, Oxfordshire; Gopsall Park and Bradgate Park, Leicestershire; Hay Park, Herefordshire; Hatfield, near Worcester; Church Stretton, Oswestry and Stiperstones, Shropshire; Bala and Aberdovey, Merioneth; Walthamstow, Langford and Epping Forest, Essex; Bury, Suffolk; Middle Forest, Westmoreland; near Ayton and Bousdale Gill, Cleveland, Yorkshire; Teesdale, Durham; Wark-on-Tyne, Northumberland; New Galloway, Kircudbrightshire; Barcaldine and Glen Falloch, Argyll; Loch Rannoch, Killin, Craig Calliach and Blair Athole, Perthshire; Countesswell's Wood, near Aberdeen; Castlemartyr, Cork.

Capitulum not pruinose.

7. *C. pusillum* Floerke Deutsche Lich. 10, p. 6 (1815).—Thallus in greyish or whitish spots or obsolete. Apothecia small, entirely black, the stalk slender; capitulum top-shaped, with a flat or convex disc; spores fusiform or clavate, 1-septate, sometimes slightly constricted in the middle, 5-10 μ long, 2.5-5 μ thick.—Cromb. in Journ. Bot. xx. p. 272 (1882).

Resembling a minute form of *C. quercinum*. In the few British specimens the thallus is obsolete and the apothecia are scattered.

Hab. On decorticated wood in wooded situations.—*B. M.* Castlemartyr, Cork.

8. *C. debile* Turn. & Borr. ex Sm. Engl. Bot. t. 2462 (1812) & Lich. Brit. p. 151.—Thallus very thin, greyish-white, or wanting. Apothecia small, scattered, the stalk short and slender, the capitulum lens-shaped or somewhat top-shaped; sporal mass compact; spores fusiform ellipsoid, nearly always simple, about

7–11 μ long, 3–6 μ thick.—Hook. in Sm. Engl. Fl. v. p. 141. *C. minutellum* Ach. in Vet. Acad. Handl. 1816, p. 118, t. 5, f. 2. *C. parietinum* Ach. op. cit. p. 260, t. 8, f. 1, A, B; Cromb. in Grevillea xv. p. 14 (1886) & Monogr. i. p. 95, incl. f. *minutellum*. Var. *minutellum* Nyl. Syn. i. p. 159, 1860. *C. subtile* Pers. Tent. Disp. Meth. Fung. p. 60 (1797)? Mudd Man. p. 258; Cromb. Lich. Brit. p. 13; Leight. Lich. Fl. p. 44; ed. 3, p. 44. *Strongyllum debile* S. F. Gray Nat. Arr. i. p. 485 (1821).

Exsicc. Leight. n. 314; Mudd n. 247.

The species has a very doubtful or no recognizable gonidia-containing thallus, and has been usually classified among fungi by recent Continental botanists. It is retained here on account of its affinity to lichen species. The spores agree in form with those of *Calicium* rather than with those of *Chanotheca* and are occasionally septate. Form *minutellum* has smaller apothecia which are sometimes greyish-pruinose beneath.

Hab. On the trunks of decorticated dead trees and on old palings and timber.—*Distr.* Local and rare in S., Central and N. England.—*B. M.* Henfield, Sussex; Lyndhurst, New Forest, Hants; Wheatfield Park, near Tetsworth, Oxfordshire (f. *minutellum*); Baysdale, Cleveland, Yorkshire.

9. *C. populneum* De Brond. ex Duby Bot. Gall. ii. p. 638 (1830).—Thallus developed under the bark (hypophlœodal) in pale or whitish spots. Apothecia minute, scattered, entirely black, somewhat shining, the stalk very short and slender; capitulum top-shaped; spores blackish, 1-septate, 10–11 μ long, 5–6 μ thick.—Mudd Man. p. 257, t. 4, f. 104; Leight. Lich. Fl. p. 45; ed. 3, p. 44. *C. curtum* var. *populinum* Turn. & Borr. Lich. Brit. p. 149 (1839); Hook. in Sm. Engl. Fl. v. p. 140. *C. triste* Koerb. Syst. Lich. Germ. p. 308 (1855)?; Cromb. Lich. Brit. p. 13 (1870).

Distinguished from the preceding by the smooth shining thallus and by the larger spores.

Hab. On the smooth bark of poplars in wooded upland tracts.—*Distr.* Rare in the S.W. Highlands of Scotland and in S.W. Ireland.—*B. M.* Airds, Appin, Argyll; Killarney, Kerry.

10. *C. diploellum* Nyl. in Flora li. p. 161 (1868).—Thallus (if proper) effuse, very thin, greyish-white. Apothecia minute, scattered, entirely black, the stalk very short; capitulum top-shaped open, the sporal mass scarcely prominent; spores simple or at length 1-septate, 6–9 μ long, 3–4 μ thick.—Carroll in Journ. Bot. vi. p. 109 (1868); Cromb. Lich. Brit. p. 13; Leight. Lich. Fl. p. 39; ed. 3, p. 39.

The smallest of all the species, and considered by Nylander as closely allied to *C. disseminatum*, a Continental species. The specimens in the herbarium of the British Museum are very imperfect.

Hab. On the bark of holly in wooded districts.—*B. M.* Cromaglow, Killarney, Kerry (the only locality).

11. *C. retinens* Nyl. in Flora li. p. 161 (1868).—Thallus effuse, then finely powdery, whitish. Apothecia minute, sessile, black; sporal mass indistinct; spores oblong or oblong-cylindrical, 1-septate, 8–11 μ long, 2.5–3.5 μ thick; hypothecium brownish-red.—Leight. in Ann. Mag. Nat. Hist. ser. 4, i. p. 482 (1868) & Lich. Fl. p. 45; ed. 3, p. 44; Cromb. in Grevillea xv. p. 14. Specimen not seen.

Differs from other species of *Calicium* in the sessile apothecia and from species of *Cyphelium* in the absence of a thalline margin to the fruits. It has been collected only once.

Hab. On the trunk of an old oak, Jersey (the only locality).

5. **STENOCYBE** Nyl. in Bot. Not. 1854, p. 84 (nomen); Koerb. Syst. Lich. Germ. p. 306 (1855). (Pl. 5.)

Thallus occurring in spots (macular), thin, often obsolete or none proper. Apothecia scattered, black, stalked, the capitulum top-shaped or clavate; paraphyses slender, thread-like, colourless; spores ellipsoid or fusiform, becoming 3- (or more-) septate, colourless, then brown, not massed in a mazædium.

The scanty or obsolete thallus and the absence of a mazædium form of fruit render the position of the genus somewhat uncertain, and might justify its transference to the Class FUNGI. Owing, however, to its close resemblance to the other Caliciaceæ, it has been included here. The species are all somewhat inconspicuous.

1. *S. major* Nyl. in Bot. Not. 1854, p. 84; Koerb. Syst. Lich. Germ. p. 306 (1855).—Thallus scarcely any proper or very diffuse or obsolete. Apothecia sparsely scattered, very small; stalk slender; capitulum clavate; spores 3-septate (5–7-septate fide Crombie), 18–36 μ long, 7–11 μ thick.—*S. euspora* Nyl. ex Cromb. in Journ. Bot. xx. p. 272 (1882) & Monogr. i. p. 97, fig. 25. *Calicium eusporum* Nyl. in Bull. Soc. Bot. Fr. xv. p. 549 (1856); Carroll in Journ. Bot. iii. p. 287 (1865) pro parte.

Has been confused with the following species, *S. septata*, which has very large spores. The specimens in the herbarium of the British Museum are too scanty to admit of examination.

Hab. On old stumps of holly in upland situations.—*B. M.* Mangerton, Kerry.

2. *S. septata* Rehm in Rabenhorst's Krypt.-Fl. i. 3, p. 414 (1891).—Thallus effuse, and very thin or obsolete, or none proper. Apothecia small; stalk short and stoutish or slender and more elongate; capitulum clavate-truncate with the margin of the disc inflexed; paraphyses slender, crowded, spores ellipsoid, 3-septate, umber-brown, large, 44–70 μ long, 14–20 μ thick. *S. eusporum* Mudd Man. p. 256, t. 4, fig. 103 (1861) (non Nyl.). *S. trajecta* Nyl. ex Cromb. in Journ. Bot. xx. p. 272 (1882) & Monogr. i. p. 97. *Sphinctrina septata* Leight. in Ann. Mag. Nat. Hist. ser. 2, xix. p. 132, t. 8, figs. 20–4 (1857). *Calicium tra-*

jectum Nyl. in Flora xlvi. p. 211 (1865); Carroll in Journ. Bot. iii. p. 287 (1865) pro parte; Cromb. Lich. Brit. p. 13; Leight. Lich. Fl. p. 46. *C. eusporum* Cromb. Lich. Brit. p. 13 (1870) (non Nyl.). *C. septatum* Leight. Lich. Fl. p. 45; ed. 3, p. 45. *Excise*. Leight. n. 228; Mudd n. 242.

The thallus is so thin as to be scarcely distinguishable from the bark on which it grows, or there is none proper. The apothecia are sometimes 2-3 congregate, with the stalks varying in length up to 6 mm., and, when long, becoming branched.

Hab. On the bark of holly, and also parasitic on the thallus of *Thelotrema lepadinum* and *Graphis elegans* in upland wooded districts.—*Distr.* Common, where it occurs, in S. and N. England and in S. and W. Ireland.—*B. M.* Near Lyndhurst, New Forest, Hants; Sheffield Park and near Withyham, Sussex; Ingleby Park and Bousdale Gill, Cleveland, Yorkshire; Glenbowe Wood and Castle-martyr, Cork; Tore Mt., Killarney, Kerry; Lough Feagh, Conemara, Galway.

3. *S. byssacea* Nyl. in Bot. Not. 1854, p. 84.—Thallus scarcely visible or obsolete. Apothecia small, scattered; stalk very slender, sometimes branched; capitulum clavate-tubiform; spores at first simple then 1-3-septate, 15-23 μ long, 5-7 μ thick. Cromb. in Grevillea xv. p. 14 (1886). *Calicium byssaceum* Fr. Sched. Crit. i. p. 6 (1824); Cromb. in Journ. Bot. xi. p. 133 (1873); Leight. Lich. Fl. ed. 3, p. 45.

Smaller and more slender than the preceding species. The apothecia are frequently branched and occasionally fasciculate.

Hab. On trunks and branches of alders in upland wooded districts.—*Distr.* Rare in W. England, N. Wales, and Central Scotland.—*B. M.* Hay Park, near Ludlow, Shropshire; Capel Curig, Carnarvonshire; Glen Lochay and Blair Athole, Perthshire.

6. *CYPHELIUM* Ach. in Vet. Acad. Handl. 1815, p. 261.—*Trachylia* Fr. in Vet. Acad. Handl. 1821, p. 324 pro parte; Nyl. in Mém. Soc. Sci. Nat. Cherb. iii. p. 167 (1855) & Lich. Scand. p. 44 (note); Cromb. Monogr. i. p. 101. *Acolium* S. F. Gray Nat. Arr. i. p. 482 (1821); Mudd Man. p. 253. (Pl. 6.)

Thallus effuse, crustaceous, granular or furfuraceous. Apothecia sessile, sometimes almost immersed in the thalline granules, semi-globose, becoming open and plane, black, with a thin thalline margin, sporal mass plane, black; paraphyses scanty, slender; spores 1-septate, rarely pluri-septate and muriform, ellipsoid, brownish-black. Spermogones with short simple sterigmata and with ellipsoid or elongate and bent spermatia.

Distinguished from other genera of *Caliciaceæ* by the thalline margin of the apothecia.

1. *C. tigillare* Ach. tom. cit. p. 266.—Thallus effuse, granular-areolate or deeply cracked, yellowish-green or citrine-yellow (K-). Apothecia small, plane, innate, the margin

prominent at first then excluded; spores 1-septate, 15–25 μ long, 8–11 μ thick.—*Lichen tigillaris* Ach. Lich. Suec. Prodr. p. 67 (1798); Engl. Bot. t. 1530. *Acolium tigillare* S. F. Gray Nat. Arr. i. p. 482 (1823); Mudd Man. p. 254. *Calicium tigillare* Turn. & Borr. Lich. Brit. p. 132 (1839); Hook. in Sm. Engl. Fl. v. p. 139. *Trachylia tigillaris* Fr. Summa Veg. Scand. p. 118 (1846); Cromb. Lich. Brit. p. 14; Leight. Lich. Fl. p. 48; ed. 3, p. 47.

The thallus is greener in damp shady places, and is then barren. The apothecia are immersed in the larger granules. The minute black spermogones are frequent, the spermatia 5–7 μ long, 2.5–3.5 μ thick.

Hab. On old palings generally about gardens, very rarely on trees.—*Distr.* Rare, at least in a well-developed state, having been gathered only sparingly in E. and N. England, and now extinct in several of the recorded localities (vide Crombie).—*B. M.* Walthamstow, Loughton, Maldon, and Colchester, Essex; Herringfleet and near Yarmouth, Suffolk; Ayton, Cleveland, Yorkshire.

2. *C. inquinans* Trev. in Flora xlv. p. 4 (1862).—Thallus effuse, coarsely granular, the granules conerescent, sometimes deeply cracked, thin or rather thick, grey or whitish (K \rightarrow yellowish). Apothecia moderate in size, prominent, plane, black, sometimes slightly grey-pruinose, with a black, thin, prominent margin, which is sometimes white-pruinose, and at length evanescent; spores 1-septate, constricted at the septum, 10–18 μ long, 7–12 μ thick.—*Lichen inquinans* Sm. Engl. Bot. t. 810 (1800). *Calicium tympanellum* Ach. Meth. p. 89 (1803); Turn. & Borr. Lich. Brit. p. 134; Hook. in Sm. Engl. Fl. v. p. 139. *Acolium tympanellum* S. F. Gray Nat. Arr. i. p. 482 (1821); Mudd Man. p. 254, t. 4, f. 101. *Trachylia tympanella* Fr. Summa Veg. Scand. p. 118 (1846); Carroll in Journ. Bot. iii. p. 287 (1865); Cromb. Lich. Brit. p. 14; Leight. Lich. Fl. p. 48; ed. 3, p. 47.

Exsicc. Cromb. n. 114; Leight. n. 88 (under the name *Lecidea dubia* Turn. & Borr.); Mudd n. 240.

The apothecia have largely the aspect of a *Lecidea* except for the loose spores, which stain the fingers blackish when touched. The thallus usually spreads extensively over the substratum.

Hab. On old posts and palings, rarely on the bark of trees in inland districts.—*Distr.* General and usually plentiful in England, rare in Ireland, not reported from Scotland.—*B. M.* New Forest, Hants; Shermanbury, Walstead Common, Albourne, and Lindfield, Sussex; near Totteridge, Middlesex; Lydd and near Penshurst, Kent; Ulting, Wickham Bishops, Walthamstow, and near Colchester, Essex; near Elstree, Herts; near Wootton Bassett, Gloucestershire; Oswestry, Haugmond Hill, and near Shrewsbury, Shropshire; Twycross and Gopsall Park, Leicestershire; Bilston, Staffordshire; Harboro' Magna, Warwickshire; Colwall, Malton, and near Malvern, Worcestershire; Derbyshire; Yarmouth and Ickworth, Suffolk; Earsham, Norfolk; Rosedale, Yorkshire; Curraghmore, Waterford.

3. *C. stigonellum* A. Zahlbr. in Engler & Prantl Pflanzenf. i. 1*, p. 84 (1903).—Thallus none proper. Apothecia parasitic, small or moderate, scarcely prominent, plane, black, the margin black, prominent, sometimes pruinose, disappearing; spores blunt at the apices, 1-septate, 9–17 μ long, 7–10 μ thick.—*Calicium stigonellum* Ach. Meth. p. 88 (1803) pro parte; *C. sessile* var. *marginatum* Turn. & Borr. Lich. Brit. p. 128 (1839); Hook. in Sm. Engl. Fl. v. p. 138. *Trachylia stigonella* Fr. Summa Veg. Scand. p. 118 (1846); Cromb. Lich. Brit. p. 15 & Monogr. i. p. 102; Leight. Lich. Fl. p. 49; ed. 3, p. 47. *Acolium stigonellum* Mudd Man. p. 254 (1861).

Exsicc. Leight. n. 226; Cromb. n. 11; Johns. n. 401.

Differs from the other species in the smaller apothecia and in the parasitic habit.

Hab. On the thallus of various *Pertusariae*.—*Distr.* General, though not common throughout England, rare in Central Scotland.—*B. M.* Lyndhurst, New Forest, Hants; St. Leonard's Forest, Sussex; Shiere, Surrey; Stansted Mount Fitchet Park, Thorndon Hall, Bocking, and Epping Forest, Essex; Cirencester, Gloucestershire; Gopsall, Leicestershire; Hindlip, Worcestershire; Barmouth, Merioneth; Llanforda and Haughmond Hill, Shropshire; Penmaenmawr, Carnarvonshire; Easby Wood, Ingleby and Cleveland, Yorkshire; Leven's Park, Westmoreland; Teesdale, Durham; Ben Lawers, Perthshire.

4. *C. Notarisii* A. Zahlbr. in Engler & Prantl Pflanzenf. i. 1*, p. 84 (1903).—Thallus bright greenish yellow, granular-areolate. Apothecia innate, plane; spores brownish-black, ellipsoid or irregularly globose, 1–5-septate and often with a longitudinal septum in one or more of the cells, 14–25 μ long, 10–17 μ thick.—*Acolium Notarisii* Tul. in Ann. Sci. Nat. sér. 3, xvii. p. 86 (1852).

Differs from other species in the genus in the muriform spores. The apothecia are numerous, each one surrounded by the granular brightly-coloured thallus. The only specimen in the herbarium is in Herb. Davies (collected by Lorbalestier, under the name *Acolium tigillare*).

Hab. On worked wood.—*B. M.* Walton, Suffolk (the only British locality).

ORDER II. SPHÆROPHORACEÆ.

Thallus fruticose (foliose in some foreign genera). Algal cells *Protooccus*. Apothecia sessile, surrounded by the thallus; asci dissolving early, the spores forming a dark-coloured, powdery mass (*mazedium*).

There is only one genus represented in Britain:—

Thallus fruticose. Apothecia terminal..... 7. *Sphærophorus*.

7. **SPHÆROPHORUS** Pers. in Ust. Ann. Bot. vii. p. 23 (1794). (*Sphærophoron* Ach. Meth. p. 134 (1803).) (Pl. 7.)

Thallus shrubby, composed of upright stalks, irregularly branched, the cortical layer cartilaginous, smooth and shining, the central medullary layer white and rather soft. Apothecia terminal on the primary stalks or branches, innate in the swollen tips, globose or subglobose, the surrounding thallus at length bursting irregularly; sporal mass copious, black; paraphyses slender; asci 8-spored, evanescent; spores globose, simple, with a dark-coloured epispore. Spermogones terminal, punctiform, black; spermatia oblong, pleurogenous, on short-celled tissue-like sterigmata lining the walls of the spermogone.

1. *S. melanocarpus* Schær. in Meisner's Naturwiss. Anzeiger, v. p. 43 (1821).—Thallus shrubby, erect, irregularly branched, whitish (K—, medulla I—), the branches short, compressed, much divided, naked, more or less laterally and minutely fibrillose. Apothecia moderate in size, oblique, globose-depressed, the covering thallus torn and the disc at length open; spores globose, 7–11 μ in diameter.—*S. compressus* Ach. Meth. p. 135 (1803); Hook. Fl. Scot. ii. p. 67 & in Sm. Engl. Fl. v. p. 232; S. F. Gray Nat. Arr. i. p. 487; Turn. & Borr. Lich. Brit. p. 115; Mudd Man. p. 264; Cromb. Lich. Brit. p. 15; Leight. Lich. Fl. p. 49; ed. 3, p. 48. *S. coralloides* var. *compressum* Tayl. in Mackay Fl. Hib. ii. p. 83 pro parte. *Lichenoides non tubulosum, ramulis scutellis nigris terminatis* Dill. in Ray Syn. ed. 3, p. 66, n. 13 (1724). *Coralloides alpinum* Dill. Hist. Musc. p. 116, t. 17, fig. 34 c (1741). *Lichen melanocarpus* Swartz Prodr. Descr. Veg. p. 147 (1788). *L. fragilis* Sm. Engl. Bot. t. 114 (1793) (non L.).

Exsicc. Dicks. Hort. Sicc. Fasc. 8, n. 23; Johns. n. 170; Larb. Lich. Hb. n. 205; Mudd n. 254.

The description by Swartz of the compressed branches is too characteristic to leave any doubt as to the identity of his plant. The thallus is normally whitish, but, in most places, the branches are occasionally a greenish-grey, and sometimes tinged with red. The spermogones, rare on British specimens, are tuberculose, brownish-black, situated on the main branches, rarely on the fibrillæ, and with minute ellipsoid spermatia, 3 μ long, 1 μ thick.

Hab. On rocks and boulders in upland tracts.—*Distr.* General, though not common, throughout the British Isles.—*B. M.* Island of Guernsey; Dartmoor, Devon; Ardingly, Sussex; High rocks near Tunbridge Wells, Kent; Aberdovey and Dolgelly, Merioneth; Cromford Moor, near Matlock, Derbyshire; Farndale, Yorkshire; Teesdale, Durham; Wark, Northumberland; Black Craig, New Galloway; Barcaldine, Lorne, Argyll; The Trossachs and Loch Tay, Perthshire; Countesswells Wood, near Aberdeen; Lochaber, Invernessshire; Torc Mt. and Cromaglow, Kerry; Diamond Mt., Connemara, Galway; Achill Island, Mayo.

2. *S. globosus* A. L. Sm.—Thallus unequally and somewhat loosely branched, ascending, greyish-white or reddish-brown (K—, medulla I + bluish), the branches numerous, rather short, with compound lateral fibrillæ. Apothecia globose, moderate in

size, irregularly deliscent above; spores spherical, 9–15 μ in diameter.—*S. coralloides* Pers. in Ust. Ann. Bot. vii. p. 23 (1794); Hook. Fl. Scot. ii. p. 67 & in Sm. Engl. Fl. v. p. 232 (incl. var. *laxum*, excl. var. *cæspitosum*); S. F. Gray Nat. Arr. i. p. 487; Tayl. in Mackay Fl. Hib. ii. p. 83 (excl. vars.); Turn. & Borr. Lich. Brit. p. 110 (excl. var. *cæspitosum*); Leight. Angioc. Lich. p. 7, t. 1, fig. 1 (incl. var. *laxum*, excl. var. *cæspitosum*) & Lich. Fl. p. 50; ed. 3, p. 48; Mudd Man. p. 263, t. 5, fig. 109; Cromb. Lich. Brit. p. 15 & Monogr. i. p. 104, fig. 28 (incl. f. *congestus* Lamy in Bull. Soc. Bot. Fr. xxv. p. 349 (1878)). *Lichenoides non tubulosum ramosissimum, fruticuli specie, cinereo-fuscum* Dill. in Ray Syn. ed. 3, p. 65, n. 9 (1724). *Coralloides cupressiforme, capitulis globosis* Dill. Hist. Musc. p. 117, t. 17, fig. 35 (1741). *Lichen globosus* Huds. Fl. Angl. p. 460 (1762). *L. globiferus* L. Mant. p. 133 (1767); Lightf. Fl. Scot. ii. p. 887 (1777); Engl. Bot. t. 115; With. Arr. ed. 3, iv. p. 40.

Exsicc. Bohl. n. 5; Johns. n. 208; Leight. n. 316; Mudd n. 253.

Distinguished from the preceding by the rounded laxly-growing thallus, the shorter branches, and the more globose apothecia. It occurs in extensive patches, varying in colour from bluish-grey in shady, to brownish or even reddish, in exposed situations. The apothecia remain closed for a considerable time; the spermatogones are similar to those of *S. melanocarpus*, though more frequent. Hudson's *Lichen globosus* was based on Dillenius, t. 17, fig. 35. Form *congestus* is, as Crombie suggested, a stunted condition of the species; there are numerous connecting stages.

Hab. On rocks and boulders, rarely on the mossy roots of trees.—*Distr.* General and common in the hilly and mountainous tracts of Great Britain and Ireland, rarer in the Channel Islands.—*B. M.* Island of Guernsey; near Wring Cheese, near Penzance, and Helmin-ton, Cornwall; Dartmoor, Bovey Tracey, and Lustleigh Cleeve, Devon; Eridge rocks and Ardingly, Sussex; Tunbridge Wells, Kent; Buckstone, near Monmouth; Charnwood Forest, Leicestershire; Malvern Hills, Worcestershire; Cader Idris, Cwm Bychan, and Aberdovey, Merioneth; Caer Caradoc and Pentregaer, Oswestry, Shropshire; Trefriw, Capel Curig, Llanberis, and Conway Falls, Carnarvonshire; Cromford Moor, near Matlock, Derbyshire; Kildale Moor, Cleveland, Yorkshire; Egglestone, Durham; Kentmere, Westmoreland; The Cheviots, Northumberland; New Galloway, Kirkcudbrightshire; Pentland Hills and Dalmahoy Hill, near Edinburgh; Inverary and Loch Creran, Argyll; Nigg, Kincardineshire; Sidlaw Hills, Reeky Linn, and Clova, Forfarshire; Loch Rannoch, Craig Calliach, near Crieff, Braeklinn Bridge, Ben Lawers, and Falls of Bruar, Perthshire; Lochnagar, Craig Coinnoch, Morrone, Braemar, Aberdeenshire; Glen Nevis, Invernessshire; near Nairn; Applecross, Rossshire; Forres, Elginshire; near Lairg, Sutherland; Achill Island and Croaghmore, Clare Island, Mayo; Devis Mt., Antrim.

3. *S. fragilis* Pers. in Ust. Ann. Bot. vii. p. 23 (1794).—Thallus more or less densely cæspitose, sparingly and dichoto-

mously branched, greyish-white, brownish or dark-greyish (K + yellowish, medulla I—), the branches rounded, clustered and erect, naked, without fibrillæ. Apothecia globose or sub-globose, irregularly dehiscent above; spores spherical or globose-ellipsoid, 7–16 μ in diameter.—Engl. Bot. t. 2474; S. F. Gray Nat. Arr. i. p. 487; Hook. Fl. Scot. ii. p. 67; Cromb. Lich. Brit. p. 15; Leight. Lich. Fl. p. 51; ed. 3, p. 49. *S. cæspitosum* DC. Fl. Fr. ii. p. 327 (1805). *S. coralloides* var. *cæspitosum* Turn. & Borr. Lich. Brit. p. 111; Hook. in Sm. Engl. Fl. v. p. 232; Leight. Angioc. Lich. p. 8, t. 1, fig. 2; var. *fragilis* Tayl. in Mackay Fl. Hib. ii. p. 83 (1836); Mudd Man. p. 264. *Coralloides alpinum*, *Corallinæ minoris facie* Dill. Hist. Musc. p. 116, t. 17, fig. 34A, B (1741). *Lichen fragilis* L. Sp. Pl. p. 1154 (1753); Lightf. Fl. Scot. ii. p. 888 pro parte. *L. cæspitosus* Roth Tent. Fl. Germ. i. p. 513 (1788).

Exsicc. Croall n. 199; Johns. n. 209.

Somewhat similar to cæspitose forms of the preceding, but distinguished by the branches being without fibrillæ. It grows in cushion-like masses less than an inch in height; the branches are often darker below, and are sometimes reddish. When fertile, which is rare, the apothecia are borne on longer protruding branches. The pycnidia are frequent with minute spores, 3 μ long, 1 μ thick.

Hab. On mossy or bare rocks and boulders in upland to alpine situations.—*Distr.* Common in the hilly and mountainous tracts of the British Isles.—*B. M.* Near Vixen Tor and Hay Tor, Devon; Ardingly Rocks, Sussex; Charnwood Forest, Leicestershire; Rhewgreidden, Merioneth; Snowdon, Carnarvonshire; Helsby, Cheshire; Ingleboro and Farndale, Yorkshire; Egglestone and Teesdale, Durham; West Allen Carrs, Northumberland; Ennerdale, Cumberland; New Galloway, Kirkcudbrightshire; Ben Lomond, Dumbartonshire; Clova, Forfarshire; Craig Calliach, Ben Lawers, near Crieff, and Loch Ericht, Perthshire; Craig Coinnoch, Glen Callater, Loch-na-gar, and Ben-naboard, Braemar, Aberdeenshire; Ben Nevis, Invernesshire; near Forres, Elginshire; Hills of Applecross, Rossshire; Glandarry and Slievemore Mts., Achill Island, Mayo; Malin Head, Donegal.

Subseries II. *CYCLOCARPINEÆ.*

Thallus crustaceous, squamulose, foliose or fruticose. Algal cells blue-green (Myxophyceæ) or bright-green (Chlorophyceæ). Fruit a roundish apothecium, open or partially open from the first, marginate or immarginate, the margin composed of hyphæ alone (*proper*) or including gonidia (*thalline*). Asci and spores various.

The Cyclocarpineæ include a large and varied series of lichens, that differ widely in the characters of thallus and fruit. The algae are blue-green in a comparatively small number of orders and genera; mostly they are bright-green (or yellow). In the former case the thallus is frequently gelatinous when moist, as are the algæ, which are distributed equally through the thallus (*homoiomerous*), though also sometimes non-gelatinous with the algæ arranged in a definite

zone (*heteromerous*). The thallus containing bright-green algæ is non-gelatinous, and nearly always heteromerous.

The Natural Orders are grouped as follows:—

- Thallus homoimerous, gelatinous when moist (more or less). Algæ blue-green, distributed equally through the thallus.
- Thallus with *Scytonema* or *Stigonema* algæ, more or less minutely fruticose... iii. EPHEBACEÆ.
 - Thallus with *Glæocapsa* algæ, crustaceous, minutely squamulose or minutely fruticose iv. PYRENOPSISACEÆ.
 - Thallus with *Rivularia* algæ, fruticose or squamulose, small..... v. LICHINACEÆ.
 - Thallus with *Nostoc* algæ, crustaceous, squamulose or foliose vi. COLLEMACEÆ.
- Thallus heteromerous, not gelatinous when moist. Algæ in a definite zone.
- Algæ blue-green (bright-green in *Psoroma*). Apothecia small.
 - Thallus crustaceous, squamulose or subfoliose, minute vii. PANNARIACEÆ.
 - Algæ blue-green or bright-green. Apothecia large.
 - Thallus foliose. Spores septate.
 - Apothecia without a thalline margin, adnate viii. PELTIGERACEÆ.
 - Apothecia marginate, scutellate ix. STICTACEÆ.
 - Algæ constantly bright-green (or yellowish).
 - Apothecia large, with thalline margin.
 - Thallus foliose. Spores simple
 - Thallus fruticose. Spores simple or septate..... x. PARMELIACEÆ.
 - Apothecia small to moderate in size, with thalline margin.
 - Thallus various. Spores polaribilocular xi. USNEACEÆ.
 - Apothecia usually small, with thalline margin.
 - Thallus crustaceous or minutely squamulose.
 - Apothecia single, superficial (or immersed at first).
 - Spores various xii. PHYSICIACEÆ.
 - Apothecia several in thalline verrucæ xiii. LECANORACEÆ.
 - Apothecia with a double margin xiv. PERTUSARIACEÆ.
 - Apothecia without a thalline margin.
 - Thallus foliose, expanded..... xv. THELOTREMACEÆ.
 - Thallus squamulose, with upright podetia xvi. GYROPHORACEÆ.
 - Thallus filamentous..... xvii. CLADONIACEÆ.
 - Thallus crustaceous or minutely squamulose xviii. CENOGONIACEÆ.
 - Thallus crustaceous or minutely squamulose xix. LECIDEACEÆ.

ORDER III. EPHEBACEÆ.

Thallus more or less gelatinous when moist, minutely fruticose or filamentous, crustaceous or partly squamulose, corticated or non-corticated. Algal cells Myxophyceæ (*Scytonema* or *Stigonema*). Apothecia rather small, discoid, with a proper margin (lecidine); spores 8 in the ascus, colourless, simple or septate. Spermogones partly immersed in the thallus, with simple or septate sterigmata and minute ellipsoid acrogenous or pleurogenous spermatia.

The lichens of this Order belonging to the British Flora are crustaceous, minutely shrubby or filamentous, and slightly gelatinous when moist. The alga is a species of *Scytonema*, with cell-rows in one series, or of *Stigonema*, with the cell-rows in several series. The resulting lichen is of a somewhat stouter texture than the alga. They are all somewhat uncommon. The crustaceous lichen *Magnopsis argilospila* Nyl. included by Crombie among Ephebacei (Monogr. i. p. 29) should be classified among Pyrenidiaceæ. The following genera are British:—

Thallus with *Scytonema*.

Thallus crustaceous..... 8. Porocyphus.

Thallus minutely fruticose.

Filaments without a cortex 9. Thermutis.

Filaments with cellular cortex.

Apothecia moderate in size, spores
1-septate 10. Polychidium.

Apothecia minute, spores simple.... 11. Leptogidium.

Thallus minutely squamulose - coralloid;
spores 1- or more-septate 12. Placynthium.

Thallus of larger *Lichina*-like fronds, fructi-
fication unknown..... 13. Schizoma.

Thallus with *Stigonema*, fruticose.

Filaments minute, apothecia black..... 14. Spilonema.

Filaments somewhat elongate, apothecia
pale.

Thallus not spiny, apothecia without
paraphyses..... 15. Ephebe.

Thallus with spiny branchlets, apothecia
with paraphyses..... 16. Ephebeia.

8. **POROCYPHUS** Koerb. Syst. Lich. Germ. p. 425 (1855).
(Pl. 8.)

Thallus crustaceous, continuous or areolate or granular, non-corticated, slightly gelatinous. Algal cells *Scytonema*. Apothecia very small, immersed, closed then open, with a stout thalline margin; paraphyses slender, discrete; asci rather irregular in form, often bent or twisted, 8-spored; spores ellipsoid, simple, colourless. Spermogones immersed, almost globose, with acrogenous short or elongate ellipsoid spermatia.

1. *P. areolatus* Koerb. Syst. Lich. Germ. p. 425 (1855).—
Thallus granular-areolate or somewhat continuous and thinnish,

brownish-black. Apothecia minute, dark-coloured, with a thick thalline margin; paraphyses slender; asci elongate, often bent; spores shortly ellipsoid, $9-16\ \mu$ long, $8-10\ \mu$ thick; hymenial gelatine bluish with iodine.—*Collempsis lecanopsoides* Nyl. ex Cromb. in Journ. Bot. xii. p. 332 (1874) pro parte; Cromb. Monogr. i. p. 78 pro parte; Leight. Lich. Fl. ed. 3, p. 35 pro parte.

Hab. On primitive rocks in mountainous regions.—*B. M.* Craig Tulloch, Blair Athole, Perthshire.

9. **THERMUTIS** Fr. Syst. Orb. Veg. p. 302 (1825). *Goniomena* Nyl. in Mém. Soc. Sci. Nat. Cherb. iii. p. 163 (1855); Leight. in Ann. Mag. Nat. Hist. ser. 3, xvi. p. 8 (1865); Cromb. Lich. Brit. p. 1 & Monogr. i. p. 18. (Pl. 9.)

Thallus minutely shrubby or felted, composed of thread-like sparingly branched filaments. Algal cells *Scytonema*, a single cell row in each filament, the lichen hyphæ growing parallel within the gelatinous sheath of the alga. Apothecia small, flattened-globose, lateral on the filaments; paraphyses unbranched, slender; asci elongate, 8-spored; spores colourless, ellipsoid or elongate, simple. Spermogones lateral or terminal on the filaments, somewhat globose; sterigmata septate; spermatia minute, ovate or elongate, pleurogenous.

1. **Th. velutina** Th. Fr. Lich. Arct. p. 287 (1860).—Thallus of slender filaments, felted, sometimes spreading extensively, brownish when moist, dark-brown when dry. Apothecia minute, dark-brown, pale within, with a tumid margin; spores oblong-ellipsoid, $10-15\ \mu$ long, $6-7\ \mu$ thick.—*Lichen velutinus* Ach. Lich. Suec. Prodr. p. 218 (1798); *Polychidium velutinum* S. F. Gray Nat. Arr. i. p. 402 (1821). *Goniomena velutinum* Nyl. in Mém. Soc. Sci. Nat. Cherb. iii. p. 163 (1855); Leight. in Ann. Mag. Nat. Hist. ser. 3, xvi. p. 8, t. 4, figs. 1-6 (1865) & Lich. Fl. p. 11; ed. 3, p. 9; Cromb. Lich. Brit. p. 1 & Monogr. i. p. 18.

Exsicc. Johns. n. 41.

The apothecia are very rarely met with in this country. The spermogones are described as pale reddish with minute spermatia, $2\ \mu$ long, and $1\ \mu$ thick.

Hab. On mica-schist rocks in mountainous districts.—*Distr.* Rare in N. Wales, N. England, and among the Grampians, Scotland, probably often overlooked.—*B. M.* Near Barmouth and Cader Idris, Merioneth; Friar's Crag, Keswick, Cumberland; Ben Cruachan, Argyll; Ben Lawers and Craig Tulloch, Perthshire; Glen Callater, Aberdeenshire.

2. **Th. compacta** A. L. Sm.—Thallus of dark-brown crowded filaments forming a tomentum or felt. Apothecia globulose, reddish, becoming dark, the epithecium rather indistinct; spores oblong, $10-15\ \mu$ long, $6-8\ \mu$ thick.—*Sirosiphon compactus* Leight.

Lich. Fl. ed. 3, p. 9 (1879) (Kütz. Tab. Phyc. ii. p. 10, t. 36, fig. 3 (1850-52) as alga). *Gonionema compactum* Nyl. in Flora Ixvi. p. 104 (1883); Cromb. in Journ. Bot. xxiii. p. 195 (1885) & Monogr. i. p. 19.

Exsicc. Johns. n. 1 (?).

Closely allied to, and possibly identical with, the preceding, differing chiefly, according to Nylander, in the form of the filaments, a variable character. The spermatia are described as somewhat smaller, measuring $1\ \mu$ long and $\frac{1}{2}\ \mu$ thick. The synonymy has generally included that of the alga *Scytonema compactum* Ag. Disp. Alg. p. 39 (1812). Leighton first included it among lichens, though the apothecia were then undiscovered. The specimens in the herbarium of the British Museum, with the exception of that from Mardale, present considerable difficulty in identification, and are doubtfully lichenoid, the filaments being mostly of a purely algal nature, and apothecia wanting.

Hab. On moist rocks in upland and subalpine districts.—*Distr.* Rather rare in N. Wales, N.W. England, Scotland, and N.W. Ireland.—*B. M.* Mardale, Westmoreland; Wastdale, Cumberland; (?) Dolgelly, Merioneth; (?) Appin, Argyll; Blair Athole, Perthshire.

10. **POLYCHIDIUM** S. F. Gray Nat. Arr. i. p. 401 (1821); emend. A. Zahlbr. in Engler & Prantl Nat. Pflanzenf. i. 1*, p. 156 (1906). *Collema*, Sect. *Polychidium* Ach. Lich. Univ. p. 658 (1810) pro parte. (Pl. 10.)

Thallus foliose with narrow laciniae or minutely shrubby and branched, the branches terete with a well-developed cellular cortex. Algal cells *Scytonema*, in parallel longitudinal lines. Apothecia moderate in size; sessile, lateral or terminal, brown; asci 8-spored; spores elongate-fusiform, 1-septate, colourless. Spermogones with septate sterigmata, the spermatia pleurogenous, small, thicker at the ends.

The only species of this genus in the British Isles has been included by recent writers in *Leptogium*, from which however it differs in the algal constituent and the consequent form of the thallus.

1. **P. muscicolum** S. F. Gray Nat. Arr. i. p. 402 (1821).—Thallus minutely shrubby, formed of slightly compressed or rounded dark-brown or olive-blackish filaments, branched, sometimes anastomosing, often nodulose at the tips, suberect or decumbent, in cushion-like tufts. Apothecia moderate in size, brownish-red, with a thin paler margin; spores oblong-fusiform, 1-septate, 23-27 μ long, 7 μ thick.—Mudd Man. p. 49, t. 1, f. 9. *Lichen muscicola* Swartz in Nov. Act. Acad. Upsal. iv. p. 248 (1784) (excl. Syn. Dill.); Dicks. Pl. Crypt. Fasc. ii. p. 23, t. 6, f. 9; With. Arr. ed. 3, iv. p. 46; Engl. Bot. t. 2264. *Collema muscicola* Ach. Lich. Univ. p. 660 (1810); Hook. Fl. Scot. p. 72 & in Sm. Engl. Fl. v. p. 214; Tayl. in Mackay Fl. Hib. ii. p. 111. *Leptogium muscicolum* Fr. Summa Veg. Scand. p. 122 (1846);

Nyl. Syn. i. p. 134, t. 4, figs. 11–15; Cromb. Lich. Brit. p. 10 & Monogr. i. p. 68; Leight. Lich. Fl. p. 27; ed. 3, p. 34.

Esicc. Leight. n. 395; Larb. Lich. Hb. n. 121.

Owing to the somewhat gelatinous nature of the thallus the filaments tend to cohere, and the rather broad apothecium looks as if perched on several different branches. It resembles young and pale states of *Parmelia pubescens*.

Hab. Among mosses on rocks and walls.—*Distr.* General and not uncommon in maritime and upland districts.—*B. M.* South Brent, Botor Rock and near Hunter Tor, Devon; Breiddon, Montgomeryshire; Cader Idris, Drews-y-nant and Ty-gwyn, near Dolgelly, Merioneth; Shropshire; Llanberis and Snowdon, Carnarvonshire; Beaumaris, Anglesea; Kentmere, Westmoreland; New Galloway, Kirkeudbrightshire; Ben Cruachan, Oban, Loch Creran and Pass of Brander, Argyll; Ben Lawers and near St. Fillans, Perthshire; Craig Guie, Braemar, Aberdeenshire; Luggelaw, Wicklow; Killarney, Kerry; Kylemore, Galway.

11. LEPTOGIDIUM Nyl. in Flora lvi. p. 195 (1873). (Pl. 11.)

Thallus minutely shrubby and tangled, the branches terete, with a well-developed cellular cortex and a central medullary strand of hyphæ. Algal cells *Scytonema*, in parallel longitudinal lines. Apothecia small, reddish or brownish; spores colourless, ellipsoid, simple.

Almost exclusively a tropical genus, S.W. Ireland being the only locality where it occurs in Europe.

1. *L. dendriscum* Nyl. l. c. (note).—Thallus of short, slender, intricately branched filaments which are rounded or obsoletely compressed, olive-greenish or pale-yellowish at the base. Apothecia small, pale or pale-reddish, the disc somewhat convex; spores ellipsoid, 10–16 μ long, 6–8 μ thick.—Cromb. in Journ. Bot. xii. p. 337 (1874); Leight. Lich. Fl. ed. 3, p. 13. *Leptogium dendriscum* Nyl. Syn. Lich. i. p. 135 (1858). *L. Moorei* Hepp ex Carroll in Journ. Bot. iii. p. 287 (1865); Cromb. Lich. Brit. p. 10; Leight. Lich. Fl. p. 27. *Ephebe byssoides* Carring. in Trans. Bot. Soc. Edinb. vii. p. 411, t. 10, fig. 2 (1863).

The few specimens collected in Ireland are without apothecia and with only imperfectly developed spermogones.

Hab. On mossy trunks of trees in S.W. Ireland.—*B. M.* Cromaglow, Glengarriff and Glena, Killarney, Kerry.

12. **PLACYNTHIUM** S. F. Gray Nat. Arr. i. p. 395 (1821). *Collema* sect. *Placynthium* Ach. Lich. Univ. p. 628 (1810). *Pannularia* Nyl. in Flora lxii. p. 360 (1879) pro parte; Cromb. Monogr. i. p. 340 pro parte. (Pl. 12.)

Thallus granular-crustaceous and areolate or minutely coralloid-squamulose, almost entirely homoiomerous with a plectenchymatous (cellular) cortex and usually with a well-developed

bluish-black hypothallus. Algal cells *Scytonema*. Apothecia sessile, plane or convex, with a proper margin only; paraphyses stoutish, unbranched, septate, thicker and dark-coloured at the tips; asci clavate, 8-spored; spores elongate or ellipsoid-ovate, 1-7-septate, colourless. Spermogones minute with cylindrical, straight or bent, pleurogenous spermatia.

Placed by Crombie and some other lichenologists in or near *Pannaria*, but classified among the Ephebaceæ on account of the homoiomerous thallus.

1. *P. nigrum* S. F. Gray Nat. Arr. i. p. 395 (1821).—Thallus subdeterminate, brownish, minutely squamulose-coralloid, cracked into granular-like areolæ, dark-greyish- or brownish-black; hypothallus bluish-black. Apothecia small, plane or slightly convex, the proper margin entire, internally pale-whitish; hypothecium brownish in thin section; paraphyses stoutish, septate, dark-bluish at the tips; spores ellipsoid, 1-3-septate, 11-18 μ long, 5-7 μ thick; hymenial gelatine deep-bluish then dark-violet with iodine.—*Lichen niger* Huds. Fl. Angl. ed. 2, p. 524 (1778); With. Arr. ed. 3, iv. p. 10; Engl. Bot. t. 1161. *Collema nigrum* Ach. Lich. Univ. p. 628 (1810) pro parte; Hook. in Sm. Engl. Fl. v. p. 207; Tayl. in Mackay Fl. Hib. ii. p. 107. *Lecothecium nigrum* Massal. Ric. Lich. p. 109, f. 215 (1852); Mudd Man. p. 175, t. 3, f. 65 (incl. var. *fuscum*). *Biatora corallinoides* var. *fusca* Hepp Flecht. Eur. n. 10 (1853). *Pannaria nigra* Nyl. Lich. Scand. p. 126 (1861); Cromb. Lich. Brit. p. 43; Leight. Lich. Fl. p. 168; ed. 3, p. 154. *Pannularia nigra* Stiz. Lich. Helv. p. 82 (1882); Cromb. in Grevillea xii. p. 58 & Monogr. i. p. 342.

Exsicc. Johns. n. 254; Leight. n. 366; Mudd n. 144.

The spores are normally 1-septate, but they vary even in one apothecium to 3-septate. The hypothecium is light yellowish-brown in thin sections, though dark in the mass.

Hab. On calcareous rocks, mortar, and flint pebbles in maritime, lowland and upland regions.—*Distr.* General and common throughout the British Isles.—*B. M.* Guernsey; Mt. Orgueil Castle and Gorey, Jersey; St. Minver, Cornwall; Paignton near Torquay, Devon; Shanklin, I. of Wight; Beeding and Glynde, Sussex; Shiere, Surrey; near Stroud and Sapperton, Gloucestershire; Bathampton Down, Somersetshire; Marlborough, Wilts; Breedon Hill, Leicestershire; Llanymynech Hill and Bridgenorth, Shropshire; Barmouth, Merioneth; Bilsdale, Cleveland, Yorkshire; Levens, Westmoreland; near Whitehaven, Cumberland; Egglestone, Durham; Appin, Argyll; Ben Lawers and Craig Tulloch, Blair Athole, Perthshire; Braemar, Aberdeenshire; Applecross, Rossshire; near Belfast, Antrim.

Form *psotina* Hue in Bull. Soc. Linn. Norm. sér. 5, ix. p. 147 (1905).—Thallus similar to that of the species. Apothecia internally somewhat paler; spores more constantly 3-septate and 4-guttulate.—*Collema trachyopum* Tayl. in Lond. Journ. Bot. vi. p. 193 (1847)? *Pannaria nigra* f. *psotina* Nyl. Lich. Scand.

p. 126 (1861); subsp. *psotina* Cromb. in Journ. Bot. xi. p. 133 (1873). *Pannaria psotina* Leight. Lich. Fl. ed. 3, p. 156 (1879). *Pannularia nigra* subsp. *psotina* Cromb. in Grevillea xviii. p. 44 (1889) & Monogr. i. p. 343.

Exsicc. Johns. nos. 30, 255.

Outwardly like the species, but with a lighter coloured hypothecium and with more pronouncedly 3-septate spores, which are sometimes irregular and blunt at the ends.

Hab. On calcareous rocks and mortar of walls in maritime and inland districts.—*Distr.* Rare in the Channel Islands, England and W. Ireland.—*B. M.* The Vale, Guernsey; Eastbourne, Sussex; near the Horse, Windsor Great Park, Berks; Whitehaven, Cumberland; Hexham, Northumberland; Westport and Castlebar, Mayo.

Form *triseptatum* Hue in tom. cit. p. 148.—Thallus subdeterminate, granular-crustaceous, cracked-areolate, brownish-black; hypothallus blackish, not very distinct. Apothecia rather small, with a thin proper margin, brownish-black, internally whitish; spores ellipsoid, 3-septate, 16–22 μ long, 6–9 μ thick.—*Pannaria nigra* f. *triseptata* Nyl. Lich. Scand. p. 126 (1861); Cromb. Lich. Brit. p. 43; subsp. *triseptata* Nyl. ex Cromb. in Grevillea i. p. 171 (1873). *Pannularia triseptata* Nyl. ex Cromb. in op. cit. xviii. p. 44 (1889); Cromb. Monogr. i. p. 343.

With slightly larger spores and more crustose thallus than in the species.

Hab. On mica-schist rocks in mountainous regions.—*Distr.* Rare among the Scottish Grampians.—*B. M.* Achrosagan Hill, Appin, Argyll; Craig Calliach and Ben Lawers, Perthshire.

2. *P. delicatula* A. L. Sm.—Thallus thin adnate, minutely granular-crustaceous, brown. Apothecia small, somewhat convex, brownish-black (reddish when moist); hypothecium colourless; paraphyses yellowish-brown at the clavate apices; spores fusiform-vermicular, straight or substraight, 7–9-septate, 40–76 μ long, 5–7 μ thick; hymenial gelatine and asci bluish with iodine.—*Arctomia delicatula* Th. Fr. Lich. Arct. p. 287 (1860). *Pannularia delicatula* Nyl. ex Cromb. in Journ. Bot. xx. p. 274 (1882); Cromb. Monogr. i. p. 345.

Placed in the genus *Placynthium* on account of the plectenchymatous homoiomerous thallus, and the multi-septate spores.

Hab. On decayed mosses in alpine situations.—*Distr.* Extremely rare among the S. Grampians, Scotland, and Mts. of W. Ireland (Connemara, Galway).—*B. M.* Ben Lawers, Perthshire.

13. **SCHIZOMA** Nyl. ex Cromb. in Grevillea v. p. 108 (1877) (note). (Pl. 13.)

Thallus lacinate-linear, gelatinous when moist, non-corticate. Algal cells *Scytonema*. Apothecia unknown. Spermogones

somewhat prominent, spermatia minute, cylindrical, slightly wider at the ends, acrogenous on sparingly branched sterigmata.

The genus is placed along with others containing *Scytonema*, though the systematic position is uncertain so long as the fructification is unknown. The *Scytonema* filaments are occasionally intact towards the centre of the thallus; as a rule they are broken up into groups, as in the genus *Heppia*. They are massed under the cortex, and the medulla is formed of crowded thin-walled branching hyphæ, mostly parallel with the long axis.

1. **S. lichenodeum** Nyl. ex Cromb. in *Grevillea* v. p. 108 (1877).—Thallus of ligulate cylindrical-angular dichotomously branched lobes flattened when dry and canaliculate, about 5–10 mm. in length and about $\frac{1}{2}$ mm. wide, occasionally sprinkled with isidiose granules dark-brown. Apothecia not yet seen.—*Collema lichenodeum* Nyl. ex Carroll in *Journ. Bot.* iii. p. 287 (1865); Cromb. *Lich. Brit.* p. 3; *Leight. Lich. Fl.* p. 18; ed. 3, p. 15; Cromb. in *Journ. Bot.* xii. p. 332 (1874).

Confusion has arisen in the rendering of the specific name, but Carroll's is the first published. The fronds bear a considerable resemblance to those of *Lichina*.

Hab. On decayed mosses and on the ground in crevices of rocks in alpine places.—*L. M.* Summit of Ben Lawers (the only locality).

14. **SPILONEMA** Bornet in *Mém. Soc. Sci. Nat. Cherb.* iv. p. 226 (1856). (Pl. 14.)

Thallus minutely shrubby with branching filaments. Algal cells *Stigonema*, in rows of several series of cells. Apothecia small, lenticular; paraphyses usually thickish, septate; spores simple or 1-septate, colourless. Spermogones like small tubercles, the sterigmata septate with pleurogenous oblong spermatia.

The thallus is well distinguished from the preceding genera by the algal constituent. As in the genus *Thermutis*, many of the filaments of the various species are algaoid in our specimens.

1. **S. paradoxum** Bornet l. c. tt. 1 & 2.—Thallus dark-brown or brownish-black, of slender cylindrical branches, intricate and felted, the secondary branchlets generally unilateral. Apothecia small, terminal on the main stalks, hemispherical, black; hypothecium dark-coloured; paraphyses clavate; asci clavate, arising from the lowest cell of a paraphysis; spores oblong-ellipsoid, simple, $9\ \mu$ long, $4\ \mu$ thick; hymenial gelatine deep-blue, then dark-violet with iodine.—Mudd *Man.* p. 35; *Leight. in Ann. Mag. Nat. Hist.* ser. 3, xvi. p. 9, t. 4, figs. 7–11 (1865) & *Lich. Fl.* p. 11; ed. 3, p. 10; Cromb. *Lich. Brit.* p. 1 & in *Journ. Bot.* xii. p. 331 (1874).

Ersicc. *Leight.* n. 347.

The thallus bears a considerable resemblance to that of the more common *Ephibe pubescens*, but it is altogether smaller, and the fructification is different.

Hab. On rocks in maritime and subalpine districts.—*Distr.* Rare in N. Wales and S.W. Highlands of Scotland.—*B. M.* Barmouth, Merioneth; Barcaldine, Argyll.

2. *S. revertens* Nyl. in *Flora* xlvi. p. 601 (1865).—Thallus of branching filaments, occurring in small compact agglutinate black or brownish-black pulvinuli. Apothecia adnate, slightly convex, immarginate, black, dark-greyish within; hypothecium not dark-coloured; paraphyses stoutish, somewhat thicker and blackened at the apices; spores colourless, oblong, simple, 8–11 μ long, 5–6 μ thick; hymenial gelatine bluish, the tips of the asci deep-blue, with iodine.—Cromb. in *Journ. Bot.* xii. p. 331 (1874); *Leight. Lich. Fl.* ed. 3, p. 11.

Differs from *S. paradoxum* in the small compact growth of the thallus. In the only British specimen the apothecia are but sparingly present, too few for examination, as are also the spermatogones, stated by Crombie (*Monogr.* i. p. 21) to be globose, immersed and colourless, with somewhat curved spermatia.

Hab. On moist rocks in subalpine districts.—*B. M.* Craig Tulloch, Blair Athole, Perthshire.

3. *S. scoticum* Nyl. in *Flora* lii. p. 82 (1869).—Thallus minutely branched, in small compact somewhat convex agglutinate black or brownish-black pulvinuli. Apothecia minute, black, thinly margined, the disc slightly convex; hypothecium colourless; paraphyses somewhat slender; spores ovoid-oblong, 1-septate, 10–14 μ long, 4–5 μ thick; hymenial gelatine bluish, the asci violet, with iodine.—Cromb. in *Journ. Bot.* vii. p. 105 (1869) & *Lich. Brit.* p. 1; *Leight. Lich. Fl.* p. 12; ed. 3, p. 11.

Very similar to the preceding in the form of the thallus, but distinguished by the internal characters of the apothecia. The latter are very rare.

Hab. On rocks and on dead mosses (also on *Stereocaulon condensatum*) in subalpine regions.—*Distr.* Rare, though perhaps overlooked, in N. Wales, N. England and the S. Grampians, Scotland.—*B. M.* Llyn Aran, Dolgelly, Merioneth; Teesdale, Durham; Ben Lawers and Craig Calliach, Perthshire.

15. **EPHEBE** Fr. *Syst. Orb. Veg.* i. p. 256 (1825) emend.; Nyl. in *Flora* lviii. p. 6 (1875). *Girardia* S. F. Gray *Nat. Arr.* i. p. 287 (1821) pro parte. (Pl. 15.)

Thallus filamentous, in spreading tufts, branched and intricate, without a cellular cortex. Algal cells *Stigonema*, the lichen hyphæ external to the alga in young stages, forming central strands in the older branches. Apothecia minute, solitary or aggregate, immersed in swollen portions of the filamentous thallus; paraphyses none; spores simple or 1–3-septate; spermatogones with long sterigmata and short cylindrical acrogenous spermatia.

Distinguished from the previous genera by the much stouter extensively spreading thallus.

1. **E. lanata** Wain. in Medd. Soc. Faun. & Fl. Fenn. xiv. p. 20 (1888).—Thallus dark-olive-green or brownish-black, somewhat shining, much branched, decumbent, the filaments slender, uneven on the surface, tapering at the apices. Apothecia minute, slightly paler than the thallus; spores simple or 1-septate, colourless, 11–16 μ long, 3–4 μ thick; hymenial gelatine not tinged or faintly violet-coloured, the asci tawny-yellow, with iodine. Spermogones lateral on the branches, the spermatia 5 μ long, 1 μ thick.—*E. pubescens* Nyl. Syn. Lich. i. p. 90, t. 2, figs. 1 & 17–20 (1858); Mudd Man. p. 34; Leight. in Ann. Mag. Nat. Hist. ser. 3, xvi. p. 10, t. 4, figs. 12–14 (1865) & Lich. Fl. p. 12; ed. 3, p. 10; Cromb. Lich. Brit. p. 1 & in Grevillea v. p. 124. *Lichen lanatus* L. Sp. Pl. p. 1155 (1753). *L. pubescens* L. Fl. Suec. n. 1126 (1745) pro parte; Engl. Bot. t. 2318. *L. exilis* Lightf. Fl. Scot. ii. p. 894 (1777) pro parte; With. Arr. ed. 3, iv. p. 47 pro parte. *Conferva atrovirens* Dillw. Brit. Conf. p. 60, t. 25 (1803). *Cornicularia pubescens* Ach. Meth. Lich. p. 305 (1803); S. F. Gray Nat. Arr. i. p. 406. *Scytonema* (?) *atrovirens* Ag. Disp. Alg. p. 39 (1812); Hook. Fl. Scot. ii. p. 78. *Girardia atrovirens* S. F. Gray Nat. Arr. i. p. 287 (1821). *Stigonema atrovirens* Ag. Syst. Alg. p. 42 (1824); Hook. in Sm. Engl. Fl. v. p. 363; Hass. Br. Freshw. Alg. p. 227, t. 66, fig. 1. *Alectoria lanata* f. *minuscule* Leight. Lich. Fl. ed. 3, p. 81 (1879) pro parte. *Exsicc.* Johns. n. 163.

Hudson's *Lichen scaber* has been quoted as a synonym, but the description by him of the "black concave marginate scutellæ" refers it rather to *Parmelia pubescens*. The apothecia are rare. The spermogones are more frequent, and are usually borne on separate plants.

Hab. Forming matted irregular tufts in somewhat large patches, on moist shady rocks, especially by streams.—*Distr.* General and fairly abundant in hilly and mountainous regions.—*B. M.* Roughton, Cornwall; near Ivy Bridge, Chagford, and near Tor, Devon; Barmouth and Dolgelly, Merioneth; Capel Curig, Snowdon and Llanberis, Carnarvonshire; near Holyhead, Anglesea; Mardale, Westmoreland; Ennerdale, Cumberland; Teesdale, Durham; New Galloway, Kirkcudbrightshire; Appin and Loch Awe, Argyll; Glen Lochay and Ben Lawers, Perthshire; Graig Guie, Braemar, Aberdeenshire; Glen Nevis, Invernessshire; Loch Shin, Sutherland; Applecross, Rossshire; Glengariff, Kerry; Kylemore, Galway; Glandarry Wood, Achill Island, Mayo; near Belfast, Antrim.

16. **EPHEBEIA** Nyl. in Flora Iviii. p. 6 (1875). (Pl. 16.)

Thallus filamentous, in spreading tufts, branched and intricate, without a cellular cortex. Algal cells *Stigonema*, the hyphæ external to the alga in young stages, but forming central strands in the older branches. Apothecia solitary, lateral, minute;

paraphyses numerous, slender, slightly clavate at the tips; spores constantly simple, colourless.

Distinguished from the preceding genus by the presence of paraphyses in the apothecium.

1. *E. hispidula* Nyl. in Flora lx. p. 231 (1877).—Thallus olive-green or dark-brown, much branched, decumbent, the filaments slender, rather uneven on the surface, with spine-like branchlets. Apothecia closed at first and subglobose, the disc becoming open and somewhat depressed; paraphyses slender, sparingly branched, slightly clavate; spores oblong-ellipsoid, 10–15 μ long, 4–5 μ thick.—Cromb. in Journ. Bot. xxiii. p. 195 (1885). *Cornicularia hispidula* Ach. Lich. Univ. p. 617 (1810). *E. pubescens* var. *hispidula* S. F. Gray Nat. Arr. i. p. 406 (1821). *Excicc.* Johns. n. 2.

Distinguished from *Ephebe pubescens* by the minute branchlets on many of the filaments, giving it a spinous or hispid appearance.

Hab.—On damp quartzose and schiztose rocks in subalpine districts.—*Distr.* Rare in N. Wales, S. and N. England, and among the Grampians, Scotland.—*B. M.* Ivy Bridge, Devon; Cader Idris, Merioneth; Snowdon, Carnarvonshire; Ben Lawers and Craig Tulloch, Perthshire.

Subsp. *Martindalei* Cromb. in Journ. Bot. xxiii. p. 195 (1885).—Differing from the species in the less hard and spiny branching. Apothecia bluish-green above; spores oblong-ellipsoid, 9–14 μ long, 4–6 μ thick.—*Ephebeia Martindalei* Cromb. ex Nyl. in Flora lxvi. p. 104 (1883) & in Grevillea xii. p. 89 (1884).

The damp locality where the plant was collected may have influenced the growth. It is lighter in colour and softer looking.

Hab. On moist rocks in mountainous districts.—*B. M.* Mardale, Westmoreland.

ORDER IV. PYRENOPSISACEÆ.

Thallus gelatinous when moist, crustaceous or partly squamulose or minutely fruticose, non-corticated. Algal cells Myxophyceæ (*Gloecapsa*, *Chroococcus*). Apothecia small, open or subimmersed and partly closed; spores 8 in the ascus, colourless, simple or rarely septate. Spermogones with minute ovate or elongate acrogenous spermatia.

The algal cells occur in small colonies, each surrounded by mucilage; they are blue-green, or coloured red or yellow, especially towards the surface of the thallus, by various colouring substances. The following genera are British:—

Alge with reddish sheath, externally.

Thallus crustaceous.

Apothecia open or plane..... 17. *Euopsis*.

Apothecia almost closed..... 18. *Pyrenopsis*.

Thallus fruticose, of short tufts 19. *Synalissa*.

Alge with yellow sheath, externally.

Thallus crustaceous, dark-coloured..... 20. *Psorotichia*.

17. **EUOPSIS** Nyl. in Flora lviii. p. 363 (1875). (Pl. 17.)

Thallus crustaceous, granular-areolate, fragile. Apothecia small or moderate in size, discoid, with a thalline margin; paraphyses distinctly septate; spores 8 in the ascus, ellipsoid, simple, colourless. Spermogones with minute acrogenous spermatia.

Separated by Nylander from the genus *Pyrenopsis* on account of the distinctly discoid apothecia and septate paraphyses. The thallus has a reddish colour due to the glæocapsin of the alga, which is more pronounced when moist.

1. **E. pulvinata** Wain. in Medd. Faun. & Flor. Fenn. vi. p. 85 (1881).—Thallus effuse, granular, coarsely areolate, dark-blood-red. Apothecia usually numerous and crowded, dark-blood-red or paler, becoming darker, plane or becoming convex and immarginate; spores ellipsoid, 11–16 μ long, 6–7 μ thick; hymenial gelatine, especially the asci, deep-blue with iodine.—*E. hamalea* Nyl. in Flora lviii. p. 363 (1875); Cromb. in Grevillea xv. p. 10 (1886) & Monogr. i. p. 22. *Lecidea pulvinata* Schær. in Meisner Naturw. Anz. ii. p. 11 (1818). *Collema hæmaleum* Sommerf. Suppl. Fl. Lapp. p. 117 (1826). *Pyrenopsis hæmalea* Stirton in Grevillea ii. p. 71 (1873); Cromb. in Journ. Bot. xii. p. 332 (1874); Leight. Lich. Fl. ed. 3, p. 15.

The red colour of the thallus due to the algal sheath is more pronounced when the lichen is moist.

Hab. On mica-schist rocks in subalpine and alpine regions.—*Distr.* Local and scarce among the Grampians, Scotland, and in W. Ireland.—*B. M.* Ben Cruachan, Argyll; Ben Lawers, Perthshire; Kylemore Mts., Connemara, Galway.

2. **E. granatina** Nyl. in Flora lviii. p. 363 (1875).—Thallus effuse, thin granular, widely cracked-areolate, reddish-brown or reddish, the granules rounded, aggregate, Apothecia small, shining, congregate in the thalline granules, reddish, whitish within, the margin thin, entire, at length excluded; the spores simple or spuriously 1-septate, ellipsoid, 9–12 μ long, 4.5–5.5 μ thick; hymenium, especially the asci, bluish with iodine.—Cromb. in Grevillea xv. p. 10 (1886). *Lecanora granatina* Sommerf. Suppl. Fl. Lapp. p. 90 (1826). *Pyrenopsis granatina* Nyl. ex Cromb. Lich. Brit. p. 27 (1870); Leight. Lich. Fl. p. 14; ed. 3, p. 15.

Differs from the preceding in the more brightly-coloured thallus and in the rounded massed granules. It is much more conspicuous in wet weather. Forssell (Bot. Centralbl. xxii. p. 54 (1885)) considers that this plant should be classified under *Lecanora*, as there are *Palmella* gonidia in the thallus as well as *Glæocapsa*.

Hab. On rocks and boulders in alpine regions.—*Distr.* Rare among the mountains of N. Wales and the S. and W. Grampians, Scotland.—*B. M.* Llyn Aran, near Dolgelly, Merioneth; Ben Cruachan, Argyll; Craig Calliach and Ben Lawers, Perthshire.

18. **PYRENOPSIS** Nyl. in Mém. Soc. Sci. Nat. Cherb. v. p. 88 (1857) & Syn. Lich. p. 97 (1858). (Pl. 18.)

Thallus crustaceous, granular, rarely subsquamulose, or subfruticulose. Apothecia somewhat innate and partly closed, small or minute; paraphyses simple, slender; spores 8 in the ascus, simple, rarely numerous. Spermogones with oblong minute acrogenous spermatia.

The species are all darker than those of *Euopsis*, but they also show the red colouration in a thin section.

1. **P. hæmatopis** Th. Fl. Lich. Arct. p. 284 (1860).—Thallus effuse, crustaceous, the granules rounded, unequally aggregate, dark- or reddish-brown, similarly coloured within or darker towards the base. Apothecia superficial, small with thick connivent entire margins; spores 8 in the ascus, 10–12 μ long, 5–6 μ thick; hymenium, especially the asci, bluish with iodine.—Carroll in Journ. Bot. iv. p. 22 (1866); Cromb. Lich. Brit. p. 2; Leight. Lich. Fl. p. 14; ed. 3, p. 14. *Collema hæmaleum* var. *hæmatopis* Sommerf. Suppl. Fl. Lapp. p. 117 (1826).

The spermogones of this species are somewhat frequent, though the apothecia are rarely seen; when sterile, it is distinguishable from *Euopsis hæmalea* by the thicker, darker thallus.

Hab. On shady rocks in alpine places.—*Distr.* Extremely rare among the S. Grampians, Scotland.—*B. M.* Ben Lawers, Perthshire.

2. **P. homœopsis** Nyl. in Flora li. p. 342 (1868).—Thallus effuse, granular, rather thick, deeply cracked-areolate, the areolæ granular, plane, dark-reddish-brown. Apothecia minute, the margins connivent, pale within, the epithecium narrow, colourless; paraphyses slender; spores 8 in the ascus, 11–18 μ long, 7–10 μ thick; hymenial gelatine red or tawny-wine-coloured with iodine.—Cromb. in Journ. Bot. vii. p. 48 (1869) & Lich. Brit. p. 2; Leight. Lich. Fl. p. 15; ed. 3, p. 14.

Closely allied to *P. granulifera*, a Finland species (Nyl. l. c.). In Nylander's original diagnosis the thallus is described as thin, but in the specimens from Ben Lawers in Herb. Crombie, as also in all the other specimens, it is comparatively thick and deeply diffract also.

Hab. On mica-schist rocks in alpine places.—*Distr.* Rare on the S. Grampians, Scotland.—*B. M.* Summit of Ben Lawers and Craig Calliach, Perthshire.

3. **P. fuscata** Nyl. in Mém. Soc. Sci. Nat. Cherb. v. p. 143 (1857).—Thallus effuse, granular, the granules often in small scattered aggregations, dark-brown or brownish-black. Apothecia small with thick connivent margins; epithecium yellowish; spores 8 in the ascus, small, 8–10 μ long, 4–5 μ thick; hymenial gelatine bluish then violet with iodine.—Leight. Lich. Fl. p. 16; ed. 3, p. 14; Cromb. in Journ. Bot. xii. p. 332 (1874).

Distinguished by the dark-brown colour and the thinner spreading thallus; considered by Nylander (l. c.) as closely allied to *P. fuliginosa*, a continental species. In this species the spermogones are more common than the apothecia. The spermatia are oblong-cylindrical, and very minute.

Hab. On granite and schistose rocks in maritime districts.—*Distr.* Rare in the Channel Islands, N. Wales and S.W. Highlands of Scotland.—*B. M.* La Moye and Boulay Bay, Jersey; Barmouth, Merioneth; Lismore, Argyll.

4. *P. subareolata* Nyl. Lich. Scand. p. 27 (1861) nomen; Cromb. Monogr. i. p. 24 (1894).—Thallus effuse, cracked-areolate, the areolæ plane, blackish. Apothecia small, innate, blackish; spores 8 in the ascus, 15 μ long, 8 μ thick; hymenial gelatine bluish then wine-reddish with iodine.—Cromb. in Journ. Bot. xx. p. 271 (1882).

Comparable with *P. concordaluta*, a Finland species, but with smaller spores (Nyl. in Flora lviii. p. 440 (1875)). The thallus, which spreads over fairly large patches of the rock, is very dark in colour and rather thin. Crombie has suggested (Monogr. i. p. 24) that *Verrucaria imbrida* Tayl. (Lond. Journ. Bot. vi. p. 153 (1847)) may be a synonym.

Hab. On moist rocks in mountainous districts.—*Distr.* Local and scarce in N. Wales and S.W. Ireland.—*B. M.* Near Barmouth, Merioneth; near Killarney, Kerry.

5. *P. phylliscella* Nyl. in Flora lviii. p. 102 (1875).—Thallus effuse, composed of small flattened adpressed squamules roundish and congregate but not contiguous, dark-brown. Apothecia immersed, minute, 5–15 in each squamule, the thalline margin thin, almost covering the epithecium; paraphyses few; spores 8 in the ascus, oblong-ellipsoid, 5–7 μ long, 3 μ thick; hymenial gelatine bluish, the asci dark-violet, with iodine.—Cromb. in Grevillea iii. p. 190 (1875); Leight. Lich. Fl. ed. 3, p. 14.

Considered by Nylander to be closely allied to *P. tasmanica*. The squamuline character of the thallus is not very pronounced, the squamules themselves are minutely granular; the apothecia, when present, are numerous and crowded. The spermogones are not uncommon, the spermatia narrowly oblong or oblong-fusiform.

Hab. On quartzose boulders in a stream.—*B. M.* Ben-y-Gloe, Blair Athole, Perthshire.

6. *P. furfurea* Nyl. ex Cromb. in Journ. Bot. xii. p. 332 (1874).—Thallus effuse, thinnish, granular-areolate, brownish-black, reddish-black when moist. Apothecia minute with tumid connivent margins; spores 10–12 μ long, 7–8 μ thick; hymenial gelatine wine-red with iodine.—Leight. Lich. Fl. ed. 3, p. 14. *Collema furfurum* Nyl. in Flora xlvi. p. 353 (1865); Carroll in Journ. Bot. iii. p. 286 (1865); Cromb. Lich. Brit. p. 3; Leight. Lich. Fl. p. 17.

The apothecia are rare in the few British specimens and the spores badly developed. The gonidia are chroococcoid, the internal structure thus resembling that of *Phylliscum*, under which genus it should perhaps be classified. The material is too scanty and poor for exact determination.

Hab. On moist mica-schist rocks.—*B. M.* Summit of Ben Lawers, Perthshire.

19. **SYNALISSA** Fr. Syst. Orb. Veg. p. 297 (1825). (Pl. 19.)

Thallus minutely fruticose or partly crustaceous, dark-coloured. Algal cells *Glæocapsa*. Apothecia terminal, partly immersed, at first closed then open, with a thalline margin; spores 8 in the ascus or numerous, simple, colourless. Spermogones immersed, with simple sterigmata and acrogenous spermatia.

Chiefly distinguished from the other genera of Pyrenopsidaceæ by the fruticose habit. The thallus is tinged red or dark-brown on the surface by glæocapsin.

1. *S. ramulosa* Fr. Syst. Orb. Veg. p. 297 (1825).—Thallus in blackish pulvinate tufts, the branches short, erect, obtuse at the apices or nodulose. Apothecia minute, at first immersed becoming open, with a tumid thalline margin; spores 8–24 in the ascus, ellipsoid or spherical, small, 9–11 μ long, 6–7 μ thick; hymenial gelatine not tinged with iodine.—*S. symphorea* Nyl. Syn. Lich. p. 94, t. 3, fig. 2 (1858); Mudd Man. p. 35, t. 1, fig. 2; Cromb. Lich. Brit. p. 3 & Monogr. i. p. 37, fig. 8; Leight. Lich. Fl. p. 16; ed. 3, p. 13. *S. vulgaris* Thwaites in Ann. Mag. Nat. Hist. ser. 2, iii. p. 220, t. 8, figs. 1–3 (1849). *Collema ramulosum* Hoffm. Deutschl. Flora ii. p. 161 (1795). *C. symphoreum* DC. Fl. Fr. ii. p. 382 (1805). *C. synalissum* Ach. Lich. Univ. p. 640 (1810) pro parte; Tayl. in Mackay Fl. Hib. ii. p. 108.

Occurs frequently with other lichens, *Lecidea lurida*, *L. testacea*, *Lecanora crassa*, etc. The apothecia are very rare. The spermogones are also rarely seen; the spermatia are very minute, 3 μ long, 1 μ thick.

Hab. On calcareous rocks in maritime and upland districts.—*Distr.* Rare in S., W. and N. England and in S.W. Scotland; record doubtful in Ireland.—*B. M.* Portland Island, Dorset; Anstey's Cove, Torquay, and near Babbicombe, Devon; St. Vincent's Rocks, Bristol, Gloucestershire; Malvern, W. Yorkshire; Barcaldine, Argyll.

2. *S. intricata* Nyl. in Flora lxvi. p. 534 (1883).—Thallus spreading, branched, brownish-black, the branches narrow, rounded, somewhat obtuse or slightly nodulose at the apices. Apothecia not seen.—Cromb. in Journ. Bot. xxiii. p. 195 (1885). *Omphalaria intricata* Arn. in Flora lii. p. 254 (1869). *Nematostoc intricatum* Nyl. in Flora lxvi. p. 104 (1883).

Of doubtful position owing to the character of the algal cells. They occur in rows, and for that reason Nylander suggested that it

might be the type of a new genus *Synalissina*. Apothecia have not been found, but spermogones are present in the British specimen.

Hab. On moist granite rocks in an upland region.—*B. M.* New Galloway, Kirkeudbrightshire (the only British locality).

20. **PSOROTICHIA** Massal. Framm. Lich. p. 15 (1855); emend. Forssell in K. Vetensk.-Soc. Nova Acta, ser. 3, xiii. n. 6, p. 66 (1885). *Collemopsis* Nyl. in Flora lvi. p. 17 (1873) (note); Cromb. in Journ. Bot. xii. p. 332 (1874) & Monogr. i. p. 77. (Pl. 20.)

Thallus crustaceous, granular-areolate, more or less corticated and loosely affixed to the substratum. Algal cells *Glæocapsa*, sect. *Xanthocapsa*. Apothecia innate, urceolate, small, the margin usually tumid and connivent; paraphyses usually simple, slender, and discrete; spores 8 in the ascus, ellipsoid, simple, colourless. Spermogones with simple sterigmata and oblong minute acrogenous spermatia.

Closely allied to *Pyrenopsis*, but differing in the yellow colour of the algal sheath. It also somewhat resembles *Pannularia*, but is outwardly distinguished from that genus by the absence of a hypothallus.

1. **Ps. Schærereri** Arn. in Verh. K. K. Zool.-Bot. Ges. Wien xxii. p. 313 (1872).—Thallus effuse, granular-areolate or minutely granular-squamulose, rather thin, brownish-black. Apothecia small or moderate in size, plane, with a distinct thalline margin, brownish or reddish-black; spores ellipsoid, 14–21 μ long, 7–11 μ thick; hymenial gelatine pale-blue and then tawny with iodine.—*Pannaria Schærereri* Massal. Ric. Lich. p. 114 (1852). *Pyrenopsis Schærereri* Nyl. in Flora xlix. p. 374 (1866); Cromb. Lich. Brit. p. 2; Leight. Lich. Fl. p. 15. *Collemopsis Schærereri* Cromb. in Journ. Bot. xii. p. 332 (1874) & Monogr. i. p. 78; Leight. Lich. Fl. ed. 3, p. 35.

Exsicc. Johns. n. 242.

The thallus is more squamulose and continuous as it becomes more fully developed. The apothecia are usually numerous and crowded.

Collema trachyopum Tayl. (Lond. Journ. Bot. vi. p. 193 (1847)) is referred by Tuckerman to this species (Prof. Farlow *in litt.*). The specimen was collected by Taylor on limestone at Durham, Kerry.

Hab. On cretaceous pebbles, and limestone walls and rocks in moist shady situations.—*Distr.* Not uncommon in England, among the Grampians, Scotland, and in W. Ireland.—*B. M.* Near Gornshall and Shiere, Surrey; Bathampton Downs and Babington, Somerset; Chelford, Oakley Park, and near Cirencester, Gloucestershire; Buxton, Derbyshire; Egremont, Cumberland; Craig Tulloch, Blair Athole, Perthshire; Craig Guic, Aberdeenshire; Kylemore, Galway.

2. **Ps. furfurella** Boist. Nouv. Fl. Lich. Part 2, p. 312 (1902).—Thallus effuse, thin, furfuraceous-granular, or in small

scattered granules, sometimes intermixed with larger, brownish-black. Apothecia minute, impressed in the granules, concolorous with the thallus, with a thick connivent margin; spores ellipsoid, rarely well-developed, 11–17 μ long, 8–11 μ thick; hymenial gelatine wine-red with iodine.—*Collema furfurellum* Nyl. in Not. Sällsk. Faun. & Fl. Fenn. iv. p. 229 (1859); Carroll in Journ. Bot. iii. p. 286 (1865); Cromb. Lich. Brit. p. 3 & Monogr. i. p. 79; Leight. Lich. Fl. p. 17. *Collemopsis furfurella* Nyl. ex Cromb. in Journ. Bot. xii. p. 332 (1874); Cromb. Monogr. i. p. 79; Leight. Lich. Fl. ed. 3, p. 35.

More distinctly granular and scattered than either of the preceding species, differing also in the habitat.

Hab. On moist schistose rocks in alpine localities.—*B. M.* Above Loch-na-Gat, Ben Lawers, Perthshire.

3. *Ps. diffundens* Sydow Flecht. Deutschl. p. 324 (1887).—Thallus effuse, thin, with minute granular squamules, cracked-areolate, black. Apothecia small, innate, somewhat plane or marginate, reddish, pale within; spores ellipsoid, 16–23 μ long, 7–11 μ thick; hymenial gelatine bluish, then wine-red with iodine.—*Pyrenopsis diffundens* Nyl. in Flora xlviii. p. 602 (1865); Carroll in Journ. Bot. iv. p. 22 (1866); Cromb. Lich. Brit. p. 3; Leight. Lich. Fl. p. 15. *Collema diffractum* Nyl. ex Carroll in Journ. Bot. iii. p. 287 (1865). *Collemopsis diffundens* Nyl. ex Cromb. in Journ. Bot. xii. p. 332 (1874); Leight. Lich. Fl. ed. 3, p. 36; Cromb. Monogr. i. p. 80.

The specimens in the British Museum are sterile. The plant has not been found again at Maidstone, Kent, where it was first discovered.

Hab. On sandstone and schistose rocks.—*Distr.* Rare in S.E. England and N. Wales.—*B. M.* Barmouth, Merioneth.

4. *Ps. pyrenopsoides* Forss. in K. Vetensk.-Soc. Nova Acta, ser. 3, xiii. n. 6, p. 77 (1885).—Thallus effuse, thin, granular-areolate or nearly continuous and somewhat scabrous, dark-brown or brownish-black. Apothecia small, concolorous with the thallus, the margin prominent, connivent; spores 4 to 8 in the ascus, ellipsoid, rather large, 12–20 μ long, 6–11 μ thick; hymenial gelatine bluish with iodine.—*Lecanora pyrenopsoides* Nyl. in Bot. Not. p. 163 (1853). *Pyrenopsis lecanopsoides* Nyl. in Flora lxi. p. 374 (1866); Carroll in Journ. Bot. v. p. 254 (1867); Cromb. Lich. Brit. p. 3; Leight. Lich. Fl. p. 15. *Collemopsis lecanopsoides* Nyl. ex Cromb. in Journ. Bot. xii. p. 332 (1874) pro parte; Cromb. Monogr. i. p. 78 pro parte; Leight. Lich. Fl. ed. 3, p. 35 pro parte.

A specimen from Craig Tulloch, Perthshire, was relegated to this species, but examination shows that the thallus contains *Scytonema* and not *Glæocapsa*, and is therefore a species of *Porocyphus*.

Hab. On calcareous rocks in maritime and mountainous regions (Kennmare, Kerry).

ORDER V. **LICHINACEÆ.**

Thallus gelatinous when moist, crustaceous, sometimes lobed at the circumference, squamulose or minutely fruticose. Algal cells *Rivularia*. Apothecia immersed and partly closed or open and with or without a thalline margin; paraphyses simple; asci 8-spored; spores colourless, globose or ellipsoid, simple or septate.

There are only two British genera:—

- Thallus minutely shrubby, maritime..... 21. **Lichina**.
 Thallus crustaceous, lobed or squamulose 22. **Pterygium**.

21. **LICHINA** Ag. Syn. Alg. p. xii. (1817) (as an alga); Mont. in Dict. Hist. Nat. vii. pp. 342 & 351 (1849). (Pl. 21.)

Thallus minutely fruticose, crowdedly branched, indistinctly corticated, dark-coloured. Apothecia terminal, immersed in the globose swollen tips, almost closed; paraphyses slender, sparingly branched; asci almost cylindrical, 8-spored; spores colourless, ellipsoid, simple. Spermogones single or crowded, borne near to the apothecia, with slender sterigmata and minute ellipsoid acrogenous spermatia.

A small maritime genus long regarded as belonging to the brown algæ. The species grow freely over rocks washed by the tide, or by the spray from the sea.

1. **L. pygmæa** Ag. Syn. Alg. pp. xii. & 9 (1817).—Thallus about $\frac{1}{2}$ inch in height, composed of short, crowded, flat, erect lobes dichotomously branched and the ultimate branchlets narrower, blackish-brown. Apothecia forming a globose swelling at the tips of the fertile branches, slightly open or irregularly dehiscent; spores ellipsoid, uniseriate in the ascus, large, 22–29 μ long, 11–16 μ thick.—S. F. Gray Nat. Arr. i. p. 388; Hook. Fl. Scot. ii. p. 96 & in Sm. Engl. Fl. v. p. 270; Grev. Fl. Edin. p. 286 & Scott. Crypt. iv. t. 219; Tayl. in Mackay Fl. Hib. ii. p. 170; Mudd Man. p. 33, t. 1, fig. 1; Leight in Ann. Mag. Nat. Hist. ser. 3, xvi. p. 12, t. 4, fig. 21 (1865) & Lich. Fl. p. 13; ed. 3, p. 11; Cromb. Lich. Brit. p. 2. *Fucus pygmæus* Lightf. Fl. Scot. ii. p. 964, t. 32 (1777); With. Arr. ed. 3, iv. p. 100; Engl. Bot. t. 1332; Turn. Fuci iv. p. 16, t. 204, figs. a to h. *F. pumilus* Huds. Fl. Angl. ed. 2, p. 584 (1778).

Ecsicc. Chalm. Alg. Scot. n. 40; Wyatt Alg. Danm. n. 155; Leight. n. 260; Larbal. Lich. Cæsar. n. 51; Cromb. n. 1; Johns. n. 42.

Long classified as a diminutive *Fucus*, though Lightfoot pointed out its great similarity to a Lichen.

Hab. On maritime rocks below high tide.—*Distr.* General and common on rocky coasts, not recorded from N.E. Scotland.—*B. M.* Guernsey, Alderney and Jersey; Scilly Isles; Mounts Bay and St. Minver, Cornwall; Torbay, Ilsham Rocks, Boveysand Bay and Big-

bury Bay, Devon; Weymouth, Dorset; Ventnor, I. of Wight; Tenby and St. Bride's Bay, Pembrokeshire; near Peel, Isle of Man; Conway Bay, Carnarvonshire; St. Bees, Cumberland; Old Cambus, Berwickshire; near Edinburgh; shores of Loch Linnhe, coasts of Islay, near Portnahaven and I. of Mull, Argyll; near Castlefreke, Cork; Renoyle, Connemara, Galway; Dugort Bay, Achill, Mayo; near Dunree, Donegal; Larne, Antrim.

2. *L. confinis* Ag. Sp. Alg. i. p. 105 (1823).—Thallus of minute erect or somewhat decumbent fronds, densely caespitose, olive- or blackish-brown. Apothecia minute, terminal, slightly open or irregularly deliscent; spores large, 22–29 μ long, 11–16 μ thick.—Grev. Fl. Edin. p. 286 & Scott. Crypt. iv. t. 221; Hook. in Sm. Engl. Fl. v. p. 270; Tayl. in Mackay Fl. Hib. ii. p. 170; Mudd Man. p. 34; Leight. in Ann. Mag. Nat. Hist. ser. 3, xvi. p. 12, t. 4, fig. 22 & Lich. Fl. p. 13; ed. 3, p. 12; Cromb. Lich. Brit. p. 2. *Lichen confinis* Ach. Lich. Suec. Prodr. p. 208 (1798); Engl. Bot. t. 2575. *Fucus pygmæus* var. *minor* Turn. Fuci p. 16, t. 204, figs. *i–o* (1819). *Lichina pumila* S. F. Gray Nat. Arr. i. p. 388 (1821). *Lichina pygmæa* var. *minor* Hook. Fl. Scot. ii. p. 96 (1821).

Exsicc. Chalm. Alg. Scot. n. 41; Greville Alg. Brit. n. 4; Johns. n. 3; Larbal. Lich. Hb. n. 281 & Lich. Cæsar. n. 1; Wyatt Suppl. n. 202.

Altogether smaller than the preceding species; the branches are more slender and round and the fruits smaller. It grows higher up on the beach and is frequently sterile.

Hab. On maritime intertidal rocks or those which are only washed by the spray of the sea.—*Distr.* General and abundant on rocky coasts.—*B. M.* Jersey, Alderney and Guernsey; Scilly Isles; Whitesand Bay, Lands End, Mounts Bay, near Anthony, Penzance and Gerrans, Cornwall; Brocastle and Southern Down, Glamorganshire; Tenby, Pembrokeshire; Barmouth, Merioneth; Puffin Island, Anglesea. Port Soderick, Isle of Man; Morecambe Bay, Westmoreland; St. Bees, Cumberland; near Caroline Park, Edinburgh; coast of Kincardineshire; Island of Mull, Islay, near Portnahaven and Loch Creran, Argyll; Kenmare, Kerry; Louisburgh and Achill Sound Bay, Mayo; Malahide, Dublin; Ballycastle, Antrim.

22. *PTERYGIUM* Nyl. in Bull. Soc. Bot. i. p. 328 (1854). *Lichiniza* Nyl. in Flora lxiv. p. 6 (1881); Cromb. Monogr. i. p. 33.

Thallus scarcely gelatinous when moist, crustaceous, granular or granular-areolate, or minutely squamulose and usually somewhat lobed at the circumference. Algal cells *Rivularia*, in rows within the thallus, the hyphæ multiseptate and linear-cellular. Apothecia sessile, without a thalline margin, the proper margin cellular; paraphyses septate, unbranched; spores ellipsoid or ovate, colourless, 1–3-septate. Spermogones with septate branched sterigmata and pleurogenous spermatia.

Differs from the preceding genus in the more or less crustaceous thallus, in the spore characters and in the habitat. The sterigmata are also unlike those of *Lichina*.

1. *Pt. filiforme* A. L. Sm.—Thallus crustaceous, granular in the centre, laciniate-radiate at the circumference, the lacinia narrow, centrifugal, chestnut-brown or blackish-brown. Apothecia doubtful.—*Pt. centrifugum* Nyl. in Bull. Soc. Bot. i. p. 328 (1854); Cromb. Monogr. i. p. 34. *Parmelia filiformis* Garov. ex Nyl. in Bot. Not. 1853, p. 164.

I have not seen the fructification of this species which is mostly sterile. Apothecia have been described as small, reddish, with a paler margin; spores 8 in the ascus, elongate, ellipsoid or fusiform, colourless, 3-septate, 14–15 μ long, 6–7 μ thick. It seems doubtful if they are the apothecia of this species.

Hab. On calcareous rocks, rare.—Recorded from Cheddar Cliffs, Somersetshire.

2. *Pt. lismoreense* Cromb. in Grevillea v. p. 108 (1877).—Thallus thin, subfurfuraceous, thinly or obsoletely radiate, adnate, irregularly cracked or confluent, blackish or olive-black. Apothecia small, thinly margined, the epithecium bluish-black; hypothecium cellular, violet-blackish; spores ovoid, 1-septate, 10–11 μ long, 5–6 μ thick; hymenial gelatine bluish then dark-yellowish with iodine.—Nyl. in Flora lx. p. 221 (1877); Leight. Lich. Fl. ed. 3, p. 12.

Exsicc. Cromb. n. 101.

Crombie has described the thallus as spreading extensively though not continuously, the radii being more discrete in younger states. It is allied to *Pt. asperellum* Nyl., a Scandinavian species.

Hab. On calcareous rocks in maritime tracts.—*B. M. I.* of Lismore, Argyll (the only locality).

3. *Pt. pannariellum* Nyl. in Sällsk. Faun. Fl. Fenn. Not. iv. p. 236 (1859).—Thallus crustaceous, rather thin, composed of minute crowded granulate squamules, areolate, generally radiate at the circumference, olivaceous-brown or black. Apothecia small, plane or slightly convex, black; spores ellipsoid, 3-septate, 15–20 μ long, 6–8 μ thick; hymenial gelatine deep-blue with iodine.—Cromb. in Grevillea v. p. 108 (1877); Leight. Lich. Fl. ed. 3, p. 12. *Pannaria nigra* subsp. *triseptata* Nyl. ex Cromb. in Grevillea i. p. 171 (1873).

The minute crowded laciniae give a finely granular appearance to the thallus. The radiate circumference is not developed on the British specimen. There is only one record in our Islands.

Hab. On schistose rocks in alpine situations.—*B. M.* Craig Tulloch, Perthshire.

4. *Pt. kenmoreense* A. L. Sm.—Thallus of stoutish small crowded or scattered squamules with an irregularly granular

appearance, brownish-black. Apothecia and spores not properly developed.—*Lichiniza kenmorensis* Nyl. in Flora lxiv. p. 6 (1881); Cromb. in Grevillea x. p. 22 (1881). *Synalissa kenmorensis* Holl ex Nyl. l. c.

The structure of the thalline squamules agrees exactly with that of *Pterygium*. Crombie states that he detected a young apothecium terminal on one of the globular squamules. The species requires further investigation.

Hab. On mica-schist rocks in upland regions.—*B. M.* Shores of Loch Tay, Kenmore, Perthshire (the only locality).

ORDER VI. COLLEMACEÆ.

Thallus gelatinous when moist, crustaceous, fruticose or foliaceous, mostly homoimerous, corticated or not corticated, sometimes with rhizinae. Algal cells *Nostoc*. Apothecia partly closed or open, immersed or sessile, a thalline margin present or wanting; spores usually 8 in the ascus, varying in form, simple, septate or muriform. Spermogones with pleurogenous or acrogenous spermatia.

In this family are found the most highly developed of the gelatinous lichens. The *Nostoc* chains retain as a rule their original form, and are scattered fairly equally through the thallus, except in some species of *Leptogium* which have more of a heteromerous character.

The following genera are British :—

Thallus non-corticated.

Spores simple.....	23. <i>Physma</i> .
Spores septate-muriform.....	24. <i>Collema</i> .
Spores elongate, pluriseptate	25. <i>Synechoblastus</i> .

Thallus more or less corticated.

Spores simple	26. <i>Lemmopsis</i> .
Spores septate-muriform.....	27. <i>Leptogium</i> .

23. **PHYSMA** Massal. Neag. Lich. p. 6 (1854); emend. A. Zahlbr. in Engler & Prantl Pflanzenf. i. 1*, p. 170 (1906). *Lempholemma* Koerb. Syst. Lich. Germ. p. 400 (1855). *Collema* Sect. A. *Lempholemma* Cromb. Monogr. i. p. 39 (1894). (Pl. 23.)

Thallus crustaceous, warted, squamulose or variously lobed, or minutely fruticose, non-corticated, gelatinous when moist, with or without rhizinae. Apothecia innate, with a thalline margin which is sometimes cellular; paraphyses slender, simple; asci clavate, often bent or twisted, 8-spored; spores fusiform-ellipsoid or globose, simple, colourless. Spermogones with slender sterigmata and short cylindrical acrogenous spermatia.

The genus is characterized by the less highly developed thallus and by the simple spores. The British species belong to Sect. *Lempholemma*, in which the thallus lies close on the substratum.

1. *Ph. polyanthes* Arn. in Verh. K. K. Zool. Bot. Ges. Wien xxix. p. 352 (1879).—Thallus olive-green or blackish, imbricate-lobed or irregularly crustaceous, the lobes crowded, folded and crisp. Apothecia minute, numerous, crowded on the thallus lobes, somewhat concave, reddish, the thalline margin tumid; asci cylindrical; spores globose or subglobose, 9–12 μ in diameter or 11–12 μ long, 9–10 μ thick; hymenial gelatine wine-red with iodine.—*Lichen polyanthes* Bernh. in Schrad. Samml. Crypt. Gen. n. 138 (1797) & in Schrad. Journ. Bot. i. p. 12, t. 1, fig. 4 (1799). *L. myriococcus* Ach. Lich. Suec. Prodr. p. 127 (1798). *Collema myriococcum* Ach. Lich. Univ. p. 638 (1810); Cromb. in Journ. Bot. xii. p. 147 (1874) & Monogr. i. p. 40; Leight. Lich. Fl. ed. 3, p. 16.

Essicc. Cromb. n. 3.

The thallus when dry is very dark-coloured and is densely sprinkled over by the small apothecia which also are rather dark-coloured.

Hab. Among mosses on old walls, in shady places in inland districts.—*Distr.* Plentiful where it occurs in W. England, S. Wales and N.E. Ireland, probably overlooked elsewhere.—*B. M.* Near Cirencester, Stroud and Ablington, Gloucestershire; Pembrokeshire; near Belfast, Antrim.

2. *Ph. chalazanum* Arn. in Verh. K. K. Zool. Bot. Ges. Wien xxiii. p. 524 (1873).—Thallus spreading, continuous, rather thin, appressed on the substratum, irregularly turgid, plicate and tuberculose. Apothecia small, numerous, the disc reddish, the margin somewhat tumid; spores ellipsoid, 20–24 μ long, 8–13 μ thick, or rather longer, or sometimes smaller; hymenial gelatine wine-red with iodine.—*Collema chalazanum* Ach. Lich. Univ. p. 630 (1810); Nyl. Syn. Lich. i. p. 104 (1858); Carroll in Journ. Bot. iv. p. 22 (1866); Cromb. Lich. Brit. p. 4 & Monogr. i. p. 39; Leight. Lich. Fl. p. 17; ed. 3, p. 16. *C. maritimum* Tayl. in Lond. Journ. Bot. vi. p. 194 (1847)?

Soft and gelatinous when moist, almost resembling *Nostoc*. When dry the apothecia are inconspicuous, being almost immersed in thalline tubercles. The spermogones are not infrequent, with minute oblong spermatia.

Hab. Among mosses on the ground.—*Distr.* Rare in S.W. England, N. Wales, S.W. Highlands of Scotland and in S.W. Ireland.—*B. M.* Lipson Road, near Plymouth and Laura Bridge, Devon; Cheddar Cliffs, Somerset; near Kendal, Westmoreland; Lamplugh, Cumberland; Appin, Argyle; Dunkerron, Kerry.

3. *Ph. chalazanodes* A. L. Sm.—Thallus dark-green or blackish, spreading, continuous, thin, wrinkled and partly lobed or lacinate. Apothecia small, numerous, the disc reddish, the margin tumid; asci clavate; spores ellipsoid or subglobose, small, 12–17 μ long, 5 μ and upwards, thick; hymenial gelatine wine-red with iodine.—*Collema chalazanodes* Nyl. in Flora lii. p. 293 (1869); Cromb.

in Journ. Bot. vii. p. 234 (1869); Lich. Brit. p. 4 & Monogr. i. p. 40; Leight. Lich. Fl. p. 17; ed. 3, p. 16.

Distinguished from the preceding species by the smaller spores. In the British specimens the thallus is also more wide-spreading.

Hab. Among mosses on old walls.—*Distr.* Local and scarce in W. England.—*B. M.* Bradley Wood, Newton Bushell, Devon; Coln Rogers, Gloucestershire.

4. **Ph. confertum** A. L. Sm.—Thallus blackish-brown, composed of minute turgid squamules. Apothecia numerous, crowded, small or moderate in size, the disc reddish, the margin tumid; paraphyses slender; spores ellipsoid or fusiform-ellipsoid, 17–23 μ long, 8–10 μ thick; hymenial gelatine bluish with iodine.—*Collema turgidum* var. *confertum* Ach. Lich. Univ. p. 634 (1810). *C. confertum* Nyl. in Flora l. p. 330 (1867); Leight. in Ann. Mag. Nat. Hist. ser. 3, xx. p. 259 (1867) & Lich. Fl. p. 18; ed. 3, p. 16; Cromb. Lich. Brit. p. 4 & Monogr. i. p. 41.

I have been unable to verify the character of the spores in the single small specimen in the British Museum.

Hab. Amongst mosses on the ground in a maritime district.—*B. M.* Dunwich, Suffolk.

24. **COLLEMA** Wigg. Prim. Fl. Hols. p. 89 (1780); emend. A. Zahlbr. in Engler & Prantl Pflanzenf. i. 1*, p. 171 (1906). *Enchylium* S. F. Gray Nat. Arr. i. p. 396 (1821). (Pl. 24.)

Thallus variously lobed, or squamulose or almost crustaceous, swollen and gelatinous when moist, mostly without rhizinae, more or less appressed to the substratum, non-corticated. Algal cells distributed through the thallus (homoiomorous). Apothecia with a thalline margin which is sometimes of plectenchyma; hypothecium colourless; paraphyses simple, mostly septate, and conglutinate; spores 8 in the ascus, fusiform or ellipsoid, variously septate and becoming muriform. Spermogones with colourless wall and with septate sterigmata and pleurogenous minute spermatia.

The genus *Collema*, as emended by Zahlbruckner, includes species with a non-corticate thallus, and with variously septate muriform spores.

Thallus granular-crustaceous or indistinct.

1. **C. terrulentum** Nyl. in Flora lvii. p. 305 (1874).—Thallus small, thin, granular, olive-brown or brownish-black. Apothecia small, concave, reddish-brown, the thalline margin thickish, entire; spores ellipsoid or oblong, usually 5-septate and submuriform, 18–24 μ long, 10–12 μ thick.—Cromb. in Grevillea iii. p. 22 (1874) & in Journ. Bot. xii. p. 333 (1874); Leight. Lich. Fl. ed. 3, p. 25.

An easily overlooked plant; possibly a reduced form of some other species. The only specimen gathered occurred in small scattered masses, most of which were sterile.

Hab. On the bark of an old ash-tree.—*B. M.* Shores of Loch Katrine, Perthshire.

2. *C. isidioides* Nyl. ex Arn. in *Flora* liii. p. 232 (1870).—Thallus of isidia-like granules in crowded groups, blackish. Fructification unknown.—Nyl. in *Flora* lxvi. p. 98 (1883). *Cromb.* in *Journ. Bot.* xxiii. p. 195 (1885). Specimen not seen.

First collected by Arnold in the Bavarian Alps; of uncertain position in the absence of all fructification.

Hab. On calcareous rocks in mountainous districts (Warton Craig, Westmoreland).

3. *C. glaucescens* Hoffm. *Deutschl. Fl.* ii. p. 100 (1795).—Thallus thin, appressed, dull- or dark-olivaceous-green, indistinctly lobate, the lobes small, round or oblong, contiguous or scattered, entire or slightly crenate, scarcely noticeable when dry. Apothecia moderate in size, appressed, plane, reddish-brown or red, with a thin scarcely prominent entire or slightly crenate margin; paraphyses stoutish; spores usually 4 or 6 in the ascus, ovoid, 4–5-septate, with one or more longitudinal septa, 27–38 μ long, 14–16 μ thick.—*Cromb.* in *Grevillea* xv. p. 11 (1886). *C. limosum* Ach. ex Borr. in *Engl. Bot. Suppl.* t. 2704, fig. 1 (1831); Hook. in *Sm. Engl. Fl.* v. p. 208; Tayl. in *Mackay Fl. Hib.* ii. p. 108; *Cromb. Lich. Brit.* p. 4; Leight. *Lich. Fl.* p. 21; ed. 3, p. 19. *C. pulposum* var. *limosum* Mudd *Man.* p. 39 (1861).

Readily recognized by the agglutinate thallus, with small almost granular lobes. The spores are larger with more definite longitudinal septa than those of the preceding species. The thallus is sometimes evanescent, when the plant may easily be overlooked.

Hab. On moist clay soil in maritime and inland tracts.—*Distr.* Rare in S.W. and E. and N. England, and in the W. Highlands, Scotland.—*B. M.* Hassocks and Albourne, Sussex; Croham Quarry, Kent; Bocking, Essex; Wootton-under-Edge and near Cirencester, Gloucestershire; Bulstrode, Bucks; Hawford and Norton, Worcestershire; Buxton, Derbyshire; near Ayton, Cleveland, Yorkshire; Speke, Lancashire; Milnthorpe, Westmoreland; Fort Augustus, Inverness-shire.

Thallus lobes crowded, erect, coralloid or proliferous.

4. *C. ceraniscum* Nyl. in *Flora* xlvi. p. 353 (1865).—Thallus small, the lobes minute, erect, coralloid, obtuse and nodulose at the apices, congested in small compact cushion-like masses, dark olive-greenish or olive-brown (I + wine-red in section). Apothecia minute, somewhat concave, brownish-red or black, the thalline margin thin, entire; spores usually 4 (sometimes 8) in the ascus, oblong-ellipsoid, blunt at the ends, 2–6 septate, irregularly and very distinctly muriform, 27–34 μ

long, 18–21 μ thick.—Carroll in Journ. Bot. iii. p. 287 (1865); Cromb. Lich. Brit. p. 6 & in Journ. Bot. xii. p. 333 (1874); Leight. Lich. Fl. p. 23; ed. 3, p. 17. *C. ceranoides* Mudd Man. p. 41 (1861) pro parte (non Borr.).

A very distinct species both in the characters of the thallus and of the apothecia which are rather rare. It is not unlike *Synalissa ramulosa* in habit.

Hab. On damp shaded rocks among mosses in alpine places.—*Distr.* Rare among the S. Grampians, Scotland.—*B. M.* Ben Lawers and Craig Calliach, Perthshire.

Thallus lobes smooth, somewhat spreading.

5. *C. pulposum* Ach. Syn. Lich. p. 311 (1814).—Thallus thickish, pulpy, subimbricate-lobed, olive-brown or dark-greenish, the lobes small, thick and swollen, nearly entire or somewhat uneven, crenate, often plicate and wrinkled, generally crowded (I + reddish). Apothecia moderate in size, concave, becoming plane or convex, reddish or dark-red, with a thick entire margin, becoming thinner with age: spores ovoid, 3-septate, later with longitudinal septa, 16–24 μ long, 7–10 μ thick.—Mudd Man. p. 38 pro parte (excl. vars.); Cromb. Lich. Brit. p. 4; Leight. Lich. Fl. p. 19 (excl. var. *tenax*); ed. 3, p. 18 (excl. f. *granulatum*, and vars. *ceranoides*, *pulposulum*, *tenax*); var. *compactum* Nyl. Syn. Lich. i. p. 109 (1858); form *compactum* Cromb. in Journ. Bot. xii. p. 333 (1874); Leight. Lich. Fl. ed. 3, p. 18. *C. compactum* Ach. tom cit. p. 313. *Lichenoides gelatinosum foliis imbricatis et cristatis* Dill. Hist. Musc. p. 140, t. 19, fig. 26 c. (1740). *Lichen pulposus* Bernh. in Schrad. Journ. Bot. i. p. 7, t. 1, fig. 1 (1799). *L. crispus* Sm. Engl. Bot. t. 834 (1801).

Exsicc. Carroll Lich. Hib. n. 39; Leight. n. 290; Cromb. n. 4.

Distinguished by the thick pulpy often crowded lobes of the thallus, and by the entire margin of the apothecia. It is not conspicuous except in wet weather. The apothecia are sometimes so abundant as almost to obscure the thallus; they are chiefly central and may become confluent.

Hab. On the ground and on old walls, chiefly calcareous, in maritime and inland districts.—*Distr.* General throughout the British Isles.—*B. M.* Roequaine Bay and St. Saviour's Hill, Guernsey; Undercliff, Luccombe and Shanklin, Isle of Wight; St. Minver, Cornwall; Starcross, near Plymouth, Torquay and Brixham, Devon; Eastbourne, Rottingdean, Poynings, Lewes and Hurstpierpoint, Sussex; Shoreham, Kent; Reigate Hill, Surrey; Preston, Wilts; Bathampton Downs, Somerset; Tetbury and Cirencester, Gloucestershire; Norton and Malvern, Worcestershire; Manorbier, Pembrokeshire; Barmouth, Merioneth; Cleveland, Yorkshire; Teesdale, Durham; Kendal, Westmoreland; near Whitehaven, Cumberland; Appin and I. of Lismore, Argyll; Killin, Perthshire; Great Island, Cork; Killarney, Kerry; Castlebar, Mayo.

Var. *pulposulum* Nyl. ex Cromb. in Journ. Bot. xii. p. 147 (1874).—Thallus scattered or but little developed, with small lobes. Apothecia numerous, small or large and irregular; spores fusiform-oblong, 3-septate with 1 or 2 longitudinal divisions, 20–28 μ long, 7–10 μ thick.—Leight. Lich. Fl. ed. 3, p. 19. *Collema pulposulum* Nyl. in Act. Soc. Linn. Bord. v. p. 59 (1864).

Exsicc. Johns. n. 281.

Differs from the species chiefly in the larger spores.

Hab. On old walls in shady places.—*B. M.* Near Cirencester, Gloucestershire, and Blackhall Rocks, Durham (maritime).

6. *C. concinnum* Flot. in Linnæa xxii. p. 361 (1849) & xxiii. p. 157 (1850).—Thallus rather small, orbicular, lobed, olive-brown or dark-glaucous-green, the lobes round or variously cut and narrow, more or less ascending or depressed. Apothecia submoderate in size, plane, reddish, with entire margin; spores ovoid, 3-septate, or submuriform, 14–20 μ long, 6–9 μ thick or larger.—Cromb. in Journ. Bot. xx. p. 272 (1882).

Exsicc. Larb. Lich. Hb. without a number.

A somewhat indefinite species midway between *C. pulposum* and *C. tenax*, differing from the former in the flatter lobes, from the latter in the more superficial apothecia.

Hab. On rocks and wall-tops in maritime districts.—*Distr.* Local and rare in S.W. England, N. Wales and W. Ireland.—*B. M.* Near Penzance, Cornwall; Barmouth, Merioneth; Achnanure Castle, Galway.

7. *C. tenax* Sm. Engl. Bot. t. 2349 (1811).—Thallus thickish, dark-greenish or bluish-green, lobed, the lobes imbricate, roundish and obtuse, or crenate and subpalmate (I + reddish). Apothecia moderate in size, innate, reddish, with an entire margin often becoming larger and irregularly convex; spores ovoid or oblong, 3-septate, with a longitudinal septum, 18–25 μ long, 7–10 μ thick.—Hook. in Sm. Engl. Fl. v. p. 209; Mudd Man. p. 39. *C. pulposum* var. *tenax* Cromb. Lich. Brit. p. 4 (1870); Leight. Lich. Fl. p. 19; ed. 3, p. 19. *Lichen tenax* Swartz in Nov. Act. R. Soc. Sci. Ups. iv. p. 249 (1784). *Enchylium tenax* S. F. Gray Nat. Arr. i. p. 397 (1821).

Exsicc. Larb. Lich. Hb. n. 201; Leight. n. 105 as *C. limosum*; Mudd n. 1.

Closely allied to the preceding, differing chiefly in the habitat, and in the more spreading thinner crenate or palmate lobes, which are often of a glaucous colour.

Hab. Among mosses on rocks and on the bare ground in inland districts.—*Distr.* Rather rare throughout England, S. Wales, S. and W. Highlands of Scotland and in W. Ireland.—*B. M.* Luccombe, Isle of Wight; Ardingly Rocks, Hurstpierpoint and Eastham, Sussex; near Ightham, Kent; Reigate, Surrey; Mendip, Somersetshire; St.

Vincent Rocks, Bristol; Hathrop Castle and near Cirencester, Gloucestershire; Cradley, Herefordshire; near Bewdley, Claines and near Malvern, Worcestershire; Twyford, Leicestershire; Pentregaer; Oswestry, Shropshire; near Brigsteer, Westmoreland; Asby, Cumberland; near Ayton, Cleveland, Yorkshire; Killin, Perthshire; Kylemore, Connemara, Galway.

Var. *coronatum* Koerb. Parerg. Lich. p. 413 (1865).—Thallus rather thinner and more appressed; apothecia superficial, plane or slightly convex, with subentire margin, often large, confluent and wrinkled.—Cromb. in Journ. Bot. xx. p. 272 (1882). *C. pulposum* var. *cristatum* Ach. Lich. Univ. p. 632 (1810); Mudd Man. p. 39 pro parte. *C. cristatum* Hook. in Sm. Engl. Fl. v. p. 208 (1833) (non Hoffm.); Tayl. in Mackay Fl. Hib. ii. p. 108. *Lichen perpusillus nigricans* &c. Buddle Hort. Sicc. ii. fol. 6, n. 10 in Herb. Sloane. *Lichenoides foliis pilosis crassioribus, obscure virentibus* Dill. in Ray Syn. ed. 3, p. 74, n. 68 (1724). *Lichenoides gelatinosum foliis imbricatis et cristatis* Dill. Hist. Musc. p. 140, t. 19, figs. 26 a, b, d (1741). *Lichen cristatus* Huds. Fl. Angl. p. 447 (1762); Lightf. Fl. Scot. ii. p. 821; With. Arr. ed. 3, iv. p. 75.

Esicc. Johns. n. 4; Leight. n. 106.

Distinguished chiefly by the more appressed lobes. The apothecia as a rule are larger and more wrinkled, but that character is often nearly approached in the species; sometimes they appear as if crowned by the thallus.

Hab. On the ground and on walls in maritime and inland districts.—*Distr.* General throughout the British Islands.—*B. M.* Amberley, Sussex; near Claverton, Somerset; Ross, Hereford; near Malvern, Worcestershire; near Shrewsbury, Shropshire; Barmouth, Merioneth; near Ayton, Cleveland, Yorkshire; Lamplugh, Cumberland; Campsie Glen, near Stirling; Appin, Argyll; Blackstone Bridge, Cork; Dúnkerron, Kerry.

8. *C. cheileum* Ach. Lich. Univ. p. 630 (1810).—Thallus dark olive-green or greenish-black, composed of moderate-sized lobes somewhat erect and imbricate or, in the centre, minute, rounded, crenate and overlapping; internal tissue of thallus very compact, the stoutish hyphæ often emerging as rhizinae, especially below the apothecia. Apothecia moderate in size or rather large, dark-reddish, the margin thin or often with small crenulate or granulate lobes; spores oblong-ellipsoid, 3-septate, then later submuriform, large, 25–45 μ long, 10–20 μ thick.—Hook. Fl. Scot. ii. p. 71 & in Sm. Engl. Fl. v. p. 208; Mudd Man. p. 40, t. 1, fig. 4; Cromb. Lich. Brit. p. 6; Leight. Lich. Fl. p. 20; ed. 3, p. 20. *Lichenoides gelatinosum atro-virens, crispum et rugosum* Dill. Hist. Musc. p. 139, t. 19, fig. 23 (1741). *Lichen cheileus* Ach. Lich. Succ. Prodr. p. 134 (1798). *L. crispus* Huds. Fl. Angl. p. 447 (1762) (non Ach.); Lightf. Fl. Scot. p. 820; With. Arr. ed. 3, iv. p. 76. *L. marginatus* Bernh. in Schrad. Journ. Bot. i. p. 6, t. 1, fig. 2, a (1799); Dicks. Pl.

Crypt. Fasc. iv. p. 25. *Enchylium crispum* S. F. Gray Nat. Arr. i. p. 396 (1821).

Exsicc. Mudd n. 3 ; Larb. Cæsar. n. 52 & Lich. Hb. n. 203 ; Carroll Lich. Hib. n. 40 ; Johns. n. 5.

Hudson's name *Lichen crispus* has priority, but it has been employed for another *Collema*. There is considerable variation in the form of the lobes, but usually it may be recognized by the minute overlapping central lobes and the more expanded ones at the circumference, as well as by the rhizinae. The *Nostoc* chains are frequently broken up into groups somewhat like those of *Synechoblastus multipartitus*. Above all, it is distinguished, when fertile, by the very large spores.

Hab. On the mortar of old walls, rarely on calcareous rocks, chiefly in inland situations.—*Distr.* General and usually common in the Channel Islands and most parts of Great Britain and Ireland.—*B. M.* Quenvais, Jersey; near Ventnor and Shanklin, Isle of Wight; St. Minver, Cornwall; Rottingdean and Falmer, Sussex; Reigate Hill, Surrey; Walthamstow and Saffron Walden, Essex; Bathampton Downs, Somerset; near Cirencester, Gloucestershire; Oaksey, Wilts; Cradley and near Malvern, Worcestershire; near Oswestry and near Shrewsbury, Shropshire; Caer Leon, Monmouthshire; near Barmouth, Merioneth; Milton and near Cuddesdon, Oxfordshire; Thetford, Norfolk; Ayton and Pinchingthorpe, Cleveland, Yorkshire; Kendal, Westmoreland; Arlecdon and near Whitehaven, Cumberland; near Darlington, Durham; near Edinburgh; near Glasgow; Appin, Argyll; Killin, Perthshire; near Aberdeen; Fort William, Invernessshire; Mallow and near Cork; near Kylemore, Galway; Clare Island, Mayo.

Form *nudum* Leight. Lich. Fl. ed. 3, p. 20 (1879).—Thallus paler in colour with somewhat broader naked lobes, the smaller lobes undeveloped.—Cromb. Monogr. i. p. 50. *C. crispum* var. *nudum* Schær. Enum. Lich. p. 257 (1850) nomen.

Hab. On the mortar of old walls.—*Distr.* Somewhat scarce in S. and W. England, S. and W. Highlands of Scotland and S. Ireland.—*B. M.* Near Torquay; Little Danny, Sussex; near Cirencester; near Farlow, Shropshire; Ben Lawers, Perthshire; Killarney and Dunkerron, Kerry.

Form *monocarpum* Cromb. in Journ. Bot. xii. p. 334 (1874) & Monogr. i. p. 50.—Thallus with minute lobes or almost obliterated, and visible chiefly round the apothecia.—Leight. Lich. Fl. ed. 3, p. 20 ; var. *monocarpum* Cromb. in Journ. Bot. xii. p. 147 (1874). *Collema monocarpum* Duf. ex Nyl. Syn. Lich. i. p. 111 (1858).

Hab. On the mortar of old walls, rarely on calcareous rocks in maritime and inland situations.—*Distr.* Scarce in S. and S.W. England.—*B. M.* Shanklin, I. of Wight; Hastings and Glynde, Sussex; near Cirencester, Gloucestershire.

Thallus lobes smooth (rarely slightly granular), somewhat erect and crowded.

9. *C. multifidum* Schær. Enum. p. 254 (1850) (incl. vars. *complicatum* and *marginale*, excl. var. *polycarpon*).—Thallus

greenish-or olive-black, generally orbicular in outline, with deeply cut laciniae, rarely granular, the lobes narrow or somewhat broad, often crowded and imbricate, more or less erect at the margins, crisp and crenate or lacerate (I + wine-red in thin section). Apothecia small to moderate in size, sessile or somewhat prominent, on or near the margins of the lobes, reddish-brown or blackish, the thalline margin entire or crimped or breaking into granules; spores ovoid, 2-3-septate, irregularly muriform, 21-27 μ long, 9-11 μ thick—*C. melænum* Ach. Lich. Univ. p. 636 (1810) (incl. var. *marginale*); Hook. Fl. Scot. ii. p. 71 (1821); Grev. Fl. Edin. p. 350; Mudd Man. p. 37; Cromb. Lich. Brit. p. 5 & Journ. Bot. xii. p. 334 (1874) (incl. f. *marginale* & f. *complicatum*); Leight. Lich. Fl. p. 19 (incl. var. *complicatum*); ed. 3, p. 20 (incl. f. *marginale* and var. *complicatum*). *C. marginale* Hook. in Sm. Engl. Fl. v. p. 210 (1833); Tayl. in Mackay Fl. Hib. ii. p. 109. *C. auriculatum* var. *pinguescens* Nyl. in Flora Iv. p. 353 (1872) & lxvi. p. 534 (1883); Cromb. in Journ. Bot. xi. p. 133 (1873); Leight. Lich. Fl. ed. 3, p. 17. *Lichenoides gelatinosum fuscum*, *Jacobææ maritimæ divisura* Dill. Hist. Musc. p. 140, t. 19, fig. 25 (1741). *Lichen multifidus* Scop. Fl. Carn. p. 396 (1772). *L. marginalis* Huds. Fl. Angl. ed. 2, p. 534 (1778); With. Arr. ed. 3, iv. p. 34; Engl. Bot. t. 1924. *Enchylium marginale* S. F. Gray Nat. Arr. i. p. 397 (1821). *Essicc.* Croall n. 604; Johns. nos. 43, 283.

The thallus is very dark-coloured when dry, with crowded, rather thin lobes, and often rather wide-spreading. The margins of the lobes are often deeply lacerate-crenate and sometimes bordered with minute outgrowths. The apothecia are generally numerous, their position exactly on the margin—a distinguishing character of f. *marginale*—is not constant.

Hab. On calcareous rocks and walls in maritime and inland districts.—*Distr.* Probably general, though somewhat uncommon, throughout the British Islands.—*B. M.* Near Torquay, Devonshire; Manorbier, Pembrokeshire; Pentregaer, near Oswestry, Shropshire; Llangollen and Wrexham, Denbigh; near Buxton, Derbyshire; near Settle, Yorkshire; near Kendal, Westmoreland; near Alston and Lamplugh, Cumberland; Teesdale, Durham; Island of Lismore and Appin, Argyll; Glen Tilt, Killin, Ben Lawers and Craig Tulloch, Perthshire; Braemar, Aberdeenshire; Gairloch, Rosshire; Middleton, Cork; Dunkerron, Kerry; Loughcooter, Galway.

Var. *jacobæifolium* Schær. Enum. p. 255.—Thallus more deeply lacinate, the lobes radiate, pinnatifid, narrow and canaliculate, the margins crisp and lacerate. Apothecia marginal, with subentire margin.—*C. melænum* var. *jacobæifolium* Ach. Lich. Univ. p. 637 (1810); Mudd Man. p. 37; f. *jacobæifolium* Cromb. in Journ. Bot. xii. p. 334 (1874) & Monogr. i. p. 52; Leight. Lich. Fl. ed. 3, p. 21. *Lichen jacobæifolius* Schrank Bai. Fl. ii. p. 530 (1789).

Essicc. Larb. Lich. Caesar. n. 2.

Differs from the species in the narrower radiating lobes. British specimens are rarely fertile.

Hab. On calcareous rocks in maritime districts.—*Distr.* Local and rare in the Channel Islands and S. England; not yet found elsewhere.—*B. M.* Quenvais, Jersey; I. of Wight.

Var. gyrosus A. L. Sm.—Thallus of crowded upright complicate lobes, crisp and crenate and often bordered with granules. Apothecia scattered, marginal, the thalline margin entire or slightly granulate.—*C. melænum* var. *gyrosus* Ach. Lich. Univ. p. 638 (1810); *f. gyrosus* Cromb. in Journ. Bot. xii. p. 334 (1874) & Monogr. i. p. 52; Leight. Lich. Fl. ed. 3, p. 21. *Lichen gyrosus* Ach. Lich. Suec. Prodr. p. 135 (1798).

The crowded undulate lobes all about the same height give a gyrose appearance to the thallus. The apothecia are very rare in a fully developed condition.

Hab. On the ground among calcareous rocks in inland situations.—*Distr.* Local and scarce in Central England and among the Grampians, Scotland.—*B. M.* Near Buxton, Derbyshire; Craig Tulloch, Blair Athole, Perthshire.

10. **C. hypergenum** Nyl. in Flora lix. p. 232 (1876).—Thallus dark-greenish or blackish, the lobes short, upright or spreading, with crisp crenate margins (I + wine-red to crimson in thin section). Apothecia marginal or submarginal, crowded, moderate in size or rather large, the disc reddish or dark-brown, the margin entire, sometimes excluded; spores broadly fusiform, 2-3-septate and muriform, 26-36 μ long, 10-16 μ thick.—Cromb. in Grevillea v. p. 25 (1876); Leight. Lich. Fl. ed. 3, p. 21. *C. melænum* subsp. *hypergenum* Cromb. Monogr. i. p. 52 (1894).

Exsicc. Johns. n. 284.

Closely allied to the preceding, differing chiefly in the larger spores, and from *C. cristatum* in the entire margin of the apothecium.

Hab. On calcareous rocks in inland districts.—*Distr.* Rare in N. England and W. Ireland.—*B. M.* Cumberland; Tullywhew Bridge, Galway.

11. **C. cristatum** Hoffm. Deutschl. Fl. ii. p. 101 (1795).—Thallus intricately lacinate, olive- or blackish-green, the lobes short, crowded, undulate and crisp, the margins dentate or crenate (I + red). Apothecia rather large, plane, reddish-brown, the margin becoming crenulate; spores broadly fusiform, 3-septate and irregularly muriform, 26-34 μ long, 10-12 μ thick.—Schær. Enum. p. 255 (1850); Cromb. in Journ. Bot. xii. p. 334 (1874); Leight. Lich. Fl. ed. 3, p. 22. *C. subplicatile* Nyl. ex Cromb. in Journ. Bot. xii. p. 147 (1874) (non Nyl. in Flora lvi. p. 297).

Closely allied to the two preceding species, differing chiefly in the more deeply cut margins of the lobes, the larger rarer apothecia, and the larger spores.

Hab. Among mosses on old walls, rocks, and on the ground in maritime and inland districts.—*Distr.* Rather rare in W. England, W. Highlands, Scotland, and in W. and S.W. Ireland.—*B. M.* St. Michael's Tor, Devon; near Cirencester, Gloucestershire; I. of Lismore and Appin, Argyll; Killin and Craig Tulloch, Perthshire; Killarney, Kerry; Castlebar, Mayo.

Thallus lobes granular.

12. *C. granuliferum* Nyl. in Flora lviii. p. 103 (1875).—Thallus dark-olive-green or blackish, imbricate-lobate, the lobes firm, usually somewhat crowded, erect in the centre and sprinkled with globose isidiose granules, beneath often longitudinally wrinkled when dry (I + red in section). Apothecia moderate in size, slightly concave or plane, the thalline margin acute or becoming suberentate and granular; spores ovoid, 3-septate, sometimes with 1-2 longitudinal septa, rather large, 24-32 μ long, 8-12 μ thick.—Cromb. in Grevillea iii. p. 191 (1875); Light. Lich. Fl. ed. 3, p. 21 (incl. forms *meizolobum* and *minor*). *C. pulposum* var. *granulatum* Mudd Man. p. 38 (1861). *C. flaccidum* var. *microlobum* Nyl. ex Carroll in Journ. Bot. vi. p. 100 (1868) fide Crombie; Cromb. Lich. Brit. p. 5. *C. subplicatile* form *meizolobum* Nyl. ex Cromb. in Journ. Bot. xii. p. 333 (1874).

Exsicc. Johns. n. 165; Larb. Lich. Hb. n. 204.

Distinguished from *C. pulposum* by the larger lobes and especially by the globose granules with which these are often entirely covered. The apothecia are rare. Crombie (Monogr. i. p. 50) states that this species also was included in *Lichen granulatus* of older British authors.

Hab. On calcareous walls and rocks, rarely among mosses on the ground.—*Distr.* Probably general and common throughout Great Britain and Ireland.—*B. M.* Shanklin, I. of Wight; St. Minver, Cornwall; Plymouth, Elburton, Paignton, Oggwell and near Kingsbridge, Devon; Bathampton Downs, Weston-super-Mare and Cheddar Cliffs, Somerset; Halnaker, Sussex; Leigh Woods, near Bristol, Gloucestershire; Tenby, Pembrokeshire; Beaumaris, I. of Anglesea; near Buxton, Derbyshire; Saffron Walden, Essex; near Whitehaven, Cumberland; Appin, Argyll; Killin and Ben Lawers, Perthshire; near Fort William, Invernessshire; Killarney, Kerry; near Kylemore and Recess, Connemara, Galway.

13. *C. crispum* Ach. Syn. Lich. p. 311 (1814).—Thallus dark bluish-green or brownish-black, lobate, the lobes granular and crowded, somewhat erect in the centre, depressed and more dilated at the circumference, the larger lobes with granular-crenate margins (I + reddish). Apothecia moderate in size or becoming expanded and larger, plane, reddish or dark-red, with granular-crenate margin; spores ovoid, usually 3-septate and irregularly muriform, 16-24 μ long, 7-11 μ thick.—Borr. in Engl. Bot. Suppl. t. 2716, fig. 1; Hook. in Sm. Engl. Fl. v. p. 212; Tayl. in Mackay Fl. Hib. ii. p. 110; Cromb. Lich. Brit.

p. 4; Leight. Lich. Fl. p. 21; ed. 3, p. 19. *Lichen crispus* Ach. Lich. Suec. Prodr. p. 126 (1798) (non Huds.).

Earsicc. Johns. n. 282; Larb. Lich. Hb. n. 202; Leight. n. 346; Mudd n. 2.

Differs from the preceding in the granular margins of the lobes and of the apothecia. The central lobes are usually crowded and erect.

Hab. Among mosses on gravelly soil and on the tops of old walls, chiefly in inland districts.—*Distr.* Somewhat scarce in the Channel Islands, Great Britain and Ireland.—*B. M.* St. Minver, Cornwall; St. Lawrence and Sandown, I. of Wight; near Torquay, Devon; The Downs and Falmer, Sussex; Bathampton Downs, Wilts; near Cirencester, Gloucestershire; Sandwich, Kent; Cradley, near Malvern, Worcestershire; Runton, Norfolk; Redcar and Cotham Marshes, Cleveland, Yorkshire; Appin, Argyll.

Subsp. *ceranoides* Nyl. ex Cromb. in Grevillea xv. p. 12 (1886) (incl. f. *cristatulum*).—Thallus dark-green or brownish-black, lobate, the lobes rather dilated upwards, with coarsely granular or proliferous margins, subimbricate and erect in the centre, flatter and more entire at the circumference (I + reddish). Apothecia rather large, plane, reddish or dark-red, the margins subentire or partly granular; spores ovoid, 3-septate and muriform, 17–25 μ long, 7–9 μ thick.—*C. ceranoides* Borr. in Engl. Bot. Suppl. t. 270 $\frac{1}{2}$, fig. 2 (1831). Hook. in Sm. Engl. Fl. v. p. 209; Mudd Man. p. 41 pro parte; Cromb. Lich. Brit. p. 6; Leight. Lich. Fl. p. 23. *C. pulposum* var. *ceranoides* Cromb. in Journ. Bot. xii. p. 333 (1874); Leight. Lich. Fl. ed. 3, p. 18. *C. crispum* var. *cristatulum* Nyl. ex Cromb. in Journ. Bot. xii. p. 334 (1874); Leight. Lich. Fl. ed. 2, p. 468; ed. 3, p. 20.

Earsicc. Johns. n. 164.

Distinguished from the species by the proliferous margins of the longer lobes and by the almost entire margin of the apothecium. It is rarely fertile.

Hab. On cretaceous or calcareous soils, on walls, and sometimes on shell-sand in maritime and inland districts.—*Distr.* Rare in the Channel Islands and in S.W. and N. England.—*B. M.* I. of Herm; St. Minver, Cornwall; Babbicombe Downs, Anstey's Cove, Torquay and near Seaton, Devon; near Brighton, The Downs, Halmaker, Boxgrove and Rottingdean Cliffs, Sussex; Sandwich, Kent; Shiere, Surrey; Bathampton Downs, Somerset; near Bristol and near Cirencester, Gloucestershire; Malvern, Worcestershire; Windsor Great Park, Berks; Madingley, Cambridgeshire; Calder Bridge, Cumberland; near Redcar, Cleveland, Yorkshire.

14. *C. granosum* Schær. Enum. p. 253 (1850) (excl. var. *ceranoides*).—Thallus membranaceous, of rather large lobes, which are irregularly laciniate, crenate, and somewhat imbricate in the centre, more or less granular, dull glaucous-green or olive-brown (I + blood-red in thin section). Apothecia moderate in size, bright

or dull reddish-brown, scattered, sessile, concave, becoming nearly plane, with entire margin; paraphyses slender, free but conglutinate above in a yellow mucilage; spores 8 in the ascus, broadly fusiform or ovoid, 3-septate with one or more cells longitudinally septate, 22–27 μ long, 10–15 μ thick.—*C. dermatinum* Ach. Lich. Univ. p. 648 (1810)? Borr. in Engl. Bot. Suppl. t. 2716, fig. 2 (two upper figs.) (1831); Hook. in Sm. Engl. Fl. v. p. 212; Mudd Man. p. 36. *C. auriculatum* subsp. *granosum* Nyl. ex Cromb. in Grevillea xv. p. 11 (1886) & Monogr. i. p. 43. *Lichenoides gelatinosum atro-virens, auriculatum et granosum* Dill. Hist. Musc. p. 140, t. 19, fig. 24 (1741). *Lichen granosus* Scop. Fl. Carn. ed. 2, ii. p. 397 (1772); Wulf. in Jacq. Coll. iii. p. 131, t. 10, fig. 2 (1789). *L. granulatus* Huds. Fl. Angl. ed. 2, p. 536 (1778) pro parte; With. Arr. ed. 3, iv. p. 73 (non Engl. Bot. t. 1757). *Leptogium dermatinum* Leight. Lich. Fl. p. 29 (1871); ed. 3, p. 32.

Characterized by the large lacinate subcoriaceous granular lobes. *Collema granosum* has been taken to represent the species as being of earlier date than *C. auriculatum*. There is some confusion as to the identity of *Lichen granulatus* Huds. with *Lichen granosus*. Both of them are based on the plant collected and described by Dillenius, which was determined by Crombie as identical with this species (Monogr. i. p. 43), though in an earlier publication he had referred it to *C. furvum* (Journ. Linn. Soc. xvii. p. 566 (1880)).

Hab. On calcareous rocks and walls.—*Distr.* Local and scarce in S. and W. England, N. Wales and S.W. Ireland.—*B. M.* Poynings, Sussex; Chudleigh, Devon; Cheddar Cliffs and opposite St. Vincent's Rocks, Bristol, Somersetshire; Pentragaer, Oswestry, Shropshire; Llangollen, Denbighshire; N. Wales.

Var. auriculatum A. L. Sm.—Lobes of the thallus rather larger, somewhat imbricate, irregularly curved and bent, rounded and crenate, but not incised and lacinate, otherwise as in the species.—*Collema auriculatum* Hoffm. Deutschl. Fl. ii. p. 98 (1795); Cromb. in Journ. Bot. viii. p. 96 (1870); Leight. Lich. Fl. p. 21; ed. 3, p. 17 (excl. var. *pinguescens*); var. *membranacea* Krempelh. Lich. Fl. Bay. p. 92 (1861); f. *membranacea* Cromb. in Journ. Bot. xii. p. 333 (1874); Leight. Lich. Fl. ed. 3, p. 17. *C. dermatinum* Borr. in Engl. Bot. Suppl. t. 2716, fig. 2 (lower fig.).

Evsicc. Johns. n. 202.

Distinguished from the species by the larger more shell-like auriculate lobes which are often wrinkled and densely covered with isidiose granules.

Hab. On rocks and old walls, chiefly calcareous. *Distr.* Local and scarce in W. Central and N. England, N. Wales, S.W. Highlands and S. Grampians, Scotland.—*B. M.* Paignton, Devon; Sherbrook and Cole Heath, Buxton, Derbyshire; Grassington, Yorkshire; Keswick and Ashgill Force, Alston, Cumberland; Appin, Argyll; Killin, Perthshire.

15. *C. furvum* Ach. Lich. Univ. p. 650 (1810).—Thallus roundly lobed, more or less granular on both sides, dark greenish-brown or olive-black, the lobes entire, usually undulate and crisp, somewhat ascendant in the centre, appressed at the circumference (I + blood-red when dry). Apothecia moderate in size, scattered over the lobes, plane, brown, the margin entire; spores ovoid or ellipsoid, 3-septate, becoming irregularly muriform, 18–24 μ long, 9–11 μ thick.—Hook. Fl. Scot. ii. p. 72; Mudd Man. p. 36; Cromb. Lich. Brit. p. 5; Leight. Lich. Fl. p. 24; ed. 3, p. 17; *C. granulatum* Hook. in Sm. Engl. Fl. v. p. 211 (1833); Tayl. in Mackay Fl. Hib. ii. p. 110. *Lichenoides gelatinosum lobis crassioribus fusco-viridibus* Dill. Hist. Musc. p. 138, t. 19, fig. 22 (1741). *Lichen furvus* Ach. Lich. Suec. Prodr. p. 132 (1798). *L. granulatus* Sm. Engl. Bot. t. 1757 (1807) (non Huds.). *Lathagrium furvum* S. F. Gray Nat. Arr. i. p. 400 (1821).
Exsicc. Cromb. n. 102; Johns n. 204.

Distinguished from the preceding by the somewhat darker apothecia and by the presence of granular isidia on both surfaces of the lobes. The thallus differs from that of *Synechoblastus rupestris* in the narrower lobes and in the reaction with iodine.

Hab. On rocks and old walls, chiefly calcareous, rarely on the ground.—*Distr.* Widely distributed though somewhat uncommon.—*B. M.* Ditcham and Torquay, Devon; Woolsonbury, Bognor and Poynings, Sussex; East Barnet, Middlesex; Marlborough, Wilts; Walthamstow and Chingford, Essex; Rodmorton and near Cirencester, Gloucestershire; Ludlow, Shropshire; Garregwn rocks, Denbighshire; Frosterley, Durham; near Alston and near Whitehaven, Cumberland; Kirkby Lonsdale, Westmoreland; Appin, Argyll; Killin and Blair Athole, Perthshire; Clare Island, Mayo.

Form *tunæforme* Cromb. in Journ. Bot. xii. p. 333 (1874).—Differs from the species in the longer more deeply incised lobes. *Collema tunæforme* Ach. Syn. Lich. p. 322 (1814); Hook. in Sm. Eng. Fl. v. p. 211; Mudd Man. p. 36. *Lichenoides gelatinosum foliis latioribus tuniformibus* Dill. Hist. Musc. p. 142, t. 19, fig. 29 A, B. *Lichen tunæformis* Ach. Lich. Suec. Prodr. p. 132 (1798); Dicks. Pl. Crypt. Fasc. iv. p. 25 (1801).

Hab. On calcareous rocks and walls.—*Distr.* Rare in W. and N. England, S.W. Highlands, Scotland, and S.W. Ireland.—*B. M.* Near Winsor, Gloucestershire; Aberdovey, Merioneth; Teesdale, Durham; I. of Lismore, Argyll; Dunkerron, Kerry.

25. **SYNECHOBLASTUS** Trev. Caratt. tre nuov. gen. Collem. Padova 1853; Koerb. Syst. Lich. Germ. p. 411 (1855); Mudd Man. p. 42. *Lathagrium* S. F. Gray Nat. Arr. i. p. 399 (1821) pro parte. (Pl. 25.)

Thallus variously lobed, gelatinous when moist, without rhizinae, more or less appressed to the substratum, non-corticated. Algal cells *Nostoc* distributed equally through the thallus (*homoimerous*). Apothecia with a thalline margin; spores 8 in

the ascus, elongate-fusiform or acicular, pluriseptate, colourless, Spermogones with septate sterigmata and pleurogenous minute spermatia.

Differs from *Collema* in the form and structure of the spores.

Thallus of narrow smooth lobes; on calcareous substrata.

1. **S. polycarpus** Dalla Torre & Sarnth. Flecht. Tirol. p. 575 (1902).—Thallus rather small, radiate-lobate, appressed, dark-green or reddish-black, the lobes narrow, short, complicate and somewhat erect in the centre, more expanded and flattened at the circumference (I + purplish-red). Apothecia small, numerous, becoming somewhat convex, dark-red or blackish, the margin thin, entire; spores oblong, or broadly fusiform, 3- rarely 5-septate, 18-27 μ long, 6-7 μ thick. *Collema multifidum* var. *polycarpon* Schær. Lich. Helv. Spic. p. 532 (1842). *C. stygium* Del. ex Schær. tom. cit. p. 544? Cromb. in Journ. Bot. xi. p. 132 (1873) & xii. p. 334 (1874); Leight. Lich. Fl. ed. 3, p. 23. *C. polycarpon* Koerb. Parerg. Lich. p. 417 (1865); Cromb. in Journ. Bot. xi. p. 133 (1873); xii. p. 334 (1874) & Monogr. i. p. 53; Leight. Lich. Fl. ed. 3, p. 22.

Æsicc. Cromb. n. 103; Johns. n. 285; Larb. Lich. Hb. n. 1.

Easily known by the small apothecia which are very prominent and abundant. The name *C. stygium* is doubtful.

Hab. On calcareous rocks and walls in inland hilly districts.—*Distr.* Rare in W. England, S.W. Highlands, Scotland, and N.W. Ireland.—*B. M.* Cleve Hill and Cheddar Cliff, Somerset; Sipton and near Cirencester, Gloucestershire; Lathhill and Buxton, Derbyshire; W. Yorkshire; near Kendal, Hevenham Head and Levens, Westmoreland; Appin, Argyll; Kylemore, Galway.

2. **S. Laureri** Flot. ex Koerb. Syst. Lich. Germ. p. 414 (1855).—Thallus deeply laciniate, smooth, or slightly rough, the lobes somewhat dilated and rounded, crowded, imbricate and undulate in the centre, more or less spreading at the circumference, the margins erect and nearly entire (I + reddish when dry). Apothecia rather small, plane, reddish-brown or dark-red, the margin entire or slightly crenate; spores linear-oblong, obtuse, 3-septate, 20-24 μ long, 5-6 μ thick.—*S. complicatus* Mudd Man. p. 44, t. 1, fig. 6 (1861). *Collema Laureri* Nyl. ex Cromb. in Journ. Bot. xi. p. 133 (1873); xii. p. 334 (1874) & Monogr. i. p. 54; Leight. Lich. Fl. ed. 3, p. 22.

Not unlike *S. polycarpus* in outward appearance, but distinguished by the broad lobes and by the obtuse spores.

Hab. On limestone walls, rare.—*B. M.* Teesdale, Durham (the only British locality).

3. **S. multipartitus** Mudd Man. p. 43.—Thallus laciniate-radiate, somewhat orbicular, the lobes multifid, narrow, rather

convex, undulate and twisted, divided and divergent at the apices, olive-brown or -black. Apothecia moderate in size, plane or convex, dark-reddish, the thalline margin thickish, becoming thinner, entire or sometimes crenulate; paraphyses stoutish, septate; spores cylindrical, straight or curved, usually 3-septate, the cells variously guttulate, 28–48 μ long, 4–7 μ thick. *Collema multipartitum* Sm. Engl. Bot. t. 2582 (1814); Hook. in Sm. Engl. Fl. v. p. 210; Tayl. in Mackay Fl. Hib. ii. p. 108 (excl. var. *fluviatile*); Cromb. Lich. Brit. p. 7 & Monogr. i. p. 56; Leight. Lich. Fl. p. 26; ed. 3, p. 24.

Exsicc. Bohl. n. 70; Johns. n. 6.

The thallus lobes radiate from a common centre or they are broken up and form irregular patches. The *Nostoc* chains are frequently congested as in *Collema cheileum*, but chains of cells are also present.

Hab. On shady calcareous rocks in maritime and inland districts.—*Distr.* Not very frequent throughout Great Britain and in S. and W. Ireland.—*B. M.* Mendip Hills, near Yatton and Cleve Hill, Somerset; Barnsley Park, Cirencester, Gloucestershire; Nant Glyn and Llangollen, Denbighshire; near Kendal, Orton Scar, Haversham Head and Cunswick Scar, Westmoreland; Lamplugh, Cumberland; near Settle, Yorkshire; Teesdale, Durham; Achosragan Hill, Appin, and I. of Lismore, Argyll; shores of Loch Tay and Ben Lawers, Perthshire; Middleton, near Cork; O'Donoghue's Prison, Kenmare and Killarney, Kerry; Kylemore, Galway; Louisburgh, Mayo.

Thallus of upright tufted lobes; on trees.

4. *S. fascicularis* A. L. Sm.—Thallus rather small, lobate, the central lobes erect, in tufts, dilated upwards, those at the circumference more spreading and somewhat crenate, brownish-green or dark-green (I+ blood-red). Apothecia small, numerous, crowded on the tips of the tufted lobules, at first concave, then convex, reddish, with a thin almost obliterated margin, spores fusiform, 3- (sometimes 1-) septate, 16–29 μ long, 4–6 μ thick.—*S. conglomeratus* Mudd Man. p. 43 (1861). *Lichenoides gelatinosum palmatum, tuberculis conglomeratis* Dill. Hist. Musc. p. 141, t. 19, f. 27, A, B (1741). *Lichen fascicularis* L. Mant. ed. 2, p. 133 (1767); Lightf. Fl. Scot. ii. p. 841; Huds. Fl. Angl. ed. 2, p. 536; With. Arr. ed. 3, iv. p. 76; Engl. Bot. t. 1162. *Collema conglomeratum* Hoffm. Deutschl. Fl. ii. p. 102 (1795); Cromb. Lich. Brit. p. 6; Leight. Lich. Fl. p. 23. *C. fasciculare* Ach. Lich. Univ. p. 639 (1810); Hook. Fl. Scot. ii. p. 71 & in Sm. Engl. Fl. p. 210; Cromb. in Journ. Bot. xii. p. 334 (1874) & Monogr. i. p. 56; Leight. Lich. Fl. ed. 3, p. 24. *Euchyllum fasciculare* S. F. Gray Nat. Arr. i. p. 398 (1821).

Easily recognized by the central fasciculate lobules widening from a common stalk-like base.

Hab. On the trunks of old trees in wooded, generally upland, districts.—*Distr.* Local and not plentiful in S. and W. England and Highlands of Scotland.—*B. M.* St. Leonard's Forest, Beeding, Hen-

field and Tunbridge Wells, Sussex; near Barmouth, Merioneth Nant Glyn, Denbighshire; Ambleside, Westmoreland; Clova, Forfarshire; Aberfeldy, Kenmore and Loch Earn, Perthshire.

Thallus of rather large granular lobes; mostly on trees.

5. *S. nigrescens* Anzi Catal. Lich. Sondr. p. 4 (1860).—Thallus thinnish, large and spreading, more or less orbicular, almost monophyllous, roundly lobed and radiately wrinkled and plicate, with a few smooth erect secondary lobes at the centre, the larger lobes of the circumference depressed, with entire or slightly crenate margins, and sometimes densely isidiose-granulose (I + reddish when dry). Apothecia numerous, crowded, small, plane, becoming convex, reddish, the margin thin, entire; spores fusiform-cylindrical, pluriseptate, 34–42 μ long, 5 μ thick.—Mudd Man. p. 42, t. 1, fig. 5. *Muscus licheniformis membranaceus nigricans* &c. Buddle Hort. Sicc. ii. fol. 6, n. 11 in Herb. Sloane. *Lichenoides saxatile membranaceum gelatinosum tenue, nigrescens* Dill. in Ray Syn. ed. 3, p. 72, n. 53 (1724). *Lichenoides gelatinosum membranaceum tenue nigricans* Dill. Hist. Musc. p. 138, t. 19, fig. 20 (1740). *Lichen nigrescens* Huds. Fl. Angl. p. 450 (1762); With. Arr. ed. 3, iv. p. 74; Engl. Bot. t. 345. *L. vesperilio* Lightf. Fl. Scot. ii. p. 840 (1777). *Collema nigrescens* Ach. Lich. Univ. p. 646 (1810); Hook. Fl. Scot. ii. p. 71 & in Sm. Engl. Fl. v. p. 211; Grev. Fl. Edin. p. 350; Tayl. in Mackay Fl. Hib. ii. p. 110; Cromb. Lich. Brit. p. 6 & Monogr. i. p. 54; Leight. Lich. Fl. p. 24; ed. 3, p. 24. *Lathagrium nigrescens* S. F. Gray Nat. Arr. i. p. 399 (1821).

Eesicc. Cromb. n. 104; Dicks. Hert. Sicc. Fasc. xi. n. 22; Johns. n. 361; Larb. Lich. Cæsar. n. 53; Leight. n. 104.

Distinguished by the radiate folds of the usually large spreading thinnish thallus, and by the small crowded apothecia. It was likened by Dillenius to a "bat's wing"; hence Lightfoot's designation.

Hab. On the trunks of old trees, chiefly poplars and willows in wooded districts.—*Distr.* General and not uncommon throughout the British Isles, chiefly in western regions.—*B. M.* Noirmont, Rozel, St. Owen's Bay, St. Peter's and Beleroute Bay, Jersey; near Ryde; Carisbrooke Castle and Shauklin, I. of Wight; Withiel, near Penzance, Bocomnoe and Ruan Minor, Cornwall; Lidford, Totnes, Paignton, Torquay, Bolt Head, Sidmouth and Cornworthy, Devon; Fairlight Glen, Hastings, Henfield, Danny, Saddlescomb, Beeding and Clayton, Sussex; Kemble, near Cirencester, Gloucestershire; Stackpole Court, Pembrokehire; Aberdovey, Merioneth; Bettws-y-Coed, Carnarvonshire; Barrow Hill, Malvern and Broadwas, Worcestershire; Levens, Westmoreland; near Guisboro', Cleveland, Yorkshire; near Galloway, Kirkeudbrightshire; Glen Lochy and Barcaldine, Argyll; Den of Glamis, Forfarshire; near Callender, Glen Lochay and Trossachs, Perthshire; Gairloch and Applecross, Rossshire; Castle-martyr, Cork; Powercourt, Wicklow; Killarney and Muckross, Kerry; Louisburg, Mayo.

6. *S. aggregatus* Th. Fr. Lich. Arct. p. 280 (1860).—Thallus rather small, somewhat rigid, lobate and irregularly plicate, the lobes rather short, sometimes crenate, or often granular and crisp at the margins (I + red). Apothecia small to moderate in size, crowded, plane, becoming convex, reddish or dark-red, the margin thin, entire or becoming granular; spores 8 (rarely 6) in the ascus, fusiform-cylindrical, straight or curved, pluriseptate, 33–65 μ long, 3–5 μ thick.—Mudd Man. p. 43. *Lichenoides gelatinosum palmatum tuberculis conglomeratis* Dill. Hist. Musc. p. 141, t. 19, fig. 27 B (1741). *Collema fasciculare* var. *aggregatum* Ach. Lich. Univ. p. 640 (1810). *C. aggregatum* Nyl. in Mém. Soc. Sci. Nat. Cherb. ii. p. 318 (1854); Cromb. Lich. Brit. p. 6 & Monogr. i. p. 55; Leight. Lich. Fl. p. 26; ed. 3, p. 25. *Enchylium fasciculare* var. *aggregatum* S. F. Gray Nat. Arr. i. p. 398 (1821).

Exsicc. Cromb. n. 105.

Distinguished from the preceding, to which it is closely allied, by the smaller thallus with short, irregularly wrinkled lobes, and by the longer spores. The apothecia, when present, are crowded, and are also somewhat larger and more irregular in form.

Hab. Among mosses on the trunks of old trees in wooded inland tracts.—*Distr.* Rather rare in S.W. and N. England, N. Wales, the W. Highlands of Scotland and S.W. Ireland.—*B. M.* St. Leonard's Forest and Henfield, Sussex; New Forest, Hants; Tunbridge Wells, Kent; near Barmouth, Merioneth; Ingleby, Cleveland, Yorks; New Galloway, Kirkcudbrightshire; Barcaldine, Argyll; near Killin and Aberfeldy, Perthshire; Loch Linnhe, Invernessshire; O'Sullivan's Cascade and Muckross, Killarney, Kerry.

7. *S. rupestris* A. L. Sm.—Thallus broadly lobed, smooth or partly covered with blackish isidiose granules, dark-green or greenish-brown, the lobes rounded, entire, rather wavy, limp and flaccid when moist. Apothecia moderate in size or rather small, scattered over the thallus, concave then plane, or somewhat convex; paraphyses rather slender, conglutinate above; spores fusiform-elongate, 3–5-septate, 23–28 μ long, 7–10 μ thick.—*S. flaccidus* Koerb. Syst. Lich. Germ. p. 413 (1855); Mudd Man. p. 42. *Lichen rupestris* Swartz Meth. Musc. p. 37 (1781) (excl. Syn. Dill); With. Arr. ed. 3, iv. p. 76. *L. flaccidus* Ach. in K. Vet. Acad. Handl. xvi. p. 14, t. 1, fig. 4 (1795). *Collema flaccidum* Ach. Lich. Univ. p. 647 (1810) pro parte; Engl. Bot. t. 1653; Hook. Fl. Scot. ii. p. 72 & in Sm. Engl. Fl. v. p. 211; Tayl. in Mackay Fl. Hib. ii. p. 110; Cromb. Lich. Brit. p. 5 & Monogr. i. p. 44; Leight. Lich. Fl. p. 35; ed. 3, p. 23. *Lathagrium flaccidum* S. F. Gray Nat. Arr. i. p. 400 (1821).

Exsicc. Johns. n. 241; Leight. n. 345.

Easily distinguished by the spore characters and in a sterile condition by the large entire granular lobes.

Hab. On old walls, rocks and trunks of trees in shady places in inland districts.—*Distr.* General and common where it occurs

throughout Great Britain and Ireland.—*B. M.* Boconnoc, Camelford, St. Minver and Looe, Cornwall; near Plymouth, near Plymstock, Kingskerswell, Cockington, near Torquay, near Weston Mills, and Totnes, Devon; I. of Wight; Pyecombe, Sussex; Gopsal, Leicestershire; near Worcester and Malvern, Worcestershire; Barmouth, Dolgelly and Llyn Gwernau, Merioneth; Nant Gwynant, Carnarvonshire; Anglesea; Rievaulx, Yorkshire; near Kendal and Windermere, Westmoreland; Keswick, Cumberland; New Galloway, Kirkcubrightshire; King's Park, Edinburgh; Barcaldine, Argyll; Killin, Kenmore, Kinnoull Hill and Craighall, Perthshire; Lochaber, Invernessshire; Applecross, Rosshire; Mallow, Cork; Blackwater Bridge, Kerry.

26. **LEMMOPSIS** A. Zahlbr. in Engler & Prantl Nat. Pflanzenf. i. 1*, p. 171 (1906). *Leptogium* sect. *Lemmopsis* Wainio Lich. Brésil i. p. 221 (1890). (Pl. 26.)

Thallus effuse, thin, granular-crustaceous, corticated. Algal cells *Nostoc*. Apothecia sessile on the thallus, with a proper margin; spores ellipsoid, colourless, simple.

The corticated thallus agrees with that of *Leptogium*, but the habit of the genus, and the spore characters are different.

1. **L. Arnoldiana** A. Zahlbr. l. c.—Thallus effuse, thin, granular-crustaceous, scattered, olive- or dark-brown. Apothecia small, somewhat prominent, with a proper margin, reddish or dark-red, the margin paler; paraphyses slender, septate; spores ellipsoid with granular oily contents, rather large, 17–20 μ long, 5–7 μ thick; hymenial gelatine slightly bluish then pale wine-red with iodine.—*Physma Arnoldiana* Hepp. ex Arn. in Flora xli. p. 94 (1858). *Collempsis Arnoldiana* Nyl. in Flora lvii. p. 305 (1874); Cromb. in Journ. Bot. xiv. p. 359 (1876) & Monogr. i. p. 79; Leight. Lich. Fl. ed. 3, p. 36.

Usually forming a thin dark-coloured crust on the stones; the waxy-looking apothecia are usually numerous and distinctive.

Hab. On calcareous stones in shady inland situations.—*Distr.* Apparently local and rare in S. and W. England.—*B. M.* Cowcombe Wood near Chalford, Gloucestershire; Gomshall and Shiere, Surrey.

2. **L. oblongans** A. L. Sm.—Thallus effuse, thin, minutely granular, and continuous, brownish-olive. Apothecia small, reddish or yellowish-red, the margin rather thick and convoluted; paraphyses slender; spores oblong, elongate, simple (or spuriously 1-septate), 16–30 μ long, 6–7 μ thick; hymenial gelatine faintly bluish then slightly wine-red with iodine.—*Collempsis oblongans* Nyl. in Flora lvii. p. 305 (1876); Cromb. in Grevillea iii. p. 22 (1874) & Monogr. i. p. 79; Leight. Lich. Fl. ed. 3, p. 36.

Resembling the previous species in the structure of the thallus, but lighter in colour and with larger spores.

Hab. On the ground in shady crevices of limestone rocks.—*B. M.* Haverbrack Hill, Westmoreland (the only locality).

3. *L. leptogiella* A. L. Sm.—Thallus effuse, coralloid-areolate, composed of extremely minute upright nodulose or irregular branchlets, with a well-developed cortex, dark olive-brown. Apothecia minute, slightly margined, brownish- or yellowish-red, the disc rather concave or at length almost plane; paraphyses slender, discrete or partially coherent, very slightly thickened at the tips; spores oblong-ellipsoid, 10–17 μ long, 5–7 μ thick; hymenial gelatine greenish-blue then tawny wine-red with iodine.—*Collemopsis leptogiella* Nyl. in Flora lx. p. 220 (1877); Cromb. in Grevillea vi. p. 18 (1877) & Monogr. i. p. 80; Leight. Lich. Fl. ed. 3, p. 36.

The leptogoid structure and the *Nostoc* alga leave no doubt as to the inclusion of this species in *Lemmopsis*. The apothecia are numerous on the specimen, but difficult to detect.

Hab. On quartzose shady rocks.—*B. M.* Kylemore, Connemara (the only locality).

27. **LEPTOGIUM** S. F. Gray Nat. Arr. i. p. 395 (1821). *Collema* sect. *Leptogium* Ach. Lich. Univ. p. 654 (1810). *Collemodium* Nyl. ex Lamy in Bull. Soc. Bot. Fr. xxv. p. 341 (1878); Cromb. Monogr. i. p. 57. *Scytenium* S. F. Gray Nat. Arr. i. p. 398 (1821). *Mallotium* S. F. Gray tom. cit. p. 399; Mudd Man. p. 44. (Pl. 27.)

Thallus more or less gelatinous when moist, lobate, the lobes minute and almost granular or large and spreading, corticated. Algal cells *Nostoc* distributed through the thallus or sometimes zoned. Apothecia with a thalline margin of plectenchyma; paraphyses simple, conglutinate; spores 8 in the ascus, variously elongate, blunt or pointed at the ends, septate and muriform, colourless. Spermogones with septate sterigmata and minute pleurogenous spermatia.

Differs from *Collema* in the corticate thallus, a very distinct character in some species, in others difficult to distinguish, especially in some of those included by Nylander in the genus *Collemodium*. As a rule the thallus is less swollen than in *Collema*, the lobes being often very thin.

A. *Cortical cells somewhat indistinct (Collemodium).*
Growing on trees.

1. *L. fragrans* Cromb. Lich. Brit. p. 8 (1870) (excl. syn. Mudd Man. p. 46).—Thallus composed of small nodulose lobules, generally crowded in cushion-like masses or effuse and coarsely granular-areolate, the lobules erect, crenate, somewhat dilated and appressed at the circumference, dark-green or olive-brown. Apothecia small, numerous, crowded, concave, reddish-brown, the margin entire, paler; spores ovoid-ellipsoid, 3–5-septate and muriform, 16–28 μ long, 8–11 μ thick.—Leight. Lich. Fl. p. 30 pro parte; ed. 3, p. 30. *L. microphyllum* Leight. Lich. Fl. ed. 3,

p. 26 (1879). *Lichen fragrans* Sm. Engl. Bot. t. 1912 (1808). *Collema microphyllum* Ach. Lich. Univ. p. 630 (1810); Borr. in Engl. Bot. Suppl. t. 2721 (1831); Hook. in Sm. Engl. Fl. v. p. 207; Mudd Man. p. 41; Cromb. Lich. Brit. p. 6; Leight. Lich. Fl. p. 22. *C. fragrans* Ach. Syn. Lich. p. 311 (1814); Hook. in Sm. Engl. Fl. v. p. 208. *Enchylium microphyllum* S. F. Gray Nat. Arr. i. p. 396 (1821). *E. fragrans* S. F. Gray l. c. *Collemodium microphyllum* Nyl. ex Lamy in Bull. Soc. Bot. Fr. xxx. p. 337 (1883); Cromb. in Grevillea xv. p. 12 & Monogr. i. p. 58. *Exsicc.* Larb. Lich. Hb. n. 2 & Lich. Cæsar. n. 3; Leight. n. 258.

The cellular cortex is mostly somewhat indistinct. The fragrance from which it obtained its specific name was accidental (see Borrer l. c.).

Hab. On the trunks of old trees, chiefly ash and elm, in shady situations.—*Distr.* Not uncommon in the Channel Islands and throughout England, not recorded from Scotland or Ireland.—*B. M.* St. Brelade's Bay, Jersey; Lyndhurst, New Forest, Hants; Southwick, near Lewes, Sussex; Hurstpierpoint, Glynde, Danny and Wiston, Sussex; Copthall and Gosfield Hall, Essex; Claines, Worcestershire; near Oswestry, Shropshire; near Bury, Suffolk; Wimpole Park, Cambridgeshire; Ingleby Park, Cleveland, Yorkshire; Leven's Park, Kendal, Westmoreland.

Growing on rocks or soil.

2. *L. biatorinum* Leight. Lich. Fl. ed. 3, p. 25 (1879).—Thallus effuse, very minutely papillate-lobate, imbricate, brown or brownish-green. Apothecia minute, innate, brown or reddish, with a thickish pale entire margin; spores ovoid, 3-4-septate, becoming sparingly muriform, 25-30 μ long, 11-12 μ thick.—*Collema biatorinum* Nyl. in Act. Soc. Linn. Bord. sér. 3, i. p. 268 (1856); Carroll in Journ. Bot. iv. p. 22 (1866); Cromb. Lich. Brit. p. 5 & in Journ. Bot. xii. p. 335 (1874); Leight. Lich. Fl. p. 21. *Collemodium biatorinum* Nyl. ex Cromb. in Grevillea xv. p. 12 (1886) & Monogr. i. 57.

Exsicc. Johns. n. 44; Larb. Lich. Hb. n. 282.

Distinguished by the waxy-looking, somewhat *Gyalecta*-like apothecia, which are generally immersed in the thallus. The thallus covers the substratum with a thin lobulate blackish scurf. The lobules are indistinctly cellular.

Hab. On cretaceous soil and the mortar of old walls in damp places, maritime and inland.—*Distr.* Plentiful where it occurs in the Channel Islands, S.W. and N. England.—*B. M.* By the sea, Alderney; Bonchurch, I. of Wight; Wadebridge, Cornwall; Woolsonbury and near Lewes, Sussex; Reigate Hill, Surrey; near Cirencester, Gloucestershire; near Winlaton Mill, Durham.

3. *L. turgidum* Cromb. Lich. Brit. p. 10 (1870).—Thallus thickish, lobate, the lobes small, turgid, ascending, with a fruticose appearance, undulate-plicate, wrinkled and concave at

the circumference, sometimes densely isidiose-granulose, dark-olive or reddish-black. Apothecia usually numerous, moderate in size, concave, becoming somewhat plane, reddish- or dark-brown, the thalline margin turgid, entire or sometimes slightly granular; spores oblong-ovoid, 3-septate and muriform, 23–32 μ long, 10–12 μ thick.—Leight. Lich. Fl. p. 28; ed. 3, p. 33. *Collema turgidum* Ach. Lich. Univ. p. 634 (1810); Hook. in Sm. Engl. Fl. v. p. 209; Mudd Man. p. 38. *Enchylium turgidum* S. F. Gray Nat. Arr. i. p. 396 (1821). *Collemodium turgidum* Nyl. ex Lamy in Bull. Soc. Bot. Fr. xxv. p. 342 (1878); Cromb. in Grevillea xv. p. 12 & Monogr. i. p. 61 (incl. var. *depressum*, a growth form, Cromb. ll. c.).

Exsicc. Leight. n. 257; Larb. Lich. Hb. n. 42.

The smaller firmer lobes and the presence of isidia distinguish this species from *L. plicatile* and *Collema pulposum*, which have a similar habitat. The crowdedly branched appearance is especially noticeable in dry plants. Sometimes the thallus (on calcareous stones) is very scanty and in scattered lobules.

Hab. On limestone and brick walls, also on calcareous and cretaceous soil.—*Distr.* Somewhat rare throughout England, rare in S.W. Highlands, Scotland, not recorded from Ireland.—*B. M.* Near Shanklin, I. of Wight; Wadebridge, Cornwall; Plymouth, Devon; Tangmere, Lewes, Aldbourne and near Hastings, Sussex; Chelsfield, Kent; Reigate Hill and Shiere, Surrey; Chew Magna, near Bristol, Cleve Hill and near Yatton, Somerset; Charfield and near Cirencester, Gloucestershire; Sevenhampton, Wilts; near Shiffnall, Shropshire; Barrington Hill and Malvern, Worcestershire; Tetsworth, Oxfordshire; Gorleston, Suffolk; Appin, Argyll.

4. *L. fragile* Nyl. in Mém. Soc. Sci. Nat. Cherb. v. p. 333 (1857).—Thallus small, laciniate or nodulose, the lobes crowded in a roughly granular crustose manner or somewhat radiate, convex and crenate at the circumference, dark olive-green or brown. Apothecia rather rare, minute, concave, becoming plane, dark-brown, the margins entire, thickish; spores ovoid, variously septate and muriform, about 29 μ long, 13 μ thick.—Cromb. Lich. Brit. p. 7; Leight. Lich. Fl. p. 36; ed. 3, p. 27. *Collema fragile* Tayl. in Mackay Fl. Hib. ii. p. 109 (1836); Mudd Man. p. 37. *Collemodium fragile* Nyl. ex Cromb. in Grevillea xv. p. 12 (1886) & Monogr. i. p. 59.

The cellular cortex is crushed in cross section and not easily seen. In some instances the thallus is like a much stouter *L. cretaceum*, in others the radiating stellate laciniae recall *Collema multipartitum*. Apothecia are sparingly present.

Hab. On calcareous rocks in maritime and inland districts.—*Distr.* Rare in S. and N. England and in S.W. Ireland.—*B. M.* Anstey's Cove, Torquay, Devon; Barrowmouth, Cumberland; Dunkerron, Kerry.

5. *L. plicatile* Nyl. ex Cromb. in Journ. Bot. xii. p. 336 (1874) (incl. f. *minor*).—Thallus of thickish upright or spreading

plicate lobes, slightly wrinkled, often crisp at the margins and more or less granular. Apothecia scattered, rather small, concave or plane, reddish-brown, with a thick entire persistent margin; spores ovoid, 3-septate and muriform, 18–30 μ long, 8–16 μ thick.—Leight. Lich. Fl. ed. 3, p. 30 (incl. f. *minor*). *Lichenoides gelatinosum atro-virens, auriculatum et granosum* Dill. Hist. Musc. p. 140, t. 19, figs. 24 B–D (1741). *Lichen plicatilis* Ach. in K. Vet. Acad. Handl. xvi. p. 11, t. 1, fig. 2 (1795). *Collema plicatile* Sm. Engl. Bot. t. 2348 (1812); Hook. in Sm. Engl. Fl. v. p. 209; Mudd Man. p. 38; Cromb. Lich. Brit. p. 5; Leight. Lich. Fl. p. 22. *Enchylium plicatile* S. F. Gray Nat. Arr. i. p. 397 (1821). *Collemodium plicatile* Nyl. ex Lamy in Bull. Soc. Bot. Fr. xxx. p. 337 (1883); Cromb. Monogr. i. p. 59 (incl. f. *minus*).

Esicc. Cromb. n. 106.

Distinguished by the very thick plicate often granular lobes, hence Nylander's name *L. firmum* (Lich. Scand. p. 34 (1861)). There is a thin inconspicuous cellular cortex. The lobes are sometimes rather thinner (f. *minus*).

Hab. On calcareous rocks and walls, rarely on trunks of trees, in maritime and inland districts.—*Distr.* Somewhat scarce in S.W. England, rare in W. Highlands of Scotland and S.W. Ireland.—*B. M.* Upton, Babbicombe and Plymouth, Devon; Shoreham, Beeding, Aldbourne and Lewes, Sussex; near Maidstone, Kent; near Cirencester, Gloucestershire; Mendip Hills, Somerset; Marlborough, Wilts; I. of Lismore and Appin, Argyll; near Kenmore, Ardtully and Dunkeanon, Kerry.

Var. hydrocharum A. L. Sm.—The thick rigid lobes more spreading and depressed, greyish or glaucous-grey.—*Parmelia hydrochara* Ach. Meth. p. 222 (1803). *Collema pulposum* f. *hydrocharum* Cromb. in Journ. Bot. xii. p. 333 (1874); Leight. Lich. Fl. ed. 3, p. 18. *Collemodium plicatile* f. *hydrocharum* Nyl. in Flora lviii. p. 302 (1875); Cromb. in Grevillea xv. p. 12 (1886) & Monogr. i. p. 60.

Hab. On damp calcareous rocks.—*B. M.* Craig Tulloch, Perthshire.

6. *L. fluviatile* Cromb. in Journ. Bot. xii. p. 336 (1874).—Thallus lacinate-lobate, thin or thickish, the lobes oblong, somewhat uneven in outline, flexuous and folded, simple or proliferous, greyish-green or dark greyish-glaucous. Apothecia small, submarginal, prominent, somewhat concave or plane, dark-red, with a paler entire margin; spores ellipsoid, usually 3-septate, becoming muriform, 16–23 μ long, 7–9 μ thick.—Leight. Lich. Fl. ed. 3, p. 32. *Lichenoides gelatinosum opuntioides* Dill. in Ray Syn. ed. 3, p. 72, n. 58 (1724). *Lichenoides gelatinosum foliis angustioribus turiformibus* Dill. Hist. Musc. p. 142, t. 19, f. 28 (1741). *Lichen fluviatilis* Huds. Fl. Angl. ed. 2, p. 536 (1778); With. Arr. ed. 3, iv. p. 97; Engl. Bot. t. 2039. *Collema fluviatile* (errore *fluviatic*) Ach. Syn. p. 314 (1814); Hook. in Sm. Engl. Fl. v. p. 209; Mudd Man. p. 40; Cromb. Lich. Brit. p. 5;

Leight. Lich. Fl. 24. *C. multipartitum* var. *fluviale* Tayl. in Mackay Fl. Hib. ii. p. 109 (1836). *Euchylium fluviale* S. F. Gray Nat. Arr. i. p. 397 (1821). *Collemodium fluviale* Nyl. ex Cromb. in Grevillea xv. p. 12 (1886) & Monogr. i. p. 60.

Distinguished from *L. plicatile* by the thinner more extended lobes, and by the habitat. Very few of the British specimens are fertile. *Collema rivulare* Ach. Syn. Lich. p. 326 (1814) is partly identical with this species. The lobes of a specimen from Lanark in Hb. Borrer have hairs on the under surface. The cellular cortex is often indistinct.

Hab. On moist rocks and boulders in streams mostly in upland situations.—*Distr.* Rare in W. and N. England, N. Wales, S.W. and Central Scotland and S.W. Ireland.—*B. M.* St. Minver, Cornwall; East Lyn River, Devon; River Elwy, Denbighshire; Snowdon, Carnarvonshire; Falls of the Clyde near Lanark; near Leven, Fifeshire; River Isla near Ruthven Wood, and Loch Earn, Perthshire; Ardtully, Kenmare, Kerry.

Cortical cells more fully developed (Eu-Leptogium).

Thallus granular; growing on rocks or mortar.

7. *L. glebulentum* Nyl. ex Cromb. in Journ. Bot. xx. p. 272 (1882).—Thallus thickly isidiose, with small subentire or lacerate lobes at the circumference, olive-brown or blackish. Apothecia and spermogones unknown. *Collemodium glebulentum* Nyl. ex Cromb. in Grevillea xv. p. 12 (1886) & Cromb. Monogr. i. p. 61.

Of doubtful position owing to the absence of fructification. The isidia are in thick cushion-like masses. The cellular cortex is well developed.

Hab. On moist limestone rocks in alpine localities.—*B. M.* Above Loch-na-gar, Ben Lawers, Perthshire; Craig Grue, Braemar, Aberdeenshire.

8. *L. rhyparodes* Nyl. in Flora xlviii. p. 210 (1865).—Thallus diffuse, thin, furfuraceous or granular and unequal, cracked, brownish-red or blackish-brown (I + wine-red). Apothecia small, at first concave, becoming plane, with the margin excluded, reddish- or brownish-black; spores ovoid, septate and muriform, 20–38 μ long, 11–16 μ thick.—Carroll in Journ. Bot. iii. p. 287 (1865); Cromb. Lich. Brit. p. 7; Leight. Lich. Fl. p. 35; ed. 3, p. 26. *Collema psorellum* Nyl. in Flora xlviii. p. 602 (1865); Carroll in Journ. Bot. iv. p. 22 (1866); Cromb. Lich. Brit. p. 3 & in Journ. Bot. xii. p. 335 (1874); Leight. Lich. Fl. p. 26.

The thallus sometimes spreads extensively and is occasionally almost evanescent. On moist shady rocks the thallus is less developed (*Collema psorellum*).

Hab. On schistose rocks in subalpine and alpine localities.—*Distr.* Local and rare among the S. Grampians, Scotland.—*B. M.* Craig Calliach, above Loch-na-gar and the summit, Ben Lawers, and Glen Lyon, Perthshire.

9. *L. humosum* Nyl. in Mém. Soc. Sci. Nat. Cherb. p. 90 (1857) & Syn. Lich. i. p. 119 (1858).—Thallus effuse, consisting of closely aggregate lobulate granules mostly small with larger granules intermixed, brown or brownish-black. Apothecia small, somewhat concave, black; spores 4 to 8 in the ascus, ovoid, or oblong-ovoid, variously septate and muriform, 20–34 μ long, 8–16 μ thick.—Cromb. in Journ. Bot. xxiii. p. 195 (1885).

Distinguished by the coarsely granular, very dark thallus. Nylander has included with this species *Leptogium tetrasporum* Th. Fr. in Vet. Akad. Förh. 1864, p. 276 (see Crombie Monogr. i. p. 65).

Hab. On mortar of walls.—*B. M.* Port Gorey, Island of Sark (the only British locality).

Thallus of small lobes; growing on soil, mortar, etc.

10. *L. pusillum* Nyl. in Mém. Soc. Sci. Nat. Cherb. v. p. 90 (1857) & Syn. Lich. i. p. 121.—Thallus effuse, papillate-lobate, the lobules erect, crowded, olive- or greenish-brown. Apothecia small, concave then plane, somewhat prominent, becoming dark-reddish, the margin concolorous; spores ovoid or broadly fusiform, 3–4-septate and muriform, 18–30 μ long, 8–10 μ thick.—Cromb. Lich. Brit. p. 7; Leight. Lich. Fl. p. 30; ed. 3, p. 27.

Essicc. Larb. Cæsar. n. 54.

Somewhat similar to *L. biatorinum* in the appearance of the thallus, though more developed and more densely papillate, but chiefly distinguished from it by the darker-coloured superficial apothecia.

Hab. On mortar of old walls and on chalky soil.—*Distr.* Local and rare in the Channel Islands and S., W. and N. England.—*B. M.* St. Brelade's Bay, Jersey; St. Peter's Port, Guernsey; Bonchurch, I. of Wight; Shiere, Surrey; Freshford, near Bath, Somerset; Cheltenham, Stroud, Cowcombe, Chedworth Woods and near Cirencester, Gloucestershire.

11. *L. tenuissimum* Koerb. Syst. Lich. Germ. p. 419 (1855).—Thallus effuse, of deeply cut or crenate thin laciniae congested into a dense crust, olive- or brownish-green. Apothecia moderate in size, deeply concave, becoming somewhat plane, embedded among the laciniae, reddish-brown, the margin pale, thickish; spores ovoid or oblong, generally narrower at the ends, 3–5-septate and muriform, 18–34 μ long, 11–13 μ thick.—Mudd Man. p. 46; Cromb. Lich. Brit. p. 7; Leight. Lich. Fl. p. 35; ed. 3, p. 26. *Lichen tenuissimus* Dicks. Pl. Crypt. fasc. i. p. 12, t. 2, fig. 8 (1785); With. Arr. ed. 3, iv. p. 61; Engl. Bot. t. 1427. *Collema tenuissimum* Ach. Syn. p. 328 (1814); Hook. in Sm. Engl. Bot. v. p. 213. *Polychidium tenuissimum* S. F. Gray Nat. Arr. i. p. 401 (1821).

Essicc. Mudd n. 4.

Distinguished from other soil species by the pulvinate growth of the thallus. The apothecia are rather large with age, but they remain

immersed, and the margin is generally fringed by the laciniae. Not to be confused with *L. lacerum* var. *pulvinatum*, which has broader laciniae and superficial apothecia.

Hab. On the ground among mosses and short grass in maritime and inland districts.—*Distr.* Rare throughout England, Scotland and Ireland.—*B. M.* Sandown and near Shanklin, I. of Wight; near Penzance, Cornwall; Twineham and near Hastings, Sussex; Writtle, Essex; near Yarmouth, Suffolk; near Norwich, Norfolk; near Easby, Cleveland, Yorkshire; New Galloway, Kirkcudbrightshire; near Cramond, Edinburgh; Appin, Argyll; Ben Lawers, Perthshire; Middleton, Cork.

12. *L. subtile* Nyl. in Mém. Soc. Sci. Nat. Cherb. v. p. 90 (1857).—Thallus effuse, composed of minute laciniae, deeply divided or granular-crenate, dark- or brownish-green. Apothecia very minute, superficial and pale-brown or reddish, darker when dry, the margin thin, entire, pale-brown; spores ovoid, 3–5-septate and muriform, 20–23 μ long (or longer), 8–10 μ thick.—Mudd Man. p. 46, t. 1, fig. 8; Cromb. Lich. Brit. p. 8; Leight. Lich. Fl. p. 31; ed. 3, p. 29. *Lichen subtilis* Schrad. Spicil. Fl. Germ. p. 95 (1794); Dicks. Pl. Crypt. fasc. iv. p. 25; Engl. Bot. t. 1008. *Collema subtile* Ach. Syn. p. 328 (1814); Hook. in Sm. Engl. Fl. v. p. 213; Tayl. in Mackay Fl. Hib. ii. p. 111. *Polychidium subtile* S. F. Gray Nat. Arr. i. p. 401 (1821).

The thallus is normally appressed to the soil, and the lacinate character difficult to see clearly. It is distinguished by the persistently minute apothecia and by the usually rather small spores.

Hab. On clay soil, on cretaceous stones in the ground, rarely on the roots of old trees in inland districts.—*Distr.* General though not very common throughout the British Isles.—*B. M.* The Grove, Jersey; Luccombe and Shanklin, I. of Wight; Withiel, Cornwall; near Henfield and near Tunbridge Wells, Sussex; near Wootton-under-Edge, near Cirencester, Gloucestershire; Folkestone, Kent; Shiere, Surrey; near Hale End, Epping Forest, Essex; Colwall, Herefordshire; Tilton Hills, Leicestershire; Pembrokehire; near Ayton, Cleveland, Yorkshire; Sunnyhow, Cumberland; Dunkerron, Kerry.

13. *L. amphineum* Nyl. Lich. Scand. p. 32 (1861).—Thallus thin, unequal, agglutinate, crustaceous, appressed to the substratum, bluish- or brownish-green. Apothecia small, pale or reddish, becoming darker, concave, becoming plane, with a distinct entire margin; spores ellipsoid or ovoid, 3-septate and muriform, 23–27 μ long, 9–11 μ thick.—Cromb. in Journ. Bot. xi. p. 133 (1873); Leight. Lich. Fl. ed. 3, p. 26. *Collema amphineum* Ach. ex Nyl. l. c.

Scarcely to be distinguished from the preceding except by the more agglutinate-crustaceous thallus and by the apothecia becoming somewhat larger.

Hab. On the ground, rarely on roots of old trees in shady places.—*Dist.* Found only sparingly in S. and W. England.—*B. M.* Newlyn Cliff, Penzance, Cornwall; Henfield, Sussex; Newbury, Worcester-shire; Wootton-under-Edge, Gloucestershire.

14. *L. minutissimum* Fr. Summ. Veg. p. 122 (1846); Koerb. Parerg. Lich. p. 423 (1865).—Thallus thin, minutely lobate, the lobes imbricate, more or less deeply crenate, olive- or bluish-green or brownish. Apothecia superficial, minute, concave, reddish-brown, with a paler thin entire margin; spores oblong-ovoid, 5-septate and irregularly muriform, 24–30 μ long, 9–15 μ thick.—*L. fragrans* Mudd Man. p. 46 (1861) (non Cromb.); Leight. Lich. Fl. p. 30 pro parte. *L. lacerum* var. *crenatum* Nyl. ex Carroll in Journ. Bot. iv. p. 22 (1866). *L. sinuatum* var. *crenulatum* Nyl. ex Cromb. in Journ. Bot. xii. p. 336 (1874); Leight. Lich. Fl. ed. 3, p. 30. *L. subtile* f. *latiusculum* Nyl. ex Joshua in Grevillea iv. p. 43 (1875) (errore *flatusculum*); Leight. Lich. Fl. ed. 3, p. 29. *Collema minutissimum* Flörke Deutsch. Lich. v. p. 14 (1819). *C. fragrans* Tayl. in Mackay Fl. Hib. ii. p. 107 (non Hook.).

Allied to *L. subtile* but differing in the more developed thallus and the persistently large spores. It looks somewhat like a miniature *L. lacerum*. The apothecia are numerous and crowded and extremely regular and dainty in appearance.

Hab. On the ground, rarely on trunks of old trees in inland districts.—*Dist.* Scarce in S.W., Central and N. England and in S. Ireland.—*B. M.* Halstead, Kent; Butler's Holt, Bucks; near Cirencester, Gloucestershire; Ayton, near Cleveland, Yorkshire; Bantry, Cork.

15. *L. cretaceum* Nyl. in Act. Soc. Linn. Bord. sér. 3, i. p. 270 (1857).—Thallus effuse, appressed or in small clustered rosulate lobules, or of deeply crenate minute lobes, unequal and rather crowded, olive-brown or dark-olive (I + red). Apothecia small, at first concave, becoming plane, reddish-brown, the margin entire, paler; spores ovoid, 3–7-septate and muriform, 22–40 μ long, 11–17 μ thick.—Mudd Man. p. 45; Cromb. Lich. Brit. p. 7; Leight. Lich. Fl. p. 32; ed. 3, p. 27. *Lichen cretaceus* Sm. Engl. Bot. t. 738 (1800). *Enchylium cretaceum* S. F. Gray Nat. Arr. i. p. 398 (1821). *Collema cretaceum* Hook. in Sm. Engl. Fl. v. p. 210 (1833).

The rosulate lobes are very characteristic, even though often but poorly developed. Sometimes the thallus is largely formed of isidiose granules.

Hab. On cretaceous and siliceous chalky nodules in moist shady inland tracts. *Distr.* Rather rare in the Chalk and Oolite districts of S. and W. England, probably often overlooked.—*B. M.* I. of Wight; Plumpton, West Dean, Preston and Eastham, Sussex; Bisley Common, Chedworth Woods and near Northleach, Gloucestershire; Folkestone, Kent; Shiere, Surrey; Stokesay, Shropshire.

16. *L. diffractum* Krempelh. ex Arn. in Flora xlv. p. 258 (1861).—Thallus small, adnate, granular-areolate, radiate-lobate at the circumference, granules and lobes convex, light or dark olive-brown. Apothecia not seen rightly developed.—*L. placo-*

dielleum Nyl. in Flora xlviii. p. 210 (1865); Cromb. in Journ. Bot. xx. p. 272 (1882) & Monogr. i. p. 68.

The form of the lobes is that of a minute *L. fragile* or *L. Schraderi*; they vary from being rather narrow to slender and wiry.

Hab. On calcareous rocks in hilly districts.—*Distr.* Rare in W. England.—*B. M.* Cleve Hill, Somerset; Warton Crag, Lancashire.

17. *L. microscopicum* Nyl. in Act. Soc. Linn. Bord. sér. 3, i. p. 272 (1856).—Thallus effuse, minute, of crowded erect slender nodulose branchlets, unequally rounded, somewhat constricted or attenuate at the base, dark olive-brown. Apothecia rare, minute, scattered, concave, pale- or reddish-brown, with an entire margin; spores ovoid or oblong, 3–5-septate and muriform, 22–27 μ long, 9–14 μ thick.—Leight. Lich. Fl. ed. 2, p. 468; ed. 3, p. 34; Cromb. in Journ. Bot. xii. p. 336 (1874).

Essicc. Cromb. n. 7.

Considered at one time to be a form of *L. lacerum*; it is, however, distinct in the form of the thallus and in the apothecia, which were discovered by Crombie on a specimen collected at Shiere.

Hab. On the trunks of old trees and on slaty rocks, but chiefly on chalk pebbles and calcareous walls in maritime and inland districts.—*Distr.* Local, though common where it occurs in the Channel Islands, S. and W. England and S.W. Highlands, Scotland.—*B. M.* Rozel and coasts of Jersey; near Lewes, Sussex; near Gomshall and Shiere, Surrey; near Maidstone, Kent; Cheddar Cliffs, near Porlock, near Clevedon, Yatton, and Weston-super-Mare, Somerset; near Chalford, Stroud, Brinscomb and near Cirencester, Gloucestershire; St. Fagan, Glamorganshire; Malvern and Aston, Worcestershire; Blaxton, Yorkshire; Eden, Westmoreland.

Thallus of larger lobes, usually dark-brown.

18. *L. Schraderi* Nyl. Syn. Lich. i. p. 133 (1858).—Thallus in crowded tufts of rather narrow elongate dichotomously branched lobes, irregularly wrinkled and somewhat angular, dilated in the middle, dull olive-green or dark reddish-brown. Apothecia rare, lateral, small, concave, reddish, with an entire paler margin; spores ellipsoid, 3–5-septate and muriform, 23–33 μ long, 11–15 μ thick.—Mudd Man. p. 49; Cromb. Lich. Brit. p. 9; Leight. Lich. Fl. p. 36; ed. 3, p. 34. *Lichen Schraderi* Bernh. in Schrad. Journ. Bot. i. p. 22, t. 2, fig. 5 (1799). *Collema Schraderi* Ach. Lich. Univ. p. 658 (1810); Engl. Bot. t. 2284; Hook. in Sm. Engl. Fl. v. p. 213. *Polychidium Schraderi* S. F. Gray Nat. Arr. i. p. 402 (1821). *Collemodium Schraderi* Nyl. ex Cromb. in Grevillea xv. p. 12 (1886); Cromb. Monogr. i. p. 62.

Essicc. Larb. Lich. Hb. n. 4.

Easily distinguished by the long narrow somewhat erect cylindrical lobes which have a distinctly cellular cortex. Sometimes they are broader and occasionally very much reduced.

Hab. Among mosses on cretaceous and calcareous soil, rarely on the mortar of old walls, in maritime and inland situations.—*Distr.* General but not common throughout the British Isles.—*B. M.* Moulin Huet, Guernsey; Shanklin, I. of Wight; St. Minver, Cornwall; near Plymouth, Torquay and Babbicombe, Devon; the Downs, Eartham, Woolsonbury, Offham and Halnaker, Sussex; Shiere, Surrey; Cheddar Cliffs and Bathampton Downs, Somerset; near Cirencester, Wyndcliff and near Bristol, Gloucestershire; near Oswestry, Shropshire; Miller's Dale, Derbyshire; Anglesea; Appin, Argyll; Blackrock near Cork; Muckross, Killarney and Dunkerron, Kerry; Dawros, Connemara, Galway; Sheep Walk, Armagh.

19. *L. sinuatum* Massal. Mem. Lich. p. 88 (1853).—Thallus of rather small lobes, crowded and suberect, plicate, wrinkled, rarely smooth, crenate and denticulate at the margins, those at the circumference rather larger, dark-brown or rarely glaucous-leaden-coloured. Apothecia rather small (up to 1 mm. in diameter), concave or plane, reddish, the margin thick, entire; spores ovoid or ellipsoid-fusiform, 3-septate and irregularly muriform, 21–50 μ long, 8–18 μ thick.—Mudd Man. p. 47 pro parte; Leight. Lich. Fl. p. 34; ed. 3, p. 29 pro parte; var. *crenatum* Leight. Lich. Fl. ed. 3, p. 30 (1879). *L. scotinum* var. *crenatum* Nyl. in Flora Iviii. p. 106 (1875); Cromb. in Grevillea xv. p. 13 (1886) & Monogr. i. p. 73. *Lichenoides tenue crispum, foliis parvis depressis* Dill. Hist. Musc. p. 145, t. 19, fig. 33 (1741). *Lichen sinuatus* Huds. Fl. Angl. ed. 2, p. 535 (1778); With. Arr. ed. 3, iv. p. 75; Engl. Bot. t. 772. *Collema sinuatum* Hoffm. Deutschl. Fl. ii. add. to p. 104 (1795); Hook. in Sm. Engl. Fl. v. p. 213; Tayl. in Mackay Fl. Hib. ii. p. 110. *Lathagrium sinuatum* S. F. Gray Nat. Arr. i. p. 400 (1821). *L. scotinum* var. *sinuatum* Malbr. in Bull. Soc. Nat. Rouen, 1866, p. 365; Cromb. Monogr. i. p. 72.

Esicc. Cromb. n. 109; Johns. n. 167.

Distinguished from the preceding by the more flattened, closely imbricate lobes and by the larger apothecia. The plant described by Mudd and Leighton and by Crombie (Lich. Brit. p. 8, as *L. scotinum*) includes both the species and the variety.

Hab. Among mosses on old walls and boulders, chiefly in maritime and hilly regions.—*Distr.* Rather rare in Great Britain, chiefly in the W., rare in S. and W. Ireland.—*B. M.* Near St. Lawrence, I. of Wight; Chagford, Devon; Storrington, Sussex; near Maldon, Essex; near Cirencester, Gloucestershire; Garn, Denbighshire; Pentregaer, Oswestry; Teesdale, Weardale and near Stanhope, Durham; Bowling, Dumbartonshire; Appin, Argyll; Glen Fender and Killin, Perthshire; Morrone, Braemar, Aberdeenshire; near Forres, Elgin; Blarney, Cork; Dunkerron, Kerry.

Form *Polinieri* Leight. Lich. Fl. ed. 3, p. 30 (1879).—Thallus pale-greenish. Apothecia somewhat scattered.—*L. scotinum* f. *Polinieri* Cromb. in Journ. Bot. xii. p. 336 (1874) & Monogr. i. p. 72. *Collema Polinieri* Del. ex Nyl. Syn. Lich. i. p. 123 (1858).

The bright-green colour of the thallus is persistent both in a moist and dry condition.

Hab. Among mosses on shady walls, rarely on rocks.—*Distr.* Very local and scarce throughout the British Isles.—*B. M.* Henfield, Sussex; Garn, Denbighshire; Appin, Argyll; Blarney, Cork; Killarney, Kerry.

Var. *scotinum* Koerb. Syst. Lich. Germ. p. 419 (1855).—Thallus lobes rounded, entire, slightly larger than those of the species; otherwise similar.—*Lichen scotinus* Ach. Lich. Suec. Prodr. p. 128 (1798). *Leptogium scotinum* Fr. Summ. Veg. p. 122 (1846); Cromb. Lich. Brit. p. 8, pro parte & Monogr. i. p. 71.

Exsicc. Mudd n. 6; Cromb. n. 109; Johns. n. 7.

Hab. Similar to the species.—*Distr.* General and common where it occurs in Great Britain; not recorded for Ireland.—*B. M.* Hoyle Sands, Cornwall; Poyning, Sussex; Chew Magna, Somerset; near Cirencester, Gloucester; Garn, Denbighshire; Bettws-y-Coed, Carmarthenshire; Lake Ogwen and Capel Curig, Carnarvonshire; Bilsdale and Buckden, Yorkshire; High Force Inn, Teesdale, near Stanhope and Wear Valley, Durham; by the Kent, Westmoreland; Whitehaven and Alston, Cumberland; Appin and I. of Lismore, Argyll; Killin and Ben Lawers, Perthshire.

20. *L. lacerum* S. F. Gray Nat. Arr. i. p. 401 (1821).—Thallus of rather large subimbricate lobes, longitudinally wrinkled, subsascending, crisp and finely crenulate and denticulate at the margin, bluish lead-coloured or dark-brown. Apothecia rare, small, scattered over the lobes, brownish or pale-red, with a thickish entire margin; spores ovoid or broadly fusiform, irregularly muriform, 34–48 μ long, 10–16 μ thick.—Mudd Man. p. 47; Cromb. Lich. Brit. p. 8 & Monogr. i. p. 69; Leight. Lich. Fl. p. 32; ed. 3, p. 28. *Lichenoides saxatile tenue rufescens* Dill. in Ray Syn. ed. 3, p. 77, n. 89 (1724). *Lichenoides pellucidum, endiviæ foliis tenuibus crispis* Dill. Hist. Musc. p. 143, t. 19, fig. 31 A, B. (1741). *Lichen atro-cæruleus, laciniatus & ciliatus* Hall. Hist. Stirp. Helv. iii. p. 94 (1768). *Lichen tremelloides* Lightf. Fl. Scot. ii. p. 842 (1777) (non Linn. fil.); Huds. Fl. Angl. ed. 2, p. 537. *L. lacerus* Liljeb. Svensk. Flora p. 335 (1792); Ach. in K. Vet. Acad. Handl. xvi. p. 18 (1795). *L. Tremella* Roth Tent. Fl. Germ. i. p. 503 (1788)? With. Arr. ed. 3, iv. p. 72 (1796). *L. lacer* Sm. Engl. Bot. t. 1982 (1809). *Collema lacerum* Ach. Lich. Univ. p. 657 (1810); Hook. Fl. Scot. ii. p. 72 & in Sm. Engl. Fl. v. p. 213; Tayl. in Mackay Fl. Hib. ii. p. 111.

Exsicc. Croall n. 488; Johns. n. 166; Larb. Lich. Cæsar. n. 4; Mudd n. 5.

Well characterized by the lacerate margin of the thallus; the whole plant is very thin and, when moist, subpellucid.

Hab. Among mosses on the ground and on old walls in shady places.

—*Distr.* General though not common throughout the British Isles.—*B. M.* Quenvais, Jersey; Ventnor and near Shanklin, I. of Wight; Penzance and near Withiel, Cornwall; Buckfastleigh, Morleigh and near Torquay, Devon; Ardingly, near Brighton, Aldrington and Arundel, Sussex; Shiere, Surrey; Cheddar Cliffs, Somerset; near Cirencester, Gloucestershire; Broadwas and Alfric, Worcestershire; Garn Dingle, Denbighshire; Beaumaris, Anglesea; near Cambridge; Cotteral Clough, Lancashire; near Kendal, Westmoreland; Keswick, Cumberland; Mulgrove Castle and near Ayton and Baysdale, Cleveland, Yorkshire; New Galloway, Kirkeudbrightshire; Reeky Linn, Forfarshire; Bracklinn Bridge, Perthshire; Appin, Argyll; Corriemulzie, Braemar, Aberdeenshire; Blarney and Kilworth, Cork; Killarney and Dingle Bay, Kerry; Connemara, Galway; near Belfast.

Form *fimbriatum* Nyl. Syn. Lich. i. p. 122 (1858).—Laciniae somewhat broader, with the margins densely fimbriate and ciliate, the cilia very much branched.—Cromb. in Journ. Bot. xii. p. 335 (1874); Leight. Lich. Fl. ed. 2, p. 468; ed. 3, p. 28. *Lichenoides pellucidum, endiviæ foliis tenuibus, crispis* Dill. Hist. Musc. p. 143, t. 19, fig. 31, c (1741). *Collema fimbriatum* Hoffm. Deutschl. Fl. ii. p. 104 (1795).

Essicc. Cromb. n. 108; Johns. n. 205; Mudd n. 5 pro parte.

Scarcely to be distinguished from the species, though generally with more densely fimbriate margins of the thallus.

Hab. Similar to that of the species.—*Distr.* Recorded only from S.W. and N. England and from S. Highlands of Scotland.—*B. M.* Luccombe, I. of Wight; near Totnes and Tavistock, Devon; Haywards Heath and Tunbridge Wells, Sussex; Chalford, Gloucestershire; Caddesdon, Oxfordshire; Broadwas and Alfrick, Worcestershire; Barnmouth, Merioneth; Kildale, Cleveland, Yorkshire; New Galloway, Kirkeudbrightshire; Appin and Inverary, Argyll; Killin, Perthshire; near Fort William, Invernessshire; Applecross, Ross-shire.

Var. *pulvinatum* Koerb. Syst. Lich. Germ. p. 418 (1855).—Thallus of smaller lobes than the species, denticulate at the margin, crowded in pulvinate masses, dark-brown. Apothecia central on the thallus, rather rare.—Mudd Man. p. 47; Cromb. Lich. Brit. p. 8; Leight. Lich. Fl. p. 33; ed. 3, p. 28. Subsp. *pulvinatum* Cromb. in Journ. Linn. Soc. Bot. xvii. p. 567 (1880) & Monogr. i. p. 70. *Lichenoides tenue crispum, foliis exiguis surrectis* Dill. Hist. Musc. t. 19, fig. 34 A (1741) and *Lichenoides tenuissimum crispum et veluti aculeatum* l. c. t. 19, fig. 35. *Lichen tremelloides* var. γ Lightf. Fl. Scot. ii. p. 842. *L. tremella* var. 3, With. Arr. ed. 3, iv. p. 73. *Collema pulvinatum* Hoffm. Deutschl. Fl. ii. p. 104 (1795).

Essicc. Johns. n. 206; Larb. Caesar. n. 55 & Lich. Hb. n. 241.

Differs from the species in the persistently brown thallus, but more especially in the pulvinate growth. The laciniae at the circumference are more spreading.

Hab. On rocks, old walls and on the ground among mosses.—*Distr.* Frequent and plentiful where it occurs throughout the British Isles.—*B. M.* Quenvais, Jersey; near Launceston, Cornwall; near Plymouth, Devon; Bonchurch and Luccombe, I. of Wight; near Arundel and Cisbury, Sussex; Shiere and Reigate, Surrey; Bathampton Downs, Somerset; Coln Rogers, and near Cirencester, Abington and Stroud, Gloucestershire; Epping Forest, Essex; Newbury, near Worcester; Clee Hills, Shropshire; Cromer, Norfolk; Kildale, Cleveland, Yorkshire; Stavely, Westmoreland; Alston, Cumberland; Appin, Argyll; Killin and Ben Lawers, Perthshire; Inchigaggin, Cork.

Var. *lophæum* Nyl. Syn. Lich. i. p. 123 (1858).—Thallus of very crowded lobes, somewhat pulvinate in habit, the lobes minute, with cylindrical branching cilia almost obscuring the lobes. Apothecia unknown.—Cromb. Lich. Brit. p. 8; Leight. Lich. Fl. p. 33; ed. 3, p. 29. Subsp. *lophæum* Cromb. in Grevillea xv. p. 13 (1886) & Monogr. i. p. 71. *Parmelia scotina* var. *lophæa* Ach. Meth. p. 238 (1803).

Considered by Crombie and others to be almost specifically distinct; but occasionally the lobes are a little more spreading, and the affinity with the species is then more apparent.

Hab. On decaying stumps of old trees.—*Distr.* Rare in N. Wales and the W. Highlands of Scotland.—*B. M.* Barmouth, Merioneth; Barcaldine, Argyll.

Thallus of large spreading lobes, dark or bluish-leadene coloured.
Smooth beneath.

21. *L. palmatum* Mont. in Webb & Berth. Hist. Nat. Iles Canar. Sect. iv. p. 128 (1840).—Thallus laciniate, the laciniae thin, often long and narrow, revolute at the margins and horn-like, or rather broad, suberect and crowded, greenish- or glaucous-brown, often tinged purplish. Apothecia rare, minute, sessile on the lobes, pale red, with an entire prominent margin; spores ellipsoid or broadly fusiform, irregularly muriform, 28–40 μ long, 16–18 μ thick.—Mudd Man. p. 48; Cromb. Lich. Brit. p. 9; Leight. Lich. Fl. p. 34; ed. 3, p. 31. *Lichenoides gelatinosum tenerius laciniatum ex fusco purpurascens* Dill. in Ray Syn. ed. 3, p. 72, n. 54 (1724). *Lichenoides pellucidum fuscum corniculatum* Dill. Hist. Musc. p. 143, t. 19, fig. 30 (1741). *Lichen palmatus* Huds. Fl. Angl. ed. 2, p. 536 (1778); With. Arr. ed. 3, iv. p. 74; Engl. Bot. t. 1635. *Scytenium palmatum* S. F. Gray Nat. Arr. i. p. 398 (1821). *Collema palmatum* Ach. Lich. Univ. p. 643 (1810); Hook. in Sm. Engl. Fl. v. p. 210.

Distinguished from the preceding by the revolute margins of the nearly erect laciniae. It is occasionally the host of the parasitic lichen *Obryzum corniculatum*.

Hab. Among mosses and short grass in sandy and gravelly places.—*Distr.* General in the Channel Islands and England, rare in Scotland and Ireland.—*B. M.* St. Brelade's Bay, Jersey; Lustleigh Cleeve, Botor Rock and near Okehampton, Devon; near Stoney Cross, New

Forest, Hants; Studland, near Swanage, Dorset; Hale End, Epping Forest, Essex; Dundey, Somerset; Machynlleth, Merioneth; near Malvern, Worcestershire; Yarmouth, Norfolk; near Ayton, Cleveland, Yorkshire; near Killin, Perthshire; Luggelaw, Wicklow.

22. *L. tremelloides* S. F. Gray Nat. Arr. i. p. 400 (1821).—Thallus lobed, thin, somewhat smooth or covered with isidia, the lobes oblong, imbricate, often crisp, with entire margins, dull olive-green, or, usually, glaucous leaden-coloured. Apothecia rare, moderate in size, concave, becoming plane, reddish with a paler thick entire margin; spores ovoid or broadly fusiform, 3-septate and muriform, 21–27 μ long, 8–9 μ thick.—Mudd Man. p. 48; Cromb. Lich. Brit. p. 8; Leight. Lich. Fl. p. 28; ed. 3, p. 31 (incl. f. *polyphyllum* Nyl.; Cromb. Monogr. i. p. 74). *Lichen tremelloides* Linn. fil. Suppl. Pl. Syst. p. 450 (1781); Engl. Bot. t. 1981. *L. cochleatus* Dicks. Pl. Crypt. fasc. i. p. 13, t. 2, fig. 9 (1785); With. Arr. ed. 3, iv. p. 74. *Collema tremelloides* Ach. Lich. Univ. p. 655 (1810); Hook. Fl. Scot. ii. p. 72 & in Sm. Engl. Fl. v. p. 213; Tayl. in Mackay Fl. Hib. ii. p. 111; var. *pichneum* Ach. Syn. Lich. p. 343 (1814); Cromb. in Grevillea xv. p. 13 (1886).

Exsicc. Cromb. n. 110; Larb. Lich. Cæsar. n. 5.

Differs from the two preceding species in the almost constant leaden colour, the large thin entire lobes, and the large apothecia. The lobes are occasionally rather smaller (f. *polyphyllum*), or some of the lobes may be densely isidiöse (f. *pichneum*).

Hab. Among mosses on moist rocks in maritime and mountainous districts.—*Distr.* General and usually plentiful in the Channel Islands, S. and W. Britain and E. and S.W. Ireland.—*B. M.* Guernsey; St. Peter's Valley, Jersey; St. Lawrence, I. of Wight; St. Issey, near Penzance and Saltash, Cornwall; Totnes, near Ditsham, Wembury, Cornworthy, Haberton, near Brixham and near Torquay, Devon; Tenby, Pembrokeshire; Barmouth and Harlech Castle, Merionethshire; Garn, Denbighshire; Llanberis Pass, Carnarvonshire; Anglesea; Dumbarton Castle; Loch Creran and Barcaldine, Appin, and I. of Mull, Argyll; Dunkerron Mt., Blackwater and Killarney, Kerry; near Kylesmore, Connemara, Galway.

23. *L. ruginosum* Nyl. ex Cromb. in Grevillea xv. p. 13 (1886).—Thallus of round rather thin large lobes, plicate, undulate and crowded, with numerous longitudinal wrinkles, and often furfuraceous with concolorous or slightly darker isidia, the margins of the lobes entire or crenulate, brownish- or greenish-leadened coloured. Apothecia rare, rather large, slightly concave or plane, red or brownish-red, the margin thick, wrinkled, plicate or granular; spores ellipsoid or broadly fusiform, 3–5-septate and sometimes muriform, 20–37 μ long, 10–17 μ thick.—*L. chloromelum* Mudd Man. p. 48 (1861) (non Nyl.); Carroll in Journ. Bot. v. p. 254 (1867); Cromb. Lich. Brit. p. 9; Leight. Lich. Fl. p. 32; ed. 3, p. 32. *Collema ruginosum* Duf. ex Schaer. Enum. p. 251 (1850).

The strongly wrinkled and densely isidiose thallus distinguish this species from all others. It has not been found fertile in Great Britain. It has sometimes been confused with two exotic species, *L. Brebrissonii* Mont. and *L. chloromelum* Nyl. The former is less wrinkled and whitish- or greyish-downy beneath; the latter, an American species, has a subsmooth thallus.

Hab. On the trunks of old trees and on rocks among mosses in maritime and mountainous districts.—*Distr.* Sparingly in S. England, N. Wales and S.W. Ireland.—*B. M.* Torquay, Devon; Garth, near Dolgelly and Barmouth, Merioneth; Eagle's Nest and Dinish, Killybegs, Kerry.

Tomentose beneath.

24. *L. saturninum* Nyl. in Act. Soc. Linn. Bord. sér. 3, i. p. 272 (1856).—Thallus olivaceous- or leaden-brown coloured, usually large, thickish, submonophyllous or polyphyllous with the lobes sinuate, round and entire at the margins, smooth or furfuraceous, beneath greyish and densely tomentose, the hairs sometimes fasciculate. Apothecia very rare, moderate in size, plane, reddish-brown, the margin thin, entire, prominent and cup-like; spores ellipsoid, 3-septate, becoming muriform, 16–24 μ long, 9–11 μ thick.—Cromb. Lich. Brit. p. 9; Leight. Lich. Fl. p. 29; ed. 3, p. 32. *L. Hildenbrandii* Nyl. l. c.; Cromb. in Journ. Bot. xii. p. 336 (1874) & Monogr. i. p. 76. *Lichen saturninus* Dicks. Pl. Crypt. fasc. ii. p. 21, t. 6, fig. 8 (1790); Sm. in Trans. Linn. Soc. i. p. 84 (1791) & Engl. Bot. t. 1980; With. Arr. ed. 3, iv. p. 60. *Collema saturninum* Ach. Lich. Univ. p. 644 (1810); Hook. Fl. Scot. ii. p. 71 & in Sm. Engl. Fl. v. p. 211. *C. Hildenbrandii* Garov. Catal. Alc. Critt. ii. p. 51 (1838). *Malloium saturninum* S. F. Gray Nat. Arr. i. p. 399 (1821).

Excicc. Cromb. n. 5.

Somewhat similar in habit to *Collema furvum*. In damp shady places the thallus often becomes blackish above when dry, contrasting with the light-grey colour of the under surface. The hairs in all the specimens tend to grow in rhizina-like strands. Apothecia are rather rare.

Hab. On the trunks of old trees, generally ash, by streams in upland or mountainous districts.—*Distr.* Rather rare in N. England and the mountainous districts of Scotland.—*B. M.* Teesdale, Durham; Clova, Forfarshire; Glen Lochay, Glen Lyon, Fortingall, Loch Earn, Glenample, Craighall and Finlarig, Killin, Perthshire; Inverary and Appin, Argyll; Loch Linnhe and Rothiemurchus, Invernessshire.

25. *L. Burgessii* Mont. in Webb & Berth. Hist. Nat. Hes. Canar. p. 129 (1840).—Thallus greenish- or leaden-brown coloured, large, crowdedly lobate, the lobes somewhat imbricate, crenulate or lacerate and crisp, beneath greyish and more or less minutely tomentose. Apothecia numerous, moderate in size to large; concave or becoming plane, reddish-brown or dark-red, the

thalline margin crowded with short crisp laciniae; spores ellipsoid or broadly fusiform, 3-5-septate and muriform, 30-40 μ long, 13-17 μ thick. *Cromb. Lich. Brit.* p. 9; *Leight. Lich. Fl.* p. 30; ed. 3, p. 33. *Lichen Burgessii* Lightf. *Fl. Scot.* ii. p. 827, t. 26 (1777); *Huds. Fl. Angl.* ed. 2, p. 538; *Engl. Bot.* n. 300; *With. Arr.* ed. 3, iv. p. 57. *Collema Burgessii* Ach. *Lich. Univ.* p. 645 (1810); *Hook. Fl. Scot.* ii. p. 71 & in *Sm. Engl. Fl.* v. p. 211; *Tayl. in Mackay Fl. Hib.* ii. p. 110. *Mallotium Burgessii* S. F. Gray *Nat. Arr.* i. p. 399 (1821); *Mudd Man.* p. 45. *Easicc.* *Cromb.* n. 6; *Dicks. Hort. Sicc. fasc.* iii, n. 24.

Well distinguished from all other *Collemaceæ* by the lacinate margin of the apothecium. The plant may be rather small and orbicular, or it may spread irregularly to a large extent.

Hab. On the trunks of old trees near water (lakes and rivers), rarely on old walls, in wooded districts.—*Distr.* General and usually common in the western districts of the British Isles.—*B. M.* Ivy Bridge and Lydford, Devon; Nannau, near Dolgelly, Cwm-Bychan and Barmouth, Merioneth; Hafod, Cardiganshire; Mardale, Westmoreland; New Galloway, Kirkeudbrightshire; Moffat and Rae Hills, Dumfriesshire; Head of Loch Awe, Inverary and Appin, Argyll; Glen Lochay, Inverarnan and Glen Falloch, Perthshire; Lochaber, Invernesshire; Eagle's Nest, Cromaglown, Dinish and Derrycuntry, Killarney, Kerry; Connemara, Galway.

ORDER VII. PANNARIACEÆ.

Thallus not gelatinous when moist, heteromorous, granular, squamulose or foliose, with hypothallus and rhizinae. Algal cells blue-green (*Myxophyceæ*), rarely bright-green (*Chlorophyceæ*). Apothecia disciform, with or without a thalline margin; paraphyses simple, or rarely branched; spores 8 in the ascus, simple or septate, colourless or slightly brownish. Spermogones with upright septate sterigmata and cylindrical pleurogenous spermatia.

Though containing blue-green algæ, the Pannariaceæ differ from the previous Orders in the non-gelatinous heteromorous character of the thallus. The following genera are represented in the British Isles:—

Algal cells *Nostoc*.

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|---|--------------------------|
| Apothecia without a thalline margin; spores usually simple..... | 28. <i>Parmeliella</i> . |
| Apothecia with a thalline margin; spores usually simple..... | 29. <i>Pannaria</i> . |

Algal cells *Scytonema*.

- | | |
|--|--------------------------|
| Apothecia without a thalline margin; spores 1-septate..... | 30. <i>Massalongia</i> . |
|--|--------------------------|

Algal cells bright-green (*Dactylococcus* ?).

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|--|----------------------|
| Apothecia with a thalline margin; spores simple..... | 31. <i>Psoroma</i> . |
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28. **PARMELIELLA** Müll.-Arg. in Mém. Soc. Phys. Hist. Nat. Genève xvi. p. 376 (1862). *Pannularia* Nyl. in Flora lxii. p. 360 (1879) pro parte; Cromb. Monogr. i. p. 340 pro parte. *Coccocarpia* Nyl. Syn. ii. p. 41 (1885) pro parte (non Pers.); Cromb. Monogr. i. p. 345. *Pannaria* Mudd Man. p. 121 (1861) pro parte. (Pl. 28.)

Thallus squamulose or almost foliose, corticate, with hypothallus and rhizinae. Algal cells *Nostoc*. Apothecia without a thalline margin, sessile, small; spores 8 in the ascus, elongate or ellipsoid, simple, rarely 1-septate, colourless.

Distinguished from other genera of the Order by the small apothecia without a thalline margin.

1. **P. corallinoides** A. Zahlbr. in Ann. K. K. Naturhist. Hofmus. Wien xiii. p. 462 (1899).—Thallus minutely granular, thinly coralloid-squamulose, brownish-green or leaden-grey, the hypothallus bluish-black or blackish. Apothecia small, plane or convex, brown or reddish-brown, usually paler at the margin, internally brownish-black; paraphyses slender, sparsely septate; spores ellipsoid, simple, 12–19 μ long, 6–8 μ thick; hymenial gelatine intensely blue with iodine.—*Stereocaulon corallinoides* Hoffm. Deutschl. Fl. ii. p. 129 (1795) fide Wainio in Medd. Soc. Faun. & Fl. Fenn. xiv. p. 23 (1888). *Lichen microphyllus* Sm. Engl. Bot. t. 2128 (1810) (non Swartz). *Lecidea microphylla* Hook. Fl. Scot. ii. p. 41 (1821) (Ach.?). *Lepidoma triptophyllum* S. F. Gray Nat. Arr. i. p. 462 (1821). *Placodium microphyllum* Hook. in Sm. Engl. Fl. v. p. 198 (1833). *Parmelia plumbea* var. *microphylla* Tayl. in Mackay Fl. Hib. ii. p. 142 (1833). *Pannaria triptophylla* Nyl. in Act. Soc. Linn. Bord. sér. 3, i. p. 313 (1856) pro parte; Mudd Man. p. 123; Leight. Lich. Fl. p. 167; ed. 3, p. 152; Cromb. Lich. Brit. p. 42. *Pannularia triptophylla* Stiz. Lich. Helv. p. 82 (1882); Cromb. in Grevillea xviii. p. 44 (1889) & Monogr. i. p. 341.

Eesicc. Cromb. n. 153.

Differs from *P. microphylla* in the less developed thallus and the darker hypothecium on which the squamules are adnate and plane, becoming broken up into granules later. It varies in colour according to situation, and may be almost black (f. *nigricans* Leight. Lich. Fl. ed. 3, p. 153). It is rarely fertile in the British Isles.

Hab. On the trunks of old trees in wooded districts.—*Distr.* Somewhat local, though plentiful where it occurs in the hilly or mountainous regions of Great Britain and Ireland.—*B. M.* St. Breock, Cornwall; near Lydford, Hustyn's Wood and Lyn, Devon; Dolgelly, Barmouth, Cwm-Bychan and Harlech, Merioneth; Beddgelert, Carnarvon; Kentmere, Westmoreland; New Galloway, Kirkcudbrightshire; Inverary, Barcaldine and Appin, Argyll; Crianlarich, Loch Katrine and Glen Lochay, Perthshire; Craig Cluny, Braemar, Aberdeenshire; Moidart, Invernesshire; Glen Ach-na-Shilloch, Rossshire; Glen Bower Woods and Glengariff, Cork; Tore Mt. and Dinish, Killarney, Kerry.

Var. *incrassata* A. L. Sm.—Thallus thick, of densely crowded closely packed upright squamules, the whole coarsely cracked, brownish-grey on a black hypothallus. Apothecia very rare, convex, brownish-black.—*Pannaria triptophylla* var. *incrassata* Nyl. in Not. Sällsk. Faun. & Fl. Fenn. Förh. v. p. 124 (1866). *P. lasiella* Stirton in Scott. Nat. iv. p. 164 (1877–8). *Pannularia triptophylla* var. *incrassata* Cromb. in Grevillea xviii. p. 44 (1889) & Monogr. i. p. 341.

Differs from the species in the more massive thallus.

Hab. On trunks of old trees, rarely on mossy ground among rocks, in upland wooded districts.—*Distr.* Local and scarce in the Scottish Highlands.—*B. M.* Barcaldine, Argyll; Glen Lochay, Killin, Perthshire.

2. *P. microphylla* Müll.-Arg. in Flora lxxii. p. 507 (1889).—Thallus subdeterminate, minutely squamulose, irregularly cracked, the squamules closely imbricate, crenate, tawny- or pale-grey, often whitish at the margins, hypothallus brownish-black. Apothecia rather small, usually convex, brownish or reddish, internally pale; paraphyses dark at the tips; spores ellipsoid, guttulate, 10–17 μ long, 5–8 μ thick; hymenial gelatine bluish then wine-red with iodine. *Lichen microphyllus* Swartz ex Westr. in Vet. Acad. Handl. xii. p. 301 (1791). *L. escharoides* Sm. Engl. Bot. t. 1247 (1803)? *Lecidea coronata* var. *escharoides* Hook. in Sm. Engl. Fl. v. p. 182 (1833). *Pannaria microphylla* Massal. Ric. Lich. p. 112 (1852); Mudd Man. p. 123; Cromb. Lich. Brit. p. 42; Leight. Lich. Fl. p. 166; ed. 3, p. 152. *Pannularia microphylla* Stiz. Lich. Helv. p. 82 (1882–3); Cromb. Monogr. i. p. 340.

Excicc. Larb. Cæsar. n. 71 & Lich. Hb. n. 89.

Well characterized by the minute crowdedly imbricate squamules. The apothecia are scattered or crowded.

Hab. On rocks or on the ground in maritime districts.—*Distr.* Rather rare in the Channel Islands and W. Scotland, more frequent in W. Ireland.—*B. M.* Guernsey; Rozel, Jersey; near Penzance, Cornwall; Loch Creran and Barcaldine, Argyll; Connemara, Galway; near Croagh Patrick and Clare Island, Mayo.

Var. *cheilea* A. L. Sm.—Thallus darker than in the species, not whitish at the margins. Apothecia somewhat immersed and plane, spores ellipsoid-oblong, frequently 1-septate.—*Pannaria cheilea* Nyl. ex Mudd Man. p. 126 (1861); Cromb. Lich. Brit. p. 43; Leight. Lich. Fl. p. 169; ed. 3, p. 155. *Massalongia cheilea* Mudd l. c.—*Pannularia microphylla* f. *cheilea* Nyl. ex Cromb. in Grevillea xviii. p. 43 (1889) & Monogr. i. p. 341.

Like the species except in the darker thallus and the septate spores, which Nylander considered to be only spuriously septate (Syn. Lich. ii. p. 35 (1885)).

Hab. On damp schistose rocks.—*Distr.* Local and scarce in

W. Scotland and S.W. Ireland.—*B. M.* Loch Creran, Barcaldine, Argyll; Western Blasquet Island and Blackwater Bridge, Kerry; Killree, Clare.

3. *P. lepidiota* Dalla Torre & Sarnth. Die Flechten Tirol &c. p. 97 (1902).—Thallus of small squamules, firm, crenulate and often with ascending margins, imbricate-crowded, especially towards the centre, rather dingy brown or tawny-whitish. Apothecia moderate in size, plane or convex, dark-red or brown, internally pale-whitish; spores ellipsoid, simple, 15–23 μ long, 8–12 μ thick; hymenial gelatine bluish then wine-red with iodine.—*Lichenoides granosum subglaucum, tuberculis planis nigricantibus* Dill. Hist. Musc. p. 544, t. 82, fig. 2 (1741). *Lecidea carnosa* var. *lepidiota* Sommerf. Supp. Fl. Lapp. p. 174 (1826). *Pannularia lepidiota* Stiz. Lich. Helv. p. 82 (1882); Cromb. in Grevillea xviii. p. 43 (1889) & Monogr. i. p. 340.

The crimped and crenate margins of the squamules give the plant often a granular appearance.

Hab. Spreading over decayed mosses on the ground in alpine situations.—*B. M.* Above Loch-na-gat, Ben Lawers, Perthshire.

4. *P. plumbea* Wain. Lich. Brés. i. p. 206 (1890).—Thallus highly developed, orbicular, coriaceous or membranaceous, sub-monophyllous, adnate, the surface marked with radiating lines and concentric shell-like conformations, occasionally with bluish-green isidiose granules, and often crowdedly tuberculose or isidiose, the outer margin broadly crenate, dull-greyish or leaden-coloured, with a thickish rhizinose leaden-bluish hypothallus. Apothecia small, plane or convex, reddish- or dark-brown, the proper margins thin, entire, paler, often obliterated, pale within; paraphyses septate, brown at the slightly swollen tips; spores ellipsoid, simple, colourless, 16–30 μ long, 7–11 μ thick; hymenial gelatine bluish with iodine.—*Lichenoides tenue et molle, Agarici facie* Dill. Hist. Musc. p. 179, t. 24, fig. 73 (1741). *Lichen plumbeus* Lightf. Fl. Scot. ii. p. 826, t. 26 (lower fig.) (1877); With. Arr. ed. 3, iv. p. 60; Engl. Bot. t. 353. *L. cœrulescens* Huds. Fl. Angl. ed. 2, p. 531 (1778). *Parmelia plumbea* Ach. Meth. Lich. p. 212 (1803); S. F. Gray Nat. Arr. i. p. 440; Hook. Fl. Scot. ii. p. 53; Tayl. in Mackay Fl. Hib. ii. p. 142 pro parte. *Pannaria plumbea* Del. ex Duby Bot. Gall. p. 606 (1830) (incl. var. *myriocarpa*); Mudd Man. p. 121 (incl. var. *myriocarpa*); Leight. Lich. Fl. p. 170; ed. 3, p. 154 (incl. f. *myriocarpa*). *Placodium plumbeum* Hook. in Sm. Engl. Fl. v. p. 197 (1833). *Coccocarpia plumbea* Nyl. in Mém. Soc. Sci. Nat. Cherb. v. p. 109 (1857); Cromb. Lich. Brit. p. 43 & Monogr. i. p. 346 (incl. var. *myriocarpa*); var. *myriocarpa* Nyl. Lich. Scand. p. 128 (1861).

Exsic. Croall n. 96; Cromb. nos. 56, 57; Dicks. Hort. Sicc. fasc. x. n. 24; Johns. nos. 96, 321; Larb. Caesar. n. 72 & Lich. Hb. n. 253; Leight. n. 233.

The genus *Coccocarpia*, in which this lichen has been included by Nylander and others, was based on species from which *P. plumbea* differs in the structure of the thallus and in the algal constituents. As already remarked by Nylander (l. c.), var. *myriocarpa* is scarcely to be distinguished from the species. It is marked by crowded tubercles, especially towards the centre of the thallus, and is evidently a growth form, as there are all gradations from the tuberculose to the smooth thallus even on one specimen. The rhizinose hypothallus is sometimes very luxuriant (panniform). The apothecia are normally bright-coloured, but may become dark-brown.

Hab. On the trunks of old trees, on mossy boulders and walls in maritime and inland wooded regions.—*Distr.* General and common throughout the British Isles.—*B. M.* La Coupe, Jersey; Guernsey; Alderney; near Penzance, Bodmin, Pentire, Bocconoc and Respring, Cornwall; Clovelly, South Brent, Bolt Head, Throwleigh, Totnes, near Slapton, Lidford, Okehampton and Torquay, Devon; Appuldurcomb, I. of Wight; Danny Wood, Tilgate and Eridge Rocks, Sussex; Romney Marsh, Kent; Aberdovey, near Dolgelly and near Barmouth, Merioneth; Bettws-y-Coed, Denbighshire; I. of Anglesea; Egglestone and Teesdale, Durham; Windermere, Westmoreland; Keswick and Ennerdale Lake, Cumberland; Maxwelton, Dumfriesshire; New Galloway, Kirkcudbrightshire; near Campsie, Stirlingshire; near Inverary, Barcaldine, Appin, Oban and Head of Loch Awe, Argyll; Glen Falloch, Glen Lochay, The Trossachs, Aberfeldy, Rannoch and Killin, Perthshire; Clova, Forfarshire; Craig Coinnoch, Braemar, Aberdeenshire; S. of Fort William and Glen Nevis, Invernesshire; Cawdor Castle, Nairnshire; Applecross, Rosshire; Castlebernard, Cork; Cromaglowm and Blackwater Bridge, Kerry; Connemara, Galway; Achill and Louisburgh, Mayo.

5. *P. melantera* A. L. Sm.—Thallus effuse, squamulose, cracked into areolæ, black, the squamules thickish, minutely papillose, bluish-black beneath. Apothecia small, sessile, plane or somewhat shining; hypothecium brownish; paraphyses septate, rather stout; spores elongate, simple or 1-3-septate, 30-45 μ long, 4-5 μ thick; hymenial gelatine bluish, the asci tawny, with iodine.—*Pannaria melantera* Stirt. Scott. Nat. v. p. 16 (1879); Leight. Lich. Fl. ed. 3, p. 544. *Pannularia melantera* Cromb. in Grevillea xviii. p. 44 (1889) & Monogr. i. p. 344. Specimen not seen.

A doubtful *Parmeliella*, but impossible to classify with certainty in the absence of data as to the gonidia contained in the squamules.

Hab. On mica-schist rocks, Ben Lawers, Perthshire.

29. **PANNARIA** Del. ex Duby Bot. Gall. p. 606 (1830); emend. Nyl. in Flora lxii. p. 360 (1879). (Pl. 29.)

Thallus granular, squamulose, or almost foliose, with a dark hypothallus of felted hyphæ on the under surface, the upper cortex a plectenchyma of vertical cell rows. Algal cells *Nostoc*. Apothecia becoming superficial, disciform with a thalline margin; hypothecium colourless or pale-coloured; spores 8 in the ascus, elongate-ellipsoid, or almost fusiform, simple, colourless. Sperm-

gonies in thalline tubercles, with septate sterigmata and short pleurogenous spermatia.

A widely-spread genus, the species of which are mostly exotic. European species are nearly all represented in the British Isles.

1. *P. rubiginosa* Del. in Duby Bot. Gall. p. 606 (1830).—Thallus orbicular, squamulose, appressed to the substratum, dull-glaucous or pale, the squamules lobulate-crenate at the circumference, crenate or crenulate in the centre and silvery-white at the margins; hypothallus spongy-tomentose, bluish-black. Apothecia numerous and crowded, moderate in size, red or reddish-brown, with a silvery-white crenate margin; spores ellipsoid, sometimes with pointed ends, 17–30 μ long, 6–11 μ thick; hymenial gelatine bluish with iodine.—Mudd Man. p. 122; Cromb. Lich. Brit. p. 42; Leight. Lich. Fl. p. 164; ed. 3, p. 150. *Lichen rubiginosus* Thunb. ex Ach. Lich. Suec. Prodr. p. 99 (1798). *L. affinis* Dicks. Pl. Crypt. fasc. iv. p. 24, t. 12, fig. 6 (1801); Engl. Bot. t. 983. *Parmelia rubiginosa* Ach. Meth. Lich. p. 212 (1803); S. F. Gray Nat. Arr. i. p. 440; Hook. Fl. Scot. ii. p. 53. *P. plumbea* var. *affinis* Tayl. in Mackay Fl. Hib. ii. p. 142 (1836). *Squamaria affinis* Hook. in Sm. Engl. Fl. v. p. 196 (1833).

Exsicc. Cromb. n. 53; Larb. Lich. Hb. n. 11; Leight. n. 234.

Well marked by the silvery-white margins of the squamules and apothecia. The squamules may be crowded and imbricate at the centre, they are radiating at the circumference.

Hab. On the trunks of old trees, rarely among mosses on walls and rocks, in maritime and upland districts.—*Distr.* General and usually plentiful in hilly or mountainous districts.—*B. M.* Guernsey; Bococonoc and near Respring, Cornwall; Cornworthy, Totnes and Clovelly, Devon; Appuldurcomb, I. of Wight; Chalton Forest, Hants; Eridge Park, Sussex; Hay Coppice, Herefordshire; Aberdovey, Merioneth; Windermere, Westmoreland; Keswick and Ennerdale, Cumberland; Teesdale and Egglestone Woods, Durham; New Galloway, Kirkcudbrightshire; Inverary, Head of Loch Awe, Appin, Barcaldine, and near Oban, Argyll; Glen Falloch, Glen Lochay and Aberfeldy, Perthshire; Corriemulzie Falls and near Braemar, Aberdeenshire; near Fort William, Invernesshire; Dunkerron and old Dromore, Kerry; Connemara, Galway.

Var. *conoplea* Koerb. Syst. Lich. Germ. p. 105 (1855).—Squamules pulverulent, sorediose at the edges, except those of the extreme circumference, but towards the centre the soredia often covering the whole surface, the powdery granules bluish-grey, minutely coralline. Apothecia small, appressed, rather rare, the thalline margin pulverulent; spores usually rather smaller than in the species.—Cromb. Lich. Brit. p. 42; var. *cæruleo-badia* Mudd Man. p. 122 (1861); Leight. Lich. Fl. p. 164; ed. 3, p. 151. *Lichen cæruleo-badius* Schleich. Cent ii. n. 71 in Schrad. Neu. Journ. Bot. p. 197 (1806) nomen nudum. *Parmelia*

conoplea Ach. Lich. Univ. p. 467 (1810). *P. plumbea* var. *tumescens* Tayl. in Mackay Fl. Hib. ii. p. 142 (1833).

Exsicc. Cromb. n. 54; Larb. Lich. Hb. n. 12.

Almost specifically distinct, but connected with the species by intermediate states.

Hab. On the trunks of old trees in maritime and inland districts.—

Distr. General and not uncommon throughout the British Isles.—*B. M.* La Coupe, Jersey; Guernsey; Withiel, Cornwall; Newton Bushell, Lidford and near South Brent, Devon; Appuldurcomb, I. of Wight; St. Leonard's Forest, Black Down and Tilgate, Sussex; Charlton Forest, Kent; Dolgelly, Merioneth; Capel Curig, Carnarvonshire; Kentmere, Westmoreland; Borrowdale, Cumberland; Teesdale, Durham; New Galloway, Kirkcudbrightshire; Barealdine, Argyll; Glen Lochay, Killin, Aberfeldy and Den of Reichip, Perthshire; S. of Fort William, Invernessshire; Glenferness, Nairnshire; Killarney, Kerry; Doughruagh Mts., Connemara, Galway.

2. *P. pezizoides* Leight. Lich. Fl. p. 165 (1871); ed. 3, p. 150 (excl. var. *coronata*).—Thallus subcircular, often rather wide-spreading, granular-squamulose, the squamules small, crenate, densely crowded and imbricate, with a granular appearance, tawny- or greyish-brown; a thin arachnoid greyish-white hypothallus sometimes visible. Apothecia moderate in size or rather large, plane, red, or reddish-brown, the thalline margin crenulate; spores fusiform-ellipsoid, minutely warted, 15–28 μ long, 7–11 μ thick; hymenial gelatine bright-blue then sordid-bluish with iodine.—*P. brunnea* Massal. Ric. Lich. p. 113 (1852) pro parte; Nyl. Lich. Scand. p. 123 (1861); Mudd Man. p. 123, t. 2, fig. 37 (excl. var. *coronata*); Cromb. Lich. Brit. p. 42. *Lichen pezizoides* Web. Spicil. Fl. Goett. p. 200 (1778). *L. brunneus* Swartz in Nov. Act. Upsala iv. p. 247 (1784); Engl. Bot. t. 1246. *Lecanora brunnea* Ach. Lich. Univ. p. 419 (1810) pro parte; Hook. Fl. Scot. ii. p. 51; Grev. Fl. Edin. p. 335. *Psoroma brunneum* S. F. Gray Nat. Arr. i. p. 446 (1821). *Lecidea coronata* Borr. ex Hook. in Sm. Engl. Fl. v. p. 182 (1833) (non Hoffm.) pro parte; Tayl. in Mackay Fl. Hib. ii. p. 127.

Exsicc. Croall n. 590; Cromb. n. 55; Johns. n. 253; Larb. Lich. Hb. n. 14; Mudd n. 90.

Frequently confused with *P. nebulosa*. The thallus of both is dark-bluish-green when moist, but in *P. pezizoides* it dries to a tawny-brown, and the formation of the thallus is different. In shady situations it is more bluish-grey with paler apothecia. At high altitudes, as on Ben Lawers, thallus and apothecia are darker, and the hypothallus blackish.

Hab. On the ground on decayed mosses, rarely on stones or decaying wood in upland regions.—*Distr.* General and not uncommon in maritime and hilly regions of Great Britain and Ireland.—*B. M.* Near Ilfracombe, Devon; Galley Wood Common, Essex; Dolgelly and Barmouth, Merioneth; Bettws-y-Coed, Gwydir, Glyder Vawr and Capel Curig, Carnarvon; Battersby Bank, Cleveland, Yorkshire; Egglestone, Durham; Mardale, Westmoreland; Whitehaven, Cumber-

land; The Cheviots, Northumberland; New Galloway, Kirkcudbrightshire; near Roslin Castle, Midlothian; Bowling Bay, Dumbartonshire; Barcaldine, Airds and Appin, Argyll; Fortingall, Killin, Ben Lawers, Craig Calliach and Den of Reichip, Perthshire; near Forfar; Linn of Dee and Corriemulzie and Glen Ey, Braemar, Aberdeenshire; near Fort William and Invermoriston, Invernessshire; Brandon Mt., Tore Mt., Cromaglow, Dunkerron and Killarney, Kerry; Killery Bay, Connemara, Galway.

3. *P. Hookeri* Nyl. in Mém. Soc. Sci. Nat. Cherb. v. p. 109 (1857).—Thallus squamulose, the squamules lobate-radiate and somewhat plicate at the circumference, appressed, crowded and imbricate, crenate towards the centre, greyish-brown or leaden-greyish in colour; hypothallus black. Apothecia rather small, plane, blackish, pale within, with a thin grey somewhat crenulate margin; spores ellipsoid-ovoid, 12–19 μ long, 5–9 μ thick; hymenial gelatine bluish then sordid-red with iodine.—Mudd Man. p. 125; Cromb. in Grevillea xviii. p. 43 (1890) (incl. var. *leucolepis*). *P. leucolepis* Nyl. Lich. Scand. p. 123 (1861); Cromb. Lich. Brit. p. 42; Leight. Lich. Fl. p. 165; ed. 3, p. 151. *P. Hookeri* var. *leucolepis* Nyl. Syn. ii. p. 33 (1885); Cromb. Monogr. i. p. 339. *Lichen Hookeri* Borr. in Sm. Engl. Bot. t. 2283 (1811). *L. leucolepis* Wahlenb. Fl. Lapp. p. 410 (1812). *Lecanora Hookeri* Hook. Fl. Scot. ii. p. 51 (1821). *Squamaria leucolepis* Hook. in Sm. Engl. Fl. v. p. 194 (1883).

Exsicc. Leight. n. 267.

Characterized by the leaden-coloured thallus. It is usually well fertile with crowded apothecia, which become black with age.

Hab. On micaceo-schistose rocks in alpine places.—*Distr.* Local and scarce on the Scottish Grampians.—*B. M.* Ben Lawers, Mael Graedha and Craig Calliach, Perthshire.

4. *P. nebulosa* Nyl. in Mém. Soc. Sci. Nat. Cherb. ii. p. 324 (1854) & Lich. Scand. p. 125.—Thallus effuse, granular-crustaceous, irregularly cracked, the granules crowded, greyish or dark-bluish-grey, often blackish-green. Apothecia small, plane, or somewhat convex, red or reddish-brown, internally pale-coloured, with an interrupted granular margin (coronate); spores ellipsoid-fusiform, the wall slightly uneven, 15–24 μ long, 6–9 μ thick; hymenial gelatine faintly bluish then wine-red with iodine.—Cromb. Lich. Brit. p. 42; Leight. Lich. Fl. p. 168; ed. 3, p. 153. *P. brunnea* var. *coronata* Massal. Ric. Lich. p. 115 (1852); Leight. Lich. Fl. p. 166 (1871); ed. 3, p. 152. *Lichen pezizoides* Dicks. Pl. Crypt. fasc. i. p. 10 (1785) (non Web.); With. Arr. ed. 3, iv. p. 21. *Patellaria nebulosa* Hoffm. Pl. Lich. ii. p. 55, t. 40, fig. 1 (1794). *Verrucaria coronata* Hoffm. Deutschl. Fl. ii. p. 175 (1795). *Lecanora pezizoides* Borr. in Engl. Bot. Suppl. t. 2801 (1837).

Exsicc. Johns. n. 95; Larb. Cæsar. n. 26 & Lich. Hb. n. 13; Leight. n. 235.

Easily distinguished from the preceding by the granular crustaceous thallus and by the persistently dark-greenish colour. The granules forming the margin of the apothecium gave origin to the name *coronata*.

Hab. On sandy soil, earth-covered walls and hedge-banks, rarely on decaying stumps in maritime and inland districts.—*Distr.* Local though plentiful where it occurs throughout the British Isles.—*B. M.* Quenvais, St. Brelade's Bay and Noirmont, Jersey; Guernsey; Alderney; Wadebridge, St. Germain's, Penzance and Withiel, Cornwall; near Bovey Tracey and Cornworthy, Devon; I. of Wight; near Hartfield and Tunbridge Wells, Sussex; Epping Forest, Essex; Hay Forest, Herefordshire; Barmouth, Merioneth; near Malvern, Worcestershire; Bangor, Carnarvonshire; I. of Man; Egglestone, Durham; near Ennerdale, Cumberland; New Galloway, Kirkeudbrightshire; Airds, Appin, Argyll; Loch Tay, Taymouth and Killin, Perthshire, Cork.

30. **MASSALONGIA** Koerb. Syst. Lich. Germ. p. 109 (1855).
(Pl. 30.)

Thallus squamulose, the cortex of the upper surface of the squamules plectenchymatous, the lower surface decorticate with a dark rhizinose hypothallus. Algal cells *Scytonema*. Apothecia plane, without a thalline margin; asci clavate, 8-spored; spores colourless or becoming brownish, 1-septate. Spermogones with septate sterigmata and pleurogenous short cylindrical straight or bent spermatia.

Separated from *Pannaria* owing to the difference in the algal constituents of the thallus.

1. **M. carnosa** Koerb. Syst. Lich. Germ. p. 109 (1855).—Thallus of medium-sized dull or tawny-brown squamules, adnexed or partly ascending and imbricate, granular-crenate and lighter coloured at the margins (when dry), the whole squamule bluish-green when moist, whitish beneath, the hypothallus brownish-black, evanescent. Apothecia rather small, plane or slightly concave, reddish-brown, the margin paler; spores oblong-fusiform or rarely ellipsoid, 1-septate, 16–31 μ long, 5–8 μ thick; hymenial gelatine yellow, the apices of the asci deep bluish, with iodine.—Mudd Man. p. 126, t. 2, fig. 39. *Lichen carnosus* Dicks. Pl. Crypt. fasc. ii. p. 21, t. 6, fig. 7 (1790); With. Arr. ed. 3, iv. p. 33; Engl. Bot. t. 1684. *Lecanora carnosa* Hook. Fl. Scot. ii. p. 51 (1821). *L. muscorum* Tayl. in Mackay Fl. Hib. ii. p. 139 (1836). *Psoroma muscorum* S. F. Gray Nat. Arr. i. p. 446 (1821). *Squamaria muscorum* Hook. in Sm. Engl. Fl. v. p. 194 (1833). *Pannaria muscorum* Del. ex Duby Bot. Gall. p. 607 (1830); Cromb. Lich. Brit. p. 43. *P. carnosa* Leight. Lich. Fl. p. 169 (1871); ed. 3, p. 155. *Pannularia carnosa* Cromb. in Grevillea xii. p. 62 (1884) & Monogr. i. p. 344.

Ecsicc. Cromb. n. 154; Leight. n. 393.

The thalline squamules are rather thin and may spread extensively over the substratum, or they may be crowded together.

Hab. Among mosses on rocks and boulders in maritime and mountainous districts.—*Distr.* Somewhat common in S.W., W. and N. England and N. Wales, rarer in S. Scotland and among the Grampians and in E. Ireland.—*B. M.* Penzance, Cornwall; Didworthy and near South Brent, Devon; Oswestry, Shropshire, Cader Idris, Dolgelly, Cwm Bychan and Barmouth, Merioneth; Teesdale, Durham; New Galloway, Kirkcudbrightshire; Head of Loch Awe, Argyll; foot of Ben More, Glen Lochay and Ben Lawers, Perthshire; Glen Ey, Braemar, Aberdeenshire; by Loch Linnhe, Invernesshire; Kippure Mts., Dublin.

Var. determinata A. L. Sm.—Thallus rather paler than in the species, the squamules with darker granular margins. Apothecia dark-reddish with a light-reddish margin; paraphyses stouter and spores larger than in the species, the latter guttulate, 26–36 μ long, 7–8 μ thick.—*Pannaria muscorum* var. *determinata* Nyl. Lich. Scand. p. 128 (1861); Cromb. Lich. Brit. p. 43. *P. carnosa* var. *determinata* Leight. Lich. Fl. p. 169 (1871); ed. 3, p. 156. *Pannularia carnosa* var. *determinata* Cromb. in Grevillea xviii. p. 44 (1889) & Monogr. i. p. 345.

Owing to the guttulæ in the spores, these may appear to be pluriseptate.

Hab. On moist soil in upland districts.—*Distr.* Apparently local and rare in E. Ireland.—*B. M.* Luggelaw, Wicklow.

31. **PSOROMA** Ach. Lich. Suec. Prodr. p. 2 (1798) pro parte; Nyl. in Mém. Soc. Sci. Nat. Cherb. iii. p. 175 (1855). *Lecanora* subgen. *Psoroma* Nyl. in Not. Sällsk. Faun. & Fl. Fenn. Förh. v. p. 125 (1866); Cromb. Monogr. i. p. 349. (Pl. 31.)

Thallus minutely squamulose-granular, corticate, the upper cortex of plectenchyma, the lower of closely packed parallel hyphæ, some of which pass out as rhizoidal filaments. Algal cells bright-green (*Dactylococcus?* *Pleurococcus?*). Apothecia with a thalline margin; hypothecium colourless; paraphyses simple, septate; asci 8-spored; spores colourless, ellipsoid or globose, simple (rarely 2-celled). Spermogones with septate sterigmata and pleurogenous short cylindrical spermatia.

Though containing bright-green gonidia the affinity of this genus is with the Pannariaceæ. Forssell has stated (Flora lxvii. p. 187) that squamules containing blue-green algae are frequently mixed with the normal thallus and that they are exactly like those of *Pannaria pezizoides*. He regards the fungus as the same in these two lichens.

1. **P. hypnorum** S. F. Gray Nat. Arr. i. p. 445 (1821).—Thallus granular-squamulose, the squamules crenate or granulate, tawny-yellow or yellowish-brown (K –). Apothecia moderate in size, or rather large up to about 4 mm. in diam. At first urceolate, becoming plane, reddish-brown; paraphyses septate, clavate and yellowish-brown at the tips; spores ellipsoid, often somewhat acute at one or both ends, the outer wall uneven, 16–25 μ long,

8-11 μ thick; hymenial gelatine bluish then wine-red with iodine.—Cromb. Lich. Brit. p. 44 (incl. var. *deaurata*); Leight. Lich. Fl. p. 163; ed. 3, p. 149; f. *deaurata* Nyl. Lich. Scand. p. 121 (1861); Cromb. Monogr. i. p. 350. *Lichen hypnorum* Dicks. Fl. Crypt. fasc. iii. p. 14 (1793) (excl. syn.); With. Arr. ed. 3, iv. p. 22; Engl. Bot. t. 740. *Lecanora hypnorum* Ach. Lich. Univ. p. 417 (1810); Hook. Fl. Scot. ii. p. 51; Grev. Fl. Edin. p. 334; Tayl. in Mackay Fl. Hib. ii. p. 139. *L. lepidora* var. *deaurata* Ach. tom. cit. p. 418. *Squamaria hypnorum* Hook. in Sm. Engl. Fl. v. p. 194 (1833). *Pannaria hypnorum* Koerb. Syst. Lich. Germ. p. 108 (1855); Mudd Man. p. 124.

Exsicc. Cromb. n. 58 pro parte; Larb. Cæsar. n. 70.

The squamules are either scattered or crowded, sometimes extremely prominent on the margin of the apothecium. Form *deaurata* does not differ except in the slightly brighter colour.

Hab. Among mosses—on the ground, rocks and walls in maritime and inland districts.—*Distr.* Not infrequent in the Channel Islands and in Great Britain, not recorded in Ireland.—*B. M.* Grosnez, Jersey; Guernsey; Tresco, Scilly Islands; Respring, Cornwall; Dartmoor, Devon; Shoreham Beach and Aldington Beach, Sussex; Hale's End, near Malvern, Worcestershire; Cym Bychan and Aberdovey, Merioneth; Egglestone, Durham; the Cheviots, Northumberland; Pentland Hills near Edinburgh; Hills above Greenock, Renfrewshire; Appin, Argyll; Killin, Craig Calliach, Falls of Bruar, Glen Lochay, Ben Lawers and Glen Fender, Perthshire; Clova, Reeky Linn, Kinnordy, Esk Burn and near Dundee, Forfarshire; Corriemulzie, Falls of Garrawalt and Craig Cluny, Braemar, Aberdeenshire, Glen Nevis, Invernessshire; Glen Dale, I. of Skye.

ORDER VIII. PELTIGERACEÆ.

Thallus foliaceous, membranaceous, heteromerous, the upper cortex of plectenchyma, lower surface non-corticate, or partly corticate, provided with loose hyphæ or with rhizoids. Algal cells blue-green (*Nostoc*) or bright-green (*Dactylococcus*). Apothecia mostly marginal and roundish, adnate on the upper or lower surface of the thallus, without a thalline margin; hypothecium colourless; paraphyses stoutish, simple, septate; spores 2-8 in the ascus, elongate, fusiform or ellipsoid, 1- or more-septate, colourless or dark-coloured. Spermogones absent or rare. Cephalodia enclosing *Nostoc* present in some of the genera. The following are British:—

Apothecia marginal, superficial.

On upper surface of the thallus 32. *Peltigera*.

On lower surface of the thallus..... 33. *Nephromium*.

Apothecia scattered, sunk in the thallus 34. *Solorina*.

32. **PELTIGERA** Willd. Fl. Berol. p. 347 (1787). *Peltidea* Ach. Meth. Lich. p. 282 (1803); Cromb. Monogr. i. p. 277. (Pl. 32.)

Thallus often wide-spreading, submonophyllous or polyphyllous, corticate on the upper surface; not corticate below, tomentose or nerved and more or less rhizinose. Algal cells blue-green, *Nostoc*, bright-green *Dactylococcus*. Apothecia marginal, adnate on the upper surface of the frond; spores elongate-fusiform, 3- or pluriseptate, colourless or brownish. Pycnidia sometimes present, with ovoid acrogenous spores.

In most of the species of this genus the algæ are blue-green. In a few the gonidial zone is bright-green, but in these there are always present groups of *Nostoc* cells enclosed in cephalodia, as small tubercles on the upper or lower surface, or within the thallus. The veins below are due to intercalary growth in the upper cortical layers, causing stretching and pulling apart of the tomentum below so that the white medulla becomes more or less exposed. The genus is divided into two sections:—

Thallus with blue-green gonidia..... i. EUPELTIGERA.
Thallus with bright-green gonidia and with cephalodia..... ii. PELTIDEA.

§ i. EUPELTIGERA Hue in Nouv. Arch. Mus. Hist. Nat. Paris sér. 4, ii. p. 92 (1900).

Algal cells blue-green (*Nostoc*); cephalodia not present.

Thallus downy above.

1. *P. canina* Willd. Fl. Berol. p. 347 (1787).—Thallus large, spreading, rather thick, of large rounded lobes usually downy above, brownish-green when moist, glaucous-grey or fawn-coloured when dry, beneath whitish, with prominent pale nerves and long white rhizinae of fasciculate hyphæ. Apothecia moderate in size, roundish, becoming revolute, brown or brownish-red, entire or slightly crenulate at the margin; spores elongate-fusiform, 3-5-septate, 66-70 μ long, about 4 μ thick.—Mudd Man. p. 82, t. 1, fig. 22 (excl. vars.); Cromb. Lich. Brit. p. 29 (incl. var. *membranacea*); Leight. Lich. Fl. p. 107; ed. 3, p. 101 (excl. f. *crispa*); var. *membranacea* Nyl. Syn. i. p. 324 (1860); Cromb. Monogr. i. p. 288. *Lichenoides peltatum terrestre cinereum majus, foliis divisis* Dill. in Ray Syn. ed. 3, p. 76, n. 87 (1724). *Lichenoides digitatum cinereum, Lactuce foliis sinuosis* Dill. Hist. Musc. p. 200, t. 27, fig. 102 E (1741). *Lichen caninus* L. Sp. Pl. p. 1149 (1753); Huds. Fl. Angl. p. 454; Lightf. Fl. Scot. ii. p. 845; With. Arr. ed. 3, iv. p. 69; Engl. Bot. t. 2299. *Peltidea canina* Ach. Lich. Univ. p. 517 (1810); S. F. Gray Nat. Arr. i. p. 428; Hook. Fl. Scot. ii. p. 60 (excl. var. *rufescens*) & in Sm. Engl. Fl. v. p. 215; Tayl. in Mackay Fl. Hib. ii. p. 153.

Ervice. Croall n. 492; Johns. n. 26; Larb. Cantab. n. 23; Leight. n. 141; Mudd n. 59.

Distinguished from other species by the white under surface, and the numerous long white rhizinae. The thallus is variable in size,

and the downy covering of the surface, due to the outgrowth of large branching anastomosing hyphæ, tends to disappear on raised or exposed portions of the thallus (a characteristic of var. *membranacea*). Pycnidia occasionally occur in tubercles on the margins of the lobes; they are brownish-black with spores 9–12 μ long, 4–5 μ thick.

Hab. Among mosses on the ground, the tops of old walls and on boulders, etc.—*Distr.* General and common throughout the British Isles.—*B. M.* Guernsey; Jersey; near Penzance, Withiel and Land's End, Cornwall; Lustleigh, Devon; New Forest, Hants; Sheffield Park and Maresfield, Sussex; Hyde Park, London, Middlesex (18th cent.); near Hereford; Malvern, Worcestershire; Polesworth, Warwickshire; Clee Hill and Haughmond Hill, Shropshire; Barmouth and near Dolgelly, Merioneth; Snowdon and near Conway, Carnarvonshire; Anglesea; Chatsworth, Derbyshire; Mildenhall, Suffolk; Ayton, Cleveland, Yorkshire; Teesdale, Durham; The Cheviots, Northumberland; near Berwick-on-Tweed; Alston and Calder Bridge and Patterdale, Cumberland; New Galloway, Kirkcudbrightshire; Appin, Barcaldine and Inverary, Argyll; Glen Lochay, Killin and Blair Athole, Perthshire; Strathmartin, Forfarshire; Durriss, Kincardineshire; Corriemulzie, Castleton of Braemar and Countess Wells, Aberdeen; near Forres, Elginshire; Glen Nevis, Invernessshire; Applecross, Rossshire; Rostellan and Castlemary, Cork; Killarney, Kerry; Kylemore and Doughruagh Mts., Connemara, Galway; Achill Island and Clare Island, Mayo; near Belfast, Antrim.

Var. *erumpens* Hue in Nouv. Arch. Mus. Paris sér. 4, ii. p. 96 (1900).—Thallus greyish-green, decumbent, thin, small, lobate, the lobes at first rounded, subintegrate, smooth or thinly tomentose, with central glaucous or whitish soredia, beneath whitish with reticulate veins.—*Peltidea erumpens* Tayl. in Lond. Journ. Bot. vi. p. 184 (1847). Specimen not seen.

Distinguished by the small size and the superficial soredia. Hue gives the size of the variety as 1 cm. long, 6–10 mm. wide, but Taylor's specimen is recorded as much larger, the thallus being 1–2 inches wide.

Hab. On sides of dry banks, Dunkerron, Kerry.

2. *P. spuria* DC. Fl. Franc. ii. p. 406 (1805).—Thallus small (2–4 cm.), subsascending, somewhat downy or pruinose, greyish-green, beneath whitish with rather strong white nerves and few white rhizinae. Apothecia on digitate lobes, rather small, roundish, then oblong and revolute, brown or reddish-brown, minutely crenulate or denticulate round the margin; spores 3–7-septate, 56–75 μ long, 3·5–4·5 μ thick.—Leight. Lich. Fl. p. 108; ed. 3, p. 103. *P. canina* var. *pusilla* Fr. Lich. Eur. p. 45 (1831); Mudd Man. p. 83. *P. rufescens* subsp. *spuria* Cromb. Lich. Brit. p. 29 (1870). *Lichenoides digitatum cinereum*, *Lactuce foliis sinuosis* Dill. Hist. Muse. p. 200, t. 27, fig. 102 A–D (1741). *Lichen spurius* Ach. Lich. Suec. Prodr. p. 159 (1798); Engl. Bot. t. 1542. *Peltidea spuria* Hook. in Sm. Engl. Fl. v. p. 215 (1833).

Essicc. Johns. n. 308.

Resembles the preceding in the colourless under-surface but is much smaller, sometimes resembling *P. venosa* in form.

Hab. On the ground among mosses and short grass, also on the stumps of trees in maritime and upland districts.—*Distr.* Rather rare in S.W. and N. England, N. Wales, and among the Grampians, Scotland.—*B. M.* Totnes, Devon; near Ryde, Shanklin and Ventnor, I. of Wight; Sussex Downs, near Brighton, Hurstpierpoint and Haywards Heath, Sussex; Ightham, Kent; Epping Forest and Ulting, Essex; near Cirencester, Gloucestershire; Sotterley, Suffolk; Gogmagog Hills, Cambridgeshire; Oswestry and Church Stretton, Shropshire; Ynsfaig, N. Wales; Ingleby, Cleveland, Yorkshire; Streatlam, Durham; Appin, Argyll; The Trossachs and Falls of Tummel, Perthshire; Durris, Kincardineshire.

3. *P. rufescens* Hoffm. Deutschl. Fl. p. 107 (1795).—Thallus spreading, horizontal, rather thickish, downy above, roundly lobed, often crisp at the edges, greenish- or greyish-brown when moist, light-brown or greyish-red when dry, beneath with thick brownish or dark nerves and scattered dark rhizinae. Apothecia moderate in size, roundish or somewhat oblong, red or brownish-red, the margin denticulate; spores 3-5-septate, 42-72 μ long, 4-5 μ thick.—Cromb. Lich. Brit. p. 29; Leight. Lich. Fl. p. 108; ed. 3, p. 102. *P. canina* var. *rufescens* Mudd Man. p. 82 (1861). *Lichenoides peltatum terrestre rufescens* Dill. in Ray Syn. ed. 3, p. 77, n. 88 (1724). *Lichenoides digitatum rufescens, foliis Lactucæ crispis* Dill. Hist. Musc. p. 203, t. 27, fig. 103 (1741). *Lichen caninus* var. *rufescens* Weiss Pl. Crypt. Gott. p. 79 (1770); Lightf. Fl. Scot. ii. p. 846. *L. rufescens* Neck. Meth. Musc. p. 79 (1771); With. Arr. ed. 3, iv. p. 405 (*L. rufus* errore p. 70); Engl. Bot. t. 2300. *Peltidea rufescens* Ach. Meth. Lich. p. 285 (1803); Hook. in Sm. Engl. Fl. v. p. 216 (1833). *P. canina* var. *crispa* Ach. Lich. Univ. p. 519 (1810); var. *rufescens* Hook. Fl. Scot. ii. p. 60 (1821). *P. crispa* S. F. Gray Nat. Arr. i. p. 428 (1821).

Exsicc. Bohl. n. 87; Cromb. n. 43; Johns. n. 227.

Closely allied to *P. canina*, intermediate stages occurring between the two species, but in general it is more reddish in colour, and the margin of the lobes are crisper. It differs also in habitat.

Hab. Among mosses on shady rocks, and the stumps of trees in maritime and mountainous districts.—*Distr.* Rather rare throughout the British Isles.—*B. M.* Guernsey; Penzance, Cornwall; Totnes, Devon; Cirencester, Gloucestershire; Gopsall, Leicestershire; Hafod, Cardiganshire; near Kendal, Westmoreland; New Galloway, Kirkcudbrightshire; Airds, Appin, Argyll; Achmore, Killin, Perthshire; near Fort William, Invernessshire; Rosscarbery, Cork; Clare Island, Mayo.

Var. *prætextata* Nyl. Syn. Lich. i. p. 325 (1860).—Varies in the isidiiferous or minutely squamulose margins of the thalline lobes.—Form *prætextata* Cromb. in Journ. Linn. Soc. xvii. p. 574 (1880) & Monogr. i. p. 289. *P. canina* var. *limbata* Mudd Man.

p. 83 (1861) (non Del.); form *crispa* Leight. Lich. Fl. ed. 3, p. 102 (1879) (non Ach.); form *lepidophora* Cromb. in Grevillea xv. p. 77 (1887) (non Nyl.). *Peltidea ulorrhiza* var. *prætextata* Floerke ex Sommerf. Suppl. Fl. Lapp. p. 123 (1826).

Esicc. Bohl. n. 30; Johns. n. 363; Larb. Lich. Hb. n. 46; Leight. n. 262 pro parte; Mudd n. 60.

Well marked by the densely isidioid margins of the thallus.

Hab. Among mosses on shady rocks, etc., generally in moist places.—*Distr.* Throughout the British Isles, more frequent than the species.—*B. M.* Rozel, Jersey; Bocconoc, Cornwall; Lustleigh and Widdicombe, Devon; near Worcester; Barmouth and Dolgelly, Merioneth; Easby, Sowerdale and Baysdale, Cleveland, Yorkshire; Teesdale, Durham; Windermere and near Kendal, Westmoreland; Keswick, Cumberland; Airds, Appin, Argyll; Glen Lochay, Killin and Glen Fender, Blair Athole, Perthshire; Craig Cluny, Braemar, Aberdeenshire; near Fort William, Invernessshire; I. of Skye; Killarney, Kerry; Glendalough, Connemara, Galway; Clare Island, Mayo.

Thallus pulverulent, granular or scabrid above.

4. *P. malacea* Fr. Lich. Eur. p. 44 (1831).—Thallus moderate in size, thickish, smooth or obsoletely pulverulent, pale-greyish-brown when moist, bright-brown or greyish when dry, beneath tomentose, dark-brown at the centre, becoming lighter and almost colourless towards the margin, without nerves. Apothecia moderate in size, orbicular, adnate, brownish-red, crenulate at the margin; spores elongate-fusiform, 3–5-septate, 58–74 μ long, 5–6 μ thick.—Cromb. in Journ. Bot. lvii. p. 147 (1874); Leight. Lich. Fl. ed. 3, p. 102 pro parte. *Peltidea malacea* Ach. Syn. Lich. p. 240 (1814) pro parte; var. *microloba* Nyl. ex Lamy in Bull. Soc. Bot. xxv. p. 378 (1878); Cromb. Monogr. i. p. 287.

Esicc. Johns. n. 362.

Distinguished by the almost continuous brown tomentum of the under surface. Apothecia are occasionally formed on the under side of the thallus, but in that case not at the extreme margin as in *Nephromium* (Bitter in Ber. Deutsch. Bot. Ges. xxii. p. 248 (1904)).

Hab. Among mosses on rocks and about the roots of trees in mountainous regions.—*Distr.* Rare in hilly or mountainous regions in W. England and Highlands of Scotland.—*B. M.* Gravesend, Kent; Bridgnorth and Hope Bowdler, Shropshire; Inverary, Argyll; Glen Lochay and Dunkeld, Perthshire.

5. *P. scutata* Koerb. Syst. Lich. Germ. p. 60 (1855).—Thallus divided into moderate-sized lobes, more or less minutely granular or furfuraceous, the lobes undulate, crenate, crisp and bluish-grey-sorediate (rarely naked) at the margins, greyish-green when moist, pale tawny-brown when dry, beneath with a pale brown tomentum, whitish interspaces and whitish rhizinae, the nerves and rhizinae both becoming darker. Apothecia rare, small, roundish, on short ascending lobes, the margin crenate and

inflexed; spores usually 3-septate, 44–60 μ long, 4–5 μ thick.—Leight. Lich. Fl. p. 110; ed. 3, p. 104. *P. polydactyla* var. *scutata* Fr. Lich. Eur. p. 47 (1831); Cromb. Lich. Brit. p. 29. *P. canina* var. *scutata* Mudd Man. p. 83 (1861). *Lichenoides subfuscum*, *peltis horizontalibus planis* Dill. Hist. Musc. p. 205, t. 28, fig. 104 c (1741). *Lichen scutatus* Dicks. Pl. Crypt. fasc. 3, p. 18 (1793) (non Wulf.); With. Arr. ed. 3, iv. p. 71; Engl. Bot. t. 1834. *Peltidea scutata* Ach. Meth. Lich. p. 285 (1803); S. F. Gray Nat. Arr. i. p. 427; Hook. Fl. Scot. ii. p. 60 & in Sm. Engl. Fl. v. p. 215.

Exsicc. Cromb. n. 44; Johns. n. 126; Leight. n. 262 pro parte.

Somewhat similar to *P. polydactyla* var. *collina* in the form of the lobes, but characterized by the furfuraceous thallus and nearly always by the sorediate margins.

Hab. Among mosses on the trunks of trees, rarely on turf-walls in wooded districts.—*Distr.* Not frequent in S.W. and N. England, in Wales and in Scotland, and in N.E. and S.W. Ireland.—*B. M.* Tregawn, Cornwall; near Plymouth, Becky Fall, Elburton, Kingsbridge, Ivy Bridge, South Brent and near Harberton, Devon; Shanklin, I. of Wight; Up Park and near Hastings, Sussex; near Oswestry, Shropshire; near Edwinstford, Caermarthenshire; Hafod, Cardiganshire; Dolgelly and Llyn Bodlyn, Merioneth; Hoggarts Wood, Cleveland, Yorkshire; Ambleside, Westmoreland; Lamplugh and Keswick, Cumberland; New Galloway, Kirkcudbrightshire; Collinton Woods, near Edinburgh; Inverary and Barcaldine, Argyll; The Trossachs, Glen Lochay and Schiehallion, Perthshire; near Fort William, Invernesshire; Glenferness, Nairnshire; Killarney, Kerry; near Belfast, Antrim.

6. *P. scabrosa* Th. Fr. Lich. Aret. p. 45 (1860).—Thallus moderate in size, subcoriaceous, finely and minutely areolate-scabrid, roundly lobed, pale-brown or greyish, beneath whitish, subreticulate with nearly confluent nerves, pale towards the periphery, blackish towards the centre. Apothecia moderate in size, roundish, at length revolute, brownish-red or dark-brown, the margin subcrenulate; spores 3- or more-septate, 68–80 μ long, or longer, 4–5 μ thick.—Cromb. in Journ. Bot. xxiii. p. 195 (1885).

Allied to *P. rufescens* but differs in the scabrid thallus and in the long narrow spores. There is no specimen in the British herbarium.

Hab. On turf-covered walls between Corriemulzie and Inverey, Braemar, Aberdeenshire.

Thallus naked, shining above.

7. *P. polydactyla* Hoffm. Deutschl. Fl. ii. p. 106 (1795).—Thallus thinnish, smooth and shining, frequently digitate-lobed and ascending at the margins, especially when fertile, glaucous-green when moist, brownish-grey or tawny-brown when dry, covered below with a brown tomentum or reticulate with white

interspaces and wide brown veins, which are often blackish towards the centre, and with or without concolorous rhizinae. Apothecia moderate in size or small, generally somewhat oblong, reddish-brown, the margin irregularly crenate; spores thinly 3-7-septate, 60-80 μ long, 4-5 μ thick.—Mudd Man. p. 83; Cromb. Lich. Brit. p. 29 (excl. var. *scutata*); Leight. Lich. Fl. p. 109; ed. 3, p. 103 (incl. var. *hymenina*); f. *microcarpa* Cromb. Monogr. i. p. 291 (1894); var. *hymenina* Cromb. loc. cit. p. 292. *Lichenoides cinereum polydactylon* Dill. Hist. Musc. p. 207, t. 28, fig. 107 (1741) & *Lichenoides membranaceum pellucidum, peltis digitatis geminatis* p. 208, t. 28, fig. 108. *Lichen polydactylon* Neck. Meth. Musc. p. 85 (1771); With. Arr. ed. 3, iv. p. 69. *L. caninus* var. *polydactylon* Lightf. Fl. Scot. ii. p. 846 (1777); vars. γ & δ Huds. Fl. Angl. ed. 2, p. 547. *Peltidea polydactyla* Ach. Meth. Musc. p. 286 (incl. var. *pellucida*); S. F. Gray Nat. Arr. i. p. 428; Hook. Fl. Scot. ii. p. 61 & in Sm. Engl. Fl. v. p. 216; Tayl. in Mackay Fl. Hib. ii. p. 154; var. *microcarpa* Ach. Lich. Univ. p. 520 (1810). *P. hymenina* Ach. Meth. Musc. p. 284 (1803).

Esicc. Bohl. nos. 56, 71; Cromb. n. 148; Johns. nos. 27, 28; Larbal. Lich. Hb. (without number); Leight. n. 172; Mudd n. 61.

Distinguished by the smooth upper surface, the brownish tomentum below and the incurving of the narrow fertile lobules and apothecia and by the septation of the spores. The veining below due to stretching growth varies; in some specimens or parts of specimens it is less evident and the tomentum is almost continuous (var. *hymenina*), in others the process is more marked. Sometimes the tomentum is blackish towards the centre. The apothecia and thallus may be small (f. *microcarpa*) or of fairly large dimensions. When the apothecia are two together it is referred to by Dillenius as geminate (var. *pellucida* Ach.). The pycnidial spores are 7-12 μ long, 3-4 μ thick.

Hab. Among mosses and short grass in maritime and inland districts.—*Distr.* General and mostly common throughout the British Isles.—*B. M.* Guernsey; near Penzance, Bocconoc and Withiel, Cornwall; near Totnes and Dartmoor, Devon; Nutley, Hants; Danny, Sussex; High Rocks, Tunbridge Wells, Kent; Epping Forest, Essex; Gogmagog Hills, Cambridgeshire; near Worcester and near Malvern, Worcestershire; Harboro' Magna, Warwickshire; Ludlow, Bridgnorth and near Caer Caradoc, Shropshire; Aberdovey and near Dolgelly, Merioneth; Anglesea; Kildale, Cleveland, Yorkshire; Egglestone, Durham; Windermere, Westmoreland; Lamplugh, Alston and near Whitehaven, Cumberland; New Galloway, Kirkcudbrightshire; Auchindenny Wood, near Edinburgh; Kennure, near Glasgow, Lanarkshire; Inverary, Appin and Barcaldine, Argyll; Glen Lochay, Glen Fender, Killin and Ben Lawers, Perthshire; Durris, Kincardineshire; Corriemulzie, Braemar, Aberdeenshire; Lochaber, Invernessshire; near Forres, Elginshire; Applecross, Rossshire; Cromaglown, Killarney, Kerry; Kylemore, Galway; near Westport, Mayo.

Form *collina* Nyl. Lich. Scand. p. 90 (1861).—Characterized by the smaller lobes, which are crisp at the margins (cf. n. 5).—

Cromb. in Journ. Bot. xiv. p. 360 (1876). Var. *collina* Leight. Lich. Fl. ed. 3, p. 104 (1879). *Lichen collinus* Ach. Lich. Suec. Prodr. p. 162 (1798).

Exsicc. Johns. n. 309.

Hab. On decayed mosses on the ground and on old walls in upland districts.—*Distr.* Rare in N. England, among the Grampians, Scotland, and S.W. Ireland.—*B. M.* Cumberland; Glen Lochay, Killin, Perthshire; Glen Cluny, Braemar, Aberdeenshire; Killarney, Kerry.

Var. *lophyra* Nyl. Lich. Scand. p. 90 (1861).—Thallus lobes rounded. Apothecia small, roundish, oblong or transversely oblong. Cromb. Lich. Brit. p. 29. *Peltidea horizontalis* var. *lophyra* Ach. Lich. Univ. p. 516 (1810).

Acharius' description of the lobes as being elevated and crisp at the margins might rather refer to f. *collina*. Acharius cites as synonymous Withering's *Lichen rufescens* and *L. rufus*, which are quoted under *P. rufescens*. There is no specimen of this variety in the British herbarium.

Hab. On decayed mosses on boulders at Finlarig, Killin, Perthshire.

8. *P. horizontalis* Hoffm. Deutschl. Fl. ii. p. 107 (1795).—Thallus rather large and spreading, smooth and somewhat shining, sometimes with frequent dents or hollows, the lobes sinuate and slightly undulate at the margins, dull or brownish-green when moist, pale-glaucous or brown when dry, beneath brownish at the circumference, becoming brownish-black towards the centre, reticulate with white interstices, and with few scattered dark rhizine. Apothecia usually abundant and large, round or elliptical, plane, reddish-brown, becoming darker, the margin suberenulate; spores 6–8 in the ascus, rather broadly fusiform, 3-septate, 30–42 μ long, 6–7 μ thick.—Mudd Man. p. 84; Cromb. Lich. Brit. p. 29; Leight. Lich. Fl. p. 110; ed. 3, p. 104. *Lichenoides subfuscum*, *peltis horizontalibus planis* Dill. Hist. Musc. p. 205, t. 28, fig. 104 A, B (1741). *Lichen horizontalis* L. Mant. p. 132 (1767); Huds. Fl. Angl. p. 543; Lightf. Fl. Scot. ii. p. 849; With. Arr. ed. 3, iv. p. 72; Engl. Bot. t. 888. *Peltidea horizontalis* Ach. Meth. Lich. p. 288 (1803); S. F. Gray Nat. Arr. i. p. 427; Hook. Fl. Scot. ii. p. 60 & in Sm. Engl. Fl. v. p. 215; Tayl. in Mackay Fl. Hib. ii. p. 153.

Exsicc. Bohl. n. 37; Cromb. n. 45; Dicks. Hort. Sicc. fasc. xvi. n. 24; Johns. n. 228; Larb. Lich. Hb. n. 249; Leight. n. 108; Mudd n. 62.

Characterized by the large thallus and the round apothecia which remain horizontal, and also by the size and septation of the spores.

Hab. Among mosses and rocks, trees and walls, mostly in upland districts.—*Distr.* General though not common in hilly districts of Great Britain and Ireland.—*B. M.* Pentire, Cornwall; Dartmoor, Ilsham Walk and near Totnes, Devon; New Forest, Hants; Eridge Rocks, Ardingly and near Henfield, Sussex; Betchworth, Surrey;

Leigh Woods near Bristol, Gloucestershire; Bardon Hill and Charnwood Forest, Leicestershire; Malvern, Worcestershire; near Simmond's Yat, Monmouthshire; Aberdovey and Barmouth, Merioneth; Bettws-y-Coed, Carnarvonshire; Oswestry and Whitcliff Rocks, Shropshire; Stogdale, Cleveland, Yorkshire; near Kendal, Westmoreland; Keswick, Cumberland; The Cheviots, Northumberland; New Galloway, Kirkeudbrightshire; Swanston near Edinburgh; Bowling Bay, Dumbartonshire; Dunoon and Barcaldine, Argyll; Loch Katrine, near Callander, Kenmore, Craighall and Dunkeld, Perthshire; Sidlaw Hills, Forfarshire; Craig Cluny, Braemar, Aberdeenshire; Lochaber, Invernesshire; near Forres, Elginshire; Killarney, Kerry; Louisburgh, Mayo.

Var. *muscorum* Schleich. ex Schær. Enum. p. 21 (1850).—Thallus lobes and apothecia constantly smaller. Cromb. in Journ. Bot. xiv. p. 360 (1876); Leight. Lich. Fl. ed. 3, p. 105; f. *muscorum* Cromb. Monogr. i. p. 294 (1894).

Ersicc. Johns. n. 229.

Hab. Among mosses at the roots of old trees in upland districts.—*Distr.* Rare in S.W. and N. England, S. Grampians, Scotland, and N.W. Ireland.—*B. M.* Paignton, Devon; Formby, Lancashire (on sandhills); near Whitehaven, Cumberland; Glen Lochay, Perthshire; Killarney, Kerry; Kylemore, Connemara, Galway.

§ ii. PELTIDEA Wain. Lich. Brés. i. p. 179 (1890).

Algal cells bright-green (*Dactylococcus*); cephalodia present.

9. *P. aphthosa* Willd. Fl. Berol. p. 347 (1787).—Thallus broadly membranaceous, thin or somewhat thickish, smooth and shining above, bright-green when moist, dull-brownish when dry, dotted with darker-coloured tubercle-like epigenous cephalodia. Apothecia roundish, moderate in size or rather large, about 8 mm. in diameter, adnate on the ends of rather narrow thallus segments, reddish-brown, slightly lacerate at the edges; spores fusiform, 3–7-septate, colourless or pale-brown, 50–90 μ long, 5–6 μ thick.—Mudd Man. p. 81; Leight. Lich. Fl. p. 107; ed. 3, p. 101. *Lichenoides digitatum lætevirens, verrucis nigris notatum* Dill. Hist. Musc. p. 207, t. 28, fig. 106 (1741). *Lichen aphthosus* L. Sp. Pl. p. 1148 (1753); Lightf. Fl. Scot. ii. p. 847; Huds. Fl. Angl. ed. 2, p. 547; With. Arr. ed. 3, iv. p. 70; Engl. Bot. t. 1119. *Peltidea aphthosa* Ach. Meth. p. 287 (1803); S. F. Gray Nat. Arr. i. p. 428; Hook. Fl. Scot. ii. p. 60 & in Sm. Engl. Fl. v. p. 215; Tayl. in Mackay Fl. Hib. ii. p. 153; Cromb. Lich. Brit. p. 28 & Monogr. i. p. 278.

Ersicc. Croall n. 491; Cromb. n. 147; Johns. n. 306; Leight. n. 321.

Chiefly distinguished by the presence of cephalodia, as small dark tubercles dotted on the surface of the thallus. Supposed to resemble spots caused by "thrush," hence the name *aphthosa*. It is more generally fruitful in northern localities.

Hab. Among mosses on rocks and boulders, as also on turf-walls

in moist shaded upland localities.—*Distr.* Rather rare in W. and N. England and S. Scotland; more plentiful in the Grampians; rare in Ireland.—*B. M.* Stout's Wood, Gloucestershire; Craigforda, Herefordshire; Llyn Bodlyn, Merioneth; Llanberris, Carnarvonshire; Buxton, Derbyshire; Walla Crag, Cumberland; Teesdale, Durham; The Cheviots, Northumberland; Falls of Clyde, Lanarkshire; near Inverary and Barcaldine, Argyll; Ben Lawers, Craig Calliach, Glen Lochay, Killin, Blair Athole and Den of Reichip, Perthshire; Clova and Sidlaw Hills, Forfarshire; Craig Cluny, Invercauld, Blair Athole and Craig Coinnoch, Braemar, Aberdeenshire; Glen Lochy and Loch Linnhe, Invernesshire; near Belfast, Antrim; Connemara, Galway.

Var. *leucophlebia* Nyl. Syn. Lich. p. 323 (1860).—Thallus usually smaller, more opaque and whitish beneath, with distinct whitish nerves. Apothecia rare (not seen in Britain); spores 3-septate, 52–66 μ long, 4–6 μ thick. *Peltidea aphthosa* var. *leucophlebia* Nyl. in Not. Sällsk. Faun. & Fl. Fenn. Förh. v. p. 117 (1866); Cromb. Monogr. i. p. 278.

Exsicc. Johns. n. 83; Mudd n. 58.

Hab. Among mosses on shady rocks or on the ground in upland districts.—*Distr.* Rare in S.W. and N. England, in S. Scotland and in the Highlands, not seen from Ireland.—*B. M.* Dartmoor, Devon; White Force, and on moors, Teesdale, Durham; near Kendal, Westmoreland; New Galloway, Kirkeudbrightshire; Dalmahoy Hill, near Edinburgh; near Inverary, Invernesshire; the Ochills, Blair Athole, Rannoch and The Trossachs, Perthshire.

10. *P. venosa* Hoffm. Pl. Lich. i. p. 31, t. 6, fig. 2 (1790).—Thallus rather small, up to 2 cm. across, the fronds ascending, roundish, entire or somewhat lobate, smooth and shining, bright-green when moist, greyish or greyish-brown or fawn-coloured when dry, beneath white with dark-brown branching nerves radiating from the base. Cephalodia somewhat globose, glaucous-green, becoming dark-coloured, hypogenous, seated on the brown tomentose nerves. Apothecia roundish, moderate in size or rather larger, up to about 5 mm. in diameter, plane, adnate, dark-brown or blackish, the proper margin somewhat crenate, evanescent; spores 6 to 8 in the ascus, fusiform, 3-septate, colourless or pale-brown, 30–45 μ long, 7–8 μ thick.—Mudd Man. p. 84, t. 1, fig. 23; Leight. Lich. Fl. p. 111; ed. 3, p. 105. *Lichenoides parvum virescens*, *peltis nigricantibus planis* L. Hist. Musc. p. 208, t. 28, f. 109 (1741). *Lichen venosus* L. Sp. Pl. p. 1148 (1753); Lightf. Fl. Scot. ii. p. 844; Huds. Fl. Angl. ed. 2, p. 546; With. Arr. ed. 3, iv. p. 69; Engl. Bot. t. 887. *Peltidea venosa* Ach. Meth. Lich. p. 282 (1803); S. F. Gray Nat. Arr. i. p. 427; Hook. Fl. Scot. ii. p. 59 & in Sm. Engl. Fl. v. p. 215; Cromb. Lich. Brit. p. 28 & Monogr. i. p. 279.

Exsicc. Cromb. n. 42.

Differs from the preceding species in the much smaller size of the thallus and in the hypogenous cephalodia.

Hab. On turf walls and on the ground in fissures of rocks in upland and mountainous situations.—*Distr.* Rare in the hilly regions of W. England, Wales, N. Ireland and S. Scotland, more frequent in the Grampians.—*B. M.* Whiteliff Rocks, near Ludlow, Shropshire; Glyder Fawr, Carnarvonshire; Kirkmichael and near Moffat, Dumfriesshire; Habbies How, Pentland Hills near Edinburgh; Menstrie Glen, near Stirling; Stronachlachar, Finlarig, Killin, Ben Lawers, Glen Lyon and Pass of Killiecrankie, Perthshire; Reeky Linn and Clova, Forfarshire; Belfast, Antrim.

33. **NEPHROMIUM** Nyl. in *Mém. Soc. Sci. Nat. Cherb.* v. p. 101 (1857) & *Syn.* i. p. 318 (1860). (Pl. 33.)

Thallus foliose, horizontal, corticate on both surfaces, the under surface sometimes tomentose. Algal cells *Nostoc*. Apothecia marginal, roundish, adfixed on the lower surface of the thallus, finally directed upwards by the turning back of the fertile lobes, without a thalline margin; paraphyses simple, septate; spores fusiform-oblong, usually brownish, 1-3-septate. Spermogones with septate sterigmata and small straight somewhat dumbbell-shaped pleurogenous spermatia.

The associated genus *Nephroma* which contains bright-green gonidia is not represented in the British Isles; the species are mostly found in cold regions.

1. **N. resupinatum** Dalle Torre & Sarnth. *Die Flechten Tirol, &c.* p. 80 (1902).—Thallus suborbicular, lobate or laciniatolobate, smooth or thinly tomentose, dull-glaucous or brown, paler beneath, densely tomentose and dotted with white granules (the medulla white, K -). Apothecia moderate in size, reddish-brown, unequal and crenulate at the margins; spores colourless or brownish, 20-24 μ long, 6-7 μ thick.—*N. tomentosum* Nyl. in *Mém. Soc. Sci. Nat. Cherb.* v. p. 101 (1857); Carroll in *Journ. Bot.* iii. p. 288 (1865); Cromb. *Lich. Brit.* p. 28; Leight. *Lich. Fl.* p. 105 (incl. var. *rameum*; ed. 3, p. 99; subsp. *rameum* Cromb. *Monogr.* i. p. 283? (non Schær.). *Lichen resupinatus* L. *Sp. Pl.* p. 1148 (1753) fide Wainio in *Med. Soc. Faun. & Fl. Fenn.* xiv. p. 6 (1886). *L. tomentosus* Swartz *Prodr. Fl. Ind.* p. 147 (1788). *Peltigera tomentosa* Hoffm. *Deutschl. Fl.* ii. p. 108 (1795). *Nephroma resupinata* Ach. *Lich. Univ.* p. 522 (1810); S. F. Gray *Nat. Arr.* i. p. 426; Hook. *Fl. Scot.* ii. p. 61 & in *Sm. Engl. Fl.* v. p. 216; Tayl. in *Mackay Fl. Hib.* ii. p. 154.

A specimen from Robt. Brown marked subsp. *rameum* agrees with the species, and is from the same locality. Both species and "sub-species" are sprinkled with white dots (pseudocypbellæ) on the under surface. The subspecies differs, however, in the longer narrower lobes and somewhat thinner texture of the thallus. There does not seem to be any authentic record of its occurrence in the British Isles.

Hab. On the trunks of old trees in rocky upland situations.—*B. M.* Craig Cluny, Braemar, Aberdeenshire.

2. *N. lævigatum* Nyl. in Mém. Soc. Sci. Nat. Cherb. v. p. 101 (1857).—Thallus suborbicular, smooth above, chestnut- or dull-brown, the lobes sinuate-crenate at the margins, beneath glabrous and slightly wrinkled, pale (medulla white, K —). Apothecia small or moderate, reddish-brown, crenulate, unequal at the margin, depressed and granulate at the back; spores 20–24 μ long, 6–7 μ thick.—Cromb. Lich. Brit. p. 28; Leight. Lich. Fl. p. 104; ed. 3, p. 99. *Lichenoides saxatile fuscum*, *peltis in aversa foliorum superficie locatis* Dill. in Ray Syn. ed. 3, p. 77, n. 91 (1724). *Lichenoides fuscum*, *peltis posticis ferrugineis* Dill. Hist. Musc. p. 206, t. 28, fig. 105 A (1741). *Lichen resupinatus* Huds. Fl. Angl. p. 453 (1762)? Light. Fl. Scot. ii. p. 843? With. Arr. ed. 3, iv. p. 71? *Nephroma lævigatum* Ach. Syn. Lich. p. 242 (1814); Mudd Man. p. 81?

Evidently a rare lichen everywhere; there is no specimen in the British herbarium. The original habitat as given by Acharius is "in mountainous places," and it is extremely doubtful to which species Dillenius and others quoted above refer, though Crombie has determined the specimens in the Dillenian herbarium collected in Sussex and Shropshire as *N. lævigatum*.

Hab. On the trunks of old trees and on mossy boulders in mountainous places.

Var. *subtomentellum* Nyl. in Not. Sällsk. Faun. & Fl. Fenn. Förh. v. p. 116 (1866).—Thallus dark-brown, beneath wrinkled, obsolete and slightly tomentose, brown (medulla white, K —). Apothecia moderate in size, dark-red, wrinkled at the back or thinly areolate-granular; spores similar to the species.—Leight. Lich. Fl. ed. 3, p. 99.

Æsicc. Cromb. n. 149.

Resembling the species in the wrinkled backs of the apothecia. The thallus is generally darker and there are vestiges of a tomentum on the under surface. According to Crombie the spermatia are 2.5 μ long and 1 μ thick, those of the species being 3.5–4 μ long.

Hab. On the trunks of old trees in mountainous regions.—*Distr.* Local and scarce in N. Wales and among the S. Grampians, Scotland.—*B. M.* Head of Loch Awe, Argyll; Glen Lochay, Killin, Perthshire.

Var. *parile* Nyl. Syn. Lich. i. p. 320 (1860).—Thallus lobes more or less crisp and bluish-grey sorediate at the margins, beneath naked, wrinkled, pale or sometimes dark-coloured. Apothecia rare; spores as in the species.—Cromb. Lich. Brit. p. 28; Leight. Lich. Fl. p. 105; ed. 3, p. 99. *N. parile* Nyl. in Flora lxviii. p. 47 (1885); Cromb. in Grevillea xv. p. 77 (1887) & Monogr. i. p. 284; Dill. l. c. t. 28, fig. 105 B, C. *Lichen parilis* Ach. Lich. Suec. Prodr. p. 164 (1798); Engl. Bot. t. 2360. *Nephroma parile* Ach. Lich. Univ. p. 522 (1810) pro parte; S. F. Gray Nat. Arr. i. p. 427; Hook. in Sm. Engl. Fl. v. p. 216. *N. lævigatum* var. *parile* Mudd Man. p. 81 (1861).

Æsicc. Cromb. n. 41.

Though sometimes given specific rank, evidently only a sorediate though well-marked variety of *N. lævigatum*. Bitter (Jahrb. Wiss. Bot. xxxvi. p. 454 (1901)) has recorded the occurrence of both species and variety in close proximity; the former on the branches of a tree bore apothecia and no soredia, while var. *parile*, abundantly sorediate, grew in a more damp situation among moss and grass on the ground. The soredia are mostly marginal, though sometimes scattered over the surface. They become dark in colour in older plants. None of the British specimens are fertile.

Hab. On mossy rocks and boulders and about the roots of old trees in wooded districts.—*Distr.* Rather rare in S. and W. England, Scotland and Ireland.—*B. M.* Ivy Bridge, Hennock, Bovey Tracey, Totnes, and near Devonport, Devon; Cound Moor and near Oswestry, Shropshire; Dolgelly and Twll Du, Merioneth; Windermere, Westmoreland; Braithwaite, Cumberland; Pentland Hills, near Edinburgh; Barcaldine, Argyll; Craig Cailliach, Glen Lochay and Pass of Killiecrankie, Perthshire; Craig Cluny, Braemar, Aberdeenshire; Caledonian Canal, Invernesshire; near Dunkerron, Kerry.

3. *N. lusitanicum* Nyl. in Flora liii. p. 38 (1870).—Thallus suborbicular, lobate, smooth and somewhat shining, the lobes rounded, crenate, crisp or undulate at the margins, chestnut- or dark-brown, beneath glabrous, somewhat wrinkled, pale (medulla yellow, K + purplish). Apothecia varying in size up to 1 cm. across, sometimes confluent, reddish-brown, incurved, sometimes crenate at the edges, somewhat depressed and minutely areolate at the back; spores 20–24 μ long, 6–7 μ thick.—Leight. in Ann. Mag. Nat. Hist. ser. 4, v. p. 41 (1870) & Lich. Fl. p. 106; ed. 3, p. 100. *N. lævigatum* f. *lusitanicum* Cromb. Lich. Brit. p. 28 (1870). *Lichen resupinatus* Sm. Engl. Bot. t. 305 (1796) (non L.); var. 2 With. Arr. ed. 3, iv. p. 71 (1796). *Nephroma lusitanicum* Schær. Enum. p. 323 (1850).

Essicc. Croall n. 99; Dicks. Hort. Sicc. fasc. xvi. n. 23; Johns. n. 226; Larb. Lich. Hb. n. 288; Leight. n. 23.

Distinguished from other species by the smoother, more shining surface and by the usually yellow medulla.

Hab. On the trunks of old trees, and on mossy rocks and boulders in wooded districts.—*Dist.* General and not uncommon throughout the British Isles.—*B. M.* Islands of Bréhon and Guernsey; Scilly Islands; near Respring, Penzance, Liskeard and St. Austell, Cornwall; Okehampton, Torquay, Lustleigh Cleeve and near Totnes, Devon; New Forest, Hants; Eridge Rocks, Pett Beach and Ardingly, Sussex; Romney Marsh and Lydd, Kent; Hatfield Forest, Essex; Malvern, Worcestershire; near Oswestry, Shropshire; Barmouth, Dolgelly and Aberdovey, Merioneth; Capel Curig and Bettws-y-Coed, Carnarvonshire; Baysdale, Cleveland, Yorkshire; Egglestone, Durham; Mardale, Westmoreland; Keswick and Bassenthwaite Lake, Cumberland; New Galloway, Kirkeudbrightshire; near Moffat, Dumfriesshire; Dumbarton Castle, Dumbartonshire; Barcaldine, Inverary and Head of Loch Awe, Argyll; The Trossachs, Glen Lochay and Pass of Leny, Perthshire; Reeky Linn, Forfarshire; near Beirn, Kincardineshire; Craig Coinnoch and Craig Cluny, Braemar, Aberdeenshire; Cawdor

Woods, Nairnshire; Glen Nevis, Loch Linnhe, Fort George and Falls of Foyers, Invernessshire; Applecross, Rossshire; Luggelaw, Wicklow; Killarney, Kerry; Derryclare, Connemara, Galway; Fairhead, Antrim.

Form **panniforme** Cromb. in *Grevillea* xv. p. 77 (1877) & *Monogr.* i. p. 286.—Thallus of small deeply cut closely imbricate lobes, dark in colour above and below.

Hab. Similar to the species.—*Distr.* Rare in S.W. England and W. Highlands of Scotland.—*B. M.* Near Penzance, Cornwall; Barcaldine, Argyll; Glen Lochay, Perthshire; Loch Linnhe, Invernessshire.

Var. **hibernicum** Nyl. ex Leight. *Lich. Fl.* ed. 3, p. 100 (1879).—Differs from the species in the white medulla (K + purple) and in the smooth back of the apothecia.

Hab. Similar to the species.—*Distr.* Rare in W. England, W. Highlands of Scotland and N.W. Ireland.—*B. M.* Near Launceston, Cornwall; near Walkingham, Devon; near Douglas, I. of Man; Barcaldine, Argyll; Doughreagh, Connemara, Galway.

34. **SOLORINA** Ach. *Lich. Univ.* p. 27 (1810). (Pl. 34.)

Thallus foliose, fragile, the upper surface corticate, the under surface partly nervose and rhizinose. Algal cells bright-green, *Dactylococcus*, rarely blue-green, *Nostoc*. Apothecia superficial, or urceolate and sunk in the upper surface of the thallus, irregularly scattered, reddish- or dark-brown, without a thalline margin; paraphyses thickish, septate; spores 2 to 8 in the ascus, fusiform-oblong or ellipsoid, 1-sepate, brownish or reddish-brown. Spermogones unknown.

The cephalodia in this genus occur as groups of *Nostoc* cells with surrounding hyphæ, embedded in the medulla, on the lower surface or in squamules. The apothecia are developed before the cortex covering them is thrown off, hence the term "veiled apothecia."

1. **S. crocea** Ach. *Lich. Univ.* p. 149 (1810).—Thallus orbicular, membranaceous, thickish, appressed, smooth or roughish on the surface, lobed and crispate, dark-green when moist, reddish or brown when dry, the medulla and lower surface deep orange or saffron-coloured, with subreticulate nerves and rhizinae. Apothecia moderate in size or rather large, up to 1 cm. in diameter, rather tumid, dark-reddish-brown; paraphyses stoutish, septate; spores 6–8 in the ascus, oblong or somewhat fusiform, 1-septate, 35–45 μ long, 10–12 μ thick.—*S. F. Gray Nat. Arr.* i. p. 429; *Hook. Fl. Scot.* ii. p. 36 & in *Sm. Engl. Fl.* v. p. 214; *Mudd Man.* p. 85; *Cromb. Lich. Brit.* p. 29; *Leight. Lich. Fl.* p. 112; ed. 3, p. 106. *Lichenoides subtus croceum*, *peltis appressis* Dill. *Hist. Musc.* p. 221, t. 30, fig. 120 (1741). *Lichen croceus* L. *Sp. Pl.* p. 1149 (1753); *Lightf. Fl. Scot.* ii. p. 856; *Huds. Fl. Angl.* ed. 2, p. 548; *With. Arr.* ed. 3, iv. p. 68; *Engl. Bot.* t. 498.

Exsicc. Croall n. 489; Cromb. n. 46; Dicks. Dried Plants n. 50.

Easily distinguished by the hyphæ of the medulla which are encrusted with saffron-coloured crystals (K + violet).

There are two types of algæ which function as gonidia: an upper bright-green layer of *Dactylococcus* cells which rises into the cortex in tooth-like projections or pyramids, beneath this a narrow band of loose hyphæ, and lower still an interrupted stratum of *Nostoc* cells. Hue (Mém. Soc. Sci. Nat. Cherb. xxxviii. p. 10 (1911)) states that the first gonidial association is with the *Dactylococcus*, that alga alone being present at the extremity of the young lobes. The *Nostoc* layer is subdiscontinuous, and is rarely present below the apothecium. It replaces in *S. crocea* the endogenous scattered cephalodia of the other species.

Hab. On the ground and in fissures of rocks and boulders in alpine places.—*Distr.* Rather local and scarce on the tops of Irish and Scottish mountains; plentiful on Ben Lawers.—*B. M.* Ben Lomond, Stirlingshire; Ben Chalum, Ben More, Benteskerney and Ben Lawers, Perthshire; Clova Mts., Forfarshire; Lochnagar, Morrone, Ben-naboard and Ben Macdhuì, Aberdeenshire; Ben Nevis, Invernesshire; Brandon Mts., Kerry.

2. *S. saccata* Ach. Lich. Univ. p. 149 (1810).—Thallus wide-spreading, orbicular, submembranaceous, rather smooth, occasionally white-pruinose, the lobes rounded or slightly crenate, lobate, bright-green when moist, reddish-brown when dry, beneath whitish, tomentose, with scattered long rhizinae. Apothecia roundish, dark-brown, scattered, deeply sunk as if urceolate in the thallus; paraphyses stoutish, septate; spores 4 in the ascus, ellipsoid or oblong, reddish-brown, 1-septate, 32–50 μ long, 18–27 μ thick.—*S. F.* Gray Nat. Arr. i. p. 429; Hook. Fl. Scot. ii. p. 36 & in Sm. Engl. Fl. v. p. 214; Tayl. in Mackay Fl. Hib. ii. p. 153; Mudd Man. p. 85, t. 1, fig. 24; Cromb. Lich. Brit. p. 29; Leight. Lich. Fl. p. 112; ed. 3, p. 106. *Lichenoides lichenis facie, peltis acetabulis immersis* Dill. Hist. Musc. p. 221, t. 30, fig. 121 (1741). *Lichen saccatus* L. Fl. Suec. p. 419, n. 1102 (1755); Lightf. Fl. Scot. ii. p. 855; Huds. Fl. Angl. ii. p. 548; Engl. Bot. t. 288; With. Arr. ed. 3, iv. p. 67.

Exsicc. Bohl. n. 4; Croall n. 391; Cromb. n. 47; Johns. n. 225; Leight. n. 111; Mudd n. 63.

Easily known by the sunk apothecia with the rather wide-spreading thallus. Cephalodia containing *Nostoc* cells are enclosed in the lower medulla, sometimes causing a slight protuberance on the under surface.

Hab. On the ground on decayed mosses, in crevices of rocks, rarely on the mortar of old walls in moist shady places in upland and subalpine districts.—*Distr.* General but not common in W. and N. England, in N. Wales and N. Scotland, rare in S.W. and N. Ireland. *B. M.* Cheddar Cliffs, Somersetshire; Apes Tor, Staffordshire; Whiteliff Rocks near Ludlow, Shropshire; Cwm Bychan, Merioneth; Garn, Derbyshire; Island of Anglesea; near Buxton, Derbyshire; Ingleborough, Whernside and Bolton Woods, Yorkshire;

Kentmere, Westmoreland; Alston, Cumberland; Teesdale, Durham; Loch Awe and Island of Lismore, Argyll; Killin, Finlarig, Ben Lawers, Craig Tulloch and Blair Athole, Perthshire; Canlochan Glen, Forfarshire; Craig Cluny, Carr Rocks and Morrone, Braemar, Aberdeenshire; Bandon Hill, Kerry; Ben Bulbin, Sligo; Colin Glen near Belfast, Antrim.

3. *S. spongiosa* Carroll in Journ. Bot. iii. p. 288 (1865).—Thallus fragile, suborbicular, of small suberect squamules, minutely crenate, becoming partly granular-crustaceous, dark-green when moist, brown when dry. Apothecia round, sunk in the thallus or becoming plane, dark-reddish-brown, surrounded by squamules or shreds of the thallus; spores 4 in the ascus, ellipsoid, brownish, 30–50 μ long, 18–23 μ thick.—Cromb. Lich. Brit. p. 30. *S. limbata* Mudd Man. p. 85 (1861); Leight. Lich. Fl. p. 113; ed. 3, p. 107. *Lichen spongiosus* Sm. Engl. Bot. t. 1374 (1804). *Collema spongiosum* Ach. Lich. Univ. p. 661 (1810); Hook. in Sm. Engl. Bot. v. p. 214; Tayl. in Mackay Fl. Hib. ii. p. 111. *Polychidium spongiosum* S. F. Gray Nat. Arr. i. p. 402 (1821). *Lecanora limbata* Sommerf. Suppl. Fl. Lapp. p. 105, t. 3 (1826).

Exsicc. Johns. n. 307.

Differs from the preceding in the much less developed thallus, and in the less deeply urceolate apothecia. The cephalodia of this species are in the form of minute green squamules, often attached to the apothecium.

Hab. On the ground among rocks and on turf walls in upland districts.—*Distr.* Rare in N. England and N.E. Ireland, more plentiful among the Grampians.—*B. M.* Buxton Dale, Derbyshire; Wherside and Guisboro' Moor, Cleveland, Yorkshire; Teesdale, Durham; near Kendal, Westmoreland; Finlarig, Killin, near Tummel Bridge and Craig Tulloch, Perthshire; Glenariff, Antrim.

4. *S. bispora* Nyl. Syn. i. p. 331, t. 8, fig. 42 (1860).—Thallus orbicular, small, thickish, fragile, wrinkled, lobate, somewhat crenate, pale-greyish or brownish-green, white-pruinose, whitish beneath. Apothecia round, sunk in the thallus, small or moderate in size, brown or dark-brown, bordered generally by the broken thallus; spores 2 in the ascus, ellipsoid, reddish-brown, 65–88 μ long, 33–42 μ thick.—Stirton in Grevillea ii. p. 60 (1873); Leight. Lich. Fl. ed. 3, p. 107.

Differs from the preceding in the white-pruinose thallus, the 2-spored ascus, and in the larger spores. Groups of *Nostoc* form cephalodia on the under surface of the thallus.

Hab. On the ground in alpine districts.—*B. M.* Ben Lawers.

ORDER IX. STICTACEÆ.

Thallus foliose, horizontal or somewhat ascending, corticate on both surfaces, beneath more or less tomentose. Cyphellæ (minute cup-like hollows) or pseudo-cyphellæ (openings in the cortex) constant on the under surface in *Sticta*. Cephalodia present in certain species. Algal cells blue-green (*Nostoc*) or bright-green (Palmellaceæ). Apothecia marginal or scattered, scutellate and shortly stalked or sessile; paraphyses simple, septate; spores elongate, 2-pluri-septate, colourless or brown. Spermogones with septate sterigmata and short straight pleurogenous spermatia.

Resembling Peltigeraceæ in that both types of gonidia, blue-green and bright-green, are represented, and in the frequent presence of cephalodia in those species with bright-green algal cells. Cyphellæ are small cup-like empty pits with a distinct rim that occur amongst the tomentum of the lower surface; pseudo-cyphellæ are less definitely marginate and are filled with loose hyphæ.

Two genera are represented in Great Britain:—

- Thallus with cyphellæ or pseudo-cyphellæ on the under surface 35. *Sticta*.
Thallus without these structures 36. *Lobaria*.

35. **STICTA** Schreb. L. Gen. Pl. ii. p. 768 (1791). (Pl. 35.)

Thallus foliose, variously lobate or lacinate, horizontal, sometimes slightly ascending or stalked and upright, cortex on both surfaces plectenchymatous; beneath cyphellate or pseudo-cyphellate and pale- or dark-brown-tomentose, with single or fasciculate hyphæ. Algal cells *Nostoc* or Palmellaceæ. Cephalodia rarely present. Apothecia marginal or scattered, with or without a thalline margin; paraphyses simple, septate; asci 8-spored, the spores elongate, fusiform or acicular, 1-7-septate. Spermogones with septate sterigmata and pleurogenous spermatia, short and slightly thickened at each end.

The genus is distinguished among foliose lichens by the minute round openings in the tomentose under-surface due to the presence of cyphellæ or pseudocyphellæ.

It is divided into two sections, distinguished by the character of the alge:—

- Thallus with blue-green alge (*Nostoc*)..... i. **STICTINA**.
Thallus with bright-green alge (Palmellaceæ) ii. **EUSTICTA**.

§ i. **STICTINA** Hue in Nouv. Arch. Mus. Hist. Nat. Paris, sér. 4, iii. p. 81 (1901). *Stictina* Nyl. Syn. Lich. p. 333 (1860); Cromb. Monogr. i. p. 265; Leight. Lich. Fl. p. 114.

Algal cells blue-green.

Thallus with cyphellæ on the under surface.

1. *S. fuliginosa* Ach. Meth. Lich. p. 280 (1803).—Thallus usually rather small, about 3–5 cm. in diameter to 10 cm. or more, submonophyllous, often several lobes from one centre, somewhat rigid, smoothish or somewhat wrinkled, light or dark-brown, the lobes broadening outwards, rounded, usually thickly sprinkled with dark-brown coralloid isidia, beneath pale-brown, tomentose, with whitish or pale cyphellæ. Apothecia small, scattered, very rare, plane or slightly convex reddish-brown, with a crenate thalline margin; spores fusiform, colourless, 1–3-septate, 27–40 μ long, 7–8 μ thick.—S. F. Gray Nat. Arr. i. p. 431; Hook. Fl. Scot. ii. p. 59 & in Sm. Engl. Fl. v. p. 206; Tayl. in Mackay Fl. Hib. ii. p. 152; Mudd Man. p. 88. *Lichenoides fuliginosum et pulverulentum, scutellis rubiginosis* Dill. Hist. Musc. p. 198, t. 26, fig. 100 A (1741). *Lichen fuliginosus* Dicks. Pl. Crypt. fasc. i. p. 13 (1785); With. Arr. ed. 3, iv. p. 70; Engl. Bot. t. 1103. *Stictina fuliginosa* Nyl. Syn. i. p. 347 (1860); Cromb. Lich. Brit. p. 30 & Monogr. i. p. 267; Leight. Lich. Fl. p. 116; ed. 3, p. 109.

Exsicc. Cromb. n. 133; Johns. n. 24; Larb. Cæsar. n. 61; Leight. n. 142.

An easily distinguished species from the dull-brown colour and the sprinkling of still darker isidia. These evidently function as the principal organs of propagation, apothecia being very rare.

Hab. On mossy trunks of old trees and on rocks in moist shady places.—*Distr.* General and fairly common, especially in western districts.—*B. M.* Jersey; Jerbourg, Guernsey; Annet Island, Scilly; Bocconoc, Camelford, Withiel and near Penzance, Cornwall; Walkhampton, Ivy Bridge, near Lustleigh, Moreton, Dewerstone Rocks, Becky Fall, near Ashburton and River Teign, Devon; I. of Wight; Lydd, Kent; Malvern, Worcestershire; Whitcliff Rocks, near Ludlow, Shropshire; Hafod, Cardiganshire; Dolgelly, Aberdovey and Cwm Bychan, Merioneth; Bettws-y-Coed, Trefriw, Capel Curig, Aberglaslyn, and near Bangor, Carnarvon; Anglesea; Windermere and near Rydal, Westmoreland; Keswick and Ennerdale, Cumberland; New Galloway, Kirkcudbrightshire; Falls of Clyde, Lanarkshire; Bowling Bay, Dumbartonshire; Inverary, Appin and head of Loch Awe, Argyll; Pass of Leny, Glen Lochay and Glen Lyon, Perthshire; Craig Cluny, Braemar, Aberdeenshire; Applecross, Rossshire; Kilmarnock, Kerry; near Kylemore, Galway; Clare Island, Mayo.

2. *S. sylvatica* Ach. Meth. Lich. p. 281 (1803).—Thallus large and spreading, rather rigid, sometimes shining and with irregular, slightly indicated pits, tawny- or dull-brown and more or less isidiose, the isidia dark-coloured, more developed along the lines of the shallow depressions, the lobes deeply cut, lacinate, variously rounded or crenulate, bifid or trifid towards the extremities, the ends obtuse; beneath tomentose, dark-brown, paler at the circumference, dotted with pale cyphellæ. “Apothecia

small or moderate in size, scattered, plane or slightly convex, the margin naked, spores as in *S. fuliginosa*.—S. F. Gray Nat. Arr. i. p. 431; Hook. Fl. Scot. ii. p. 59 & in Sm. Engl. Fl. v. p. 207; Tayl. in Mackay Fl. Hib. ii. p. 152; Mudd Man. p. 87. *Lichenoides polyschides villosum et scabrum, peltis parvis* Dill. Hist. Musc. p. 199, t. 27, fig. 101 (1741). *Lichen sylvaticus* Huds. Fl. Angl. p. 453 (1762); Lightf. Fl. Scot. p. 848; With. Arr. ed. 3, iv. p. 71; Engl. Bot. t. 2298. *Stictina sylvatica* Nyl. Syn. Lich. i. p. 348 (1860); Cromb. Lich. Brit. p. 30 & Monogr. i. p. 268; Leight. Lich. Fl. p. 116; ed. 3, p. 109.

Exsicc. Croall n. 487; Cromb. n. 134; Larb. Lich. Hib. n. 209; Leight. n. 109.

Closely allied to the preceding but differing in the more developed thallus, the very different form of the lobes and the darker under surface. The isidia may be crowded as in *S. fuliginosa*, but generally they are less abundant and outline the shallow depressions. The apothecia are evidently very rare, the British specimens in the herbarium being all sterile.

Hab. On mossy rocks, old walls and about the roots of trees in shady moist places.—*Distr.* Plentiful in the western districts of Great Britain and Ireland.—*B. M.* Bocconoc and near Penzance, Cornwall; Lidford, Widdecombe, Meavy, Lustleigh, Cleeve and Bigbury, Devon; near Oswestry, Shropshire; Hafod, Cardiganshire; Aberdovey, Dolgelly, Barmouth and Rhewgreidden, Merioneth; Conway Falls, Carnarvonshire; Anglesea; Mardale, Westmoreland; Keswick, Cumberland; Egglestone, Durham; The Cheviots, Northumberland; New Galloway, Kircudbrightshire; Beld Craig, Moffat, Dumfriesshire; Falls of the Clyde, Lanarkshire; Callender rocks near Stirling; Inverary, Appin and Barcaldine, Argyll; Falls of Leny, Falls of Moness, Glen Lochay, Finlarig, Killin, Aberfeldy and Bracklinn Bridge, Perthshire; Reeky Linn, Forfarshire; Craig Cluny and Craig Coinnoch, Braemar, Aberdeenshire; S. of Fort William and Rothiemurchus, Invernessshire; Cawdor Woods, Nairnshire; Blackwater Bridge and Killarney, Kerry; near Kylemore and Derryclare, Conne-mara, Galway; near Carrickfergus, Antrim.

3. *S. Dufourii* Del. Stict. p. 78, t. 6, fig. 22 (1823–25).—Thallus rather small, thin, smooth, glaucous-green or -brown, mostly smooth and somewhat shining, the lobes laciniate, crisp at the edges and minutely fimbriate, often also coralloid-isidiose on the margins and on the surface of the thallus, beneath slightly tomentose, often reticulately wrinkled, pale- to dark-brown, with paler cyphellæ. Apothecia unknown. *S. ciliata* Tayl. in Mackay Fl. Hib. ii. p. 152 (1836). *S. fimbriata* Tayl. in Lond. Journ. Bot. vi. p. 180 (1847). *S. elegans* Deak. ex Mudd Man. p. 89 (1861). *Stictina Dufourei* Nyl. in Bull. Soc. Linn. Norm. sér. 2, ii. p. 500 (1868); Leight. Lich. Fl. p. 117; ed. 3, p. 110; Cromb. Monogr. i. p. 269. *S. sylvatica* subsp. *Dufourei* Cromb. Lich. Brit. p. 30 (1871).

Exsicc. Cromb. n. 135; Leight. n. 173.

Easily recognized by the thinner lighter-coloured thallus and fimbriate margins, though occasionally it is darker, with the margin more entire.

Hab. On mossy rocks and trees.—*Distr.* Rather rare in S.W. England, N. Wales, W. Highlands of Scotland and S.W. Ireland.—*B. M.*—Pentire, Penzance, near the Lizard and Liskeard, Cornwall; near Totnes, Lidford and Torquay, Devon; Ty Gwyn, Dolgelly, Merioneth; Tongland, Kirkcudbrightshire; Barcaldine, Argyll; Askew Wood and Hyde's Cottage, Killarney, Kerry.

4. *S. limbata* Ach. Meth. Lich. p. 280 (1803).—Thallus moderate in size, monophyllous, but deeply lobate, smooth or slightly pitted, somewhat shining, dull-glaucous or pale-brown, the lobes broad and rounded, sprinkled with soralia towards the periphery, the margins densely sorediate; beneath pale-brownish-tomentose, dotted with lighter coloured cyphellæ. Apothecia unknown.—S. F. Gray Nat. Arr. i. p. 431; Hook. Fl. Scot. ii. p. 59 & in Sm. Engl. Fl. v. p. 206; Tayl. in Mackay Fl. Hib. ii. p. 152; Mudd Man. p. 88. *Lichenoides fuliginosum et pulverulentum, scutellis rubiginosis* Dill. Hist. Musc. p. 198, t. 26, fig. 100 B, C. *Lichen limbatus* Sm. Engl. Bot. t. 1104 (1802). *Stictina limbata* Nyl. Syn. Lich. i. p. 346 (1860); Leight. Lich. Fl. p. 115; ed. 3, p. 108; Cromb. Monogr. i. p. 268. *S. fuliginosa* subsp. *limbata* Cromb. Lich. Brit. p. 30 (1870).

Exsicc. Cromb. n. 35; Larb. Cæsar. n. 15; Johns. n. 190.

Distinguished from the preceding by the sorediate thallus and the absence of isidia. The soredia are greyish or dull bluish-grey. *Buellia Parmeliarum* Oliv. is frequently found on the thallus.

Hab. On mossy trunks of trees and on shady rocks among mosses.—*Distr.* General and fairly common especially in the western counties of Great Britain and Ireland, rare in the Channel Islands.—*B. M.* Rozel, Jersey; Jerbourg, Guernsey; Bocconoc, Withiel, near the Tavy and near Penzance, Cornwall; Shaugh, Torquay, Okehampton, Dartmoor, Clovelly, Kestor near the Teign and near Exeter, Devon; near Ryde, I. of Wight; Lyndhurst, New Forest, Hants; Ardingly and Tilgate, Sussex; Lydd, Kent; Malvern, Worcestershire; near Pembroke; Hafod, Cardiganshire; Hay Coppice, Herefordshire; Dolgelly and Barmouth, Merioneth; Bettws-y-Coed; Capel Curig and near Bangor, Carnarvonshire; Anglesea; near Stavely, Kendal, Westmoreland; Thornthwaite, Cumberland; Teesdale, Durham; The Cheviots, Northumberland; New Galloway, Kirkcudbrightshire; Beld Craig, Moffat, Dumfriesshire; Falls of the Clyde, Lanarkshire; Turfin Hill, near Edinburgh; Inverary, Barcaldine and Appin, Argyll; Loch Katrine, Pass of Leny and Glen Lochay, Killin, Perthshire; Clova, Forfarshire; Craig Cluny, Braemar, Aberdeenshire; Glen Nevis, Invernesshire; I. of Skye; Aghada, Cork Harbour and Castlebernard Park, Bandon, Cork; Cromaglown, Killarney, and Old Dromore, Kerry; near Belfast, Antrim.

Thallus with pseudocyphellæ on the under surface.

5. *S. intricata* Del. var. *Thouarsii* Mudd Man. p. 90 (1861).—Thallus coriaceous, spreading, sinuate and shortly lobed, somewhat

shining, greenish-brown when moist, reddish-brown when dry, the lobes somewhat crumpled and crowded, sprinkled over the surface with roundish or irregular greyish-white soralia or with masses of isidia becoming sorediate, the margins of the lobes also frequently white-sorediate; beneath densely tomentose, dark-brown, paler towards the circumference, with a few pseudo-cyphellæ. Apothecia not seen rightly developed. *S. Thouarsii* Del. Stict. p. 90, t. 8, fig. 29 (1823-25). *Stictina intricata* var. *Thouarsii* Nyl. Syn. i. p. 335 (1860); Leight. Lich. Fl. p. 114; ed. 3, p. 108; Cromb. Monogr. i. p. 266.

Exsicc. Cromb. n. 33.

A tropical or subtropical lichen. Neither species nor variety occurs in Europe except in the British Isles, where the variety is widely distributed though not common. It is easily distinguished from the other species by the character of the soredia and by the pseudocyphellæ, which are midway between cyphellæ and pseudocyphellæ.

Hab. On mossy rocks and boulders and on the trunks of old trees.—*Distr.* Local and rare in the S.W. and N. districts of Great Britain and Ireland.—*B. M.* Near Bovey Tracey, Dartmoor, Devon; near Dolgelly and Barmouth, Merioneth; New Galloway, Kirkcudbrightshire; Inverary, Falls of Brander, Barcaldine and Oban, Argyll; Loch Tay, Perthshire; S. of Fort William, Invernessshire; Cromaglow, Derry-cunihy and Killarney Woods, Kerry Maam, Torc Mts., Galway; Fenagh, Carlow; Glenarm, Antrim.

6. *S. crocata* Ach. Meth. Lich. p. 277 (1803).—Thallus of moderate size, opaque or somewhat shining, generally reticulate-pitted, the lobes rather broad, crenate, dark-olive-green or dull-brown, the medulla usually citrine-yellow, the surface and the ridges between the pits yellow-sorediate; beneath densely tomentose, with a few small yellow pseudo-cyphellæ. Apothecia scattered or nearly marginal, moderate in size, dark-coloured, the margin crenate, at length nearly excluded; spores oblong-fusiform, brown, 1-septate, 20-32 μ long, 9-10 μ thick.—Hook. Fl. Scot. ii. p. 58 & in Sm. Engl. Fl. v. p. 205; S. F. Gray Nat. Arr. i. 430; Tayl. in Mackay Fl. Hib. ii. p. 151; Mudd Man. p. 89. *Lichen crocatus* L. Mant. iii. p. 310 (1771); Dicks. Pl. Crypt. fasc. ii. p. 22; With. Arr. ed. 3, iv. p. 52; Engl. Bot. t. 2110. *Stictina crocata* Nyl. Syn. i. p. 338; Cromb. Lich. Brit. p. 31 & Monogr. i. p. 266; Leight. Lich. Fl. p. 114; ed. 3, p. 108.

Exsicc. Cromb. n. 34; Dicks. Hort. Sicc. fasc. iv. n. 24.

Easily recognized by the greenish-yellow soredia and pseudo-cyphellæ; the latter occur sparingly and irregularly in the form of minute pustules.

Hab. Among mosses on trees and rocks in shady places, frequently in ravines.—*Distr.* Local in S.W. England and S. Scotland, more frequent in the W. Highlands; scarce in S., W. and N. Ireland.—*B. M.* Carn Galven, near Penzance, Cornwall; Tavistock, Walkham

River and near Vixen Tor, Dartmoor, Devon; Dalmahoy Hill, near Edinburgh; Inverary, Oban and Head of Loch Awe, Argyll; ravine at foot of Ben More, Glen Falloch and Aberfeldy, Perthshire; Glen Morriston, Invernesshire; Kenmare, Kerry; Cushendall, Antrim.

§ ii. *EUSTICTA* Wain. Lich. Brés. i. p. 191 (1890).

Algal cells bright-green.

Thallus with cyphellæ on the under surface.

7. *S. damæcornis* Ach. Meth. Lich. p. 276 (1803).—Thallus smooth, slightly shining, pale glaucous or reddish-brown, wide-spreading, lacinate-lobate, the lobes sinuate, elongate and narrow or very broad, the margins mostly entire, dichotomous and truncate at the ends. Apothecia scattered or chiefly marginal, reddish-brown, with a lighter coloured entire or slightly crenulate margin; spores fusiform, 1-3-septate, 26-36 μ long, 8-11 μ thick.—Cromb. Lich. Brit. p. 32; var. *macrophylla* Nyl. in Mém. Soc. Sci. Nat. Cherb. v. p. 102 (1857); Mudd Man. p. 88; Leight. Lich. Fl. p. 119; ed. 3, p. 112; form *latior* Cromb. in Grevillea xv. p. 76 (1887) & Monogr. i. p. 273. *S. macrophylla* Borr. in Engl. Bot. Suppl. t. 2697 (1831) (non Bory ex Del.); Hook. in Sm. Engl. Fl. v. p. 205 (1833); Tayl. in Mackay Fl. Hib. ii. p. 150.

Exsicc. Cromb. n. 38.

An exotic species confined to S. and S.W. Ireland, the only European locality. There is no real distinction between *S. damæcornis* and var. *macrophylla*.

Hab. On shady rocks in maritime and upland districts.—*Distr.* Very local but plentiful in S. and S.W. Ireland.—*B. M.* Cromaglow and Tore Cascade, Killarney, Kerry.

Thallus with pseudocyphellæ on the under surface.

8. *S. aurata* Ach. Meth. Lich. p. 277 (1803).—Thallus horizontal, moderate in size, opaque or slightly shining, broadly and deeply lobed, tawny- or reddish-brown when dry, the lobes crisp and crenate undulate, usually bright-yellow-soresidiate at the margins, beneath with a dense dark-brown short tomentum at the centre, becoming lighter-coloured and bare at the periphery, and sprinkled with bright-yellow pulverulent pseudocyphellæ. Apothecia very rare, large, marginal or submarginal, reddish-black, the margin thin, incurved; spores fusiform, 3-septate, brownish, 21-24 μ long, and 6-7 μ thick, or 19-21 μ long, and 7-8 μ thick.—S. F. Gray Nat. Arr. i. p. 430; Hook. in Sm. Engl. Fl. v. p. 205; Mudd Man. p. 90; Cromb. Lich. Brit. p. 31; Leight. Lich. Fl. p. 119; ed. 3, p. 112; form *subglaucescens* Cromb. in Grevillea xv. p. 76 (1887) & Monogr. i. p. 274. *Lichenoides lacunosum rutilum marginibus flavis* Dill.

Hist. Musc. p. 549, t. 84, fig. 12 (1741). *Lichen auratus* Sm. Engl. Bot. t. 2359 (1811).

Essic. Cromb. n. 39; *Larb. Cæsar.* n. 16; *Leight.* n. 261.

Distinguished by the bright-yellow colour of the sorediate margins of the lobes. Form *subglaucescens*, collected at Lyme Regis, differs only in being bright-green when moist. The British plants are sterile. Cephalodia are sometimes formed on the under surface.

Hab. On trees, rocks, heather, etc., in maritime localities.—*Distr.* Local and scarce in the Channel and Scilly Islands and in S.W. England.—*B. M.* Near the Eperquerie, Sark; Jerbourg, Guernsey; Fresco, St. Mary's and Bryer Islands, Scilly; coasts of Cornwall; Undercliff, Lyme Regis, Dorset; near Shanklin, Ventnor and Ryde, I. of Wight.

36. **LOBARIA** Schreb. L. Gen. Pl. ii. p. 768 (1791); emend. Wain. Lich. Brés. i. p. 193 (1890). *Lobarina* Nyl. in Flora lx. p. 233 (1871); Cromb. Monogr. i. p. 270. *Ricasolia* De Not. in Giorn. Bot. Ital. ii. p. 178 (1846); *Leight. Lich. Fl.* p. 120; Cromb. Monogr. i. p. 274. (Pl. 36.)

Thallus broadly foliose, horizontal or partly ascending, cortex on both surfaces of plectenchyma, tomentose below, with the hyphal filaments single or in strands. Algal cells *Nostoc*, *Cystococcus* or *Protococcus*. Cephalodia sometimes present. Apothecia at first almost closed, then discoid, marginate, generally with gonidia in the margin; paraphyses simple, septate; spores 8 in the ascus, elongate, 1-9-septate, colourless or brown.

Distinguished from *Sticta* by the absence of cyphellæ or pseudo-cyphellæ on the lower surface. The British species of *Lobarina* are classified in two sections:—

Thallus with blue-green gonidia..... i. LOBARINA.
Thallus with bright-green gonidia..... ii. RICASOLIA.

§ i. **LOBARINA** Wain. Lich. Brés. i. p. 193 (1890).

Algal cells blue-green (*Nostoc*).

1. **L. scrobiculata** DC. Fl. Fr. ii. p. 402 (1805).—Thallus wide-spreading, rigid, somewhat opaque, irregularly reticulate-pitted (scrobiculate), greyish-green, sprinkled especially at the margins with white or bluish-grey soralia, the lobes rounded, undulate more or less crenate at the margins, beneath pale- or dark-brown-tomentose, with scattered naked white blister-like elevations corresponding to the depressions of the upper surface. Apothecia very small, scattered, red or brownish-red, the margin thick, inflexed, entire, sometimes sorediate; spores fusiform, 3-7-septate, colourless, 50-80 μ long, 6-7 μ thick.—*Lichenoides arborum foliosum cinereum et sinuatum, inferne scabrum* Dill. in Ray Syn. ed. 3, p. 75, n. 77 (1724). *Lichenoides pulmoneum villosum, superficie scrobiculata et peltata* Dill. Hist. Musc. p. 216, t. 29, fig. 114 (1741). *Lichen scrobiculatus* Scop. Fl. Carn. ed. 2, ii.

p. 384 (1772); Lightf. Fl. Scot. ii. p. 850; With. Arr. ed. 3, iv. p. 59; Engl. Bot. t. 497. *L. verrucosus* Huds. Fl. Angl. ed. 2, p. 545 (1778). *Sticta scrobiculata* Ach. Lich. Univ. p. 453 (1810); S. F. Gray Nat. Arr. i. p. 430; Hook. Fl. Scot. ii. p. 59 & in Sm. Engl. Fl. v. p. 206; Tayl. in Mackay Fl. Hib. ii. p. 151; Mudd Man. p. 87, t. 1, fig. 26. *Stictina scrobiculata* Nyl. Lich. Scand. p. 94 (1861); Cromb. Lich. Brit. p. 30; Leight. Lich. Fl. p. 117; ed. 3, p. 110. *Lobarina scrobiculata* Nyl. in Flora lx. p. 233 (1877); Cromb. in Grevillea xv. p. 76 (1877) & Monogr. i. p. 270.

Essicc. Cromb. n. 36; Johns. n. 223; Larb. Cæsar. n. 14 & Lich. Hb. n. 325; Leight. n. 201; Mudd n. 65.

A species well-marked by the greyish-green colour and the scrobiculate sorediate surface. The apothecia are rather rare and are frequently blackened by the parasitic fungus *Celidium Stictarum*.

Hab. On the trunks of old trees and on moist shady rocks chiefly near streams and lakes.—*Distr.* General and common in most parts of the British Isles.—*B. M.* La Coupe, Jersey; Jerbourg, Guernsey; Bryer Island, Scilly; Helmen Tor and Liskeard, Cornwall; South Brent, Ivy Bridge, Okehampton, near Totnes and Dartmoor, Devon; New Forest, Hants; Quarn Wood, Ryde and Ventnor, I. of Wight; Eridge Park and Hastings, Sussex; Tunbridge Wells and Lydd, Kent; Malvern, Worcestershire; Llanbedr, Cader Idris, near Dolgelly and Barmouth, Merioneth; Capel Curig, Trefriew and Bettws-y-Coed, Carnarvonshire; Anglesea; Oggeray Gill, Cleveland, and near Halifax, Yorkshire; Teesdale, Durham; Mardale, Westmoreland; Keswick and Calder Abbey, Cumberland; New Galloway, Kirkcudbrightshire; Beld Craig, Moffat, Dumfriesshire; Turfin Hill, near Edinburgh; near Inverary, head of Loch Awe, Appin and Barcaldine, Argyll; Loch Katrine, Pass of Leny, Loch Conn, Loch Rannoch, Glen Lochay, Glen Falloch, Finlarig and Killin, Perthshire; Clova, Forfarshire; Craig Coinnoch, Invercauld and Loch Muick, Aberdeenshire; S. of Fort William, Invernessshire; Hill of Doon, Nairnshire; Muckcross, Killarney, Kerry; Kylemore and near Renvyle, Connemara, Galway.

§ ii. *RICASOLIA* Wain. Lich. Brés. i. p. 196 (1890).

Algal cells bright-green (*Protococcus*).

2. *L. laciniata* Wain. in Természetráji Füzetek xxii. p. 307 (1899).—Thallus horizontal, wide-spreading, rigid, smooth or somewhat wrinkled, sinuate-lobate, the lobes elongate, broadly and elegantly crenate, glaucous-green, becoming greyish-white or pale-brown, beneath pale, with brownish tomentum or fasciculate rhizinae (K + yellowish, except the medulla, Ca Cl -). Apothecia at first almost closed then large, concave or plane, reddish-brown with a thin inflexed entire or granulate margin; spores elongate-fusiform, 1-3-septate, colourless, 32-60 μ long, 6-7 μ thick.—*Lichenoides subglaucum cumatile, foliis tenacibus, eleganter laciniatis* Dill. Hist. Musc. p. 197, t. 26, fig. 99 (1741). *Lichen laciniatus* Huds. Fl. Angl. p. 469 (1762). *L. amplissimus* Scop. Fl. Carn. ed. 2, ii. p. 386 (1772). *L. glomuliferus* Lightf. Fl. Scot. ii.

p. 853 (1777); With. Arr. ed. 3, iv. p. 57; Engl. Bot. t. 293. *Parmelia glomulifera* Ach. Meth. Lich. p. 218 (1803); S. F. Gray Nat. Arr. i. p. 436; Hook. Fl. Scot. ii. p. 52 & in Sm. Engl. Fl. v. p. 198. *Sticta glomulifera* Del. Stict. p. 129 (1823-25); Mudd Man. p. 91. *Ricasolia amplissima* De Not. in Giorn. Bot. Ital. ii. p. 179 (1846); Leight. Lich. Fl. p. 120 (1871); ed. 3, p. 112; Cromb. Monogr. i. p. 275. *R. glomulifera* Nyl. in Act. Soc. Linn. Bord. sér. 3, i. p. 300 (1856); Cromb. Lich. Brit. p. 32. *Æsicc.* Cromb. n. 138; Johns. n. 25; Larb. Cæsar. n. 62; Leight. n. 110.

Generally recognized by the presence of massed groups of dark-green coralloid cephalodia, which have been sometimes described as a separate plant, *Dendriscoaulon bolacinum* (Nyl. in Flora lxviii. p. 299 (1885); Cromb. Monogr. i. p. 77). It is one of our largest lichens and is of a rigid coriaceous texture; the somewhat imbricate lobes are elegantly crenate. Apothecia are rare; spermogones are more frequent, with spermatia about $5\ \mu$ long and $1\ \mu$ thick.

Hab. On the trunks of old trees, chiefly ash and oak, rarely on rocks in maritime and inland districts.—*Distr.* Chiefly in the western tracts of Great Britain, rare in S.W. and N. Ireland and in the Channel Islands.—*B. M.* Near Rozel, Jersey; Jerbourg, Guernsey; Chateau Point, Sark; Bocconoc, near Launceston, Cornwall; Chagford, Manaton Moor, Brent Tor and Ivy Bridge, Devon; New Forest, Hants; I. of Wight; Eridge Park, Sussex; Llanforda, near Oswestry, Shropshire; Hafod, Cardiganshire; near Dolgelly, Barmouth, Aberdovey and Llanbedr, Merioneth; Sedburgh and Windermere, Westmoreland; Keswick, Cumberland; Horsleyhope Denes, Durham; New Galloway, Kirkcudbrightshire; Mintó Crags, Roxburghshire; Mugdock Castle, Stirlingshire; Loch Long, near Roseneath, Inverary and Barcaldine House, Argyll; Loch Katrine, Glen Lochay and Kenmore, Perthshire; Lochaber, Invernessshire; Dinish Island, Killarney, Kerry.

3. *L. lætevirens* A. Zahlbr. in Engler & Prantl Nat. Pflanzenf. i. 1*, p. 188 (1906).—Thallus orbicular, spreading, smooth or wrinkled, often shining, green when moist, pale-brown when dry, the lobes somewhat lacinate, rounded, subcrenate and undulate, beneath covered with a pale tomentum, and with pale rhizine (K —, Ca Cl—). Apothecia small or large, generally crowded towards the centre of the thallus, reddish, the margins rather granulate, inflexed; spores fusiform, 1-sepate, becoming pale-brown, 26-44 μ long, 9-11 μ thick.—*Lichenoides arboreum cinereo-virens, tenue et læve ubique, scutellis minoribus* Dill. in Ray Syn. ed. 3, p. 73, n. 64 (1724). *Lichenoides lætevirens, scutellis fulvis* Dill. Hist. Musc. p. 195, t. 25, fig. 98 (1741). *Lichen lætevirens* Lightf. Fl. Scot. ii. p. 852 (1877); Engl. Bot. t. 294; With. Arr. ed. 3, iv. p. 58. *L. herbaceus* Huds. Fl. Angl. ed. 2, p. 544 (1778). *Parmelia herbacea* Ach. Meth. Lich. p. 218 (1803); Hook. Fl. Scot. ii. p. 52 & in Sm. Engl. Fl. v. p. 200; Tayl. in Mackay Fl. Hib. ii. p. 141. *Sticta herbacea* S. F. Gray Nat. Arr. i. p. 431; Mudd Man. p. 91, t. 2, fig. 27. *Ricasolia*

herbacea De Not. in Giorn. Bot. Ital. ii. p. 180 (1846); Cromb. Lich. Brit. p. 32. *R. læteviridis* Leight. Lich. Fl. p. 121 (1871); ed. 3, p. 113.

Exsicc. Cromb. n. 40; Dicks. Dried Plants, n. 23; Johns. nos. 81, 82; Larb. Lich. Hb. n. 326; Leight. n. 75.

Somewhat resembling the preceding but with a thinner less coriaceous thallus. Apothecia and spermogones are generally present. Several specimens (Johns. n. 82, etc.) bear apothecia in which the margins have become partly and minutely lacinate.

Hab. On the trunks of old trees, occasionally on mossy boulders.—*Distr.* General and mostly common throughout the British Isles.—*B. M.* Island of Bréchou; near Rozel, Jersey; Bryer Island, Scilly; Bococonnoc and St. Minver, Cornwall; Ivy Bridge, South Brent, near Totnes, Becky Fall and near Harberton, Devon; New Forest, Hants; Shanklin and Appuldurcomb, Isle of Wight; Ardingly and Charlton Forest, Sussex; Charnwood Forest and Bardon Hill, Leicestershire; Dynevor Castle, Carmarthenshire; near Dolgelly, Aberdovey and Barmouth, Merioneth; Bettws-y-Coed, Carnarvonshire; Anglesea; Derbyshire; Baysdale, Cleveland, Yorkshire; near Egglestone, Durham; Windermere and near Stockgill, Westmoreland; Keswick and Calder Abbey, Cumberland; New Galloway, Kircudbrightshire; Largs, Ayrshire; near Inverary, Barcaldine and Appin, Argyll; The Trossachs, Glen Lochay, Craighall and Bracklin Falls, Perthshire; Lochaber, Invernesshire; Cawdor Woods, Nairnshire; Applecross, Rossshire; Killarney and Cromaglow, Kerry; near Kylemore, Galway; Clare Island, Mayo.

4. *L. pulmonaria* Hoffm. Deutschl. Fl. ii. p. 146 (1795).—Thallus wide-spreading, rigid, shining, pitted-reticulate, with narrow rather sinuate truncate lobes at the margins, generally sorediiferous on the ridges, more rarely bearing isidia, olive-green when moist, tawny- or dark-brown when dry, beneath unequal, bullate or blistered opposite the pits on the upper surface, whitish with a reddish-brown tomentum between the bullate swellings. Apothecia moderate in size, marginal or sub-marginal, light-red or dark-brown, the margin thin, entire or becoming crenulate, at length excluded; spores 1-3-septate, 18-30 μ long, 5-9 μ thick.—Cromb. in Grevillea xv. p. 76 (1887). *Lichenoides peltatum arboreum maximum* Dill. in Ray Syn. ed. 3, p. 76, n. 86 (1724). *Lichenoides pulmonicum reticulatum vulgare, marginibus peltiferis* Dill. Hist. Musc. p. 212, t. 29, fig. 113 (1761). *Lichen pulmonarius* L. Sp. Pl. p. 1145 (1753); Huds. Fl. Angl. p. 449; Lightf. Fl. Scot. ii. p. 831; With. Arr. ed. 3, iv. p. 54; Engl. Bot. t. 572. *Parmelia pulmonacea* Ach. Meth. Lich. p. 220 (1803). *Sticta pulmonacea* Ach. Lich. Univ. p. 449 (1810) (incl. var. *pleurocarpa*); S. F. Gray Nat. Arr. i. p. 430; Mudd Man. p. 87, t. 1, fig. 25; Cromb. Lich. Brit. p. 31; Leight. Lich. Fl. p. 118; var. *aggregata* Del. Stict. p. 143, t. 17, fig. 62 (1825). *S. pulmonaria* Hook. Fl. Scot. ii. p. 58 (1821) & in Sm. Engl. Fl. v. p. 206; Tayl. in Mackay Fl. Hib. ii. p. 151; Leight. Lich. Fl. ed. 3, p. 111. Tree lungwort.

Æsicc. Carroll Lich. Hib. n. 1; Croall n. 486; Cromb. nos. 37, 137 (as var. *pleurocarpa*); Johns. n. 224; Leight. n. 74; Mudd n. 64.

The thallus is attached to the substratum more or less centrally and spreads free on all sides, sometimes attaining very large dimensions when the lacinate character is less evident. Soredia are frequent on the margins and ridges though the surface may be wholly or partly naked and shining. Isidia are not uncommon mixed with the soredia.

The apothecia are occasionally blackened and rendered abortive by the parasitic fungus *Celidium Stictarum* (var. *pleurocarpa*). Cephalodia—or cephaloid tubercles—have been described as sometimes occurring on both surfaces, and as being simple or aggregate, reddish or dark-coloured (f. *aggregata* Cromb. in Grevillea xv. p. 76 & Monogr. i. p. 273). The single British specimen from Inverary determined as f. *aggregata* by Crombie bears somewhat deformed apotheca only. Immersed cephalodia have been found by Hue in var. *tenuior* from Japan.

Hab. On the trunks of trees, especially old oaks, rarely on mossy rocks in inland and maritime districts.—*Distr.* General and not uncommon throughout the British Isles.—*B. M.* Guernsey; Bryer Island, Scilly; Bococonoc, St. Minver and near Penzance, Cornwall; Lidford, Totnes, Newton Bushell, Okehampton and Buckfastleigh, Devon; New Forest, Hants; Ryde and Appuldurcomb, I. of Wight; near Balcombe, Eastham and Ardingly, Sussex; near Lydd, Kent; near Loughton, Essex; Chedworth Woods near Cirencester, Gloucestershire; Bagley Wood, near Oxford; Charnwood Forest, Leicestershire; near Ludlow, Shropshire; Hafod, Cardiganshire; Cader Idris, Cwm Bychan, Rhewgreiddan, Aberdovey, Barmouth and Dolgelly, Merioneth; Bettws-y-Coed, Bangor, Conway and Devil's Bridge, Carnarvonshire; Anglesea; Kildale, Cleveland, Yorkshire; Egglestone, Durham; Cheviots, Northumberland; Windermere and near Grasmore, Westmoreland; Patterdale and Calder Abbey, Cumberland; New Galloway, Kirkcudbrightshire; Ayrshire; near Moffat, Dumfriesshire; Turfin Hill, near Edinburgh; Inverary, Head of Loch Awe, Barcaldine and Appin, Argyll; The Trossachs, Loch Katrine, Killin and Pass of Leny, Perthshire; Den of Airlie, Reeky Linn, Lundie Craigs and Glen Dole, Forfarshire; Dunottar Castle, Kincardineshire; Craig Cluny and Corrienuizie, Braemar, Aberdeenshire; near Fort William, Invernessshire; Cawdor Wood, Nairnshire; Applecross, Rossshire; Dinish, Ronayne's Islands and Cromaglow, Killarney, Kerry; Lough Inagh, Galway.

Form *hypomela* Cromb. in Grevillea xv. p. 76 (1887).—Thallus with a brownish-black tomentum on the under surface between the bullate swellings; upper surface frequently isidioid.—*Sticta pulmonacea* var. *hypomela* Del. Stict. p. 144, t. 17, fig. 64 (1825).

Æsicc. Cromb. n. 136.

Hab. Similar to the species.—*Distr.* Seen in a characteristic state only from S. W. England, N. Wales and the S. and W. Grampians, Scotland.—*B. M.* Bryer Island, Scilly; Bettws-y-Coed, Carnarvonshire; Inverary and Barcaldine, Argyll; Glen Lochay, Perthshire; Loch Linnhe, Invernessshire.

ORDER X. **PARMELIACEÆ.**

Thallus foliose, horizontal, decumbent, sometimes partly ascending or fruticose, corticate on one or both surfaces, beneath with rhizinæ or naked. Algal cells *Pleurococcus*. Apothecia sessile or shortly stalked, with a thalline margin; asci 2-8-spored or rarely many-spored; spores colourless, simple. Spermogones with pleurogenous or more rarely acrogenous spermatia.

The following genera are British:—

- Thallus rhizinose, squamulose or foliose. Apothecia superficial.
- Thallus squamulose; asci many-spored..... 37. **Candelaria.**
 Thallus foliose; asci 2-8-spored..... 38. **Parmelia.**
- Thallus scarcely rhizinose, foliose or fruticose.
 Apothecia marginal..... 39. **Cetraria.**

37. **CANDELARIA** Massal. Mem. Lich. p. 46 (1853). *Lecanora* subg. *Candelaria* Nyl. in Flora lxiv. p. 454 (1881); Cromb. Monogr. i. p. 366 pro parte. (Pl. 37.)

Thallus minutely foliose or squamulose, corticate on both surfaces, yellow above, beneath almost colourless, rhizinose. Apothecia sessile, scattered, discoid, with a thalline margin; paraphyses discrete, simple or rarely branched, septate and clavate upwards; asci many-spored; spores simple, colourless, sometimes bi-guttulate and pseudo-septate. Spermogones in small tubercles, with acrogenous ellipsoid spermatia.

Differs from *Parmelia* in the squamulose thallus and the many-spored ascus. The yellow colour of the thallus is due to stictaurin, which gives no reaction with potash.

1. **C. concolor** Wain. Lich. Brés. i. p. 70 (1890).—Thallus suborbicular or spreading, the lobes small, lacinate-crenate, subimbricate or crowding over each other, the margins crisp, isidiose, granular or sorediose, bright-greenish-yellow (K—). Apothecia small, sessile, dull-brownish-yellow, the thalline margin entire or granulate; spores numerous, ellipsoid, simple, often bi-guttulate, 6-14 μ long, 4-6 μ thick.—*Lichen candelarius* L. Sp. Pl. p. 1141 (1753) *nomen vagum*; Huds. Fl. Angl. p. 444? Lightf. Fl. Scot. ii. p. 810 pro minore parte; Engl. Bot. t. 1794 (1807). *L. concolor* Dicks. Pl. Crypt. fasc. iii. p. 18, t. ix. fig. 8 (1793). *Lecanora candelaria* Ach. Lich. Univ. p. 416 (1810) pro parte; Hook. Fl. Scot. ii. p. 51 pro parte; Tayl. in Mackay Fl. Hib. ii. p. 139; Cromb. Lich. Brit. p. 48; Leight. Lich. Fl. p. 182 (incl. var. *granulosa*); ed. 3, p. 167 (incl. var. *granulosa*). *Parmelia parietina* var. *laciniosa* Duf. ex Fr. Lich. Eur. p. 73 (1831). *Physcia parietina* vars. *laciniosa* & *concolor* Mudd Man. pp. 113 & 114 (1861). *P. candelaria* Nyl. in Mém. Soc. Sci. Nat. Cherb. p. 106 (1857); Mudd Man. p. 114.

Psoroma candelarium S. F. Gray Nat. Arr. i. p. 445 (1821).
Squamaria candelaria Hook. in Sm. Engl. Fl. v. p. 194 (1833).
Lecanora laciniosa Nyl. in Flora lxiv. p. 454 (1881); Cromb.
 Monogr. i. p. 367, fig. 62.

Esicc. Larb. Lich. Hb. n. 53; Leight. n. 12.

Hab. On trunks of trees and on old palings, rarely on walls.—
Distr. General throughout Great Britain, rare in Ireland and the
 Channel Islands.—*B. M.* St. Lawrence, Jersey; Vale Castle, Guernsey;
 near Penzance, Cornwall; near Torquay, Devon; Lyndhurst, New
 Forest, Hants; Hurst and Hassocks, Sussex; Penshurst Park, Kent;
 Walthamstow and Epping Forest, Essex; Windsor Park, Berkshire;
 Stowell Park, Gloucestershire; Cherry Hinton, near Cambridge;
 Berwick near Shrewsbury, Shropshire; near Barmouth, Merioneth;
 Stokesley, Yorkshire; Levens Park, Westmoreland; near Keswick,
 Cumberland; Doune Castle and Killin, Perthshire; Durris, Kincardine-
 shire; Abergeldie, Braemar, Aberdeenshire; Fort William and
 Rothiemurchus, Invernessshire; Blackrock, near Cork; Killarney and
 Dunkerron, Kerry; near Limerick.

38. **PARMELIA** Ach. Meth. Lich. p. 153 emend De Not.
 in Mem. R. Acad. Sci. Torino ser. 2, x. p. 378 (1849). (Pl. 38.)

Thallus foliose, horizontal, rarely ascending, lobate or lacinate
 or linear, variously coloured, generally somewhat shining, cortex
 more or less distinctly plectenchymatous; soredia and isidia
 frequent, beneath rhizinoe or almost naked, usually darker in
 colour, the rhizinae of fasciculate hyphae, frequently mucilaginous
 at the tips. Apothecia scattered, sessile or shortly stalked, often
 becoming rather large, round, with a thalline margin; hypo-
 thecium colourless, with gonidia underneath; paraphyses usually
 branched and septate, involved in mucilage; asci 2–8-spored;
 spores ellipsoid or subglobose, simple, colourless. Spermogones
 scattered, becoming prominent, blackish, with septate sterigmata,
 the minute pleurogenous spermatia cylindrical or fusiform or
 thickened at each end.

The genus is divided into subgenera as follows:—

Thallus normally without rhizinae, lobes narrow....	i. HYPOGYMNA.
Thallus without rhizinae, lobes broader, pierced with holes.....	ii. MENEGAZZIA.
Thallus more or less rhizinoe, lobes various.....	iii. EUPARMELIA.

Subgenus i. **HYPOGYMNA** Nyl. in Flora lxiv. p. 537 (1881).—
 Thallus normally without rhizinae, attached by discs or haustoria,
 or by rhizinae formed as the result of friction; lobes generally
 narrow. Spores small.

1. **P. physodes** Ach. Meth. p. 250 (1803) (excl. var. *vittata*).—
 Thallus very variable in size, often very wide-spreading, sub-
 stellate, smooth, lacinate-lobed, glaucous-grey, the lobes multifid,
 linear-sinuate, crenulate or blunt, dilated, and sometimes
 sorediate and recurved at the somewhat swollen apices, beneath

generally brownish-black, paler towards the circumference, shining, somewhat wrinkled, with occasional rhizine or haustorial discs where it is attached (cortices K + yellow, CaCl—, medulla K (CaCl) + red). Apothecia rare in Britain, subpedicellate, moderate in size, becoming large with age, brownish-red, the margin entire; spores subspherical, 6–8 μ long, 5–6 μ thick; margins of the apothecia rarely sorediate.—Hook. Fl. Scot. ii. p. 56 & in Sm. Engl. Fl. v. p. 204; Tayl. in Mackay Fl. Hib. ii. p. 149; Mudd Man. p. 96; Cromb. Lich. Brit. p. 36 (incl. var. *labrosa*, excl. var. *vittata*); Leight. Lich. Fl. p. 125; ed. 3, p. 116 (incl. var. *recurva*); var. *labrosa* Ach. Lich. Univ. p. 493 (1810). *Lichenoides ceratophyllum obtusius et minus ramosum* Dill. in Ray Syn. ed. 3, p. 76, n. 85 (1724) & Hist. Musc. p. 154, t. 20, fig. 49 A, B, C (1741). *Lichen physodes* L. Sp. Pl. p. 1144 (1753); Huds. Fl. Angl. p. 447; Lightf. Fl. Scot. ii. p. 322; Engl. Bot. t. 126 pro parte; With. Arr. ed. 3, iv. p. 32. *Physcia physodes* S. F. Gray Nat. Arr. i. p. 436 (1821). *Exsicc.* Bohl. n. 13; Croall n. 98; Cromb. nos. 31, 144; Johns. nos. 123, 304 (f. *paucula*), 305; Larb. Lich. Hb. n. 290; Leight. nos. 48, 389; Mudd n. 70.

One of our commonest lichens, and, though variable, easily recognized by the narrow lobes and generally dark, bare undersurface; no rhizine are produced on the free parts. As the plant becomes older, wide soralia develop at the apex of the lobes; the lobes tend to rise up and become recurved, a condition known as vars. *labrosa* and *recurva*. Form *paucula*, recorded by Johnson, is, he concludes, a dwarf form with narrow lobes and eroded at the tips. The thallus is more or less appressed, the sorediate lobes being somewhat ascending. This lichen is attached in various ways to the substratum: rhizine are occasionally developed as the result of friction. Spermogones are frequent as clusters of black points.

Hab. On trees, heather, old walls, sometimes on sandy ground, etc., in maritime and inland districts, more generally fertile in mountainous regions.—*Distr.* General and common throughout the British Isles.—*B. M.* Quenvais, Jersey; Guernsey; Withiel and Penzance, Cornwall; Hay Tor, Dartmoor, Devon; New Forest, Hants; Maresfield, Pondlye and Ardingly, Sussex; Mill Hill, Middlesex; Boreham, Walthamstow and Epping Forest, Essex; Sandy, Bedfordshire; Brandon, Suffolk; Lickey Hills, Worcestershire; Charnwood Forest, Leicestershire; Church Stretton, Stiperstones, Wrekin Hill and Haughmond Hill, Shropshire; Stormy Down, Glamorganshire; Beddgelert, Cwm Bychan, Cader Idris, Garth, near Barmouth, and near Dolgelly, Merioneth; Llanberis, Bettws-y-Coed and Carnedd Dafydd, Carnarvonshire; Anglesea; near Matlock, Derbyshire; Lounsdale, Cleveland, Yorkshire; Windermere, Westmoreland; Ennerdale, Ashgill Woods (f. *paucula*) and Gateshead Fell, Cumberland; Dalry and New Galloway, Kirkeudbrightshire; near Glasgow; Swanston Wood, Edinburgh; Inverary, Argyll; Crianlarich, Killin, Loch Tay, Ben Lawers, Rannoch, Craig Tulloch and Moncrieffie Hill, Perthshire; Sidlaw Hills, Baidovan and Deerhill Wood, Forfar; Durriss, Kincardineshire; Invercauld, Castleton, Morrone, Glen Derry and Glen Candlich, Braemar, Hill of Ardo and Countess Wells, Aberdeenshire;

Rothiemurchus and Glen Morriston, Invernessshire; Forres, Elginshire; Lairg, Sutherland; Unst, Shetland; near Cork; Dunkerron, Kerry.

Var. *tubulosa* Mudd Man. p. 97 (1861).—Thallus lobes tubular, erect, ascending, turgid and sorediate at the tips.—Var. *labrosa* Cromb. Lich. Brit. p. 36 pro parte; Leight. Lich. Fl. p. 126; ed. 3, p. 117; f. *tubulosa* Cromb. Monogr. i. p. 259 (1894). *P. ceratophylla* var. *tubulosa* Schær. Enum. p. 42 (1850). *Lichen physodes* Engl. Bot. t. 126, lower fig. (1793).

Exsicc. Johns. n. 124; Leight. n. 48 pro parte; Mudd n. 70 pro parte.

Well marked by the cylindrical hollow lobes, which branch out from the substratum. It is more confined to hilly districts than the species. Apothecia are rarely found.

Hab. On trees and stone walls in maritime and upland districts.—*Distr.* Fairly general and common in Great Britain.—*B. M.* Near Penzance and Withiel, Cornwall; Lustleigh Cleeve, Devon; Leith Hill, Surrey; Malvern Hills, Worcestershire; Sweeny, Shropshire; near Monmouth; Rhewgreidden, Merioneth; Bettws-y-Coed and Beddgelert, Carnarvonshire; Kildale Moor, Baysdale and Lounsdale, Cleveland, Yorkshire; near Kendal, Westmoreland; Asby, Cumberland; New Galloway, Kirkcudbrightshire; Ben Lawers, Killin and Abernethy, Perthshire; Park and Hill of Ardo, Aberdeenshire; Rothiemurchus Woods, Invernessshire; Lairg, Sutherland.

Var. *platyphylla* Ach. Meth. Lich. p. 251 (1803).—Lobes rather wide, wrinkled and plicate, rounded and rather deeply crenate at the circumference, more or less sorediate at the tips, generally towards the centre. Apothecia not common.—Leight. Lich. Fl. p. 126; ed. 3, p. 117.

Exsicc. Larb. Lich. Hb. n. 329.

The crowded wrinkled sometimes almost tuberculose thallus distinguishes the variety. The whole plant has an undivided monophyllous appearance.

Hab. On old palings and stone walls in maritime and hilly districts.—*Distr.* General though not common throughout the British Isles.—*B. M.* Boulay Bay, Jersey; New Forest, Hampshire; Brading, I. of Wight; Lydd, Kent; Harboro' Magna, Warwickshire; near Barmouth, Merioneth; Killin, Craig Tulloch, Ben Lawers, Trossachs and Aberfeldy, Perthshire; Guthrie, Forfarshire; near Nigg, Kincardineshire; Rothiemurchus, Invernessshire.

Form *fuscescens* Cromb. Monogr. i. p. 260 (1894).—Differs from var. *platyphylla* in the brown-coloured thallus and in the greater rarity of soredia.—*Parmelia physodes* var. *obscurata* Cromb. in Journ. Bot. xiv. p. 360 (1876) (non Ach.); Leight. Lich. Fl. ed. 3, p. 118.

Crombie suggests that the colour of the thallus may be due to the habitat by the sea.

Hab. On old palings in maritime districts.—*Distr.* Local in S.E.

England and N.E. Scotland.—*B. M.* Lydd, Kent; near Cove, Kincardineshire.

2. *P. vittata* Nyl. in *Flora* lviii. p. 106 (1875).—Thallus horizontal, of rather elongate narrow sparsely branching hollow laciniae, loosely adherent to the substratum, smooth and often shining, sometimes sorellate at the tips, glaucous-grey, beneath generally shining-black, the dark colour spreading round and forming a margin to the lobes, the lower cortex pierced here and there by round holes (K \pm yellow, CaCl—). Apothecia stalked, rather large, brownish-red, the margin thin, entire or inflexed; spores very small, 4–6 μ long, almost globose, 3–4.5 μ thick.—Cromb. in *Grevillea* xv. p. 76 (1887). *Parmelia physodes* var. *vittata* Ach. *Meth. Lich.* p. 251 (1803); *Mudd Man.* p. 96 pro parte; *Cromb. Lich. Brit.* p. 36 pro parte; *Leight. Lich. Fl.* p. 126; ed. 3, p. 117 pro parte.

There is a somewhat doubtful specimen in *Herb. Crombie*, collected on firs, Ben Lawers; the dark margin of the laciniae is not well marked nor are the holes on the under surface very clear. There is no other specimen.

Hab. On mossy stones, on bark, or on the ground in mountainous regions.—*B. M.* Ben Lawers, Perthshire?

3. *P. encausta* Ach. *Meth. Lich.* p. 202 (1803).—Thallus suborbicular, appressed, composed of numerous elongate branching laciniae, generally rather broader and spatulate, crenate at the circumference, the more central lobes very narrow and sub-cylindrical, sometimes of almost radiate structure, the tips somewhat turgid, silver-grey or greenish or very dark in colour, often dotted with the black spermogonia, beneath black, rather wrinkled (K + yellow, CaCl—). Apothecia adnate, moderate in size or rather large, plane, becoming flexuose, reddish-brown, with a thin crenulate margin; spores ellipsoid, small, 7–10 μ long, 5–7 μ thick.—S. F. Gray *Nat. Arr.* i. p. 441; *Hook. Fl. Scot.* ii. p. 54 & in *Sm. Engl. Fl.* v. p. 203 pro parte; *Mudd Man.* p. 97 (incl. var. *candefacta*, excl. var. *stygioides*); *Cromb. Lich. Brit.* p. 36. *Parmelia physodes* var. *candefacta* Ach. *Lich. Univ.* p. 490 (1810); var. *encausta* Fr. *Lich. Eur.* p. 64 (1831); *Leight. Lich. Fl.* p. 127; ed. 3, p. 117. *Lichen encaustus* Sm. in *Trans. Linn. Soc.* i. p. 83, t. 4, fig. 6 (1791).

An alpine species found only at the top of our highest mountains.

Hab. On granite boulders.—*Distr.* The Grampians, Scotland.—*B. M.* Ben Lawers, Perthshire; Ben-naboord and Cairntoul, Braemar, Aberdeenshire.

4. *P. alpicola* Th. Fr. *Lich. Arct.* p. 57 (1860).—Thallus orbicular or expanded, appressed or adnate, of narrow, rugose-plicate or torulose laciniae, crowded and imbricate or coherent in the centre, more free at the circumference and crenate, nodulose

or incurved at the tips, dark-olivaceous or blackish, beneath very black ($K \pm$ yellowish, $CaCl-$). Apothecia moderate in size or small, 2-4 mm. across, becoming slightly convex, blackish, with a thin entire margin; spores subglobose or ellipsoid, $7-12 \mu \times 5-9 \mu$.—Cromb. in Journ. Bot. x. p. 357 (1872); Leight. Lich. Fl. ed. 3, p. 118. *P. encausta* var. *stygioides* Linds. in Trans. Roy. Soc. Edinb. p. 224 (1859); Mudd Man. p. 97. *P. Mongeotii* f. *discreta* Nyl. Syn. Lich. i. p. 392 (1861). *P. stygia* f. *minor* Nyl. ex Carroll in Journ. Bot. iii. p. 288 (1865); Cromb. Lich. Brit. p. 35. *P. discreta* Cromb. Lich. Brit. p. 36 (1870). *P. physodes* var. *discreta* Leight. Lich. Fl. p. 127 (1871). *Lichen encaustus* Sm. Engl. Bot. t. 2049 (1809) (non Ach.).

Esicc. Cromb. n. 32; Dicks. Hort. Sicc. fasc. ii. n. 25.

Differs from the preceding in the more compact wrinkled growth of the thallus, which is generally darker in colour and more shining. Apothecia are frequent. The spermogones are minute and black, with spermatia 7μ long, 1μ thick.

Hab. On granitic and quartzose boulders in alpine places.—*Distr.* Local and scarce on the Grampians, Scotland; rare in N. W. Ireland. *B. M.* Ben More and Cairn Gowar, Perthshire; Clova Mts. Forfarshire; Cairn Drochit, Morrone and Ben-naboord, Braemar, Aberdeenshire; Ben Nevis, Invernessshire; Mayo.

Subgenus ii. MENEGAZZIA A. Zahlbr. in Engler & Prantl Nat. Pflanzenf. i. 1*, p. 212 (1907).—Thallus without rhizinae, attached by haustoria or mucilage; lobes perforate above. Spores large.

5. *P. pertusa* Schaer. Lich. Helv. Spicil. p. 457 (1840).—Thallus orbicular, spreading, appressed, glabrous and shining, dotted with round holes, frequently sorediate, whitish or brownish, the lobes narrow, with palmate sinuate branching, somewhat convex, wider, crenate and brown at the tips, beneath black, naked, wrinkled ($K +$ yellow, $CaCl-$). Apothecia moderate in size up to 4 mm. across, or smaller, reddish-brown, the margin entire or crenulate, prominent; "spores 2-4 in the ascus, very large, $45-60 \mu$ long, $22-28 \mu$ thick."—Cromb. Lich. Brit. p. 36; Leight. Fl. p. 129; ed. 3, p. 120. *P. diatrypa* Ach. Meth. Lich. p. 251 (1803); Hook. Fl. Scot. ii. p. 56 & in Sm. Engl. Fl. v. p. 204; Tayl. in Mackay's Fl. Hib. ii. p. 150. *P. terebrata* Mudd Man. p. 97 (1861). *Lichen pertusus* Schrank Baier. Fl. ii. p. 519, n. 1513 (1789). *L. diatrypus* Ach. Lich. Succ. Prodr. p. 116 (1798); Sm. Engl. Bot. t. 1248. *Lobaria terebrata* Hoffm. Deutschl. Fl. ii. p. 151 (1795). *Physcia diatrypa* S. F. Gray Nat. Arr. i. p. 436 (1821).

Esicc. Cromb. n. 145; Larb. Caesar. n. 66; Leight. n. 264.

A lichen with a very neat regular appearance. Soredia borne at the apex of small upright branchlets are not uncommon. The upper cortex only is perforated; the lower cortex has mostly split from the upper so that the lobes are hollow, the hyphæ belonging to the

under part of the thallus are dark brown. The whole thallus is closely attached to the substratum. British specimens are sterile.

Hab. On rocks among mosses and on the trunks of trees in maritime and inland districts.—*Distr.* Rare, though widely distributed throughout the British Isles.—*B. M.* Bonne Nuit, Jersey; Land's End, near St. Austell and near Penzance, Cornwall; Bolt Head and Valley of Rocks, Lynton, Devon; New Forest, Hants; Hendremynech, Cardiganshire? Cwm Bychan, Barmouth and Dolgelly, Merioneth; foot of Snowdon, Carnarvonshire; New Galloway, Kirkcudbrightshire; Roseneath, Barcaldine and Ballachulish, Argyll; Keimaniegh Pass, Cork; Cromaglow, Glenmore Lake and Dunkerron, Kerry; Cushendun, Antrim.

Subgenus iii. EUPARMELIA Nyl. ex Hue Add. Nov. Lich. Eur. p. 39 (1886).—Thallus lobes narrow or wide; beneath more or less rhizinoæ.

A. *Rhizinæ* very scanty.

6. *P. pubescens* Wain. in Medd. Soc. Faun. & Fl. Fenn. xiv. p. 22 (1886).—Thallus of rounded or somewhat flattened slender filaments, spreading, decumbent, dichotomously and intricately branched, olive-brown or brownish-black, somewhat shining, beneath paler, attached to the rock by short stoutish discoid hold-fasts or by short rhizinæ (?) (K—, CaCl—). Apothecia seated on the thallus or terminal, moderate in size, plane or convex, concolorous with the thallus, the margin subentire or granular; spores 7–11 μ long, 6–8 μ thick.—*P. lanata* Wallr. Fl. Crypt. Germ. i. p. 529 (1831) (non Linn.); Mudd Man. p. 101; Cromb. Lich. Brit. p. 35; Leight. Lich. Fl. p. 124. *Usnea cæspitosa exilis, capillacea, atra* Dill. Hist. Musc. p. 66, t. 13, fig. 9 (1741). *Lichen pubescens* L. Sp. Pl. p. 1155 (1753); Engl. Bot. t. 846 (middle fig.). *L. scaber* Huds. Fl. Angl. ed. 2, p. 562 (1778). *Cornicularia lanata* Ach. Meth. Lich. p. 304 (1803); S. F. Gray Nat. Arr. i. p. 405; Hook. Fl. Scot. ii. p. 69 & in Sm. Engl. Fl. v. p. 229; Tayl. in Mackay Fl. Hib. ii. p. 87. *Alectoria lanata* Leight. Lich. Fl. ed. 3, p. 80 (1879).

Exsicc. Croall n. 498.

Frequently referred to the radiate fruticose lichens, but the habit is decumbent, the structure is partly dorsiventral, the gonidia being more or less massed on the upper side of the central medullary strand, and the plant is anchored to the substratum by disc-like hold-fasts. Th. Fries records the presence of rhizinæ (Lich. Scand. p. 126). Spermogones are frequent and give a somewhat nodulose character to the filaments.

Hab. On rocks and boulders, rarely on gravelly soil in subalpine and alpine localities.—*Distr.* Rare in S.W. and N. England and in N. Wales and S.W. Ireland; more frequent on the Grampians, Scotland.—*B. M.* Dartmoor Tors, Devon; Cader Idris and Aran Mawddwy, Merioneth; Llangollen, Denbighshire; Snowdon, Carnarvonshire; Teesdale, Durham; New Galloway, Kirkcudbrightshire; Glen Tilt, Ben More, Mael Girdy and Ben Lawers, Perthshire; Clova Mts. and

Katelow, Forfarshire; Loch Phadrig, Lochnagar, Morrone, Cairngorm and Ben-naboord, Braemar, Aberdeenshire; Ben Nevis, Invernesshire; Hills of Applecross, Rossshire; Bennabad, Caithness; Mangerton, Killarney and Maegillicuddy's Reeks, Kerry; Doughruagh Mts., Connemara, Galway.

Var. *reticulata* A. L. Sm.—Thallus with shorter branching, forming a kind of reticulation especially at the circumference, the tips very shortly furcate. Apothecia frequently ciliate at the margins. *P. lanata* var. *reticulata* Cromb. in Grevillea xii. p. 72 (1884); var. *subciliata* Nyl. in Flora li. p. 346 (1868); Cromb. in Journ. Bot. vii. p. 50 (1869) & Lich. Brit. p. 35; Leight. Lich. Fl. p. 125. *Coralloides tenuissimum nigricans, mundi muliebris instar textum* Dill. Hist. Musc. p. 113, t. 17, fig. 32 (1741). *Lichen pubescens* Lightf. Fl. Scot. ii. p. 893 (1777) (non Linn.); Huds. Fl. Angl. ed. 2, p. 562? With. Arr. ed. 3, iv. p. 48. *L. reticulatus* Wulf. in Jacq. Coll. ii. p. 187, t. 13, fig. 6 (1788). *Alectoria lanata* var. *parmelioides* Cromb. in Journ. Bot. x. p. 233 (1872); Leight. Lich. Fl. ed. 3, p. 81 (incl. f. *subciliata*).

Distinguished by the shorter more profuse branches, and by the subciliate apothecia which are more frequent than in the species.

Hab. On rocks and boulders in alpine localities.—*Distr.* Plentiful on some of the higher Grampians, Scotland.—*B. M.* Ben Lawers, Perthshire; Clova Mts., Forfarshire; Cairngorm, Glen Callater, Morrone and Invercauld, Braemar, Aberdeenshire.

7. *P. corniculata* A. L. Sm.—Thallus of narrow, roundly compressed stiff fronds 1–2.5 cm. high, crowded and suberect, sparingly branched, the branches tapering, olive-brown or brownish-black and somewhat shining, base attached by a hold-fast (K—, CaCl—). Apothecia plane, becoming convex, concolorous with the thallus, with an entire or fimbriate margin; spores 8–11 μ long, 4–6 μ thick.—*P. tristis* Wallr. Fl. Crypt. Germ. p. 528 (1831); Nyl. in Act. Linn. Soc. Bord. sér. 3, i. p. 304 (1856); Cromb. in Grevillea xii. p. 71 (1884). *Coralloides corniculatum, fuci tenuiores facie* Dill. Hist. Musc. p. 118, t. 17, fig. 37 (1741). *Lichen corniculatus* Lightf. Fl. Scot. ii. p. 885 (1777) (e. descript.). *L. radiatus* Huds. Fl. Angl. ed. 2, p. 559 (1778). *L. tristis* Web. Spicil. p. 209 (1778); With. Arr. ed. 3, iv. p. 43; Engl. Bot. t. 720. *Cornicularia tristis* Hoffm. Pl. Lich. ii. p. 36, t. 34, fig. 1 (1794); S. F. Gray Nat. Arr. i. p. 404 (1821); Hook. Fl. Scot. ii. p. 69 & in Sm. Engl. Fl. v. p. 228; Tayl. in Mackay Fl. Hib. ii. p. 86; Mudd Man. p. 76. *Platysma triste* Nyl. Syn. Lich. i. p. 307 (1860); Cromb. Lich. Brit. p. 26; Leight. Lich. Fl. p. 99; ed. 3, p. 94.

Esicc. Croall n. 497; Dicks. Hort. Sicc. fasc. ix. n. 25; Johns. n. 70.

A mountain species, occurring either in dense swards or in isolated tufts on the rocks. Though largely fruticose in habit, the structure

is dorsiventral, with the gonidial layer almost touching each margin, and rising in pyramid-like projections towards the upper cortex. The apothecia, which are frequent, are subterminal. Spermogones are numerous and prominent, with spermatia $5\ \mu$ long and $1\ \mu$ thick.

Lightfoot's description leaves no doubt as to the identity of *Lichen corniculatus*, which antedates both Hudson's and Weber's names.

Hab. On rocks and boulders in mountainous districts.—*Distr.* Rather rare in W. and N. England and N. Wales; more frequent in the Scottish Highlands; rare in S.W. Ireland.—*B. M.* Dartmoor, Devon; Malvern Hills, Worcestershire; Sugar Loaf Mt., Monmouthshire; Cader Idris, Merioneth; The Glyders, Snowdon and Moel Siabod, Carnarvonshire; Llangollen, Denbighshire; Crickley Scar, Yorkshire; Egglestone, Durham; The Cheviots, Northumberland; Mardale, Westmoreland; Ennerdale, Cumberland; New Galloway, Kirkcudbrightshire; Ben More, Ben Lawers, Ben Vrackie and Aberfeldy, Perthshire; Clova Mts., Head of the White Water and Katelaw, Forfarshire; near Invercauld, Craig Coinnoch, Morrone, Glen Callater, Glen Dee and Ben-naboord, Braemar and Hill of Ardo, Aberdeenshire; Ben Nevis, Invernessshire; Applecross, Rossshire; Dunkerron, Kerry.

8. *P. stygia* Ach. Meth. Lich. p. 203 (1803).—Thallus orbicular, appressed, somewhat shining, smooth, olive-brown or blackish, the lobes narrow, with spreading palmate branching, somewhat convex and incurved at the apices, beneath pitch-black but paler towards the edge, with few stoutish rhizine (K—, CaCl—). Apothecia becoming large and flexuose, dark olive-brown or black, with a dark-coloured crenulate margin; spores small, $8-10\ \mu$ long, $6-7\ \mu$ thick.—S. F. Gray Nat. Arr. i. p. 441; Hook. Fl. Scot. ii. p. 54 & in Sm. Engl. Fl. v. p. 202; Mudd Man. p. 100; Cromb. Lich. Brit. p. 35; Leight. Lich. Fl. p. 124; ed. 3, p. 116. *Lichen stygius* L. Sp. Pl. p. 1143 (1753); Dicks. Pl. Crypt. fasc. iii. p. 16; With. Arr. ed. 3, iv. p. 30; Engl. Bot. t. 2048.

Essicc. Dicks. Hort. Sicc. fasc. ii. n. 25 pro parte.

Might be confused with *Platysma fahlunense* on account of the partly shining thallus, but it is blacker, and the lobes thicker and more convex. It is generally fertile. Spermogones are frequent, with spores $5\ \mu$ long, $1\ \mu$ thick.

Hab. On granitic and quartzose rocks and boulders in subalpine and alpine regions.—*Distr.* Local and rare among the Grampians, Scotland.—*B. M.* Ben More, Perthshire; Lochnagar, Ben-naboord and Ben Macdhuil, Braemar, Aberdeenshire; Ben Nevis, Invernessshire.

B. *Rhizine* abundant or scanty, but absent from the margin
(*Amphigymnia*).

a. *Thallus* glaucous-grey.

9. *P. perlata* Ach. Meth. Lich. p. 216 (1803).—Thallus horizontal, wide-spreading, somewhat orbicular in outline, smooth, glaucous greyish-white, lobate, the lobes rounded, ascending,

undulating, crisp and often with turgid soralia at the margins; beneath brownish-black, with short scattered or crowded rhizinae, paler and without rhizinae towards the circumference (K $\frac{+}{-}$ orange-yellow, CaCl-). Apothecia very rare, moderate in size or becoming rather large, reddish-brown, the margin thin, entire, incurved; spores ellipsoid, 11-17 μ long, 7-10 μ thick.—S. F. Gray Nat. Arr. i. p. 437; Hook. Fl. Scot. ii. p. 52 & in Sm. Engl. Fl. v. p. 200; Tayl. in Mackay Fl. Hib. ii. p. 148; Mudd Man. p. 92; Cromb. Lich. Brit. p. 33; Leight. Lich. Fl. p. 128; ed. 3, p. 119. *Lichenoides glaucum perlatum, subtile nigrum et cirrosum* Dill. Hist. Musc. p. 147, t. 20, fig. 39, A, B, D, E (1741). *Lichen perlatus* Huds. Fl. Angl. p. 448 (1762); Lightf. Fl. Scot. ii. p. 839; With. Arr. ed. 3, iv. p. 68; Engl. Bot. t. 341.

Exsicc. Johns. n. 23; Larb. Lich. Hb. n. 291; Leight. nos. 76, 392.

Usually about 4 to 6 inches across. Though the turgid marginal soredia are a characteristic feature, they are sometimes absent; the species being recognisable by the smooth thallus, and the orange colour produced on the upper surface on the application of potash.

Hab. On the trunks of old trees, and on rocks in maritime and inland tracts.—*Distr.* General and plentiful throughout the British Isles.—*B. M.* Island of Guernsey; Bocconoc, near Penzance and Withiel, Cornwall; Torquay, near Lidford, South Brent, Dartmoor and Ilfracombe, Devon; New Forest, Hants; Isle of Wight; St. Leonards Forest, Fairlight Glen, near Hastings; Mark Cross, near Brighton, Henfield and Arundel, Sussex; Lydd, Kent; Little Waltham, St. Ossyth, and near Messing, Essex; Cheltenham, Gloucestershire; Gopsall Wood and Twycross, Leicestershire; Wrighton Park, Herefordshire; Haughmond Hill, Shropshire; Llanbedr, Barmouth and Dolgelly, Merioneth; Bousdale Gill, Cleveland, Yorkshire; Stavely, Kendal and Windermere, Westmoreland; New Galloway, Kirkeudbrightshire; Swanston Wood, near Edinburgh; near Inverary and Barcaldine, Argyll; Loch Katrine and Killin, Perthshire; S. of Fort William, Invernessshire; Applecross, Rossshire; near Cork; Dunkerron, Kerry; Achill Island and Clare Island, Mayo.

Var. *ciliata* Schaer. Enum. p. 34 (1850).—Thallus similar to that of the species, with rounded crenate lobes, crisp and ciliate at the margins and with turgid soralia. Apothecia rare.—Leight. Lich. Fl. p. 129; ed. 3, p. 120. Subsp. *ciliata* Nyl. in Flora lxi. p. 247 (1878); Cromb. in Grevillea xv. p. 74 (1887) & in Monogr. i. p. 233 pro parte. *P. perforata* Hook. in Sm. Engl. Fl. v. p. 200 (1833) pro parte. *Lobaria perlata* var. *ciliata* DC. Fl. Fr. ii. p. 403 (1805).

Distinguished by the presence of cilia on the margins of the lobes; frequently confused with *P. proboscidea*, to which the above references partly refer.

Hab. On the trunks of trees, and on rocks and boulders in maritime and inland districts.—*Distr.* Possibly not uncommon, but recorded only

in the southern and western counties of Great Britain and Ireland.—*B. M.* Helmen Tor, Cornwall; Hay Tor, Dartmoor, Devon; I. of Wight; Barmouth, Merioneth; Eskdale, Cumberland; Helensburgh, Dumbartonshire; Inverary and Barcaldine, Argyll; Clare Island and Achill Island, Mayo.

b. *Thallus greenish-yellow.*

10. *P. caperata* Ach. Meth. Lich. p. 216 (1803).—Thallus spreading, lobate, wrinkled; sometimes pulverulent-sorediate towards the centre, the lobes broad, rounded, narrowly sinuate and crenulate, pale-yellowish-green or pale ochraceous, beneath blackish, rhizino-se, brown and naked at the circumference (K + yellowish, CaCl -). Apothecia moderate in size, brownish-red, the margin crenulate and often sorediate; spores 17–20 μ long, 7–10 μ thick.—S. F. Gray Nat. Arr. i. p. 437; Hook. Fl. Scot. ii. p. 52 & in Sm. Engl. Fl. v. p. 198; Tayl. in Mackay Fl. Hib. ii. p. 146; Mudd Man. p. 101, t. 2, fig. 30; Cromb. Lich. Brit. p. 32; Leight. Lich. Fl. p. 122; ed. 3, p. 114. *Lichenoides crusta foliosa, ex cinereo et luteo virescente superne, inferne nigra et lævi* Dill. in Ray Syn. ed. 3, p. 73, n. 62 (1724). *Lichenoides caperatum, rosacee expansum, e sulphureo virens* Dill. Hist. Musc. p. 193, t. 25, fig. 97 (1741). *Lichen caperatus* L. Sp. Pl. p. 1147 (1753); Huds. Fl. Angl. ed. 2, p. 543; With. Arr. ed. 3, iv. p. 58; Engl. Bot. t. 654.

Exsicc. Bohl. n. 123; Cromb. n. 140; Johns. n. 220; Larb. Cæsar. n. 63 & Lich. Hb. n. 289; Leight. n. 77; Mudd n. 73.

Also a wide-spreading species, it is well distinguished by the colour and the wrinkling of the thallus. The apothecia are somewhat rare, and are chiefly central. Spermogones are minute and brown, with spermatia 6–7 μ long, 1 μ thick.

Hab. On the trunks of old trees, palings and boulders.—*Distr.* General and fairly abundant throughout the British Isles, though rare in N. Scotland.—*B. M.* St. Brelade's and Boulay Bay, Jersey; Guernsey; St. Mary's, Scilly; Bocconoc, Penzance and Withiel, Cornwall; Ivy Bridge, Bolt Head, Newton Bushell, Totnes and Dartmoor, Devon; Lyme Regis, Dorset; Lyndhurst, Hants; Carisbrooke and Ryde, Isle of Wight; Lewes, Hastings, Pondlyc, and near Brighton, Sussex; near Tunbridge Wells, Kent; Walthamstow, Hainault Forest and near Bocking, Essex; Stonehenge, Wilts; Elstree, Herts; near Malvern, Worcestershire; Gamlingay, Cambridgeshire; Charnwood Forest and Twycross, Leicestershire; Haughmond Hill, Shropshire; Hafod, Cardiganshire; Cwm Bychan and near Barmouth, Merioneth; Llanberis, Carnarvonshire; Anglesea; Buxton, Derbyshire; Teesdale, Durham; near Hexham, Northumberland; Stavely, Windermere, Westmoreland; Keswick and Asby, Cumberland; New Galloway, Kirkeudbrightshire; Rivelstone and Pentland Hills, near Edinburgh; Airds, Appin, Argyll; Blairdrummond, Aberfoyle, Kenmore and Ben Lawers, Perthshire; Ben Nevis, Invernessshire; Rostellan, Cork; Dunkerron, Kerry; Achill Island, Mayo.

c. *Thallus olivaceous or brownish.*

11. *P. subaurifera* Nyl. in Flora lvi. p. 22 (1873).—Thallus orbicular, thin in texture, closely appressed, crumpled and lobate, olive- or umber-brown, with a yellowish medulla, generally glabrous at the circumference, isidiose towards the centre and more or less sprinkled with yellowish soredia, the lobes rounded and crenate, beneath blackish, shortly fibrillose, lighter coloured and bare at the edge (K $\bar{+}$ yellowish, CaCl $\bar{+}$ reddish). Apothecia small, dark chestnut-coloured, the margin subentire, often yellow-sorediate; spores 11–13 μ long, 7–8 μ thick.—Cromb. in Journ. Linn. Soc. xvii. p. 572 (1880) & in Grevillea x. p. 25 (1881). *Lichenoides olivaceum*, *scutellis lævibus* Dill. Hist. Musc. p. 182, t. 24, fig. 77 c (1741). *Lichen olivaceus* var. 3 With. Arr. ed. 3, iv. p. 35 (1796) (fide Crombie Monogr. i. p. 252).

Exsicc. Larb. Lich. Hb. 210.

Differs from allied species in the yellow medulla and scattered soredia, a character more distinctly marked in northern specimens (cf. *P. Mougeotii*). Apothecia are extremely rare; they occur on only one of our specimens, collected at Penzance. Spermogones are also very rare; spermatia 5 μ long, 1 μ thick.

Hab. On the trunks of trees, chiefly oaks and firs, also on branches of shrubs.—*Distr.* Rare in N. Wales, the Highlands of Scotland and N.W. Ireland.—*B. M.* Near Penzance, Cornwall; Henfield, Sussex; Lydd, Kent; Gopsall Park, Leicestershire; Wimpole Park, Cambridgeshire; Kempsey, Worcestershire; Aberdovey, Merioneth; Bettws-y-Coed, Carnarvonshire; Ayton, Cleveland, Yorkshire; Hindburndale, Lancashire; Windermere, Westmoreland; Glen Lochay, Perthshire; Durris, Kincardineshire; near Banchory, Aberdeenshire; Applecross, Rossshire; Kylemore, Galway.

12. *P. Mougeotii* Schær. Enum. Lich. p. 46 (1850).—Thallus rather small, orbicular, appressed and closely adnate, generally darker and subareolate in the centre, greenish or greyish-yellow towards the outside, usually sprinkled with small yellowish-white soralia, the laciniae narrow, linear, multifid, slightly convex and spreading at the apices, frequently transversely cracked, beneath brownish-black, with very short rhizinae, smooth at the edges (K + yellowish, CaCl –). Apothecia rare, minute, reddish-brown, the margin pulverulent; spores 8–10 μ long, 5–6 μ thick.—Mudd Man. p. 102; Cromb. Lich. Brit. p. 34. *P. conspersa* f. *Mougeotii* Leight. Lich. Fl. p. 136; ed. 3, p. 125. *Lichen incurvus* Sm. Engl. Bot. t. 1375 (1804) pro parte (non Pers.).

Exsicc. Cromb. n. 143; Larb. Lich. Hb. nos. 87, 251; Leight. n. 143; Mudd n. 74.

Distinguished by the linear appressed lobes and by the yellowish soredia. It has frequently been considered as allied to *P. conspersa*, but the smooth edges of the under surface place it in this section.

The spermogones are rather rare, minute and brownish-black; the spermatia are 5-6 μ long and 1 μ thick.

Hab. On rocks and boulders, chiefly granite and gneiss in maritime and upland districts.—*Distr.* Local and rather scarce, in Great Britain and Ireland; most frequent perhaps on the Grampians, Scotland.—*B. M.* Withiel and Bodmin, Cornwall; Charnwood Forest, Leicestershire; near Barmouth and Capel Arthog, Merioneth; Bettws-y-Coed, Carnarvonshire; Battersby and Ingleby, Cleveland, Yorkshire; Teesdale, Durham; near Kendal, Westmoreland; New Galloway, Kirkcudbrightshire; Achosragan Hill, Appin, Argyll; Ben Lawers and Craig Tulloch, Perthshire; Durrus, Kincardineshire; Glen Dee, Braemar and Crathes, Aberdeenshire; Curraghmore, Waterford; Dunkerron, Kerry; Connemara, Galway.

Form *dispersa* Cromb. in *Grevillea* xv. p. 75 (1887).—Thallus of scattered narrow short lacinia, sparingly sorediate. Apothecia not seen.

Hab. On schist rocks in shady situations in subalpine tracts.—*B. M.* Achosragan Hill, Appin, Argyll.

13. *P. olivetorum* Nyl. in Not. Sällsk. Faun. & Fl. Fenn. Förh. v. p. 180 (1866).—Thallus horizontal, roundly lobed, smooth, greyish-green becoming yellowish-brown and shining when dry, the lobes somewhat ascending, crisp, incurved, thickened and sorediate at the margins, beneath blackish, brownish at the circumference, wrinkled, very sparingly rhizinose (K \pm yellow, CaCl \mp red). Apothecia moderate in size (5-10 mm. across), shortly pedicellate, brownish-red, the excipulum and margin smooth, becoming sometimes sorediose; spores 14-18 μ long, 7-12 μ thick. Leight. Lich. Fl. p. 130; ed. 3, p. 121. *P. perlata* var. *olivetorum* Ach. Lich. Univ. p. 458 (1810).

Distinguished from *P. perlata* by the almost complete absence of rhizinae and by the thin lines of marginal soredia. The British specimens are sterile. The spermatia are cylindrical.

Hab. On trunks of trees and on rocks in wooded maritime and mountainous districts.—*Distr.* Rare in S. England, N. Wales and S.W. Highlands of Scotland.—*B. M.* Drews-y-nant, Merioneth; Barcaldine, Argyll.

14. *P. cetrarioides* Del. ex Nyl. in *Flora* lii. p. 290 (1869).—Thallus large, orbicular or irregular, roundly lobed, smooth, generally wrinkled, the lobes broad, crenate, somewhat ascending, crisp and sorediate at the margins, beneath blackish, brownish at the circumference, wrinkled, very sparingly rhizinose (K \pm yellow, CaCl —, medulla K (CaCl. f. + reddish). Apothecia moderate or large, brownish-red, the margin entire, becoming sorediose; spores 14-16 μ long, 11-12 μ thick. Cromb. Lich. Brit. p. 34; Leight. Lich. Fl. p. 128; ed. 3, p. 119. *P. perlata* var. *cetrarioides* Duby Bot. Gall. ii. p. 601 (1830).

Very similar to the preceding, but distinguished by the reactions and by the form of the spermatia which are lageniform (broadly clavate). The apothecia are rare.

Hab. On the trunks of old trees, rarely on rocks in wooded maritime and upland regions.—*Distr.* Rather rare; the Channel Islands, S. and S.W. England, N. Wales, and hilly regions of Scotland.—*B. M.* Rozel, Jersey; Helmen Tor, Cornwall; Dartmoor and Bickleigh Vale, Devon; New Forest, Hants; Dolgelly, Aberdovey and near Barmouth, Merioneth; New Galloway, Kirkeudbrightshire; Appin, Argyll; Loch Katrine, Perthshire; Loch Linnhe, Invernessshire.

C. *Rhizine* abundant or scanty, up to edge of lobes (*Hypotrachyna*).

a. *Thallus* whitish or grey-coloured.

Isidia and *Soredia* absent.

15. *P. tiliacea* Ach. Meth. Lich. p. 215 (1803).—Thallus orbicular, rather thin, laciniate-lobed, appressed, smooth or partly wrinkled or subpruinose, pale greyish-glaucous, the lobes subimbricate, deeply divided and crenate, beneath brownish-black, rhizinose to the margin (K \pm yellowish, CaCl \mp red). Apothecia moderate in size, crowded when present, concave or nearly plane, brownish-red, the margin becoming crenulate; spores ellipsoid, small, 7–11 μ long, 5–7 μ thick.—S. F. Gray Nat. Arr. i. p. 438; Hook. in Sm. Engl. Fl. v. p. 200; Mudd Man. p. 93, t. 2, fig. 28 (excl. var. *scortea*): Cromb. Lich. Brit. p. 33 (excl. subsp. *scortea*): Leight. Lich. Fl. p. 131 pro parte (incl. var. *rugosula*); ed. 3, p. 121 pro parte (incl. var. *rugosula*). *Lichen tiliaceus* Hoffm. Enum. Lich. p. 96, t. 16, fig. 2 (1784); Dicks. Pl. Crypt. fasc. iii. p. 16; Sm. in Trans. Linn. Soc. i. p. 83 (1791); With. Arr. ed. 3, iv. p. 31.

Evsicc. Larb. Lich. Hb. n. 292.

Distinguished by the more closely appressed thallus with narrowly sinuate and closely contiguous lobes, crenate at the margin and sometimes wrinkled and pruinose. The apothecia are chiefly central; the spermatogones are prominent and brownish with spermatia 7 μ long, 1 μ thick.

Hab. On the trunks of trees, rarely on rocks in maritime and inland districts.—*Distr.* Rather rare in the Channel Islands, S. and N. England, N. Wales and W. Scotland, not yet recorded for Ireland.—*B. M.* Petit Port, Jersey; near Exeter, Ilsham, near Torquay, and Chagford, Devon; Lymington, Hants; near Ryde, I. of Wight; Lewes, Wiston and St. Leonard's Forest, Sussex; Esher and Dorking, Surrey; near Barmouth and Harlech, Merioneth; Clapdale, Yorkshire; near Kendal, Westmoreland.

Subsp. *carporhizans* Nyl. Syn. Lich. i. p. 384 (1860).—Thallus similar to that of the species. Apothecia occasionally perforated, the excipulum blackish and black-setulose. Cromb. in Grevillea xv. p. 75 (1887). *Parmelia carporhizans* Tayl. in Hook. Journ.

Bot. vi. p. 163 (1847); Cromb. in Journ. Bot. xx. p. 272 (1882).
Lichen tiliaceus Sm. Engl. Bot. t. 700 (1800).

Distinguished from the species by the dark setulose under surface of the base of the apothecium. The dark fibrils are not always easily seen. In Engl. Bot. t. 700 they are omitted, though quite clearly indicated in one of Sowerby's unpublished drawings, and present in the specimen of *Lichen tiliaceus* preserved in the British Museum.

Hab. On the trunks of trees in wooded districts.—*Distr.* Not uncommon in the Channel Islands and S. England.—*B. M.* Jerbourg, Guernsey; Chagford, Ashburton, Cornworthy, and near Torquay, Devon; Dunster Tower, Somerset; Lymington, Hants; near Ryde, I. of Wight.

Isidia or Soredia on surface of lobes.

16. *P. scortea* Ach. Lich. Univ. p. 461 (1810).—Thallus orbicular, spreading, coriaceous, whitish, more or less densely covered towards the centre with darker isidia, the lobes short, rounded-crenate; beneath densely black rhizinose to the margin ($K \pm$ yellowish, $CaCl \mp$ reddish). Apothecia moderate in size, scattered, reddish-brown, the margin subentire; spores 7–11 μ long, 5–7 μ thick.—Hook. in Sm. Engl. Fl. p. 199. *P. tiliacea* var. *scortea* Mérat Nouv. Flor. envir. Paris ed. 4, i. p. 393 (1836); Mudd Man. p. 93; Leight. Lich. Fl. p. 131; ed. 3, p. 122. Subsp. *scortea* Cromb. Lich. Brit. p. 33 (1870). *Lichen scorteus* Ach. Lich. Suec. Prodr. p. 119 (1798); Engl. Bot. t. 2065.

Essicc. Larb. Cæsar. n. 18; Leight. n. 87.

Differs from *P. tiliacea* in the slightly thicker isidiöse thallus. A specimen from Bolt Head, Devon, with small congested lobes, has been described as f. *concresecens* Cromb. Monogr. i. p. 240 (1894).

Hab. On trees and old palings, rarely on rocks in maritime and inland districts.—*Distr.* Rare in the Channel Islands, England and Wales, S. and W. Scotland and S.W. Ireland.—*B. M.* L'Etacq, Jersey; Sark; Bolt Head, Devon; Shanklin, I. of Wight; New Forest, Hants; Stonchenge, Wilts; near Lewes and Henfield, Sussex; Harboro' Magna and Newbold-on-Avon, Warwickshire; Twycross, Leicestershire; Little Stretton, Shropshire; Holyland, Pembrokeshire; Llanforda and near Barmouth, Merioneth; Stokesley, Cleveland, Yorkshire; near Egglestone, Durham; near Kendal, Westmoreland; Castle Douglas, Kirkcudbrightshire; West Kilbride, Ayrshire; Askew Wood, Dunkerron, Kerry.

17. *P. proboscidea* Tayl. in Mackay Fl. Hib. ii. p. 143 (1836) (non Allioni ex Ach. Lich. Univ. p. 458 (1810)).—Thallus moderate in size or wide-spreading often bearing isidia changing into soredia over the surface, glaucous- or whitish-grey, the lobes imbricate, crisp and crenate or often finely dissected at the margins, cilia present on the margins and generally associated with the isidia on the surface; beneath black, densely rhizinose, generally naked and brown at the edge ($K +$ yellow, then red).

Apothecia rare, subpedicellate, reddish-brown, the outer wall rugose, areolate and isidiose; margins incurved, crenate and often becoming sorediate; spores ellipsoid, 23–33 μ long, 15–17 μ thick (fide Hue) with a thick epispore.—*P. perlata* var. *ciliata* Cromb. Lich. Brit. p. 33 (1870) (non Schær.). *P. pilosella* Hue in Journ. Bot. Fr. xii. p. 247 (1898). *Lichen perforatus* Sm. Engl. Bot. t. 2423 (1812) (excl. mid. fig.).

Exsicc. Cromb. n. 30; Johns. n. 68; Larb. Cæsar. n. 17 & Lich. Hb. n. 86; Leight. n. 112.

The absence of marginal soralia, the superficial cilia, and the large spores distinguish the species from *P. perlata* var. *ciliata*. Sometimes the sorediose isidia form scab-like excrescences (*P. pilosella* f. *excrescens* Arn. ex Hue tom. cit. p. 249). Apothecia are rare; the spores in a specimen from Anglesea were smaller than the recorded size, measuring from 20 μ in length.

Hab. On trees, rocks and boulders in shady situations.—*Distr.* General, though not common throughout the British Isles.—*B. M.* Jersey; Guernsey; St. Mary's Isle, Scilly; near Penzance, Cornwall; Lustleigh Cleeve and near Bolt Head, Devon; St. Leonards, Sussex; Tunbridge Wells, Kent; Malvern, Worcestershire; Barmouth and Dolgelly, Merioneth; Anglesea; near Kendal, Westmoreland; Keswick, Cumberland; New Galloway, Kirkcudbrightshire; Barcaldine, Argyll; the Trossachs and near Loch Tay, Perthshire; S. of Fort William, Invernesshire; Applecross, Ross-shire; Dunkerron, Denis and Derrycunihy, Kerry; Killery Bay, Connemara, Galway; Clare Island, Mayo.

18. *P. saxatilis* Ach. Meth. Lich. p. 204 (1803).—Thallus thin, spreading or suborbicular, laciniate-lobate with reticulate lines or markings, or even reticulate-lacunose, frequently more or less isidose, greyish white or glaucous-grey, the lobes generally rather narrow, sinuous, crenate and truncate or retuse at the apices; beneath black, rhizinose to the margin (K₊^{yellowish}/₊^{yellow}, then red. CaCl₂). Apothecia moderate in size or rather large, the excipulum and margin thin, crenulate or often isidiose, the disc reddish-brown; spores ellipsoid, 14–18 μ long, 7–9 μ thick, with an epispore 1–1.5 μ thick.—S. F. Gray Nat. Arr. i. p. 440; Hook. Fl. Scot. ii. p. 53 & in Sm. Engl. Fl. v. p. 199; Tayl. in Mackay Fl. Hib. ii. p. 144; Mudd Man. p. 94 (excl. vars. *leucochroa* and *omphalodes*); Cromb. Lich. Brit. p. 34 (excl. vars. *sulcata* and *omphalodes*); Leight. Lich. Fl. p. 137 (excl. vars. *sulcata* and *omphalodes*, incl. var. *panniformis*); ed. 3, p. 126. *Lichenoides crusta foliosa, superne cinereo-glaucæ, inferne nigra et cirrosa, scutellis nigricantibus* Dill. in Ray Syn. ed. 3, p. 72, n. 61 (1724). *Lichenoides vulgatissimum cinereo-glaucum lacunosum et cirrosum* Dill. Hist. Musc. p. 188, t. 24, f. 83 A (1741). *Lichen saxatilis* L. Sp. Pl. p. 1142 (1753); Huds. Fl. Angl. p. 446; Lightf. Fl. Scot. ii. p. 816; With. Arr. ed. 3, iv. p. 33; Engl. Bot. t. 603.

Exsicc. Cromb. n. 27; Leight. n. 203 pro parte.

A very common species, easily recognized by the reticulate lines on the thallus which are mostly whitish, though sometimes becoming darker, and sometimes marked by isidia. Apothecia are very rare. Spermogones are minute with spermatia about $7\ \mu$ long and $1\ \mu$ thick. There is a sterile form with very narrow crowded laciniaë which are sometimes isidioid (f. *panniformis* Cromb. in Grevillea, xv. p. 75 (1887)).

Hab. On trees, walls, rocks and boulders in lowland and upland districts.—*Distr.* General throughout the British Isles.—*B. M.* Island of Guernsey; near Penzance, Cornwall; Dartmoor, Devon; New Forest, Hants; Sussex; Malvern Hills, Worcestershire; Lambeth, S. Wales; Dolgelly, Merioneth; Stavely, Westmoreland; Ayrshire; Appin, Argyll; Finlarig, Ben Lawers, Glen Falloch, Abernethy, Inverrosachs, Black Wood of Rannoch and Ben Vrackie, Perthshire; Cortachy, Forfarshire; Portlethen, Kincardineshire; Corriemulzie, Braemar, Aberdeenshire; Ben Nevis, Invernessshire; Clare Island and Achill Island, Mayo.

Form *furfuracea* Schaer. Lich. Helv. Spic. p. 455 (1846).—Thallus spreading, greyish white, generally densely covered with greyish-brown isidia which frequently obliterate the lobes except at the circumference, otherwise similar to the species. Var. *furfuracea* Mudd Man. p. 95 (1861); Leight. Lich. Fl. p. 138; ed. 3, p. 127. *Parmelia horrescens* Tayl. in Mackay Fl. Hib. ii. p. 144 (1836) pro parte. *Lichenoides vulgatissimum cinereo-glaucum lacunosum et cirrosum* Dill. Hist. Musc. p. 188, t. 24, fig. 83 c, d (1741).

Exsicc. Bohl. n. 11; Johns. n. 187; Larb. Lich. Hb. n. 211; Leight. n. 46 pro parte.

More frequent than the species with which it is connected by every stage of isidiose development. Frequently fertile, and the apothecial margins rough with isidia.

Hab. On rocks, walls and trees, chiefly in upland districts.—*Distr.* General and common in many parts of the British Isles.—*B. M.* Alderney; near Penzance and Helminton, Cornwall; Throwley Down and near South Brent, Devon; Basingstoke and New Forest, Hants; Maresfield Common, Eridge Rocks and Ardingly, Sussex; Savernake Forest, Wilts; Charnwood Forest, Leicestershire; Malvern, Worcestershire; Lambeth, S. Wales; Barmouth and near Dolgelly, Merioneth; Capel Curig, Carnarvonshire; Anglesea; The Wrekin, Shropshire; Chatsworth and near Buxton, Derbyshire; Cleveland, Yorkshire; Kentmere, Westmoreland; Keswick, Cumberland; New Galloway, Kirkcudbrightshire; Dalmahoy Crags, near Edinburgh; near Helensburgh, Dumbartonshire; Appin, Argyll; Trossachs, Ben Lawers and near Dunkeld, Perthshire; Clova and Cortachy, Perthshire; Glen Callater, Morrone, Ben Avon and Craig Coinnoch, Braemar and Crathes, Aberdeenshire; Glen Nevis, Invernessshire; Applecross, Rossshire; Lambay Island, near Dublin; near Cork; Dunkerron, Kerry; Kylesmore, Galway; Clare Island and Achill Island, Mayo.

19. *P. sulcata* Tayl. in Mackay Fl. Hib. ii. p. 145 (1836).—Thallus orbicular, spreading, laciniate-lobate, the lobes sinuate, branched, irregularly imbricate, subtruncate at the apices,

greyish or glaucous white and more or less marked with reticulate lines, the reticulations frequently changing to furrowed oblong or linear white-margined soralia; beneath blackish, rhizino-se (K⁺_{yellowish}, then red, CaCl⁻). Apothecia and spores as in *P. saxatilis*, or rather smaller.—Cromb. in Grevillea xv. p. 75 (1887). *P. saxatilis* var. *leucochroa* Wallr. Fl. Crypt. Germ. i. p. 499 (1831); Mudd Man. p. 94; var. *sulcata* Cromb. Lich. Brit. p. 34; Leight. Lich. Fl. p. 138; ed. 3, p. 126. *Lichenoides vulgatissimum cinereo-glaucum, lacunosum et cirrosum* Dill. Hist. Musc. p. 188, t. 24, fig. 83 B (1741).

Easicc. Cromb. n. 28; Dicks. Hort. Sicc. fasc. xiv. n. 22; Johns. n. 69; Leight. n. 203; Mudd n. 66.

Distinguished from the preceding by the absence of isidia and by the furrowed soralia which are often abundant on the thallus and along the margins of the lobes, giving the whole plant a rough scabrous appearance.

Hab. On trees and old walls in maritime and inland districts.—*Distr.* General and common throughout the British Isles; fertile chiefly in the Highlands of Scotland.—*B. M.* Guernsey; Penzance and Withiel, Cornwall; Beeding and Newtimber, Sussex; New Forest, Hants; near Cirencester and Sapperton, Gloucestershire; near Malden, Epping and Hainault Forests, Essex; Harboro' Magna, Warwickshire; Aberdovey, Merioneth; Ludlow, Shropshire; Haddon Hall and Darley, Derbyshire; Ayton and Ingleby, Cleveland, Yorkshire; near Hexham, Northumberland; Dalry, Kirkcudbrightshire; Dreghorn and Craiglockart, near Edinburgh; Barcaldine, Argyll; Loch Katrine and Killin, Perthshire; Baldovan, Forfarshire; near Braemar and Den of Murtle, Aberdeenshire; near Fort William, Invernessshire; Applecross, Rossshire; Rostellan, Cork; Dunkerron, Kerry; Clare Island and Achill Island, Mayo.

20. *P. dubia* Schær. Enum. Lich. p. 45 (1850).—Thallus suborbicular, thinnish in texture, appressed, lobate, smooth or slightly wrinkled, glaucous-grey or pale-whitish-grey, the surface more or less thickly sprinkled with small round soralia, the lobes rather broad, rounded, sinuate, the edges frequently sorediate; beneath almost black, wrinkled, sparingly rhizino-se (K⁺_{yellow}, CaCl⁻_{red}, soredia CaCl⁺_{red}). Apothecia moderate in size or larger, brownish-red, the margin elevated, inflexed; spores 11–15 μ long, 8–11 μ thick.—*P. Borreri* Turn. in Trans. Linn. Soc. ix. p. 148, t. 13, fig. 2 (1808); S. F. Gray Nat. Arr. i. p. 437; Hook. in Sm. Engl. Fl. v. p. 199; Tayl. in Mackay Fl. Hib. ii. p. 146; Mudd Man. p. 94, t. 2, fig. 29; Cromb. Lich. Brit. p. 34; Leight. Lich. Fl. p. 133; ed. 3, p. 122. *P. reddenda* Stirton in Scott. Nat. iv. p. 298 (1878); Leight. Lich. Fl. ed. 3, p. 119; Cromb. in Grevillea x. p. 26 (1881). *Lichenoides glaucum perlatum, subtile nigrum et cirrosum* Dill. Hist. Musc. p. 147, t. 20, fig. 39 c (1741). *Lichen dubius* Wulf. in Jacq. Collect. Bot. iv. p. 275, t. 19, fig. 1 (1790). *L. Borreri* Turn. in Sm. Engl. Bot. t. 1780 (1807).

Æsicc. Larb. Cæsar. n. 20 ; Leight. n. 231.

Somewhat similar to *P. sulcata*, but differing in the form of the soredia and in the thalline reactions. Apothecia are rare in British specimens, they are chiefly central and become perforate with age. Spermata are lageniform (broadly clavate), $4\cdot5\ \mu$ long, $1\ \mu$ thick.

Hab. On trunks of old trees, rarely on rocks in wooded districts.—*Distr.* General in the Channel Islands and in S. and W. England, rarer in Scotland and Ireland.—*B. M.* Rozel, Jersey; near Jerbourg, Guernsey; near Penzance and Withiel, Cornwall; Basingstoke and Lyndhurst, Hants; Ryde and Shanklin, I. of Wight; near Brighton, Henfield, Hayward's Heath, Angmering Park, Hurstpierpoint, Hastings and near St. Leonards, Sussex; Maidstone, Kent; Walthamstow, near Maldon and Great Totham, Essex; Kemble and Sapperton, Gloucestershire; near Oxford; Harboro' Magna, Warwickshire; Hindlip and Malvern, Worcestershire; Twycross, Leicestershire; Barmouth and Dolgelly, Merioneth; Dynevor Castle, Caermarthenshire; near Kendal, Westmoreland; New Galloway, Kirkcudbrightshire; West Kilbride, Ayrshire; Riverstown, Cork; near Limerick; Dunkerron, Kerry; Westport and Achill Island, Mayo.

21. *P. ambigua* Ach. Meth. Lich. p. 207 (1803).—Thallus orbicular, closely adnate, straw-coloured or glaucous-grey, sprinkled with sulphur-coloured soralia, the lobes narrow, somewhat pinnatifid, plane, widening outwards; beneath brownish-black, lighter towards the circumference with a few scattered stoutish rhizine almost to the edge (K—, CaCl—). Apothecia small, with a rather prominent entire or crenulate margin; spores oblong or ovoid-oblong, often slightly curved, $7\text{--}11\ \mu$ long, $2\cdot5\text{--}3\cdot5\ \mu$ thick.—Borr. in Engl. Bot. Suppl. t. 2796 (two lower figs.). Hook. Fl. Scot. ii. p. 55 & in Sm. Engl. Fl. v. p. 203; Leight. Lich. Fl. p. 127; ed. 3, p. 118. *P. diffusa* Mudd Man. p. 103 (1861) (non Web.). *Lichen ambiguus* Wulf. in Jacq. Coll. Bot. iv. p. 239 (1790). *Parmeliopsis ambigua* Nyl. in Not. Sällsk. Faun. & Fl. Fenn. Förh. n. ser. v. p. 121 (1866); Cromb. Lich. Brit. p. 37 & Monogr. i. p. 263.

Æsicc. Cromb. n. 146; Johns. n. 222; Leight. n. 373; Mudd n. 75.

Well distinguished from *P. Mougeotii*, which it resembles in the yellow soralia by the more developed thallus, by the unbroken lobes, the absence of reaction, and the form of the ascospores and spermata. The latter are long, slender and arcuate, about $18\cdot25\ \mu$ long, $\cdot5\ \mu$ thick. Because they differ from those of other *Parmelia*, this species and *P. aleurites*, in which they also occur, have been placed by several writers in a separate genus, *Parmeliopsis*.

Hab. On the trunks of old fir trees near the roots and on old fir palings in upland districts.—*Distr.* Rare but common where it occurs throughout England and Central Highlands, Scotland.—*B. M.* Ightham, Kent; Twycross and Gopsall Park, Leicestershire; near Oswestry, Shropshire; Cwm Bychan, Merioneth; Ingleby Greenhow, Yorkshire; Killin, Perthshire; Kinnordy, Forfarshire; Mar Forest and Glen Derry, Braemar, Aberdeenshire; Larig Guie, Banffshire; Rothiemurchus, Invernesshire.

22. *P. hyperopta* Ach. Syn. Lich. p. 208 (1814); (in Hb. Ach. fide Wainio in Termesz. Füzet. xxii. p. 280 (1899)).—Thallus orbicular, closely appressed, greyish-white, with whitish pulverulent soredia, the lobes narrow, spreading, not much branched; beneath brownish-black, with scanty rhizinae to the edge (K^+ yellow, $CaCl^-$). Apothecia very long, small or nearly moderate in size, brownish or reddish-brown, concave or becoming plane, the margin thin, slightly crenulate; spores oblong or fusiform-oblong, usually somewhat curved, 11–12 μ long, 3–4 μ thick.—Mudd Man. p. 98; Leight. Lich. Fl. ed. 2, p. 478; ed. 3, p. 119. *P. ambigua* Borr. in Engl. Bot. Suppl. t. 2796 (1835) (two upper figs.). *Parmeliopsis aleurites* Nyl. in Flora lii. p. 445 (1869) (non Ach.); Cromb. Monogr. i. p. 263.

Distinguished from the preceding by the white soredia, and by the reaction with potash. There is considerable confusion in nomenclature between this species and *Cetraria (aleurites) diffusa*. The latter is isidiöse, brown beneath, while *P. hyperopta* is sorediose and black beneath.

Hab. On the trunks of old firs near the roots, and on fir palings in mountainous districts.—*Distr.* Rare in the N. Grampians, Scotland.—*B. M.* Glen Dee, Braemar, Aberdeenshire; Larig Guie, Banffshire; Aviemore, Invernesshire.

Soredia on tips or margins of lobes.

23. *P. cetrata* Ach. Syn. Lich. p. 198 (1814); Wain. Lich. Brés. i. p. 40 (1890).—Thallus suborbicular, lobate, smooth, minutely reticulate-rimulose, glaucous or whitish, the lobes irregular, rather deeply crenulate and ascending at the circumference, more deeply divided towards the centre, occasionally black ciliate, frequently sorediate on the tips or the margins, more rarely on the surface; beneath blackish towards the centre, dark-brown at the edges; rhizinae over the entire lower surface or reduced to papillae towards the edge (K^+ yellow, then red, $CaCl^-$). Apothecia very rare, typically pedicellate, brown, the margin entire, generally perforate at the centre when mature; spores 14–15 μ long, 7–8 μ thick. *P. perforata* S. F. Gray Nat. Arr. i. p. 437 (1821)? Nyl. Syn. Lich. i. p. 377 (1860) pro parte (non Ach.) (incl. var. *cetrata*), p. 378; Hook. in Sm. Engl. Fl. v. p. 200 pro parte. Cromb. Lich. Brit. p. 32; Leight. Lich. Fl. p. 134; ed. 3, p. 123. *P. reticulata* Tayl. in Mackay Fl. Hib. ii. p. 148 (1836). *P. perlata* var. *ciliata* Mudd Man. p. 92 (1861). *Lichenoides glaucum, foliorum luciniis crinitis* Dill. Hist. Musc. t. 20, fig. 42 A (1741). *Lichen perforatus* Sm. Engl. Bot. t. 2423 (mid. fig.) (1812) (non Jacq.).

Essicc. Cromb. n. 29; Larb. Lich. Hib. n. 250.

Distinguished by the faint mosaic of minute cracks on the upper surface, and by the presence of rhizinae or papillae right up to the edge. It has been confused with *P. perforata*, also an Acharian species, but

the examination of the types by Wainio (l. c.) has definitely decided the point of nomenclature. In *P. perforata* Ach. the lobes are naked at the edge of the under surface.

Hab. On mossy rocks and the trunks of old trees chiefly in maritime districts.—*Distr.* Rather uncommon in the Southern and Western counties of the British Isles.—*B. M.* Rozel, Jersey; Alderney; Penzance and Withiel, Cornwall; South Brent, Devon; Lyme Regis, Dorset; Carisbrooke, I. of Wight; Nannau, Dolgelly and Tan-y-Croes, Merioneth; Barcaldine, Argyll; Dunkerron, Kerry; near Kylemore, Connemara, Galway.

24. *P. lævigata* Ach. Syn. Lich. p. 212 (1814).—Thallus suborbicular, horizontal, lobate, the lobes sinuate at the axils, multifid, narrow or rather broad, spreading (divaricate), partly imbricate, often with turgid soralia at the apices, glaucous-white or whitish; beneath blackish, densely rhizinose up to the margin ($K \pm$ yellow, $CaCl_2$, medulla $K (CaCl_2) + red$). Apothecia moderate in size or large, reddish-brown, the margin becoming crenulate or sorediate; spores 6–8 in the ascus, 17–23 μ long, 10–14 μ thick with a stout epispore.—*S. F. Gray Nat. Arr. i. p. 443*; *Hook. Fl. Scot. ii. p. 55* & in *Sm. Engl. Fl. v. p. 200*; *Tayl. in Mackay Fl. Hib. ii. p. 148*; *Cromb. Lich. Brit. p. 33*; *Leight. Lich. Fl. p. 139*; ed. 3, p. 128. *P. sinuosa* var. *lævigata* Schær. Enum. p. 43 (1850); *Mudd Man. p. 95*. *Lichen lævigatus* Sm. Engl. Bot. t. 1852 (1808).

Exsicc. *Cromb. n. 141*; *Larb. Caesar. n. 64* & *Lich. Hib. n. 124*; *Mudd n. 69*.

Distinguished by the sinuous rounded axils and the rather blunt square tops of the laciniae. The apothecia are very rare and imperfect. The spore sizes have been taken from Nylander's description (Syn. Lich. p. 384), there being no material wherewith to verify them. Spermogones are more frequent; they are minute, blackish with spermatia about 5–7 μ long, 1 μ thick.

Hab. On rocks, boulders, and trunks of trees, chiefly in maritime and mountainous districts.—*Distr.* General and not uncommon in the Southern and Western districts of the British Isles.—*B. M.* Jersey; Guernsey; Penzance and near Withiel, Cornwall; Okehamp-ton, Lustleigh Cleeve, Dartmoor, Lynton and Bolt Head, Devon; New Forest and Bournemouth, Hants; near Dolgelly, Aberdovey, and Barmouth, Merioneth; Llanberis and Beddgelert, Carnarvonshire; Beaumaris, Anglesea; Asby, Cumberland; Inverary and Barcaldine, Argyll; Trossachs, Perthshire; Ben Nevis, Invernessshire; Glen Ach-na-Shilloch, Rossshire; Gougaumbara, Cork; Killarney, Kerry; Connemara, Galway; Achill Island, Mayo.

Var. *dissecta* Oliv. Lich. d'Eur. i. p. 189 (1907).—Thallus yellowish, small, deeply dissected and isidiiferous; beneath with short rhizinae (medulla $K(CaCl) + red$). Apothecia unknown.—*Parmelia dissecta* Nyl. in *Flora lxv. p. 451* (1882); *Cromb. in Grevillea xv. p. 75* (1887) & *Monogr. i. p. 247*.

Recorded by Nylander as a saxicolous lichen rare in Ireland. A corticolous specimen collected by H. B. Holl in N. Wales, and deter-

mined by Crombie as *P. dissecta*, has an orbicular thallus of sinuous narrow pinnatifid lobes, like a very fine *P. sinuosa*. Here and there isidia are developed on the surface.

Hab. On rocks or trunks of trees.—*B. M.* Cwm Bychan, Merioneth.

25. *P. revoluta* Flörke Deutsch. Lich. i. p: 11 (1815).—Thallus orbicular, moderate in size (usually 2–3 inches across), smooth, narrowly sinuate-lobate or laciniate, glaucous-white or whitish, the lobes slightly hooded-revolute and sometimes with turgid soralia at the tips, the sorediate area spreading over the lobes; beneath blackish, rhizinose up to the brownish margin, but often becoming naked ($K \pm$ yellowish, $CaCl \mp$ reddish). Apothecia rather small, brownish-red, the margin entire or crenate; spores 6–8 in the ascus, 11–19 μ long, 7–12 μ thick.—Cromb. in Grevillea xv. p. 75 (1887). *P. tiliacea* vars. *revoluta* and *sublævigata* Leight. Lich. Fl. p. 132 (1871); var. *sublævigata* ed 3, p. 122 (1879) (? Nyl.). *P. lævigata* vars. *revoluta* and *subsinnuosa* Leight. op. cit. ed. 3, p. 129.

Excicc. Johns. n. 186; Larb. Lich. Hib. n. 293; Leight. n. 202 (as *P. Fosteri* Borr.), n. 357 (as *P. rugosa* Tayl.); Mudd n. 68.

A smaller plant than *P. lævigata*, which it resembles in the sinuous branching and rounded axils, but is distinguished by the slightly revolute tips of the lobes.

Hab. On rocks and trees among mosses in maritime and mountainous districts.—*Distr.* General, but not common in S.W. and N. England, rare in the Channel Islands, S. Scotland and W. Highlands and W. Ireland.—*B. M.* La Coupe, Jersey; St. Breock, Withiel and Penzance, Cornwall; Ilsham, Ullacombe, Dartmoor and Lynton, Devon; I. of Wight; near Lyndhurst and Bournemouth, Hants; St. Leonard's Forest, Eridge Rocks and Ardingly, Sussex; Cader Idris, near Barmouth, near Dolgelly and Aberdovey, Merioneth; Anglesea; Bedale, Yorkshire; near Kendal, Westmoreland; New Galloway, Kirkeudbrightshire; Barcaldine, Argyll; Loch Linnhe, Invernessshire; Castlebernard Park, Bandon, Cork; Killarney, Kerry; Letterfrack, Connemara, Galway.

Var. *rugosa* Cromb. in Grevillea xv. p. 75 (1887) (incl. f. *panniformis*).—Thallus more expanded, the lobes broader, often bulging at the centre and rugose or tuberculate-rugose. Apothecial margin becoming rugose. *P. rugosa* Tayl. in Mackay Fl. Hib. ii. p. 145 (1836). *P. tiliacea* var. *rugosa* Leight. Lich. Fl. p. 133 (1871). *P. lævigata* var. *rugosa* Leight. op. cit. ed. 3, p. 128 (1879).

The lobes are more crowded in the centre and somewhat less revolute at the tips, and soredia are less frequently developed than in the species. Form *panniformis* is crowded with short lobes, evidently a growth condition.

Hab. On rocks, boulders, railings, etc., in maritime and inland districts.—*Distr.* Less frequent but mostly coextensive with the species.—*B. M.* Pentire and the Lizard, Cornwall; Cornworthy, Devon;

Bramber, Sussex; Barmouth, Dolgelly and Aberdovey, Merioneth; Llanberis, Carnarvonshire; Barcaldine, Argyll.

Var. *concentrica* Cromb. in Grevillea xv. p. 75 (1887).—An erratic globular form, the lobes growing in concentric layers. Apothecia not seen.—*P. saxatilis* var. *concentrica* Leight. in Exsicc. n. 232 (1856), cf. Berk. in Gard. Chron. 1856, pp. 84 & 172. *P. sinuosa* var. *erratica* Linds. in Trans. R. Soc. Edin. xxii. 1, p. 218 (1859); var. *concentrica* Mudd Man. p. 96 (1861). *P. lævigata* var. *concentrica* Cromb. Lich. Brit. p. 33 (1870). *P. tiliacea* var. *concentrica* Leight. Lich. Fl. p. 132 (1871); ed. 3, p. 122.

Exsicc. Leight. n. 232.

This curious variety has been collected in two different localities. It was first found unattached on the downs of Melbury Hill. Crombie points out that there is no reason to suppose the lichen was at first free, but it had become detached and subsequently globular in form (Journ. Bot. x. p. 307 (1872)), an observation confirmed by Paulson and Somerville Hastings (Knowledge xxxvii. p. 319 (1914)).

Hab. On upland downs.—*B. M.* Melbury Hill near Shaftesbury, Dorset; downs near Seaford, Sussex.

26. *P. endochlora* Leight. Lich. Fl. p. 140 (1871).—Thallus horizontal, moderate in size, sinuate-lobate rather of a thin texture, the lobes imbricate, blunt at the ends sometimes with turgid soralia, whitish or glaucous-white; medulla sulphur-yellow; beneath black, rhizinose up to the edge (K + yellow). Apothecia moderate in size or large, brownish-red, the amphithecium verrucose, margin incurved, verrucose-crenate; spores 6–8 in the ascus, 16–19 μ long, 8–11 μ thick.—Leight. op. cit. ed. 3, p. 130. *P. McMillana* Stirton in Grevillea iii. p. 79 (1874). *P. xanthomyela* Nyl. in Flora lvii. p. 306 (1874); Cromb. in Journ. Bot. xii. p. 360 (1876) & Monogr. i. p. 236.

Altogether a slightly smaller plant than *P. lævigata*, and distinguished by the yellow medulla; the soredia become dark-coloured with age.

Hab. On rocks and boulders in shady mossland districts.—*Distr.* Local and scarce in N. Wales, Scottish Highlands and W. Ireland.—*B. M.* Dolgelly, Merioneth; Barcaldine, Appin, and Glen Croc, Argyll; Askew Wood, Dunkerron, Kerry; Kylemore, Connemara, Galway.

b. *Thallus greenish-yellow.*

27. *P. conspersa* Ach. Meth. Lich. p. 205 (1803).—Thallus orbicular, spreading widely, appressed, laciniate-lobate, somewhat smooth and shining, the lobes plane, sinuate, crenate, greenish-straw-coloured; beneath brown, with short black rhizinae mostly up to the edge (K + yellow, then red, CaCl⁻). Apothecia generally central and numerous, dark-brown, with an entire, inflexed margin; spores 8–12 μ long, 5–8 μ thick.—S. F. Gray

Nat. Arr. i. p. 442; Hook. Fl. Scot. ii. p. 55 & in Sm. Engl. Fl. v. p. 199; Tayl. in Mackay Fl. Hib. ii. p. 143; Mudd Man. p. 102; Cromb. Lich. Brit. p. 34; Leight. Lich. Fl. p. 134; ed. 3, p. 124. *Lichenoides imbricatum viridans, scutellis badis* Dill. Hist. Musc. p. 180, t. 24, fig. 75 A (1741). *Lichen centrifugus* Huds. Fl. Angl. p. 445 (1762) (non Linn.); Lightf. Fl. Scot. ii. p. 814; With. Arr. ed. 3, iv. p. 32 pro parte. *L. conspersus* Ehrh. ex Ach. Lich. Suec. Prodr. p. 118 (1798); Engl. Bot. t. 2097.

Exsicc. Cromb. n. 26; Johns. n. 303; Larb. Cæsar. n. 65; Leight. n. 78.

The thallus is normally orbicular, but it may spread extensively and become more irregular in outline. Towards the centre the lobes are frequently more divided and somewhat convex, and tend to become isidiöse. The spermogones are black and irregularly scattered, with spermatia 5-6 μ long, and 1 μ thick.

Hab. On the trunks of old trees or palings, and on boulders.—*Distr.* General and common throughout the British Isles, especially in mountainous districts.—*B. M.* Jersey; Sark; near Penzance and Helmington, Cornwall; Dartmoor, Ivy Bridge and Temple Moor, Devon; Westerham, Kent; Malvern Hills, Worcestershire; Charnwood Forest, Leicestershire; near Oswestry, Shropshire; Llanbedr, Barmouth, and Cader Idris, Merioneth; Beddgelert and Bangor, Carnarvonshire; Llandyssil, Cardiganshire; Beaumaris, Anglesea; Teesdale, Durham; near Kendal, Westmoreland; New Galloway, Kirkcudbrightshire; near Moffat, Dumfriesshire; Ayrshire; King's Park, Stirling; Inverary, Crinan Canal and Appin, Argyll; Loch Ard, Ben Lawers and Aberfeldy, Perthshire; Glen Cluny, Braemar, Aberdeenshire; Applecross, Rossshire; Dunkerron, Kerry; Louisburgh, Mayo.

Form *isidiata* Leight. Lich. Fl. p. 135 (1871).—Thallus covered with densely crowded isidia except towards the circumference.—Leight. Lich. Fl. ed. 3, p. 125. *Lichenoides* &c. Dill. l. c. fig. 75 B. *Imbricaria conspersa* f. *isidiata* Anzi Catal. Lich. Sondr. p. 28 (1860).

Exsicc. Bohl. n. 110; Johns. n. 221; Leight. n. 79 pro parte.

Differs chiefly in the densely isidioid thallus, the lobes being often scarcely distinguishable. It is usually sterile.

Hab. On rocks and boulders in upland regions.—*Distr.* Rather rare in S.W., W. and N. England, Wales, and S. Scotland and N.W. Ireland, more frequent in the S. and W. Highlands.—*B. M.* Withiel, Roscorea, and near Penzance, Cornwall; Dartmoor, Devon; Maresfield, Sussex; Herefordshire Beacon, Malvern, Worcestershire; Bardon Hill, Leicestershire; Coed Coch, Denbighshire; near Dolgelly and Barmouth, Merioneth; Snowdon, Carnarvonshire; near Kendal, Westmoreland; New Galloway, Kirkcudbrightshire; King's Park, Stirling; Appin, Argyll; near Aberfeldy, Ben Lawers and Rannoch, Perthshire; near Cortachy, Forfarshire; Crathes, Aberdeenshire.

Var. *stenophylla* Ach. Meth. Lich. p. 206 (1803).—Thallus lobes narrower, more divided, crowded and imbricate. Apothecia smaller, rare.—Mudd Man. p. 102; form *stenophylla* Schær.

Enum. Lich. p. 46 (1850); Cromb. Lich. Brit. p. 34; Leight. Lich. Fl. p. 135; ed. 3, p. 124.

Exsicc. Johns. n. 121; Leight. n. 79 pro parte.

Distinguished by the form of the laciniae, which are also occasionally crowded and panniform. The thallus is normally smooth, but sometimes isidiiferous.

Hab. On boulders and old walls in upland districts.—*Distr.* Rare in S., Central and W. England, N. Wales, S.W. Highlands and S. Grampians, Scotland, rare in S.W. and W. Ireland.—*B. M.* Near Penzance, Cornwall; Bardon Hill, Leicestershire; near Oswestry, Shropshire; Rhewgreidden, Llanbedr, Barmouth and Dolgelly, Merioneth; near Kendal, Westmoreland; Wastdale, Cumberland; Inverary and Appin, Argyll; Ben Lawers, Perthshire; Dunkerron, Kerry; Corraun Mt., Mayo.

28. *P. sinuosa* Ach. Syn. Lich. p. 207 (1814).—Thallus suborbicular, rather small, laciniate-lobed, widely sinuate, smooth, the lobes narrow, pinnatifid, dilated and often sorediate at the apices, yellowish-green; beneath blackish and densely rhizinose, usually to the edge, sometimes lighter in colour and bare at the tips (Kf $\frac{+}{+}$ ^{yellow,} _{yellow, then red,} CaCl₂). Apothecia central, rare, moderate in size or small, reddish-brown, the margin thin, entire; spores 11–20 μ long, 8–12 μ thick.—S. F. Gray Nat. Arr. i. p. 442; Hook. Fl. Scot. ii. p. 54 & in Sm. Engl. Fl. v. p. 203; Tayl. in Mackay Fl. Hib. ii. p. 149; Mudd Man. p. 95 pro parte; Cromb. Lich. Brit. p. 33; Leight. Lich. Fl. p. 136; ed. 3, p. 125. *Lichen sinuosus* Sm. Engl. Bot. t. 2050 (1809).

Exsicc. Larb. Lich. Hb. n. 8.

Somewhat resembling *P. lavigata* in the sinuous branching, but differing in the narrower lobes and the colour of the thallus, and in the thalline reaction.

Hab. On trunks of trees and on boulders in maritime and upland districts.—*Distr.* Rather rare in the Channel Islands, S. and W. England, S. and W. Scotland, and S. and W. Ireland.—*B. M.* Guernsey; Ullacombe, Devon; Barmouth, Ty Gwn, near Dolgelly, Merioneth; Anglesea; Brodrick Castle, Arran; Appin, Argyll; Glen Nevis, Invernessshire; Applecross, Rosshire; near Macroom, Cork; Cromaglow and Dunkerron, Kerry; Connemara, Galway.

29. *P. multifida* A. L. Sm.—Thallus orbicular or irregularly spreading, narrowly laciniate, greenish-straw-coloured or pale ochraceous, sometimes dark-greenish-brown towards the centre and sometimes with large tuberculose sulphur-coloured soralia, the lobes narrow, convex, rather gnarled, incurved at the apices; beneath dark-coloured with short crowded black rhizinae (K₂, CaCl₂). Apothecia small, reddish-brown, the margin subentire; spores 8–12 μ long, 5–6 μ thick.—*P. recurva* Ach. Meth. Lich. p. 201 (1803); S. F. Gray Nat. Arr. i. p. 442; Hook. Fl. Scot. ii. p. 54. *P. incurva* Fr. Nov. Sched. Crit. p. 31 (1826); Hook. in Sm. Engl. Fl. v. p. 202; Tayl. in Mackay

Fl. Hib. ii. p. 149; Mudd Man. p. 102; Cromb. Lich. Brit. p. 34 & Monogr. i. p. 249; Leight. Lich. Fl. p. 140; ed. 3, p. 129. *Lichen multifidus* Dicks. Pl. Crypt. fasc. iii. p. 16, t. 9, fig. 7 (1793). With. Arr. ed. 3, iv. p. 28. *L. incurvus* Pers. in Ust. Ann. Bot. vii. p. 24 (1794).

Distinguished from allied species in the incurved apices of the lobes, and generally in the gnarled and twisted aspect of the whole plant. Apothecia are rare, but spermogones are frequent, with spermatia 5-7 μ long, 1 μ thick.

Hab. On granite rocks and boulders in subalpine and alpine places.—*Distr.* Local and rare in S.W. Ireland and S. Scotland, more frequent among the Grampians.—*B. M.* New Galloway, Kirkeudbrightshire; Craig Coinnoch, Beu-naboord, Morrone and Upper Glen Dee, Braemar, Aberdeenshire.

c. *Thallus dark-green, olivaceous or brown.*

30. *P. acetabulum* Dub. Bot. Gall. ii. p. 601 (1830).—Thallus orbicular, coriaceous-membranaceous, smooth or wrinkled, lobate, dark-green or dull-olivaceous, the lobes imbricate, rounded, appressed at the circumference, ascending, crumpled or undulating in the centre; beneath pale-brown, sparingly rhizinose (K^+ yellowish, then red, $CaCl^-$). Apothecia becoming rather large, brownish-red, the margin crenulate, inflexed; spores 12-16 μ long, 8-10 μ thick.—Mudd Man. p. 99; Cromb. Lich. Brit. p. 35; Leight. Lich. Fl. p. 136; ed. 3, p. 125. *P. corrugata* Ach. Meth. Lich. p. 215 (1803); S. F. Gray Nat. Arr. i. p. 438; Hook. in Sm. Engl. Fl. v. p. 201. *Lichenoides acetabulis cutaneis et rugosis* Dill. Hist. Muse. p. 185, t. 24, fig. 79 (1741). *Lichen acetabulum* Neck. Delic. Gallo-Belg. p. 506 (1768). *L. corrugatus* Sm. in Trans. Linn. Soc. i. p. 83, 1791 & Engl. Bot. t. 1652.

Exsicc. Cromb. n. 142; Leight. n. 362.

Distinguished by the dull dark green or brown colour of the corrugate thallus. Apothecia are rather rare; spermogones are abundant, with spermatia about 7 μ long, 1 μ thick.

Hab. On the trunks of old trees in woods and parks in lowland districts.—*Distr.* Not general nor common throughout England, rare in Scotland, not seen from Ireland. *B. M.* Okehampton, Devon; near Netley Abbey, Hants; St. Leonard's Forest, Poyning's Hill, Hayward's Heath, Bramber Castle and Beeding Priory, Sussex; Maidstone and Broome Park, Kent; near Chelmsford and Epping Forest, Essex; Somerford Keynes, Wiltshire; near Cirencester and Fairford, Gloucestershire; near the Ketch, Worcestershire; Rendham and near Bury, Suffolk; Harboro' Magna, Warwickshire; near Buckingham; Nesseliff, Shropshire; Ayton and Stokesley, Cleveland, Yorkshire; Auldbar, Forfarshire.

31. *P. olivacea* Ach. Meth. p. 213 (1803). Thallus orbicular, appressed, lobate, wrinkled, olive- or deep umber-brown, the lobes plane rounded and crenate: beneath dark-brown, sparingly

rhizinose (K^- , $CaCl^-$). Apothecia moderate in size, dark-umber-brown, the margin entire or subentire; spores 11–19 μ long, 7–10 μ thick.—Cromb. Lich. Brit. p. 35 pro parte & in Grevillea x. p. 24; Leight. Lich. Fl. p. 122 pro parte; ed. 3, p. 114 pro parte. *Lichenoides olivaceum*, *scutellis lævibus* Dill. Hist. Musc. p. 182, t. 24, fig. 77 A (1741). *Lichen olivaceus* L. Sp. Pl. p. 1143 (1753).

A northern species found in the British Isles only in N. Scotland. *Lichen olivaceus* and *Parmelia olivacea* of earlier British authors refer to other species. It may be readily recognized by the wrinkled thallus.

Hab. On the trunks of trees, birch and alder, in wooded upland districts.—*Distr.* Local and rare in the N. Grampians, Scotland.—*B. M.* Banks of the Cluny, Braemar, Aberdeenshire.

32. *P. exasperata* Carroll in Journ. Bot. iii. p. 288 (1865).—Thallus orbicular or spreading irregularly, closely appressed, lobate, more or less thickly sprinkled with minute roundish papillæ with an opening above (breathing pores), olive-brown, the lobes variable, generally obliterated towards the centre, sometimes pinnatifid, rounded and crenate at the circumference; beneath somewhat paler and rhizinose to the edge (K^- , $CaCl^-$). Apothecia generally moderate in size, or rather large, up to nearly 1 cm. across, brownish-red, the margin raised, and generally thickly papillose with breathing pores; spores 9–12 μ long, 7–10 μ thick.—Cromb. in Journ. Linn. Soc. xvii. p. 572 (1880). *P. olivacea* S. F. Gray Nat. Arr. i. p. 438 (1821) (non Ach.); Hook. Fl. Scot. ii. p. 52 & in Sm. Engl. Fl. v. p. 200; Tayl. in Mackay Fl. Hib. ii. p. 143; Mudd Man. p. 99 pro parte; subsp. *exasperata* Nyl. Syn. Lich. i. p. 396 (1860); Cromb. Lich. Brit. p. 35; var. *exasperata* Leight. Lich. Fl. p. 123 (1871); ed. 3, p. 115. *Lichenoides crusta foliosa scutellata, pullum* Dill. in Ray Syn. ed. 3, p. 72, n. 60 (1724). *Lichenoides olivaceum, scutellis amplioribus verrucosis* Dill. Hist. Musc. p. 184, t. 24, fig. 78 (1741). *Lichen olivaceus* Huds. Fl. Angl. p. 446 (1762) (non L.); Lightf. Fl. Scot. ii. p. 819 pro parte; With. Arr. ed. 3, iv. p. 35; Engl. Bot. t. 2180. *Collema exasperatum* Ach. Lich. Univ. p. 645 (1810).

Excicc. Lerb. Lich. Hb. n. 327; Leight. nos. 263, 356; Mudd n. 72.

Resembles *P. fuliginosa* var. *lætevirens* in colour and habit, but is well distinguished by the constantly papillose thallus—not isidioid—and in the absence of thalline reactions. The spermogones are immersed in the thallus, towards the circumference of the thalline lobes; they are globose and extremely minute, measuring 25 μ to 35 μ in diameter; the spermatia are somewhat fusiform, 8–10 μ long, about 1 μ thick.

Hab. On the trunks of old trees in maritime and upland districts.—*Distr.* General and common in the S. and W. counties of Great

Britain and Ireland.—*B. M.* Withiel, Cornwall; New Forest, Hants; Danny and Tilgate, Sussex; Gad's Hill, Kent; Cricklade, Wiltshire; Pembridge, Herefordshire; Crowle, Worcestershire; near Dolgelly, Merioneth; Island of Anglesea; Ayton, Cleveland, Yorkshire; Egglestone, Durham; near Kendal, Westmoreland; New Galloway, Kirkcudbrightshire; Largs, Ayrshire; Pentland Hills, near Edinburgh; Appin, Argyll; Glen Calliach and Glen Lochay, Perthshire; S. of Fort William, Invernessshire; Kilravock, Nairnshire; Applecross, Rossshire; Glencar and Mangerton, Kerry; Killery Bay, Connemara, Galway.

33. *P. omphalodes* Ach. Meth. p. 204 (1803).—Thallus orbicular, sometimes widely spreading, rather smooth and shining, lacinate-lobate, the lobes generally narrow, crowded variously subtruncate or retuse at the apices, dark-brown to purplish-black, often with whitish dotted reticulations; beneath densely black-rhizinoze (K \ddagger ^{yellowish,} _{yellow, then red,} CaCl $\bar{\square}$). Apothecia often numerous, moderate in size or large, up to about 2 cm. across, dark reddish-brown, the amphithecium and margin thin and light-coloured; spores 12–16 μ long, 6–7 μ thick.—S. F. Gray Nat. Arr. i. p. 440; Hook. Fl. Scot. ii. p. 53 & in Sm. Engl. Fl. v. p. 199; Tayl. in Mackay Fl. Hib. ii. p. 145; f. *cæsiopruinosa* Nyl. ex Stiz. in St. Gall Nat. Ges. 1876, p. 206; Cromb. in Journ. Bot. lxx. p. 272 (1882) & Monogr. i. p. 214. *P. saxatilis* var. *omphalodes* Fr. Lich. Eur. p. 62 (1831); Mudd Man. p. 95; Cromb. Lich. Brit. p. 34; Leight. Lich. Fl. p. 138; ed. 3, p. 127; var. *lævis* Nyl. Syn. Lich. i. p. 389 (1860). Subsp. *omphalodes* f. *cæsiopruinosa* Nyl. ex Norrl. in Not. Sällsk. Faun. & Fl. Fenn. Förh. xiii. p. 324 (1873). *P. sulcata* var. *lævis* Cromb. in Journ. Bot. lviii. p. 140 (1875) & Monogr. i. p. 242. *Lichenoides saxatile tinctorium, foliis pilosis purpureis* Dill. in Ray Syn. ed. 3, p. 74, n. 70 (1724) & Hist. Musc. p. 185, t. 24, fig. 80 (1741). *Lichen omphalodes* L. Sp. Pl. p. 1143 (1753); Huds. Fl. Angl. p. 446; Lightf. Fl. Scot. ii. p. 818; With. Arr. ed. 3, iv. p. 34; Engl. Bot. t. 604.

Essicc. Bohl. n. 18; Croall nos. 389, 390; Dicks. Hort. Sicc. fasc. xvii. n. 22; Johns. n. 188; Larb. Cæsar. n. 19; Leight. n. 7; Mudd n. 67.

Closely allied to *P. saxatilis*, of which along with *P. sulcata* it is frequently classified as a variety. It differs in the more shining generally much darker thallus, less marked reticulations, and in the entire absence of soredia or isidia. *P. sulcata* var. *lævis* is similar, but somewhat lighter in colour. Occasionally the thallus is bluish-white as if pruinose (f. *cæsiopruinosa*). It often spreads extensively, covering large boulders. Spermogones are not uncommon.

Hab. On rocks, boulders, etc., in maritime, upland and alpine regions.—*Distr.* Widely distributed and common throughout the British Isles, especially in hilly regions.—*B. M.* Guernsey; Alderney; Jersey; near Penzance, Camelford, Temple Moor, and Helmington, Cornwall; Lynton, Dartmoor, Hay Tor and Lustleigh Cleeve, Devon; Malvern Hills, Worcestershire; Barmouth, Rhewgreden.

and Cader Idris, Merioneth; Conway Mt., Cwm Idwal, and Llanberis, Carnarvonshire; Holyhead and Anglesea; near Malloch, Derby; Cleveland, Yorkshire; near Egglestone and Teesdale, Durham; Kentmore, Westmoreland; Cumberland; Cheviots, Northumberland; Moffat, Dumfriesshire; New Galloway, Kirkcudbrightshire; Dalmahoy Crags near Edinburgh; Appin, Argyll; Killin, Ben Lawers, Ben Croin, the Trossachs, Rannoch, Abernethy and near Dunkeld, Perthshire; Canlochan and Clova, Forfarshire; Durris, Kincardineshire; near Invercauld, Morron. Glen Dee, Braemar, near Aviemore and Ben Nevis, Invernesshire; Applecross, Rossshire; Dunkerron and Caher, Kerry; Corraun and Achill Island, Mayo.

Var. *panniformis* Ach. Meth. p. 204 pro parte.—Thallus more or less spreading, divided into narrow laciniae which are crowdedly imbricate. Apothecia as in the species.—Cromb. in *Grevillea* xv. p. 75 (1877) incl. ff. *glomulifera* and *subconcentrica* & Monogr. i. p. 244. *P. saxatilis* var. *panniformis* Cromb. Lich. Brit. p. 34 (1870); Leight. Lich. Fl. ed. 3, p. 128; var. *omphalodes* ff. *subconcentrica* and *glomulifera* Cromb. in Journ. Bot. x. p. 307 (1872); form *glomulifera* Leight. Lich. Fl. ed. 3, p. 126 (1879).

Exsicc. Johns. n. 189.

A densely imbricate form; very rarely the lobes crowd over each other in many layers (f. *subconcentrica*). On specimens from Cwm Idwal, Carnarvonshire, and Morron, Aberdeenshire, there are gall-like formations of upright massed isidioid outgrowths (f. *glomulifera*), some rare growth condition rather than a true form.

Hab. On rocks and boulders in upland and subalpine regions.—*Distr.* Somewhat rare, though plentiful where it occurs in S.W. and N.W. England, N. Wales, S. Scotland, on the Grampians and in W. Ireland.—*B. M.* Near Penzance and Helminton, Cornwall; Hay Tor, Dartmoor and Didsworth, Devon; Stiperstones Hill, Shropshire; Llyn Gwrionydd, Merioneth; Cwm Idwal, Carnarvonshire; Cumberland; New Galloway, Kirkcudbrightshire; Ben Cruachan, Argyll; Ben More and Ben Lawers, Perthshire; Morron, Braemar and Ben-naboord, Aberdeenshire; Ben Nevis, Invernesshire; Corraun Mt. and Achill Sound, Mayo.

34. *P. prolixa* Carroll in Journ. Bot. iii. p. 288 (1865).—Thallus suborbicular, appressed, narrowly lobate, the lobes imbricate, crowded, convex and wrinkled, crenate, scarcely dilated at the apices, very dark-olive or blackish-umber, somewhat shining; beneath blackish, sparingly rhizinose all over (K₂, CaCl₂). Apothecia small or moderate in size, coloured like the thallus with an entire or subentire margin; spores 9–12 μ long, 5–6 μ thick.—Cromb. in *Grevillea* x. p. 25 (1881). *P. dendritica* Pers. in Ann. Wetter. Ges. ii. p. 16 (1811)? *P. olivacea* var. *prolixa* Ach. Meth. Lich. p. 214 (1803); Leight. Lich. Fl. p. 122; ed. 3, p. 115; var. *dendritica* Leight. l. c.

Exsicc. Leight. n. 365 (as *P. stygia*).

Distinguished from *P. olivacea* by the narrower lobes, the dark colour, and by the habitat.

Hab. On rocks in maritime and upland districts.—*Distr.* Rare in W. England and Wales, in S. Scotland and the N. Grampians, and in W. Ireland.—*B. M.* Malvern Hills, Worcestershire; Caer Caradoc, Shropshire; Llandegley Rocks, Radnorshire; Moel-y-golfa, Montgomeryshire; Douglas Head, Isle of Man; New Galloway, Kirkcudbrightshire; Port Lethen, Kincardineshire; Craig Guie, Braemar, Aberdeenshire.

Subsp. *Delisei* Nyl. in Bull. Soc. Linn. Norm. sér. 2, vi. p. 303 (1872).—Thallus larger, and paler in colour, light-brown, the lobes broader at the circumference (K(CaCl \mp f. reddish)).—Cromb. in Journ. Bot. xi. p. 133 (1873) & in Grevillea x. p. 25. *P. olivacea* var. *Delisei* Dub. Bot. Gall. p. 602 (1830); var. *aquiloides* Linds. in Trans. Roy. Soc. Edin. xxii. p. 236 (1859); Mudd Man. p. 99. *P. Delisei* Leight. Lich. Fl. ed. 3, p. 129 (1879).

Exsicc. Bohl. n. 109 pro parte; Larb. Lich. Hb. n. 328; Leight. n. 291 pro parte.

To this subspecies refer also the citations *Lichen olivaceus* pro parte and *Parmelia olivacea* pro parte of various British authors already quoted. In old plants the apothecia are rather larger and crowded.

Hab. On rocks and boulders in maritime and upland districts.—*Distr.* Local in the Channel Islands, S. and W. England, N. Wales, Central Scotland and S. Ireland.—*B. M.* Rozel and La Moye, Jersey; Jerbourg, Guernsey; Helmin-ton and near Penzance, Cornwall; Wembury, Devon; Shanklin, I. of Wight; Barmouth, Merioneth; Anglesea; Douglas, I. of Man; near Kendal, Westmoreland; Loch Creran, Argyll; King's Park, Stirling; Mizzen Head, Cork.

Var. *isidiascens* Nyl. ex Cromb. in Grevillea x. p. 25 (1881).—Thallus more or less sprinkled with conglomerate stoutish concolorous wart-like isidia, which become sometimes whitish-sorediate at the apices.—*P. isidiotylo* subsp. *isidiascens* Nyl. in Flora lviii. p. 8 (1875).

Exsicc. Bohl. n. 109 pro parte; Leight. n. 291 pro parte.

Evidently a distinct variety, as the subspecies is entirely smooth. The isidia are generally more crowded towards the centre of the thallus.

Hab. The same as the subspecies.—*Distr.* Local and scarce in the Channel Islands, S. England, S. Wales and Central Scotland.—*B. M.* Island of Sark; the Lizard, Roche Rocks, near Penzance and Helmin-ton, Cornwall; near Plymouth, Devon; Fifield, Wilts; Barmouth, Merioneth; Anglesea; King's Park, Stirling; Lough Dan, Wicklow.

35. *P. fuliginosa* Nyl. in Flora li. p. 346 (1868).—Thallus orbicular or spreading irregularly, membranaceous, appressed, lobate, greenish or blackish-brown, crowded with rather elongate cylindrical or irregularly formed brownish-black isidia, the lobes when bare smooth, shining, rather plane and crenate; beneath

blackish, rhizinose to the margin (K^- , $CaCl^+_{red}$). Apothecia small or moderate in size, scattered, rather dark-coloured, with a thickish, slightly crenulate margin; spores 9–12 μ long, 5–6 μ thick.—Cromb. Lich. Brit. p. 36; Leight. Lich. Fl. p. 134; ed. 3, p. 123. *P. olivacea* Fr. in Duby Bot. Gall. p. 602 (1830); f. *furfuracea* Schær. Enum. Lich. p. 47 (1850); var. *furfuracea* Mudd Man. p. 100 (1861). *Lichenoides olivaceum, scutellis lævibus* Dill. Hist. Musc. p. 182, fig. 77, B (1741).

Exsicc. Croall n. 591; Johns. n. 122.

Characterized among brown *Parmeliæ* by the chemical reaction and by the dense covering of almost black isidia, sometimes only isolated lobes being visible. The apothecia and spermatogones are rare, especially on saxicolous specimens.

Hab. Chiefly on rocks and stones, also on old palings and on trees, in maritime and upland districts.—*Distr.* General though not common throughout the British Isles.—*B. M.* La Moye, Jersey; Penzance and near St. Breock, Cornwall; Runnymede, Surrey; North Hill and Herefordshire Beacon, Malvern, Worcestershire; Haughmond Hill and Stiperstones, Shropshire; Hafod-Morfa and Borthwynog near Dolgelly and Rhew-greidden, Merioneth; Trefriw and Bettws-y-Coed, Carnarvonshire; near Ayton, Cleveland, Yorkshire; near Kendal, Westmoreland, Cumberland; New Galloway, Kircudbrightshire; Head of Loch Awe, Argyll; Glen Lochay, Falls of Tummel and Blair Athole, Perthshire; Glen Shee, Forfarshire; Portlethen and Durris, Kincardineshire; Hill of Ardo and Castleton of Braemar, Aberdeenshire; S. of Fort William, Invernessshire; near Abernethy, Elgin; Dawros River, near Kylemore, Connemara, Galway; Clare Island and Achill Island, Mayo.

Var. *lætevirens* Nyl. in Bull. Soc. Linn. Norm. sér. 2, vi. p. 272 (1872).—Thallus orbicular or spreading, lobes large and colour lighter than in the species, with generally fewer, lighter-coloured isidia (medulla $CaCl^+$ red, fugitive). Apothecia similar to the species.—Cromb. in Grevillea x. p. 26 (1881). Form *olivacea* Leight. Lich. Fl. ed. 3, p. 123 (1879). *P. Borreri* f. *olivacea* Leight. Lich. Fl. ed. 2, p. 479 (1871). *Imbricaria olivacea* var. *lætevirens* Flot. in Uebers. Schles. Ges. Breslau, 1850, p. 131 (1851).

Exsicc. Bohl. n. 86; Johns. nos. 248, 249.

Though lighter in colour and largely different in habitat there are transition forms between this and the species. In some species the isidia are crowded and dark coloured, in others they are very sparingly formed (f. *denudata* Cromb. in Grevillea x. p. 71 (1887)). Frequently the isidia are abraded, giving the thallus a white-punctate appearance.

Hab. On old trees and palings, rarely on walls in maritime and upland districts.—*Distr.* Not uncommon throughout Great Britain and Ireland.—*B. M.* Ardingly, Sussex; North Hill, Malvern, Worcestershire; Devil's Bridge, Cardiganshire; near Dolgelly and Rhew-greidden, Merioneth; Capel Curig and Bettws-y-Coed, Carnarvonshire; Hopton, Suffolk; near Guisboro, Cleveland, Yorkshire; Kendal and Leven's Park, Westmoreland; Keswick, Cumberland; Appin and head of Loch Awe, Argyll; Craig Calliach, Loch Ard and Glen

Lochay, Perthshire; Durris, Kincardineshire; Morrone, Braemar, Aberdeenshire; Cromaglow, Killarney, Kerry; Deryclare and near Kylemore, Connemara, Galway; Westport and Achill Island, Mayo.

36. *P. sorediata* Th. Fr. Lich. Arct. p. 56 (1860).—Thallus suborbicular, generally small, lobate, appressed, greenish- or umber-black, sprinkled with small, greyish-white, round soredia, the lobes narrow, contiguous, rather plane, multifid and slightly dilated at the apices; beneath rhizinose generally to the edge (K₂, CaCl₂). Apothecia very rare, subconcolorous with the thallus, concave, the margin entire; spores more or less oblong, 10–12 μ long, 5–6 μ thick.—*Parmelia stygia* var. *sorediata* Ach. Lich. Univ. p. 471 (1810). *P. proluxa* subsp. *sorediata* Cromb. in Journ. Bot. xx. p. 273 (1882) & Monogr. i. p. 253.

The description of the apothecium is taken from Th. Fries l. c. There are no apothecia present on the British specimens. The smallness of the plant, with the flatter lobes and the presence of soredia, distinguish it from *P. proluxa*.

Hab. On rocks in upland mountainous districts.—*Distr.* Rare in W. England and among the Central and N. Grampians, Scotland.—*B. M.* North Hill, Malvern; Craig Tulloch, Blair Athole, Perthshire; Craig Guie, Braemar, Aberdeenshire.

39. **CETRARIA** Ach. Meth. Lich. p. 292 (1803). *Cornicularia* Schreb. Linn. Gen. Pl. ii. p. 768 (1791); emend. Ach. Meth. Lich. p. 300 (1803) pro parte; S. F. Gray Nat. Arr. i. p. 404 pro parte; Mudd Man. p. 76 (1861) pro parte. *Platysma* Nyl. in Mém. Soc. Sci. Nat. Cherb. v. p. 100 (1857) pro parte; Cromb. Monogr. i. p. 219. *Lobaria* sect. *Platysma* Hoffm. Deutschl. Fl. ii. p. 138 (1795) pro parte. (Pl. 39.)

Thallus foliaceous (*Platysma*), partly horizontal or ascending, or fruticose (*Cetraria*), with the fronds compressed, rarely cylindrical, sparingly rhizinose or attached at the base and soon loose from the substratum, corticate on both surfaces, the cortex mostly of small-celled plectenchyma, the under surface shining, concolorous with the upper surface or darker; pseudo-cyphella present in some species. Apothecia marginal or submarginal, sessile or shortly stalked, round, with a thaline margin; hypothecium light-coloured; paraphyses simple or rarely branched, septate; asci 6–8-spored; spores colourless, simple, very small. Spermogones in marginal tubercles or thorn-like papillæ, with pleurogenous spermatia, varying in form.

A. *Thallus foliaceus, more or less horizontal (Platysma).*

Thallus grey in colour.

1. **C. glauca** Ach. Meth. Lich. p. 296 (1803).—Thallus foliaceous, wide-spreading, lobate, loosely attached, the lobes sinuate, broad or divided into rather narrow segments, more or less ascending, smooth or wrinkled-lacunose, the margins crenate

or lacerate and often sorediate, glaucous-grey or darker coloured, beneath blackish, brown at the circumference and shining, very sparingly rhizinose ($K \pm$ yellowish, $CaCl -$). Apothecia rare, marginal, moderate or rather large, reddish-brown, the margin thin, evanescent; spores ellipsoid, 6-9 μ long, 3-5 μ thick.—S. F. Gray Nat. Arr. i. p. 433; Hook. Fl. Scot. ii. p. 57 & in Sm. Engl. Fl. v. p. 220; Tayl. in Mackay Fl. Hib. ii. p. 154; Mudd Man. p. 79, t. 1, fig. 20. *Lichenoides Endiviæ foliis crispis et splendentibus, subtus nigricantibus* Dill. Hist. Musc. p. 192, t. 25, fig. 96 (1741). *Lichen glaucus* L. Sp. Pl. p. 1148 (1753); Huds. Fl. Angl. p. 453; Lightf. Fl. Scot. ii. p. 838; With. Arr. ed. 3, iv. p. 53; Engl. Bot. t. 1606. *Platysma glaucum* Nyl. in Act. Soc. Linn. Bord. sér. 3, i. p. 295; Cromb. Lich. Brit. p. 27 & Monogr. i. p. 225; Leight. Lich. Fl. p. 102; ed. 3, p. 97 (incl. f. *sorediosa*).

Esicc. Bohl. n. 79; Croall n. 395; Leight. n. 44; Mudd n. 54.

Distinguished from *Parmelia* by the thin texture and the naked under surface of the lobes. It often forms large patches. The British plants are rarely fertile; spermogones, when present, occur in tuberculose marginal papillæ, the sterigmata are 2-4-septate and the spermatia 7 μ long, 1 μ wide.

When attacked by the parasitic lichen *Buellia Parmeliarum* (*Abrothallus*) bullate swellings may be found on the lobes, a condition recorded as a distinct species by early writers;—*Lichenoides saxatile tinctorium foliis latioribus non pilosis, vesiculas proferens* Dill. in Ray Syn. ed. 3, p. 74, n. 71 (1724). *Lichenoides tinctorium glabrum vesiculosum* Dill. Hist. Musc. p. 188, t. 24, fig. 82 (1741). *Lichen ampullaceus* L. Sp. Pl. p. 1146 (1753); Huds. Fl. Angl. p. 450; With. Arr. ed. 3, iv. p. 61. *Platysma glaucum* f. *ampullaceum* Cromb. in Journ. Linn. Soc. xvii. p. 572 (1880) & Monogr. i. p. 227. There is no specimen in the British herbarium.

Hab. On trunks of trees, walls, rocks, and on the ground, more especially in maritime or upland situations.—*Distr.* General throughout the British Isles, more abundant in mountainous districts; not very frequent in Ireland.—*B. M.* Boulay Bay, Jersey; Lamorna and Hehninton, Cornwall; Hay Tor and Lustleigh Cleeve, Dartmoor. Bovey Tracey, Meavy and Lynton, Devon; New Forest, Hants; Tunbridge Wells, Kent; Thorndon Hall and High Beech, Epping Forest, Essex; near Sprouston, Suffolk; Sale, Norfolk; Malvern, Worcestershire; near Oswestry and Wrekin Hill, Shropshire; Barmouth, Dolgelly and Aran Mawddwy, Merioneth; Capel Curig, Carnarvonshire; Charnwood Forest and Gopsall Park, Leicestershire; near Matlock, Derbyshire; Kildale Moor, Cleveland, Yorkshire; Teesdale and Cronkley Fell, Durham; Stavely Head, Westmoreland; Ashgill, Cumberland; New Galloway, Kirkcudbrightshire; near Loch Skene, Moffat, Dumfriesshire; Pentland Hills and Swanston Wood, Midlothian; near Inverary and Loch Creran, Argyll; Killin, Ben Lawers, Loch Earn and Birnam Hill, Dunkeld, Perthshire; Baldovan, Rossie Moor and Deerhill Wood, Forfarshire; Countesswells Wood, near Aberdeen, Glen Callater and Lion's Face, Braemar, Aberdeenshire; Rothiemurchus, Glen Nevis, Loch Ennich and Invermoriston, Inver-

nessshire; near Forres, Elginshire; Hills of Applecross, Rossshire; Loch Shin, Sutherland; Killarney, Lough Bruil and Finnehey Bridge, Kerry.

Var. *fallax* Ach. Lich. Univ. p. 509 (1810).—Thallus white beneath or only partially black, often fimbriate or coralloid at the margins.—Hook. Fl. Scot. ii. p. 57 & in Sm. Engl. Fl. v. p. 220; Mudd Man. p. 80. *Lichenoides membranaceum, tubæ Fallopianæ æmulum* Dill. Hist. Musc. p. 165, t. 22, fig. 58. *Lichen fallax* Web. Spicil. Fl. Goett. p. 244 (1778); Dicks. Pl. Crypt. fasc. i. p. 13; With. Arr. ed. 3, iv. p. 53; Engl. Bot. t. 2373. *Platysma glauca* f. *fallax* Nyl. Syn. Lich. i. p. 314 (1860); Leight. Lich. Fl. p. 103 (incl. f. *coralloidea*); ed. 3, p. 98 (incl. f. *coralloidea*); Cromb. Monogr. i. p. 226; var. *fallax* Cromb. Lich. Brit. p. 27 (1871).

Exsicc. Mudd n. 55.

Distinguished by the partially white colour of the under surface and more or less by the fimbriate margins of the lobes. Perhaps more a growth form than a variety, as it generally occurs in moist or shady conditions.

Hab. On the trunks of old trees in shady woods, rarely on moist rocks in upland districts.—*Distr.* Local and scarce in S.W. and N. England, Central Scotland and S.W. Ireland.—*B. M.* Helminton, Cornwall; Dartmoor, Devon; Tunbridge Wells, Kent; Garth, Dalgely, Merioneth; Ingleby Park, Cleveland, Yorkshire; Alston, Cumberland; near Inverary, Argyll; Glen Falloch, Glen Lochay and Finlarig, Killin, Perthshire; Sidlaw Hills and Deerhill Wood, Forfarshire; Glen Nevis, Invernessshire.

Var. *tenuisectum* A. L. Sm.—Thallus darker in colour, the laciniae short, narrow, much divided and crowded in a panniform manner. *Platysma glaucum* f. *tenuisectum* Cromb. in Grevillea xv. p. 49 (1886) nomen; var. *tenuisectum* Cromb. Monogr. i. p. 227 (1894).

Distinguished by the much divided lobes. Crombie suggests that the darker colour may be due to the habitat.

Hab. On exposed boulders in mountainous regions.—*Distr.* Rather local, though not uncommon in the mountainous regions of England and Scotland.—*B. M.* Stiperstones, Shropshire; Clougha, Lancashire; Creanlarich and Ben Lawers, Perthshire; Morrone, Braemar, Aberdeenshire; Glen Nevis, Invernessshire.

2. *C. lacunosa* Ach. Meth. p. 295 (1803).—Thallus broadly foliaceous-lobate, reticulate-lacunose, whitish- or bluish-grey, the lobes crenate-undulate, incised, rounded at the apices; beneath blackish, pale-brown towards the circumference (K ± yellowish, CaCl⁻). Apothecia prominent, moderate in size or rather large, reddish-brown, the margin entire; spores ellipsoid, 6–8 μ long, 4–5 μ thick.—*Platysma lacunosum* Nyl. in Mém. Soc. Sci. Nat. Cherb. v. p. 100 (1857); Carroll in Journ. Bot. iii. p. 288 (1865); Cromb. Lich. Brit. p. 27; Leight. Lich. Fl. p. 103; ed. 3, p. 98.

Distinguished from the preceding by the reticulate wrinkled upper surface. Sometimes the thallus is isidiiferous, especially when growing in damp localities. On dry exposed rocks it is of a dark chestnut colour. Apothecia have not been found in this country; spermogones are similar to those of *C. glaucum*.

Hab. On rocks in subalpine districts.—*Distr.* Local among the Grampians, Scotland.—*B. M.* Glen Falloch, Ben Lawers and Craig Calliach, Perthshire; Craig Cluny and Morrone, Braemar, Aberdeenshire; near Fort William, Invernessshire.

3. *C. diffusa* A. L. Sm.—Thallus orbicular, closely appressed, finely and densely isidiose in the centre, the lobes naked at the circumference, sinuate, narrow, rounded and crenate at the apices, greyish- or brownish-white, beneath pale-brown with a few long rhizinae (K + deep yellow, CaCl —). Apothecia marginal, rather small, reddish-brown, the margin crenulate and soresiate; spores ellipsoid, 6–9 μ long, 5–6 μ thick.—*Lichen diffusus* Dicks. Pl. Crypt. fasc. iii. p. 17, t. 9, fig. 6 (1793) (Web. ?); With. Arr. ed. 3, iv. p. 32. *L. aleurites* Ach. Lich. Suec. Prodr. p. 117 (1798); Engl. Bot. t. 858. *Parmelia aleurites* Ach. Meth. Lich. p. 208 (1803); Hook. Fl. Scot. ii. p. 54 & in Sm. Engl. Bot. v. p. 203; Mudd Man. p. 98; Leight. Lich. Fl. p. 130. *P. diffusa* S. F. Gray Nat. Arr. i. p. 442 (1821). *P. horrescens* Tayl. in Mackay Fl. Hib. ii. p. 144 (1836); Cromb. in Grevillea vii. p. 98 (1879). *Parmeliopsis aleurites* Cromb. Lich. Brit. p. 37 (1870). *Platysma diffusum* Nyl. in Flora lv. p. 247 (1872); Cromb. in Journ. Bot. x. p. 234 (1872) & in Monogr. i. p. 222; Leight. Lich. Fl. ed. 3, p. 95.

Exsicc. Dicks. Hort. Sicc. fasc. xi. n. 23; Leight. n. 47; Mudd n. 71.

Not unlike *Parmelia hyperopta* (*P. aleurites*), with which it has been often confused. The lobes are frequently almost obliterated by the isidia, described by older writers as “farinose.” The apothecia are rather rare, but when present are numerous and crowded. The spermogones are marginal and prominent, with spores 4 μ long and 1 μ thick.

There is some uncertainty as to the identity of Weber’s *Lichen diffusus* (Spic. Fl. Gœtt. p. 250), described as “farinose and black below.” Dickson’s specimen and description of *L. diffusus*, however, give priority over *L. aleurites* Ach. for this species, which name has been adopted by Wainio and some others.

Hab. On old palings, rarely on trunks of trees or among mosses on rocks in wooded lowland and upland districts.—*Distr.* Here and there in England, and in the Highlands of Scotland; rare in Ireland.—*B. M.* Wakehurst, Ardingly, Burton Park, Eridge Park and Amberham, Sussex; Woolmer Forest, Hants; near Windsor, Berks; Stoke Park and Sotterly Park, Bucks; Croft Castle and near Hereford, Herefordshire; Gopsall, Leicestershire; near Oswestry and Ellesmere, Shropshire; Cwm Bychan, Merioneth; Baysdale, Cleveland, Yorkshire; Barcaldine, Argyll; Inverarnan and Criannlarich, Perthshire; Glen Dee, Braemar, Aberdeenshire; Rothiemurchus, Invernessshire; Dunkerron, Kerry.

Thallus bright-yellow.

4. *C. juniperina* Ach. Meth. Lich. p. 298 (1803) (excl. var. *pinastri*).—Thallus of crowded ascending lobes, crisp and deeply crenate at the upturned margins, generally marked with brown papillæ, citrine or greenish-yellow, rather paler beneath, the medulla more deeply coloured (K —, CaCl —). Apothecia marginal on the upper surface of the laciniaë, rather small, reddish or brown, with narrow corrugate or denticulate margin; spores ellipsoid, 6–9 μ long, 4–6 μ thick.—S. F. Gray Nat. Arr. i. p. 432; Hook. in Sm. Engl. Fl. v. p. 220; Mudd Man. p. 79. *Lichen juniperinus* L. Sp. Pl. p. 1147 (1753); Huds. Fl. Angl. p. 452? *Platysma juniperinum* Nyl. in Act. Soc. Linn. Bord. sér. 3, i. p. 295 (1857); Cromb. Lich. Brit. p. 27; Leight. Lich. Fl. p. 102; ed. 3, p. 96 (excl. var. *pinastri*).

The few authentic specimens in the herbarium are less highly developed than those collected in higher altitudes. Only one of the specimens (from Teesdale) is sparingly fertile. The spermatia are elongate and slightly thicker at one end; they measure 7 μ long, 1 μ thick. Hudson's *Lichen juniperinus* according to Smith (Engl. Fl. t. 194) as well as Lightfoot's plant (Fl. Scot. ii. p. 836) are forms of *Xanthoria parietina*.

Hab. On the trunks of old pine trees in mountain woods.—*Distr.* Extremely local and rare in N. England and among the N. Grampians, Scotland.—*B. M.* Near High Force Inn, Teesdale, Durham; Clova, Forfarshire; Rothiemurchus Woods, Invernesshire.

5. *C. pinastri* S. F. Gray Nat. Arr. i. p. 432 (1821).—Thallus appressed, the lobes roundish, plane and sometimes imbricate, greenish-yellow, the margins intensely yellow-pulverulent, the medulla also deeply coloured; beneath concolorous (K —, CaCl —). Apothecia as in the preceding species, very rare.—*C. juniperina* var. *pinastri* Ach. Meth. Lich. p. 298 (1803); Hook. Fl. Scot. ii. p. 57 & in Sm. Engl. Fl. v. p. 220; Mudd Man. p. 79. *Lichen pinastri* Scop. Fl. Carn. ed. 2, ii. p. 382 (1772); Dicks. Pl. Crypt. fasc. iii. p. 18; With. Arr. ed. 3, iv. p. 51; Engl. Bot. t. 2111. *Platysma pinastri* Nyl. in Flora iii. p. 442 (1869); Cromb. Monogr. i. p. 225. *P. juniperinum* subsp. *pinastri* Cromb. Lich. Brit. p. 27 (1870) & in Journ. Bot. x. p. 234 (1872); var. *pinastri* Leight. Lich. Fl. p. 102 (1871); ed. 3, p. 97.

A smaller plant than the preceding, but with broader lobes; chiefly characterized by the pulverulent margins. The British species are sterile.

Hab. On the trunks of old firs and on larch palings in upland wooded districts.—*Distr.* Local and rare in E. and N. England and among the Grampians, Scotland. *B. M.* Framlingham, near Norwich, Norfolk; Holwick, Yorkshire; Teesdale, Durham; near Kendal, Westmoreland; Ben Lawers, Perthshire; Rothiemurchus Woods, Invernesshire.

Thallus brown.

6. *C. sepincola* Ach. Meth. Lich. p. 297 (1803).—Thallus decumbent or ascending, of small plane laciniae, short or slightly elongate, with undulate-sinuate or crenate margins, olive- or chestnut-brown, beneath paler. Apothecia adnate on or near the margin of the lobes, moderate in size, dark-brown, shining, the margin thin, crenate; spores ellipsoid, 6–10 μ long, 5–6 μ thick.—*Lichen sepincola* Ehrh. Beitr. ii. p. 95 (1788); Engl. Bot. t. 2386, fig. 2. *Platysma sepincolum* Nyl. in Act. Soc. Linn. Bord. sér. 3, i. p. 295 (1857) (excl. var. *ulophyllum*); Cromb. Lich. Brit. p. 26 pro parte; Leight. Lich. Fl. p. 100 (excl. var. *ulophylla*); ed. 3, p. 94 (excl. var. *ulophylla*).

A small plant, with the lobes closely packed or sometimes effuse. It is rarely fertile in Great Britain. Spermogones, when present, have spermatia 6 μ long, 1 μ thick.

Hab. On branches of trees, mostly firs, and on old palings in mountainous districts.—*Distr.* Local and rare in N. England and in the N. Grampians, Scotland.—*B. M.* Teesdale, Durham; Glen Quoich and Glen Dee, Braemar, Aberdeenshire.

7. *C. chlorophylla* Wain. in Act. Soc. Faun. & Fl. Fenn. xiii. n. 6, p. 7, 1896 (1897).—Thallus moderate in size, greyish- or reddish-brown, smooth or slightly wrinkled and lacunose, broadly or narrowly laciniate and branched, the margins sinuate-undulate and crisp, sometimes isidiose, generally white-pulverulent. Apothecia rather small, with subcrenulate or entire margin; spores 6–10 μ long, 5–6 μ thick.—*C. sepincola* var. *ulophylla* Ach. Meth. Lich. p. 297 (1803). *C. sepincola* S. F. Gray Nat. Arr. i. p. 432 (1821) (non Ach.). *C. sepincola* Hook. Fl. Scot. ii. p. 57 (1821) and in Sm. Engl. Fl. p. 220; Mudd Man. p. 80. *Lichen chlorophyllus* Humb. Fl. Frib. p. 20 (1793). *L. sepincola* Dicks. Pl. Crypt. fasc. iii. p. 18 (1793) (non Ehrh.); With. Arr. ed. 3, iv. p. 73; Engl. Bot. t. 2386, fig. 1. *Platysma ulophyllum* Nyl. in Flora lii. p. 442 (1869); Cromb. Monogr. i. p. 221. *P. sepincolum* var. *ulophyllum* Nyl. in Mém. Soc. Sci. Nat. Cherb. v. p. 101 (1857); Leight. Lich. Fl. p. 100; ed. 3, p. 95.

Esicc. Croall n. 593; Leight. n. 45; Mudd n. 56.

Differs from the preceding in the larger size of the lobes, and the crisp isidiose or generally white pulverulent margins. It is very rarely fertile.

Hab. On old palings and on firs, rarely on boulders in upland and mountainous districts.—*Distr.* General, though not common in England; more frequent in the mountainous districts of Scotland; not recorded from Ireland.—*B. M.* Vixen Tor and Hay Tor, Dartmoor, Devon; near St. Leonards, Ifield and Balcombe, Sussex; Bardon Hill and Gopsall, Leicestershire; Oteley Park, Ellesmere, Shropshire; Cwm Bychan, Merioneth; between Yarmouth and Caistor, Suffolk; Teesdale, Durham; Ingleby Park, Cleveland, Yorkshire; Skiddaw

and Ashgill, Cumberland; New Galloway, Kirkeudbrightshire; Glen Falloch, Killin, Ben Lawers, Glen Lyon, Crianlarich and Falls of Bruar, Perthshire; Deerhill Wood, Kinnoul Wood, Clova and Rossie Moor, Forfarshire; Ballochbuie, Morrone, and Linn of Quoich, Braemar, Aberdeenshire; Glen Nevis, Loch Ennich, Rothiemurchus Woods and Invermoriston, Invernesshire.

Thallus almost black, lobes very narrow.

8. *C. hepatizon* Wain. in Termesz. Fuz. xxii. p. 278 (1899).—Thallus suborbicular, appressed, imbricate, dark-reddish-brown or brownish-black, the laciniae rather narrow, multifid, sinuate, smooth, somewhat grooved, the margins slightly raised, with marginal papillae, rounded and crenate at the apices; beneath blackish with a few rhizinae at the circumference (K \mp ^{yellowish}, CaCl₂). Apothecia moderate in size, generally about 2 or 3 mm. wide, reddish-brown, the exterior plicate and wrinkled, the irregularities continued as stoutish granules on the margins; spores ellipsoid, 5–11 μ long, 4–6 μ thick.—*Lichenoides tinctorium atrum, foliis minimis crispis* Dill. Hist. Musc. p. 188, t. 24, f. 81 (1841). *Lichen hepatizon* Ach. Lich. Succ. Prodr. p. 110 (1798). *L. fahlunensis* Lightf. Fl. Scot. ii. p. 819 (1777)? Huds. Fl. Angl. ed. 2, p. 532 pro parte (1778); With. Arr. ed. 3, iv. p. 30 pro parte; Sm. Engl. Bot. t. 653 (descript. only). *Parmelia fahlunensis* S. F. Gray Nat. Arr. i. p. 441 (1821) (non Ach.); Hook. Fl. Scot. ii. p. 53 pro parte & in Sm. Engl. Bot. v. p. 202; Mudd Man. p. 100 pro parte. *Platysma fahlunense* Nyl. Syn. Lich. i. p. 309 (1860); Cromb. Lich. Brit. p. 27 & Monogr. i. p. 222; Leight. Lich. Fl. p. 101; ed. 3, p. 95.

Esicc. Croall n. 97.

Linnaeus's type specimens of *Lichen fahlunensis* belong to the following species, which was delimited by Nylander and given the specific name "commixtum." The species are very similar in appearance and are easily confused. The spermogones in both species are borne in the marginal papillae, with short simple sterigmata and elongate or ellipsoid spermatia.

Hab. On rocks and boulders in alpine and subalpine districts.—*Distr.* Local and scarce in S.W. England, N. England and N. Wales; more frequent among the Grampians, Scotland; recorded from Ireland.—*B. M.* Hay Tor, Dartmoor, Devon; Cader Idris, Merioneth; the Cheviots, Northumberland; Ben Lawers, Perthshire; Clova Mts., Forfarshire; Lochnagar, Morrone, Ben-naboord and Ben Avon, Aberdeenshire.

9. *C. fahlunensis* Schaer. Lich. Helv. Spicil. p. 256 (1833) pro parte; Wainio in Meddel. Grönland xxx. p. 126 (1907).—Thallus suborbicular, appressed, imbricate, dark reddish-brown or blackish, the laciniae somewhat ascending, narrow, multifid, the segments frequently entangled, almost plane, the margins crisp, often with papillae; beneath concolorous with a few rhizinae

near the circumference (K—, CaCl—). Apothecia moderate in size or rather small, the exterior smoothish, and the margin entire or partly crenulate; spores ellipsoid, 5–11 μ long, 4–6 μ thick.—*Lichen fallunensis* L. Sp. Pl. p. 1143 (1753) (cfr. Wainio in Medd. Soc. Faun. & Fl. Fenn. xiv. p. 4 (1886)) (non Ach. Lich. Suec. Prodr. p. 110 (1798)); Engl. Bot. t. 653 (fig. only). *Platysma commixtum* Nyl. Syn. Lich. i. p. 310 (1860); Carroll in Journ. Bot. iv. p. 22 (1866); Cromb. Lich. Brit. p. 27 & Monogr. i. p. 223; Leight. Lich. Fl. p. 101; ed. 3, p. 96; f. *tenuisectum* Cromb. in Grevillea xv. p. 49 (1886) & Monogr. i. p. 224. *Cetraria commixta* f. *tenuisecta* Th. Fr. Lich. Scand. p. 109 (1871).

Exsicc. Cromb. n. 25; Dicks. Hort. Sicc. fasc. 14, n. 23.

Often confused with *C. hepaticum*, but differs in the more ascending lobes, and in the almost entire margins of the apothecia; the latter are generally numerous and they become large with age; they are chiefly borne on the central lobes. In f. *tenuisecta* the lobes are generally narrower.

Hab. On rocks and boulders, chiefly in alpine localities.—*Distr.* Rare in N. Wales, S. and W. Scotland, but more plentiful among the Grampians.—*B. M.* Carnedd Llewelyn, Carnarvonshire; New Galloway, Kirkeudbrightshire; Ben More, Ben Lawers and hills near Amulree, Perthshire; Katelaw, Forfarshire; Ben-naboord, Morrone, and Lochnagar, Aberdeenshire; Ben Nevis, Invernesshire; Island of Mull, Argyll.

10. *C. polyschiza* Lett. in Hedwigia lii. p. 221 (1912).—Thallus orbicular, the lobes short, crowded and imbricate, narrow, rather raised at the margins and slightly grooved, thickish and smooth, rounded crenate at the apices, greyish or dark-olive-brown, beneath generally paler (K—, CaCl—). Apothecia moderate in size, brownish-red, externally wrinkled, with a stout rugose margin; spores ellipsoid, 5–11 μ long, 4–6 μ thick. *Platysma polyschizum* Nyl. in Flora xlv. p. 82 (1862); Cromb. in Journ. Bot. xx. p. 272 (1882) & Monogr. i. p. 223.

Distinguished from the preceding by the crowded panniform habit of growth and the lighter colour of the under surface.

Hab. On rocks and boulders.—*B. M.* Ben-naboord, Braemar, Aberdeenshire (the only British locality).

B. *Thallus ascending, more or less fruticose (Eucetraria).*
Thallus pale-yellowish.

11. *C. cucullata* Ach. Meth. Lich. p. 293 (1803).—Thallus in tufts, ascending, sinuate-laciniate, branching, the fronds flat or generally connivent at the very undulate margins, slightly recurved at the apices, pale-yellowish or straw-coloured. Apothecia very rare, subterminal, adnate to the back of the lobes, pale flesh-coloured, up to about 1 cm. across, the margin thin, crenulate, or at length excluded; spores 7–10 μ long, 4 μ thick.

—Mudd Man. p. 78. *Lichenoides lacunosum candidum*, etc.; var. β *cum marginibus cœvutibus ut velut tubulosa*, etc. Dill. Hist. Musc. p. 162, t. 21, fig. 56 B (1741). *Lichen cucullatus* Bellardi Oss. Bot. p. 54 (1788); Sm. in Trans. Linn. Soc. i. p. 84, t. 4, fig. 7 (1791). *Platysma cucullatum* Hoffm. Pl. Lich. iii. p. 17, t. 66, fig. 2 (1801). *Platysma cucullatum* Nyl. in Act. Soc. Linn. Bord. sér. 3, i. p. 295 (1857); Cromb. in Journ. Bot. viii. p. 96 (1870); Leight. Lich. Fl. p. 99; ed. 3, p. 94.

Exsicc. Cromb. n. 132.

Somewhat resembling *C. nivalis* in the colour of the thallus, but differing in the narrower (up to about .5 cm. wide) connivent fronds and in the position of the apothecia. In Great Britain it is sterile and occurs only in small scattered tufts.

Hab. On the ground among mosses, etc., in alpine places.—*Distr.* Recorded only from the summits of the higher Scottish Grampians.—*B. M.* Cairntoul and Cairngorm, Braemar, Aberdeenshire.

12. *C. nivalis* Ach. Meth. Lich. p. 294 (1803).—Thallus pale-straw-coloured or yellowish-white, ascending, branched, sinuate-laciniate, the laciniae wide and foliaceous or narrow, with the margins somewhat connivent, irregularly reticulate-lacunose, the margins crisp, crenate and dentate at the apices. Apothecia adnate towards the tips of the laciniae, becoming rather large (about 1 cm. across), somewhat brownish-flesh-coloured, with a crenulate margin; spores small, 7–9 μ long, 4–5 μ thick.—*S. F. Gray* Nat. Arr. i. p. 433; *Hook.* Fl. Scot. ii. p. 57 & in *Sm. Engl. Fl.* v. p. 221; *Mudd Man.* p. 78. *Lichenoides lacunosum candidum glabrum*, *Endivixæ crispæ facie* Dill. Hist. Musc. p. 162, t. 21, fig. 56 A (1741). *Lichen nivalis* L. Sp. Pl. p. 1145 (1753); *Dicks.* Pl. Crypt. fasc. iii. p. 17; *With.* Arr. ed. 3, iv. p. 60; *Engl. Bot.* t. 1994. *Platysma nivale* Nyl. in Act. Soc. Linn. Bord. sér. 3, i. p. 295 (1857); *Cromb. Lich. Brit.* p. 26 & *Monogr.* i. p. 220; *Leight. Lich. Fl.* p. 99; ed. 3, p. 93.

Exsicc. Croall n. 394; *Cromb.* n. 24; *Leight.* n. 43; *Mudd* n. 53.

This beautiful species, characteristic of alpine and Arctic regions, often forms widely spreading dense tufts. British plants are mostly sterile, though spermatogones are occasionally present; they occur as black marginal papillae with simple or septate sterigmata and spermatia 6–7 μ long, 1 μ thick.

Hab. On the ground among mosses and bare detritus in mountainous places.—*Distr.* Plentiful among the Scottish Grampians, especially in Braemar.—*B. M.* Ben Lawers, Perthshire; Bassies and Clova Mts., Forfarshire; Lochnagar, Ben-naboord, Ben Macdhuil, Cairngorm, Cairntoul, and Sources of the Dee, Braemar, Aberdeenshire; Ben Nevis, Invernesshire.

Thallus pale to dark-brown; *pseudocyphellæ* present.

13. *C. islandica* Ach. Meth. Lich. p. 293 (1803).—Thallus ascending, branched, strap-shaped and narrow or subfoliaceous,

somewhat rigid, pale-chestnut or dark-brown, alike on both surfaces, often stained a blood-red colour at the base, the fronds more or less regularly bordered with small spines and generally incurved, the lower side frequently dotted with white impressed decorticated spots (pseudo-cyphellæ). Apothecia adnate on the upper surface of the apices, large or moderate in size, with a thin entire or crenulate disappearing margin; spores 7–11 μ long, 4–6 μ thick.—S. F. Gray Nat. Arr. i. p. 433; Hook. Fl. Scot. ii. p. 58 & in Sm. Engl. Fl. v. p. 221; Tayl. in Mackay Fl. Hib. ii. p. 155; Cromb. Lich. Brit. p. 25; Leight. Lich. Fl. p. 96; ed. 3, p. 91. *Lichenoides rigidum*, *Eryngii folia referens* Dill. in Ray Syn. ed. 3, p. 77, n. 90 (1724) & Hist. Musc. p. 209, t. 28, f. 111A. *Lichen islandicus* L. Sp. Fl. p. 1145a (1753); Huds. Fl. Angl. p. 448; Lightf. Fl. Scot. ii. p. 829; Engl. Bot. t. 1330. *Cornicularia islandica* Mudd Man. p. 77, t. 1, fig. 19 (1861).

Esicc. Leight. n. 42; Mudd n. 51.

A northern lichen, well known as Iceland Moss, and famed for its edible and medicinal qualities. The fronds vary in width from 1–2 mm. to several cm. The marginal spines are usually occupied by spermogones, but sometimes they develop as haptera and anchor the plant to the surrounding vegetation. The white spots on the under surface are described by Wainio as *pseudo-cyphellæ*. (Ark. Bot. viii. 4, p. 20 (1909)).

Hab. On the ground in heathy or stony places in upland or alpine situations.—*Distr.* Somewhat uncommon in the mountainous districts of the British Isles though plentiful among the Grampians, Scotland.—*B. M.* Wootton Common and King's Lynn, Norfolk; near Scarborough, Lowthorpe Moor, Stockton Forest, Langwith Moor and Stenshall Common, Yorkshire; Snowdon, Carnarvonshire; Pentland Hills near Edinburgh; Ben Lomond, Stirlingshire; Ben More, Ben Lawers, Mael Graedha and Ben-y-Gloe, Blair Athole, Perthshire; Clova Mts. and Sidlaw Hills, Forfarshire; Ben-naboord, Lochnagar, Ben Macdhui, Morrone, Braemar and Countess Wells, Aberdeenshire.

Form *platyna* Fr. Lich. Eur. p. 37 (1831).—Fronds broad, about 2 to 3 cm. wide, sparingly branched and less constantly spinulose at the margins. Apothecia large, about 1 cm. in diameter, submarginal, rather rare.—Leight. Lich. Fl. p. 96; ed. 3, p. 91 pro parte. *C. islandica* f. *dilatata* Norrl. in Medd. Sällsk. Faun. & Fl. Fenn. i. p. 16 (1876); Cromb. in Journ. Linn. Soc. Bot. xvii. p. 575 (1880). *Lichenoides rigidum*, *Eryngii folia referens* Dill. Hist. Musc. p. 209, t. 28, fig. 111B (1741).

Differs chiefly in the wider fronds; there are numerous intermediate stages.

Hab. On the ground among heaths in alpine places.—*Distr.* Confined to the higher Grampians.—*B. M.* Lochnagar, Ben-naboord, Cairngorm, and Cairntoul, Braemar, Aberdeenshire.

Var. *tenuifolia* Wain. in Ark. Bot. viii. 4, p. 21 (1909).—Fronds caespitose, crowded, narrow, erect or depressed, the margins spinulose and connivent, the apices flattened out, white naked spots frequently present on the lower surface.—*Cetraria*

islandica var. *crispa* Ach. Lich. Univ. p. 513 (1810); Cromb. Lich. Brit. p. 26; form *subtubulosa* Fr. Lich. Eur. p. 37 (1831); form *crispa* Leight. Lich. Fl. p. 97 (1871); ed. 3, p. 92; subsp. *crispa* Cromb. in Grevillea xii. p. 73 (1884). *C. crispa* Lamy in Bull. Soc. Bot. Fr. xxv. p. 362 (1878); Cromb. Monogr. i. p. 216 (incl. f. *subtubulosa*). *Lichenoides Eryngii foliis referens, tenuioribus et crispioribus foliis* Dill. Hist. Musc. p. 212, t. 28. fig. 112 (1741). *Lichen islandicus* var. *tenuifolius* Retz. Fl. Scand. Prodr. p. 227 (1779); var. β . Lightf. Fl. Scot. ii. p. 830 (1777); Huds. Fl. Angl. ed. 2, p. 539; With. Arr. ed. 3, iv. p. 54. *Cornicularia islandica* var. *crispa* Mudd Man. p. 77 (1861).

Exsicc. Croall n. 493; Leight. n. 42 (in some specimens); Mudd n. 52.

Distinguished from the species by the narrower, generally connivent fronds. The form of the branching fronds gives it a somewhat crisp curled appearance.

Hab. On the ground among mosses mostly in mountainous districts.—*Distr.* Rare in N. Wales, N. England, and in S.W. and N. Ireland, more plentiful among the Grampians, Scotland.—*B. M.* Snowdon and Carnedd Llewellyn, Carnarvonshire; Mael Graedha, Ben Lawers and Rannoch, Perthshire; Katelaw and Clova, Forfarshire; Lochnagar, Morrone, Ben-naboord and Cairntoul, Braemar, Aberdeenshire; Ben Nevis, Invernesshire; Mangerton, Kerry; Slieve Donard, Down.

14. *C. hiascens* Th. Fr. Lich. Scand. p. 98 (1871).—Thallus of erect densely crowded narrow fronds, plane or partly connivent, repeatedly branched towards the apex, sparingly spinulose at the margins, pale- or dark-brown, often yellowish-brown at the base, the lower side frequently dotted with impressed decorticated white spots (pseudo-cyphellæ). Apothecia adnate to the upper surface of the fronds, elevated, moderate in size, the disc subconcolorous, the margins sometimes denticulate; spores 7–11 μ long, 4–6 μ thick.—*C. aculeata* var. *hiascens* Fr. Lich. Eur. p. 36 (1831). *C. islandica* var. *Delisei* Bory ex Schær. Enum. p. 16 (1850). *C. Delisei* Th. Fr. in K. Svensk. Vet.-Akad. Handl. vii. n. 2, p. 11 (1867); Cromb. Lich. Brit. p. 26; Leight. Lich. Fl. p. 97; ed. 3, p. 92.

The British species are sterile. Th. Fries and Crombie give chemical reactions as K —, medulla Ca Cl f +; Wainio, however, could get no reaction with any of his specimens (Ark. Bot. viii. n. 4, p. 22).

Hab. Among mosses on the ground in alpine places.—*Distr.* Extremely rare on the summits of the loftier Grampians, Scotland.—*B. M.* Lochnagar and Ben Macdhui, Aberdeenshire.

Thallus dark-chestnut-brown, without pseudo-cyphellæ.

15. *C. aculeata* Fr. Syst. Orb. Veg. p. 239 (1825).—Thallus rigid, of narrow shining shrubby rounded or slightly compressed

fronds, sometimes lacunose, almost hollow, intricately and irregularly much branched, chestnut- or dark-brown, the branches divergent, forked, more or less spinulose. Apothecia rare in Britain, rather small, lateral or subterminal, concolorous, the margin spinulose-denticulate; spores small, 5–9 μ long, 3–4 μ thick.—Cromb. Lich. Brit. p. 26; Leight. Lich. Fl. p. 97 (f. *typica*); ed. 3, p. 92 (f. *typica*). *Lichenoides non tubulosum ramosissimum fruticuli specie, rufo-nigrescens* Dill. in Ray Syn. ed. 3, p. 66, n. 10 pro parte (1724). *Coralloides fruticuli specie fuscum spinosum* Dill. Hist. Musc. p. 112 pro parte (1741). *Lichen aculeatus* Schreb. Fl. Lips. p. 125 (1771). *L. islandicus* γ Huds. Fl. Angl. ed. 2, p. 539 (1778). *Cornicularia aculeata* Ach. Meth. Lich. p. 302 (1803); S. F. Gray Nat. Arr. i. p. 405; Hook. Fl. Scot. ii. p. 69 & in Sm. Engl. Fl. v. p. 228; Tayl. in Mackay Fl. Hib. ii. p. 86; Mudd Man. p. 77 (incl. var. *calocaula*); var. *calocaula* Flot. ex Koerb. Syst. Lich. Germ. p. 8 (1855).

Exsicc. Croall n. 198; Johns. n. 60; Larb. Lich. Cantab. n. 8; Leight. n. 3; Mudd n. 50.

A distinct though somewhat variable species, the branches are round, or compressed more especially at the axils. It always grows in interlaced clumps. The spermogones, which are rare, are seated in the tips of the spines; the spermatia measure 4 μ long and 1 μ thick.

Hab. On the ground in sandy and gravelly places among grasses and heath of moorland in upland localities.—*Distr.* Fairly common on heathlands, etc., throughout the British Isles.—*B. M.* Quenvais, Jersey; Dartmoor, Devon; Studland, Dorset; Lyndhurst Common, Hants; near Chelmsford, Essex; Thetford Warren, Suffolk; Malvern Hills and Hartlebury Common, Worcestershire; Charnwood Forest and Bardon Hill, Leicestershire; Haughmond Hill, Shropshire; Nant Ffrancon, Carnarvonshire; Llaniestyn, Anglesea; near Over, Cheshire; Farndale and Ayton Moor, Cleveland, Yorkshire; Gateshead, Durham; Kilhope Law and West Allen Carrs, Northumberland; New Galloway, Kirkcudbrightshire; Pentland Hills, near Edinburgh; Glen Lochay, Birnam Hill and Ben Lawers, Perthshire; Baldovan Woods, Sidlaw Hills and Clova, Forfarshire; Lochnagar, Aberdeenshire; Glen Nevis, Invernessshire; Culbin, Elginshire.

Form *hispidus* Cromb. Monogr. i. p. 218 (1894).—Thallus smaller, more slender and intricate, densely caespitose, the crowded branches more or less spinulose, generally darker in colour than the species. Apothecia numerous, dilated, the disc lighter-coloured than the thallus.—Var. *hispidus* Cromb. in Journ. Linn. Soc. Bot. xvii. p. 561 (1880). *C. aculeata* var. *muricata* Nyl. Lich. Scand. p. 80 (1861); Cromb. Lich. Brit. p. 26; form *muricata* Leight. Lich. Fl. p. 98; ed. 3, p. 93. *Coralloides fruticuli specie fuscum, spinosum* Dill. Hist. Musc. p. 112, t. 17, fig. 31A (1741). *Lichen hispidus* Lightf. Fl. Scot. ii. p. 883 (1777); With. Arr. ed. 3, iv. p. 43; Engl. Bot. t. 452. *L. muricatus* Ach. Lich. Suec. Prodr. p. 214 (1798). *Cornicularia spadicea* Ach. Meth. Lich. p. 301 (1803). *C. aculeata* var. *spadicea* Hook. Fl. Scot. ii. p. 69 (1821).

Exsicc. Johns. n. 61; *Larb. Lich. Hb.* n. 163; *Leight.* n. 4; *Mudd* n. 49.

Forms low dense tufts up to about 3 cm. in height. Though a fairly well-marked form, it is very closely connected with the species, and is sometimes spinous like the more developed f. *acanthella*.

Hab. On the ground on moorlands in upland districts.—*Distr.* Frequent in moorland and hilly districts of Great Britain, rare in Ireland.—*B. M.* Scilly Islands; Rough Tor, Cornwall; Dartmoor, Devonshire; Lewes, Sussex; Lydd, Kent; Hainault Forest, Essex; Wokingham Heath, Bucks; Malvern, Worcestershire; Haughmond Hill, near Oswestry, and Longmynd, Shropshire; Cwm Bychan, Merioneth; Breidden, Montgomeryshire; Black Edge, near Buxton, and Chatsworth, Derbyshire; North Wootton, Norfolk; near Beverly, Hainworth Moor, Battersby Moor and Ayton, Cleveland, Yorkshire; Swinhope Fell, Northumberland; near Kendal, Westmoreland; Asby and Lamplugh, Cumberland; New Galloway, Kirkcudbrightshire; Dalmahoy Hill and Pentland Hills, near Edinburgh; Ben Lawers, Craig Tulloch and Rannoch Moor, Perthshire; Sidlaw Hills, Montrose links and near Cortachy, Forfarshire; Glen Dee and Glen Muick, Braemar, Aberdeenshire; Hills of Applecross, Rossshire; Killarney, Kerry; Mt. Errigal, Donegal.

Form *acanthella* Nyl. *Lich. Scand.* p. 80 (1861).—Thallus similar to that of the species, but beset with denticulate spines and generally very dark in colour. Apothecia rare, lighter in colour than the thallus.—*Leight. Lich. Fl.* p. 98; ed. 3, p. 93. Var. *acanthella* Nyl. in *Mém. Soc. Sci. Cherb.* v. p. 100 (1857); *Cromb. in Journ. Bot.* viii. p. 96 (1870). *Coralloides fruticuli specie fuscum, spinosum* Dill. *Hist. Musc.* p. 112, t. 17, fig. 31b (1741). *Cornicularia spadicea* var. *acanthella* Ach. *Lich. Univ.* p. 612 (1810).

Exsicc. Johns. n. 62.

Distinguished by the more spinous branches; it is well-marked, though possibly a form due to growth conditions of greater illumination.

Hab. On the ground, sand dunes, etc., among mosses in maritime and upland districts.—*Distr.* Rather uncommon throughout Great Britain.—*B. M.* Harting Combe, Sussex; Godalming, Surrey; Clifton, Gloucestershire; Dolgelly, Merioneth; Farndale, Yorkshire; Prestwich Carr and West Allen Carrs, Northumberland; Baldovan Woods, Sidlaw Hills and Clova Mts., Forfarshire; S. of Lochnagar, Aberdeenshire; Glen Nevis, Invernessshire; Findhorn, Elginshire.

16. *C. odontella* Ach. *Syn. Lich.* p. 230 (1814).—Thallus densely caespitose, the fronds short, plane, rather narrow and palmately branched, spinulose at the margins, chestnut- or dark-brown, paler at the base or sometimes red. Apothecia terminal, concolorous, the margin denticulate; spores 7–10 μ long, 4–5 μ thick.—*Cromb. in Journ. Bot.* xx. p. 272 (1882). *Lichen odontellus* Ach. *Lich. Succ. Prodr.* p. 213 (1788).

Distinguished by the small size and by the flattened fronds. The only British specimen is sterile.

Hab. Among mosses or rocks in alpine districts.—*B. M.* Cairntoul, Braemar, Aberdeenshire.

ORDER XI. USNEACEÆ.

Thallus fruticose, elongate, filamentous or strap-shaped, branched, attached at the base, usually radiate in structure; strengthening hyphæ generally present. Algal cells *Protococcus*, within the inner cortex. Apothecia roundish, sessile or shortly stalked, marginate; asci 1-8-spored; spores colourless or rarely brown, simple or septate. Spermogones immersed; sterigmata simple, sparingly septate, with acrogenous or pleurogenous spermatia.

Distinguished by the generally upright or pendulous elongate thallus, with basal attachment. Transition stages between the foliaceous and fruticose types occur in the genus *Evernia*, in which the structure is only subradiate and the thallus, though usually with a single penetrating foothold, may form secondary basal sheaths. *Cerania* (*Thamnolia*) is doubtfully included in the Order. The British genera are as follows:—

Thallus strap-shaped, narrow or broad.

Structure subdorsiventral, with under surface
of different colour 40. *Evernia*.

Structure radiate, alike on both surfaces 41. *Ramalina*.

Thallus filamentous.

Medulla with central chondroid strand..... 42. *Usnea*.

Medulla of loose arachnoid hyphæ..... 43. *Alectoria*.

Thallus stalk-like.

Fronds hollow, tapering upwards 44. *Cerania*.

40. **EVERNIA** Ach. Lich. Univ. p. 84 (1910). (Pl. 40.)

Thallus erect or pendulous or somewhat decumbent, strap-shaped, divided or repeatedly branched, rather soft and flaccid, attached by a basal sheath, occasionally by a few rhizina; differently coloured above and below. Algal cells *Protococcus*. Structure subdorsiventral; cortex on both surfaces of gelatinous cells; gonidia mostly confined to a layer below the upper surface. Apothecia lateral or almost terminal, with a thalline margin; paraphyses stoutish, simple; spores 8 in the ascus, small, ellipsoid, simple. Spermogones lateral, immersed, with pleurogenous straight acicular spermatia.

1. *E. prunastri* Ach. Lich. Univ. p. 442 (1810).—Thallus at first ascending then more or less decumbent or pendulous, the fronds irregularly strap-shaped, wrinkled-lacunose or somewhat furrowed, greenish-grey above, white beneath, becoming brownish and concolorous in herbarium, repeatedly divided and branched, especially towards the apex, usually about 5-10 cm. long, frequently sorediate at the margins or on the wrinkles (K_{+} yellow. $CaCl_{-}$). Apothecia rare, on a short stout pedicel, chiefly lateral, moderate in size, the disc reddish-brown, the margin inflexed; spores 7-10 μ long, 4.5-6 μ thick.—S. F. Gray Nat. Arr. i.

p. 425; Hook. Fl. Scot. ii. p. 61 & in Sm. Engl. Fl. v. p. 224; Tayl. in Mackay Fl. Hib. ii. p. 84; Mudd Man. p. 72; Cromb. Lich. Brit. p. 24 (incl. f. *sorediifera*); Leight. Lich. Fl. p. 90; ed. 3, p. 82. *Lichenoides arboreum ramosum majus et mollius colore candicante* Dill. in Ray Syn. p. 75, n. 80 (1724). *Lichenoides cornutum bronchiale molle subtus incanum* Dill. Hist. Musc. p. 160, t. 21, fig. 55 A (1741). *Lichen prunastri* L. Sp. Pl. p. 1147 (1753); Huds. Fl. Angl. p. 452; Lightf. Fl. Scot. p. 835; With. Arr. ed. 3, iv. p. 52; Engl. Bot. t. 859.

Exsicc. Bohl. n. 64; Croall n. 396; Johns. n. 22; Lerb. Lich. Hb. n. 246; Leight. n. 36; Mudd n. 41.

A variable species according to age and habitat, but always readily distinguished by the white under surface. Though the structure is on the whole dorsiventral, groups of algæ frequently occur on the lower side, especially near the tips. Apothecia and spermatogones are rare. The latter have spermatia 6-7 μ long, 5 μ thick.

Hab. On the trunks and branches of trees, or on hedge bushes, in orchards, woods, etc.—*Distr.* General and usually plentiful in most parts of the British Isles; more frequently fertile on the Grampians, Scotland.—*B. M.* Islands of Jersey and Guernsey; near Penzance and Withiel, Cornwall; Ullacombe near Bovey Tracey, Devon; New Forest, Hants; St. Leonards Forest, Eridge Park, near Tilgate, near Hapstead and Bolnore, Sussex; Lydd, Kent; Shiere, Godalming, Surrey; Langford, Epping Forest and Walthamstow, Essex; Cirencester, Gloucestershire; Broadwas and Malvern, Worcestershire; Oswestry, the Wrekin and near Shrewsbury, Shropshire; Madingley near Cambridge; near Cromer, Norfolk; Welbeck Park, Notts; Cwm Bychan, Merioneth; Anglesea, Cheshire; near Matlock, Buxton and near Bank House, Derbyshire; Lounsdale and Ayton, Cleveland, Yorkshire; near Kendal, Westmoreland; Hale Mill and Alston, Cumberland; Gibside Woods, Durham; New Galloway, Kirkcudbrightshire; Currie, near Edinburgh; near Glasgow; Appin, Argyll; Killin, Aberteldy and Blaeberry Hill, Perthshire; Deerhill Wood, Sidlaw Hills, Guthrie, and Kinnordy, Forfarshire; Countesswells Woods, Durris Woods, and Ballochbuie Forest, Braemar, Aberdeenshire; Invermoriston and Rothiemurchus Woods, Invernessshire; Cawdor Woods, Nairnshire; Lairg, Sutherlandshire; near Cork; Achill Island, Mayo; near Belfast, Antrim.

Form *retusa* Cromb. in Journ. Linn. Soc. xvii. p. 569 (1880).—Thallus of short crowded erect fronds which are retuse and emarginate at the apices. Apothecia not seen.—*Lichenoides cornutum bronchiale molle subtus incanum* Dill. Hist. Musc. p. 160, t. 21, fig. 55 H. *Parmelia prunastri* var. *retusa* Ach. Meth. Lich. p. 257 (1803).

Grows in dense tufts about 1 or 2 cm. in height, and often spreads extensively. It is more or less sorediiferous.

Hab. On old palings, chiefly larch, in lowland or upland districts.—*Distr.* Seen only from a few localities in S. England, E. and N. Scotland.—*B. M.* Park, near Aberdeen and Durris, Aberdeenshire.

Var. *stictoceros* Hook. in Sm. Engl. Fl. v. p. 224 (1833) (non Ach.).—Thallus pendulous or prostrate, subcompressed, greenish-

sulphur-coloured, mostly similarly coloured on both surfaces, the fronds rather narrow, attenuate upwards, frequently dotted with dark-coloured tubercles. Apothecia very rare.—Mudd Man. p. 72; Leight. Lich. Fl. p. 91; ed. 3, p. 83 (incl. var. *gracilis*). Var. *gracilis* Ach. Lich. Univ. p. 442 (1810)? Cromb. in Journ. Bot. x. p. 233 (1872); form *stictocera* Cromb. Lich. Brit. p. 25 (1870). *Lichenoides corniculatum candidum molle, segmentis angustis* Dill. Hist. Musc. p. 159, t. 21, fig. 54 (1741). *Lichen prunastri* β Huds. Fl. Angl. ed. 2, p. 541 (1778); With. Arr. ed. 3, iv. p. 53 pro parte. *Lichen stictoceros* Sm. Engl. Bot. t. 1353 (1804).

Æsicc. Larb. Cæsar. n. 59.

Distinguished by being generally concolorous on both surfaces. It approaches the genus *Letharia*, but there are no chondroid strands in the pith and the algæ of the lower surface are very scanty. The structure otherwise is similar to that of the species. The dark-coloured tubercles are of hyphal nature; they arise at points where the lichen fronds are attached to other branches.

Hab. On bare sandy soil, and on heather in maritime regions, rarely on the trunks of old firs in mountainous districts.—*B. M.* Quenvais, Jersey; Dawlish and Exmouth Downs, Devon; Lydd Beach, Kent; Stronachlachan Woods, Killin, Perthshire; Deerhill Wood, Forfarshire; Findhorn, Elginshire.

2. *E. furfuracea* Mann Lich. Bohem. p. 105 (1825).—Thallus ascending, pendulous or decumbent, of long narrow fronds repeatedly dichotomously branched, incurved at the margins, attenuate upwards, greyish or greyish-green at becoming dark-grey; beneath black, naked, attached by a rhizinose basal sheath (K⁺ yellowish, CaCl⁻). Apothecia moderate in size or large, subpedicellate, brownish-red, the margin thin, inflexed; spores 7–10 μ long, 4–5 μ thick.—Mudd Man. p. 71; Cromb. Lich. Brit. p. 24; Leight. Lich. Fl. p. 90; ed. 3, p. 82; form *nuda* Cromb. Monogr. i. p. 231 (1894). *Lichenoides cornutum amarum superne cinereum, inferne nigrum* Dill. Hist. Musc. p. 157, t. 21, fig. 52 (1741). *Lichen furfuraceus* L. Sp. Pl. p. 1146 (1753); Huds. Fl. Angl. p. 450; Lightf. Fl. Scot. ii. p. 832; With. Arr. ed. 3, iv. p. 56. *Parmelia furfuracea* Ach. Meth. Lich. p. 254; Tayl. in Mackay Fl. Hib. ii. p. 144. *Borreria furfuracea* Ach. Lich. Univ. p. 500 (1810) (incl. var. *nuda*); S. F. Gray Nat. Arr. i. p. 435; Hook. Fl. Scot. ii. p. 56 & in Sm. Engl. Fl. v. p. 223.

Æsicc. Croall n. 494; Johns. n. 302; Leight. n. 37; Mudd n. 60.

Differs from the preceding in the black under surface. It has been sometimes classified as a *Parmelia*, but though the structure is mainly dorsiventral, it is frequently radiate for some distance (about .5 cm.) below the tips. The fronds are frequently attached to each other by haptera, and to the support by a secondary stolon-like sheath which forms a new base for further fronds.

Hab. On the trunks of trees, old palings, walls or rocks in upland districts.—*Distr.* General and somewhat frequent in upland districts of Great Britain; apparently rare in Ireland.—*B. M.* Helmlinton, Cornwall; Dartmoor and South Brent, Devon; New Forest, Hants; Eridge, Sussex; Twycross, Leicestershire; near Oswestry, Caer Caradoc and Wrekin Hill, Shropshire; Dolgelly, Barmouth and Cwm Bychan, Merioneth; Carnedd Dafydd, Carnarvonshire; Anglesea; Chesterfield and near Buxton, Derbyshire; Farndale, Yorkshire; Egglestone, Durham; Chillingham Park, Northumberland; New Galloway, Kirkeudbrightshire; Swanston Wood near Edinburgh; Glen Falloch, Argyll; Blaeberry Hill, Glen Lochay, Killin, Crianlarich, Pass of Leny and Glen Lyon, Perthshire; Deerhill Wood and Rossie Moor, Forfarshire; Durris, Kincardineshire; Invercauld, Auchindryne and Castleton, Braemar, Aberdeenshire; Glen Nevis, Invernesshire.

Form *scobicina* Cromb. Lich. Brit. p. 24 (1870).—Fronds frequently broader, darker in colour, densely isidiose and fibrillose; otherwise as in the species.—Leight. Lich. Fl. p. 90. *Parmelia furfuracea* var. *scobicina* Ach. Meth. Lich. p. 255 (1803).

Exsicc. Johns. n. 66.

A growth form of very pronounced character and frequently associated with the smoother species. It is rarely fertile and the apothecia may be isidiose on the receptacle and on the margin.

Hab. On the trunks of trees, old palings and stone walls in upland districts.—*Distr.* Rather local, though plentiful in W. and Central England; but chiefly in the Grampians, Scotland.—*B. M.* Weald Hall, Essex; Chesterfield and Chatsworth, Derbyshire; Gopsall Park, Leicestershire; Malvern, Worcestershire; Arkendale, Yorkshire; Langley, Northumberland; Killin and Ben Lawers, Perthshire; Johnston Hill, Forfarshire; Morrone and Castleton, Braemar, and Countesswells, Aberdeenshire; Rothiemurchus, Invernesshire.

Form *ceratea* Cromb. in Grevillea vi. p. 21 (1877).—Thallus decumbent, fronds narrow, convex and subcylindrical, acuminate, isidiose or subglabrous.—*Parmelia furfuracea* var. *ceratea* Ach. Meth. Lich. p. 255 (1803).

Exsicc. Cromb. n. 139; Johns. n. 67.

Distinguished by the narrow fronds. The British specimens are barren, though Acharius (Lich. Univ. p. 501) says the apothecia chiefly occur on this form.

Hab. On rocks and old walls in upland districts.—*Distr.* Rare in various districts of England and Scotland.—*B. M.* Helmlinton, Cornwall; Hunter Tor, Dartmoor, Devon; near Buxton, Derbyshire; near Kendal and Windermere, Westmoreland; Alston, Cumberland; Pentland Hills, near Edinburgh; Glen Falloch, Perthshire; near Countesswells, Aberdeenshire.

41. **RAMALINA** Ach. Lich. Univ. pp. 122 & 598 (1810). (Pl. 41.)

Thallus of erect or partly pendulous fronds, branched,

compressed and strap-shaped or narrow and almost cylindrical, attached by a basal sheath or by penetrating hyphæ; structure radiate, the medulla generally of loose hyphæ, the gelatinous cortex formed of shortly branched thick-walled coalescing hyphæ, growing in a direction vertical to the long axis of the thallus; inner cortex of longitudinal strengthening hyphæ in a ring or as separate strands, which are rarely absent; soralia not infrequent; air-pores occurring as breaks in the thallus. Algal cells *Protococcus*. Apothecia terminal or lateral, sometimes on the angle of bent fronds (geniculate), marginate; hypothecium colourless; paraphyses simple, concrete; spores 8 in the ascus, ellipsoid, colourless, 1-septate, straight or slightly curved.

Thallus corticolous, without soredia.

1. *R. calicaris* Fr. Lich. Eur. p. 30 (1831) pro parte (incl. f. *canaliculata*); emend. Nyl. in Bull. Soc. Linn. Norm. sér. 2, iv. p. 131 (1870).—Thallus erect, compressed, the fronds narrow or sometimes rather broader, often longitudinally lacunose and canaliculate, pale glaucous- or greyish-green (medulla K —). Apothecia subpedicellate, marginal, generally rather crowded near the tips of the frond, frequently on a bent angle (geniculate), small or moderate in size, the disc pale flesh-coloured or greenish, the receptacle wrinkled below; spores ellipsoid, straight, 10–16 μ long, 5–7 μ thick.—Mudd Man. p. 72 pro parte; Cromb. Lich. Brit. p. 25 pro parte; Leight. Lich. Fl. p. 92 (incl. f. *canaliculata*, excl. ff. *farinacea* and *thrausta*); ed. 3, p. 83. *R. fastigiata* var. *calicaris* Ach. Syn. Lich. p. 297 (1814); Hook. Fl. Scot. ii. p. 68; Tayl. in Mackay Fl. Hib. ii. p. 85. *Lichenoides arboreum ramosum, angustioribus cinereo-virentibus ramulis* Dill. in Ray Syn. ed. 3, p. 75 n. 81 (1724). *Lichenoides coralliforme rostratum et canaliculatum* Dill. Hist. Musc. p. 170, t. 23, fig. 62 A (1741). *Lichen calicaris* L. Sp. Pl. p. 1146 (1753) pro parte; Huds. Fl. Angl. p. 451 pro parte; Lightf. Fl. Scot. p. 834 pro parte; With. Arr. ed. 3, iv. p. 51 pro parte. *L. fastigiatus* Sm. Engl. Bot. t. 890 (upper fig.) (1801) (non Pers.). *Lobaria calicaris* Hoffm. Deutschl. Fl. ii. p. 139 (1795) pro parte.

Exsicc. Cromb. n. 21; Johns. n. 16; Mudd n. 44.

Lichen calicaris L. is a mixture and referable partly to the above, partly to *R. siliquosa*. Established custom has restricted it to corticolous forms. It is distinguished by the arboreal habit and the rather narrow channelled thallus. The fronds vary in height and in branching; short crowded narrow outgrowths arise at right angles to the main frond on some specimens. Spermogones are fairly common, with minute spermatia 3–4 μ long, 1 μ thick. The strengthening tissue forms a ring within the cortex, and here and there projects into the medulla; the cortex is formed of irregular branching thick-walled cells which pass out at right angles to the longitudinal axis. The alge lie in groups.

Hab. On trees.—*Distr.* General and common in the British Isles, rare in the Channel Islands.—*B. M.* St. Aubin's, Jersey; near Respring and Penzance, Cornwall; near Totnes and Torquay, Devon; New Forest, Hants; Lavington Common, Sussex; Lydd, Kent; Old Windsor, Berkshire; Pyle, Glamorganshire; Dynevor Castle, Carmarthenshire; Anglesea; Airyholme Woods, Cleveland, Yorkshire; near Stavely, Westmoreland; Wastdale, Cumberland; Pentland Hills, near Edinburgh; Barcaldine and Appin, Argyll; Killin, Kenmore and Abernethy, Perthshire; Deerhill Wood and near Arbroath, Forfarshire; Countesswells Woods and Abergeldie, Aberdeenshire; S. of Fort William and Invermoriston, Invernessshire; Loch Shin, Sutherland; Achill Island, Mayo; Antrim.

Var. subampliata Nyl. in tom. cit. p. 132.—*Lacinia* broader than in the species. Apothecia mostly subterminal; spores as in the species.—Leight. Lich. Fl. p. 471; ed. 3, p. 84.—*Lichenoides coralliforme rostratum et canaliculatum* Dill. Hist. Musc. p. 170, t. 23, fig. 62 B (1741).

Exsicc. Mudd n. 42.

The thallus is intermediate between the species and that of *R. fraxinea*, but the straight spores indicate the true relationship.

Hab. On the trunks of trees in maritime and upland districts.—*Distr.* Local and scarce in England, Wales and S.W. Scotland.—*B. M.* Penzance, Cornwall; New Forest, Hants; Beeding Priory and Tunbridge Wells, Sussex; Malvern, Worcestershire; Aberdovey, Merioneth; Ayton, Cleveland, Yorkshire; Stavely, Westmoreland; Barcaldine, Argyll.

Var. subfastigiata Nyl. l. c.—*Lacinia* broader, subequal in length. Apothecia terminal; spores as in the species.—Leight. Lich. Fl. ed. 2, p. 471; ed. 3, p. 84.

The thallus approaches that of *R. fastigiata* in form, but the spores conform to those of the above species.

Hab. On trees in maritime and upland districts.—*Distr.* S.W. England, S. Wales and the S.W. Highlands of Scotland.—*B. M.* Near Penzance, Cornwall; Appin, Argyll.

2. *R. fraxinea* Ach. Lich. Univ. p. 602 (1810).—Thallus partly upright or subpendulous, the fronds compressed, narrow or broad, generally narrowing upwards, longitudinally and partly transversely wrinkled or nerved, greyish-green. Apothecia abundant, marginal and superficial, pedicellate, moderate in size or large, the disc reddish-flesh-coloured or greenish, the receptacle unequally wrinkled; spores oblong-ellipsoid, curved, 10–12 μ long, 5–7 μ thick.—Hook. Fl. Scot. ii. p. 68 & in Engl. Fl. v. p. 225; Tayl. in Mackay Fl. Hib. ii. p. 84; Leight. Lich. Fl. ed. 2, p. 472; ed. 3, p. 85. *R. calicaris* var. *fraxinea* Fr. Lich. Eur. p. 30 (1831); Mudd Man. p. 73; Cromb. Lich. Brit. p. 25; form *fraxinea* Leight. Lich. Fl. p. 94. *Lichenoides arboreum ramosum scutellatum, majus et rigidius, colore virescente* Dill. in Ray Syn. ed. 3, p. 75, n. 79 pro parte (1724). *Lichenoides*

longifolium rugosum rigidum Dill. Hist. Musc. p. 165, t. 22, fig. 59 A, B (1741). *Lichen fraxineus* L. Sp. Pl. p. 1146 (1753); Huds. Fl. Angl. p. 451 pro parte; Lightf. Fl. Scot. ii. p. 835; With. Arr. ed. 3, iv. p. 56; Engl. Bot. t. 1781.

Esicc. Croall n. 495; Bohl. n. 21 pro parte; Dicks. Hort. Sicc. fasc. xii. n. 24; Johns. n. 17; Larb. Lich. Cantab. n. 5; Leight. n. 38 pro parte; Mudd n. 42.

A variable species in the length and width of the fronds. On the wider laciniae the apothecia tend to become superficial on both surfaces, more especially on the better-lighted portions. The outer cortex is composed of thick-walled confused hyphæ; the strengthening hyphæ occur in irregular strands. There are longitudinally ellipsoid breaks in the thallus of this species which function as breathing-pores.

Hab. On trees in open places or in forests in lowland and upland districts.—*Distr.* General and fairly common throughout the British Isles.—*B. M.* Near Penzance, Cornwall; New Forest, Hants; Brading Downs and Bembridge, I. of Wight; Amberley, Shoreham and near Glynde, Sussex; Epping Forest and Ulting, Essex; Cirencester, Gloucestershire; Harboro Magna, Warwickshire; Clungunford and near Shrewsbury, Shropshire; Cleveland, Yorkshire; Teesdale, Durham; Windermere, Westmoreland; Alston, Cumberland; near Berwick-on-Tweed; New Galloway, Kirkcudbrightshire; near Moffat, Dumfriesshire; Roslin and near Edinburgh, Midlothian; Barcaldine and near Oban, Argyll; Blair Athole, Perthshire; Reeky Linn, Baldovan Woods and Rossie Moor, Forfarshire; Countesswells Wood, Invercauld, Craig Coinnoch and Glen Clunie, Braemar, Aberdeenshire; Glen Nevis, Invernessshire; Killarney, Kerry.

Var. ampliata Ach. Lich. Univ. p. 603 (1810).—Laciniae very broadly developed, tapering or blunt at the tips, longitudinally and transversely nerved and wrinkled.—Cromb. in Grevillea vii. p. 141 (1879) (incl. f. *monophylla*); form *ampliata* Leight. Lich. Fl. ed. 2, p. 473; ed. 3, p. 86. *Lichenoides longifolium rugosum rigidum* Dill. Hist. Musc. p. 165, t. 22, fig. 59 c (1741). *Parmelia fraxinea* var. *ampliata* Ach. Meth. p. 259 (1803).

Esicc. Bohl. n. 21 pro parte; Johns. n. 18; Larb. Lich. Hb n. 286; Leight. n. 38.

Connected with the species by intermediate forms, though well-marked in extreme specimens. The apothecia are usually abundant and sometimes very large.

Hab. On old trees, chiefly oak and ash, in wooded upland districts.—*Distr.* Rather local and not plentiful in the British Isles.—*B. M.* Dartmoor, Devon; New Forest, Hants; Amberley, Sussex; Epping Forest, Essex; Bartonbury, Gloucestershire; Gopsall Park, Leicestershire; Alfric, Worcestershire; Oswestry, Shropshire; Barmouth and Aberdovey, Merioneth; Island of Anglesea; near Willington, Cheshire; Darley, Derbyshire; Ayton, Cleveland, Yorkshire; East Allendale, Northumberland; New Galloway, Kirkcudbrightshire; Blair Athole, Perthshire; Abergeldie, Braemar, Aberdeenshire; Fort Augustus, Invernesshire.

Var. calcariformis Nyl. in Bull. Soc. Linn. Norm. sér. 2, iv. p. 136 (1870).—Laciniae long and rather narrow, attenuate

upwards, wrinkled and nerved. Apothecia marginal and sub-terminal.—Cromb. in Journ. Bot. xx. p. 272 (1882).

Esicc. Johns. n. 183.

Distinguished by the persistently narrow fronds somewhat similar to those of *R. calicaris*, from which it differs in the curved spores.

Hab. On the branches of trees in upland situations.—*Distr.* Rather rare in S.W., W. and N.E. England and N. Wales.—*B. M.* Dartmoor, Devon; Pickeridge, near Taunton, Somerset; near Barmouth, Merioneth; near Kendal, Westmoreland; Lamplugh, Cumberland; Teesdale, Durham.

3. *R. fastigiata* Ach. Lich. Univ. p. 603 (1810) pro parte.—Thallus erect, rather rigid, of short crowded subequal fastigiate fronds, generally compressed, sometimes hollow, smooth or longitudinally wrinkled and nerved, greyish-green (medulla, K —). Apothecia numerous, terminal, on a broad base, plane or becoming convex, generally small or moderate in size (5 mm. and under), wrinkled beneath, the disc pale greyish-green; spores oblong, ellipsoid, curved, 9–17 μ long, 5–7 μ thick.—S. F. Gray Nat. Arr. i. p. 406; Hook. Fl. Scot. ii. p. 68 & in Sm. Engl. Fl. v. p. 225; Tayl. in Mackay Fl. Hib. ii. p. 85; Leight. Lich. Fl. ed. 2, p. 473; ed. 3, p. 86. *R. calicaris* var. *fastigiata* Fr. Lich. Eur. p. 30 (1831); Mudd Man. p. 73; Cromb. Lich. Brit. p. 25; form *fastigiata* Leight. Lich. Fl. p. 94 (1871). *Lichenoides cornutum bronchiale molle, subtus incanum* Dill. Hist. Musc. p. 160, t. 21, fig. 55 B (1741) & *Lichenoides coralliforme, rostratum et canaliculatum*, p. 170, t. 23, fig. 62 c. *Lichen populinus* Ehrh. Exs. n. 276 (1793), ined. *L. fastigiatus* Pers. in Ust. Ann. Bot. xii. p. 256 (1794); Engl. Bot. t. 890 (lower fig.). *L. calicaris* Huds. Fl. Angl. p. 451 pro parte; Lightf. Fl. Scot. ii. p. 834 pro parte.

Esicc. Croall n. 496; Bohl. n. 22; Larb. Lich. Caesar. n. 60; Lich. Hb. n. 287 & Lich. Cantab. n. 6; Leight. n. 39; Mudd n. 43.

Distinguished by the compact growth of the generally short laciniae, which tend to widen at the tips into the base of the apothecia. Spermogones are rare, with minute spermatia about 3.5 μ long and 1 μ thick.

Hab. On trees in wooded districts.—*Distr.* General and common in Great Britain, rare in the fir woods of the Highlands, in Ireland and the Channel Islands.—*B. M.* Jersey; Guernsey; near Penzance and Withiel, Cornwall; near Torquay, Devon; New Forest, Hants; near Ryde, I. of Wight; Beeding Priory, Lewes, Hurstpierpoint and Shoreham, Sussex; Chiselhurst and Penshurst, Kent; near Croydon and Reigate Hill, Surrey; Hainault Forest, Epping Forest and Cophall Green, Essex; Cirencester, Gloucestershire; Malvern and Broadwas, Worcestershire; Causeway, Warwickshire; Aberdovey, Merioneth; Anglesea; Broome, near Oswestry and Shrewsbury, Shropshire; near Over, Cheshire; Eversden Wood, Cambridgeshire; Charnwood Forest, Leicestershire; Cleveland, Yorkshire; Teesdale, Durham; near Kendal, Westmoreland; Lamplugh, Cumberland;

New Galloway, Kirkcudbrightshire; Roslin and Bonally, Midlothian; Bowling Bay, Dumbarton; Barcaldine, Argyll; Loch Tay, Blaeberry Hill and Blair Athole, Perthshire; Guthrie and Tealing, Forfarshire; Den Fenella, Kincardineshire; Abergeldie and Craig Coinnoch, Braemar and Countesswells Wood, Aberdeenshire; Glen Nevis and Invermoriston, Invernesshire; near Strathpeffer, Rossshire; Lairg, Sutherland; Derriquin, Kerry.

Form *minutula* Cromb. in *Grevillea* vii. p. 141 (1879).—Thallus of short slender much branched fastigiate laciniae. Apothecia not seen.—*Ramalina farinacea* var. *minutula* Ach. Lich. Univ. p. 606 (1810); Th. Fr. Lich. Scand. i. p. 37 (1871). *Lichenoides segmentis argutioribus, ad margines verrucosis et pulverulentis* Dill. Hist. Musc. p. 172, t. 23, fig. 63 A (1741), fide Cromb. in Journ. Linn. Soc. xvii. p. 570 (1880).

Considered by Crombie and others to belong to the present species, of which it is probably a young and barren state.

Hab. On palings, chiefly larch, in wooded districts.—*Distr.* Local and scarce in S. England and in Scotland; probably overlooked.—*B. M.* New Forest, Hants; Swanston near Edinburgh; Park, near Aberdeen; Lairg, Sutherland.

4. *R. dilacerata* Wain. in Medd. Soc. Faun. & Fl. Fenn. xiv. pp. 14 & 21 (1886).—Thallus small, in rounded cushion-like groups, the laciniae soft, rounded or compressed longitudinally, nerved, subpellucid, branched, attenuate, pale straw-coloured (medulla K -). Apothecia numerous, small, terminal, plane or convex, yellowish flesh-coloured or glaucous, smoothish beneath; spores oblong or fusiform-oblong, straight, 9-15 μ long, 4-6 μ thick.—*R. calicaris* f. *minuscule* Nyl. in Not. Sällsk. Faun. & Fl. Fenn. v. p. 114 (1866). *R. minuscule* Nyl. in Bull. Soc. Linn. Norm. sér. 2, iv. p. 164 (1870); Cromb. in *Grevillea* xii. p. 142 & Monogr. i. p. 200. *Lobaria dilacerata* Hoffm. Deutschl. Fl. p. 140 (1795) (excl. syn. Dill.).

Of the same habit as the preceding, but distinguished by the small soft thallus and straight spores. The cortex is narrow, with a narrow ring of strengthening longitudinal hyphæ; the medulla is loose and arachnoid.

Hab. On the branches of conifers and erratic on rocks in mountainous districts.—*B. M.* Craig Cluny, Braemar, Aberdeenshire (the only British record).

5. *R. geniculata* Hook. & Tayl. in Lond. Journ. Bot. iii. p. 655 (1844).—Thallus rather short, the laciniae smooth, longitudinally nerved, subcompressed, fistulose and frequently perforated, subfastigiately branched, ending in numerous narrow divaricate points, pale or pale straw-coloured (medulla K -). Apothecia moderate in size, sometimes rather large, pale flesh-coloured, smooth or wrinkled below; spores oblong or fusiform-oblong, straight or slightly curved, 9-15 μ long, 4-7 μ thick.

Cromb. in Journ. Bot. xiv. p. 360 (1876); Leight. Lich. Fl. ed. 3, p. 90.

An exotic species described first from N. Zealand; British specimens are confined to W. Ireland.

Hab. On stems of shrubs (thorns) in maritime districts.—*B. M.* Killery Bay, Connemara, Galway.

Thallus corticolous, sorediate.

6. *R. farinacea* Ach. Lich. Univ. p. 606 (1810) (incl. forms *phalerata* & *pendulina*, p. 607).—Thallus of rather narrow attenuate, generally compressed fronds, stiff or somewhat flaccid and pendulous, irregularly lacunose or obsoletely nerved, pale greenish-glaucous, the margins beset with roundish-ellipsoid soralia. Apothecia rare, pedicellate, small, terminal and lateral, smooth beneath, the disc greenish or pale reddish-brown; spores fusiform-ellipsoid, straight, 8–16 μ long, 4–7 μ thick.—*S. F. Gray* Nat. Arr. i. p. 407; *Hook.* Fl. Scot. ii. p. 68 & in *Sm. Engl. Fl.* v. p. 225; *Tayl.* in *Mackay Fl. Hib.* ii. p. 85; *Leight. Lich. Fl.* ed. 2, p. 472; ed. 3, p. 84; f. *phalerata* *Cromb.* in *Grevillea* vii. p. 141 (1879) & f. *pendulina* op. cit. xv. p. 47 (1886). *R. calicaris* var. *farinacea* *Mudd Man.* p. 73 (1861); *Cromb. Lich. Brit.* p. 25; f. *farinacea* *Leight. Lich. Fl.* p. 93 (1871). *Lichenoides segmentis angustioribus, ad margines verrucosis et pulverulentis* *Dill. Hist. Musc.* p. 172, t. 23, fig. 63 B, C, D, E (1741). *Lichen farinaceus* *L. Sp. Pl.* p. 1146 (1753); *Huds. Fl. Angl.* p. 451; *Lightf. Fl. Scot.* ii. p. 833; *With. Arr. ed.* 3, iv. p. 50; *Engl. Bot.* t. 889. *Parmelia farinacea* *Ach. Meth. Lich.* p. 264 (1803) (incl. vars. *pendulina* & *phalerata*).

Exsicc. *Cromb.* n. 22; *Johns.* nos. 57, 58; *Leight.* n. 40; *Mudd* n. 45.

The thallus varies greatly, and may be very luxuriant in somewhat damp localities (f. *pendulina*) or short and stunted when opposite conditions prevail (f. *phalerata*). The strengthening hyphæ occur in strands within the cortex, which is formed of shortly branching thick-walled hyphæ; the algæ lie in groups.

Hab. On trunks and branches of trees in wooded districts.—*Distr.* General and usually plentiful in the British Isles.—*B. M.* Boulay Bay, Jersey; Penzance and Withiel, Cornwall; New Forest, Hants; Carisbrooke, I. of Wight; Lavington Common and Glynde, Sussex; Lydd, Kent; Shiere, Surrey; near Quendon, near Loughton and Hatfield Peverel, Essex; Dynevor Castle, Carmarthenshire; Anglesea; Bettws-y-Coed, Carnarvonshire; Malvern and Broadwas, Worcester-shire; near Oswestry and Shrewsbury, Shropshire; Newton, Cleveland, Yorkshire; Egglestone, Durham; Staveley, near Kendal, Westmoreland; Alston, Cumberland; New Galloway, Kirkeudbrightshire; near Edinburgh; Appin, Argyll; Loch Katrine, Finlarig, Craig Calliach, Blueberry Hill and Balthayock Woods, Perthshire; Baldovan Wood and Reeky Linn, Forfarshire; Countesswells Woods and Invercauld, Braemar, Aberdeenshire; Glen Nevis and Invermoriston, Inverness-

shire; Applecross, Rosshire; near Cork; Dunkerron, Kerry; Glengarry Wood and Dugort, Achill Island, Mayo.

Subsp. *intermedia* Cromb. in *Grevillea* xv. p. 47 (1886).—Laciniae much branched, crowded, short, smooth, the ultimate branchlets slender, otherwise as in the species.—*R. minuscula* subsp. *intermedia* Del. ex Nyl. in *Bull. Soc. Linn. Norm. sér. 2, iv.* p. 166 (1870). *R. intermedia* Nyl. in *Flora* lvi. p. 66 (1873); Cromb. in *Journ. Bot.* xi. p. 133 (1873); Leight. *Lich. Fl.* ed. 3, p. 90.

Exsicc. Larb. *Lich. Hb.* n. 248.

Distinguished from the species by the smoother and more slender thallus.

Hab. On branches of shrubs in maritime districts.—*Distr.* Local and scarce in the Channel Islands, S.W. England, W. Scotland and N.W. Ireland.—*B. M.* Sark; Annet Island, Scilly; near Penzance, Cornwall; Killery Bay, Connemara.

7. *R. pollinaria* Ach. *Lich. Univ.* p. 608 (1810)—Thallus suberect, slightly shining, pale straw-coloured or glaucous-green, the laciniae compressed, elongate, often rather wide and somewhat flacid, very much branched, longitudinally and unequally wrinkled and lacunose, the edges often crispate or lacerate, soredia white-farinose, scattered over the surface. Apothecia rare, subterminal, concave, moderate in size; spores oblong, straight or slightly curved, 10–15 μ long, 4–6 μ thick.—*S. F. Gray Nat. Arr.* i. p. 407; *Hook. in Sm. Engl. Fl.* v. p. 225; *Tayl. in Mackay Fl. Hib.* ii. p. 85 pro parte; *Mudd Man.* p. 74; *Cromb. Lich. Brit.* p. 25; *Leight. Lich. Fl.* p. 95; ed. 2, p. 475; ed. 3, p. 87. *Lichenoides lacunosum lacerum, latius et angustius* Dill. *Hist. Musc.* p. 163, t. 21, fig. 57 D, E (1741). *Lichen pollinarius* Westr. in *Vet. Acad. Handl.* xvi. p. 56 (1795); *Engl. Bot. descr.* pro parte of t. 1607. *L. farinaceus* var. 3, *With. Arr.* ed. 3, iv. p. 51 (1796).

Exsicc. Cromb. n. 130; *Mudd* n. 46 pro parte.

Distinguished from *R. farinacea* by the scattered soredia and by the generally wider fronds, from *R. evernioides* by the longitudinal ribbing. It agrees with the latter species in the compact structure of the medulla and in the gelatinized firm cortex, but it is also further strengthened by some strands of hyphæ within the cortex.

Hab. On old trees, rarely on rocks in wooded tracts.—*Distr.* General and common in S. and W. England, local in N. Wales and the Channel Islands, rare in S. Scotland and Ireland.—*B. M.* La Roche, Jersey; Sark; Tresco Island, Scilly; Pentire, The Lizard and near Penzance, Cornwall; Plymouth and Streat, Devon; New Forest, Hants; near Ryde, I. of Wight; Henfield and near Lewes, Sussex; near Maidstone, Kent; Waltham Abbey, Essex; Stowe Park, Bucks; Twycross, Leicestershire; Haughmond Hill, Shropshire; Ingleby, Cleveland, Yorkshire; Teesdale, Durham; near Hexham, Northumberland; near Skelton, Cumberland; New Galloway, Kirkcudbrightshire; Salisbury Crags, Edinburgh.

Form *humilis* Cromb. in Journ. Bot. x. p. 73 (1872).—Laciniae short, congested and complicate, often flexuose; soredia large, often confluent. Apothecia very rare.—Leight. Lich. Fl. ed. 2, p. 475; ed. 3, p. 88. Var. *humilis* Ach. Lich. Univ. p. 608 (1810).

Exsicc. Larb. Lich. Hb. n. 208; Leight. n. 41 pro parte.

Distinguished from the species by the dwarfed, pulvinate habit of growth, and by the occasionally abundant soredia. Apothecia not seen on British specimens.

Hab. On trees, palings, etc., occasionally on rocks and stones in maritime and upland regions.—*Distr.* Local though plentiful where it occurs throughout England, rare in Scotland.—*B. M.* Near Penzance, Cornwall; Taunton, Somerset; near Lyndhurst, New Forest, Hants; Peshurst, Kent; Gopsall, Leicestershire; Lakenham, Suffolk; Salisbury Crags, Edinburgh.

8. *R. evernioides* Nyl. in Act. Soc. Linn. Bord. sér. 3, i. p. 293 (1856).—Thallus greyish or greenish straw-coloured, sub-erect, of rather large plane irregular laciniae, variously branched and lacerate, crowdedly reticulate-wrinkled and scrobiculate (not longitudinally nerved), with scattered roundish superficial or marginal soralia frequently on the lines of the reticulation. Apothecia rare, marginal, moderate in size, wrinkled beneath; spores oblong, slightly curved, 10–15 μ long, 3–5 μ thick.—Cromb. in Journ. Bot. x. p. 73 (1872) (incl. f. *monophylla*); Leight. Lich. Fl. ed. 2, p. 475; ed. 3, p. 88. *Lichenoides lacunosum lacinum, latius et angustius* Dill. Hist. Musc. p. 163, t. 21, fig. 57 A, B, C (1741). *Lichen pollinarius* Sm. Engl. Bot. t. 1607, fig. et descr. pro parte (1806) (non Westr.).

Exsicc. Cromb. n. 131; Leight. n. 41 pro parte; Mudd n. 46 pro parte.

Easily distinguished by the scrobiculate thallus from all forms of *R. pollinaria* with which it mainly agrees in the internal structure except for the strengthening strands, which are absent in this species. The thallus, which varies greatly in the form and width of the laciniae, is rather flaccid. Crombie's f. *monophylla* is merely a growth form. *R. evernioides* is, in Europe, found only in the West.

Hab. On old trees, chiefly oaks, in wooded upland districts.—*Distr.* General and common in S. and W. England and S. and E. Ireland; rare in the Channel Islands, not seen from Scotland.—*B. M.* Endellion and Tintagel, Cornwall; Islington, S. Devon; Testwood Park and near Lyndhurst, New Forest, Hants; Bembridge, I. of Wight; Earnley, Eridge and Worthing, Sussex; near Reigate, Surrey; Braxted Park, Essex; Stowe Park, Bucks; Bourton-on-Water, Gloucestershire; Twycross and Gopsall, Leicestershire; Anglesea; Ingleby, Cleveland, Yorkshire; near Belfast, Antrim.

Thallus saxicolous, without soredia.

9. *R. siliquosa* A. L. Sm.—Thallus upright, rigid, greyish- or yellowish-green, the fronds rather shining, varying in length,

more or less compressed, smoothish or longitudinally furrowed and lacunose, generally rather narrow, branched and attenuate (medulla K + yellowish, then rusty-red, reaction often uncertain). Apothecia subpedicellate, marginal and subterminal, moderate in size, becoming convex, pale-reddish or glaucous; spores oblong-ellipsoid, straight or slightly curved, 12–19 μ long, 4–6 μ thick.—*R. scopulorum* Ach. Lich. Univ. p. 604 (1810) (incl. vars. *cuspidata* & *cornuta*); S. F. Gray Nat. Arr. i. p. 406 (incl. var. *cornuta*, p. 407); Hook. Fl. Scot. ii. p. 68 & in Sm. Engl. Fl. v. p. 225; Tayl. in Mackay Fl. Hib. ii. p. 85; Mudd Man. p. 74; Cromb. Lich. Brit. p. 25 & Monogr. i. p. 196 (incl. var. *incrassata*); Leight. Lich. Fl. p. 91; ed. 2, p. 476; ed. 3, p. 88 (incl. var. *incrassata*). *R. cuspidata* Nyl. in Bull. Soc. Linn. Norm. sér. 2, iv. p. 158 (1870) (incl. var. *crassa*, p. 159; Cromb. in Journ. Bot. x. p. 74 (1872); op. cit. xii. p. 147 (1874) (incl. var. *crassa*) & Monogr. i. p. 197 (incl. var. *crassa*); Leight. Lich. Fl. ed. 2, p. 477; ed. 3, p. 89 (incl. var. *crassa*, p. 90). *Coralloides fasciculare verrucosum et veluti siliquosum* Dill. Hist. Musc. p. 119, t. 17, fig. 38 (1741). *Lichen siliquosus* Huds. Fl. Angl. p. 460 (1758); With. Arr. ed. 3, iv. p. 40. *L. scopulorum* Retz. Obs. Bot. iv. p. 30 (1786); Dicks. Pl. Crypt. iii. p. 18; With. tom. cit. p. 57; Engl. Bot. t. 688.

Exsicc. Bohl. n. 112; Johns. nos. 59, 218; Larb. Lich. Hb. nos. 247, 324; Leight. n. 2.

The two species *R. scopulorum* and *R. cuspidata*, which are here united under *R. siliquosa* (a name of older date), were differentiated by Nylander (l. c.) solely on account of the chemical reaction. Continued experience proves the extreme uncertainty of the test, as it seems to be associated with a varied exposure to sea water (M. C. Knowles in Sci. Proc. Roy. Dublin Soc. xiv. (N.S.), no. 6 (1913), pp. 87 and 88). With these should also be included *R. armorica* (Nyl. in Flora lx. p. 562 (1877)) with the medulla K + yellow, recorded as a variety by M. C. Knowles (tom. cit. p. 123). A distinction recorded between spores is also misleading, as in both "species" they are straight or slightly curved, and black spots sometimes on the tips of the fronds are not confined to *R. cuspidata*. The vars. *incrassata* and *crassa* of the two "species" are also alike morphologically. The distorted form characteristic of them has been proved by Zopf (Ber. Deutsch. Bot. Ges. xxv. (1907) p. 233) to be due to insect action.

The lichen is provided with a stout band of longitudinal strengthening hyphæ which projects irregularly into the medulla. The outer cortex is narrow and very gelatinous.

Hab. On rocks and boulders in maritime districts, rarely at a distance from the sea.—*Distr.* General and common on rocky coasts of the British Isles.—*B. M.* Guernsey; La Moye, Mount Orgueil and Grisnez Common, Jersey; St. Mary's, Scilly; St. Michael's Mount, Land's End, Lamorna Cliff, Tintagel, The Lizard, St. Breock, Pentire, Fowey and Penzance, Cornwall; near Plymouth, Leigh Tor, Dartmoor, Bolt Head, Wembury and Torquay, Devon; I. of Wight; Tenby, Manorbier and near Fishguard, Pembrokeshire; Aberystwith.

Cardiganshire; Barmouth, Aberdovey, Dolgelly and Harlech Castle, Merioneth; Pwllheli, Carnarvonshire; South Stacks, Anglesea; Port Soderick, Isle of Man; Holy Island and Dunstanborough, Northumberland; St. Bees and near Whitehaven, Cumberland; Solway Firth, Kirkcudbrightshire; Ailsa Craig and I. of Cumbræ, Firth of Clyde; Innerkip, Renfrewshire; Isle of May, Rivelston and Cramond near Edinburgh; Island of Mull and Airds, Appin, Argyll; Westwater, Fifeshire; Kinnoul Hill, Perthshire; Banks of the Tay and Turin Hill, Forfarshire; Portlethen, Kincardineshire; near Peterhead, Aberdeenshire; Invermoriston, Invernesshire; Applecross, Rossshire; Orkney Islands; Great Island, Cork; Renoyle, Connemara; The Bills, Clare Island, Achill Island and near Westport, Mayo; Ardglass, Down.

Form *minor* A. L. Sm. Thallus small, erect, with slender sparingly branched attenuate fronds. Apothecia small.—*R. cuspidata* f. *minor* Nyl. in Bull. Soc. Linn. Norm. sér. 2, iv. p. 159 (1870); Cromb. in Grevillea vii. p. 141 (1879) & Monogr. i. p. 198.

A much dwarfed condition about 1 inch in height.

Hab.—On dry exposed rocks in maritime districts.—*Distr.* Plentiful though local in the Channel Islands, S. and W. England and N.E. Scotland, and probably elsewhere.—*B. M.* The Vale, Guernsey; Fowey and near Penzance, Cornwall; Wembury, Devon; near Tenby, Pembrokeshire; Aberystwith, Cardiganshire; St. Bees, Cumberland; Portlethen, Kincardineshire.

Subsp. *breviuscula* A. L. Sm.—Thallus of short laciniae, firm, congested, variously difform (medulla K—). Apothecia small or submoderate, the margin of the receptacle subcrenate.—*R. polymorpha* Tayl. in Mackay Fl. Hib. ii. p. 84 (1836) pro parte; Leight. p. 92; ed. 2, p. 474 pro parte; ed. 3, p. 86 pro parte; Cromb. Lich. Brit. p. 25 pro parte; form *depressa* Cromb. in Journ. Bot. x. p. 72 (1872). *R. scopulorum* var. *polymorpha* Mudd Man. p. 74 (1861) (non Ach.). *R. cuspidata* f. *breviuscula* Nyl. in Bull. Soc. Linn. Norm. sér. 2, iv. p. 159 (1870); subsp. *breviuscula* Nyl. ex. Cromb. in Grevillea vii. p. 141 (1879) & Monogr. i. p. 198.

Esicc. Leight. n. 73; Mudd n. 47.

A very deformed-looking plant not unlike vars. *crassa* and *incrassata*. In some of the smaller states it is closely appressed to the substratum.

Hab. On rocks in maritime districts and on mountains.—*Distr.* Rather rare in the Channel Islands, S.W. and N. England, N.E. coast of Scotland and probably among the Grampians.—*B. M.* Sark; Tintagel and Polperro, Cornwall; Gower Peninsula, Glamorganshire; Moel-y-goffa, Montgomeryshire; near Thirsk and Roseberry, Cleveland, Yorkshire; Portlethen, Kincardineshire.

Form *gracilescens* A. L. Sm.—Thallus small, congested pulvinate, the laciniae shortly much divided at the apices which are often incurved, or revolute and curled.—*R. cuspidata* subsp.

breviuscula f. *gracilescens* Cromb. in Grevillea vii. p. 141 (1879) & Monogr. i. p. 199.

The Irish specimens listed below have the characteristic growth of this form; they give the reaction K + yellow, medulla becoming red. The Kerry specimen was collected three miles from the sea.

Hab. On rocks, etc., at or near the sea.—*Distr.* Rather rare in the Channel Islands, S. England and E. and W. Ireland, probably overlooked elsewhere.—*B. M.* Guernsey; Sark; near Brighton; Cloghane, Kerry; Achill Island, Mayo.

10. *R. Curnowii* Cromb. ex Nyl. in Flora lviii. p. 441 (1875).—Thallus subrigid, slender, rounded or slightly compressed, sparingly branched, pale greyish-green, blackish at the base (medulla K-). Apothecia marginal-geniculate and terminal, rather small, becoming convex, smooth below; spores ellipsoid, straight, 11–15 μ long, 4–6 μ thick.—Cromb., in Grevillea iv. p. 180 (1876); Leight. Lich. Fl. ed. 3, p. 90.

Exsicc. Cromb. n. 129; Larb. Cæsar. n. 13.

Very near the preceding species. Though the medulla is unaffected, the cortex, at least in some specimens, takes a red stain with potash. The apothecia and spermogones are frequently numerous; the latter are blackish, thus, according to Nylander, suggesting affinity with *R. carpathica*, a Hungarian species in which the margin of the apothecium is black. The spermatia measure 3 μ long, 1 μ thick.

Hab. On rocks in maritime districts.—*Distr.* Common in the Channel Islands, S.W. England and W. Ireland.—*B. M.* Grisnez Common, Jersey; St. Mary's, Scilly; St. Michael's Mount, near Land's End, and Penzance, Cornwall; Clare Island, Mayo.

Thallus saxicolous, sorediate.

11. *R. subfarinacea* Nyl. in Flora lvi. p. 66 (1873).—Thallus erect or subpendulous, pale-greenish or greenish-grey, formed of tufts of crowded branched rather narrow compressed laciniae, smooth or slightly channelled, attenuate and often much divided upwards; soralia numerous, ellipsoid or roundish, marginal (medulla and soredia K + yellowish, then rusty-red). Apothecia rare, small, marginal or subterminal, becoming convex; spores oblong, straight, 12–15 μ long, 4–6 μ thick.—Cromb. in Grevillea xv. p. 47 (1886). *R. calicaris* var. *thrausta* Mudd Man. p. 73 (1861) (non Ach.); Leight. Lich. Fl. p. 94 pro parte. *R. scopulorum* var. *subfarinacea* Nyl. ex Cromb. in Journ. Bot. x. p. 74 (1872); Leight. Lich. Fl. ed. 2, p. 476; ed. 3, p. 89.

Exsicc. Cromb. n. 23; Johns. n. 19; Larb. Lich. Hb. n. 323.

A stouter plant than *R. farinacea*, which it partly resembles in habit and structure, more especially in the form and position of the soralia. It differs in the well-marked reaction with potash and in the saxicolous habitat. It occurs in small tufts or occasionally forms extensive swards.

Hab. On rocks and old walls in maritime and upland districts.—*Distr.* General and common where it occurs on rocky shores or mountainous tracts of the British Isles.—*B. M.* Alderney; La Coupe, Jersey; Annet Island, Scilly; Land's End, The Lizard and near Penzance, Cornwall; near Plymouth, Ivy Bridge and Dartmoor, Devonshire; Malvern Hills, Worcestershire; Long Mynd, Shropshire; near Dolgelly and Harlech Castle, Merioneth; Moel-y-golfa, Montgomeryshire; Beddgelert and Snowdon, Carnarvonshire; Langbraugh, Cleveland, Yorkshire; near Hexham, Northumberland; near Staveley, Westmoreland; Penruddock and St. Bees, Cumberland; Airds, Appin, Argyll; Killin, Perthshire; Portlethen and Crathes, Kincardineshire; Banchoy-Devenick and Morrone, Braemar, Aberdeenshire; Applecross, Rosshire.

12. *R. polymorpha* Ach. Lich. Univ. p. 600 (1810) pro parte.—Thallus rigid, compressed, irregularly lacunose and longitudinally nerved, rather short (5 cm. or less), pale-greenish, the margins and surface of the laciniae dotted with granular ellipsoid soralia (K—). Apothecia very rare, marginal or subterminal, concave, small, wrinkled or smoothish below; spores oblong, straight or almost straight, 11–16 μ long, 4–5 μ thick.—Cromb. Lich. Brit. p. 25 pro parte; Leight. Lich. Fl. ed. 2, p. 474 pro parte; ed. 3, p. 87 (incl. f. *lyulata*). *Lichen polymorphus* Ach. in Vet. Acad. Handl. xviii. p. 270 (1797) pro parte.

Distinguished from allied rock forms by the soralia. British specimens are sterile. Strands of strengthening hyphæ lie within the outer cortex.

Hab. On exposed alpine or maritime rocks. —*B. M.* Portlethen, Kincardineshire (the only British locality).

Var. *emplecta* Ach. Lich. Univ. p. 601 (1810).—Laciniae more slender, very much branched and tapering.—Cromb. in Grevillea xv. p. 47 (1886); f. *emplecta* Leight. Lich. Fl. ed. 2, p. 475 pro parte; ed. 3, p. 87 pro parte. *Parmelia polymorpha* var. *emplecta* Ach. Meth. Lich. p. 267 (1803).

Hab. On rocks and boulders in mountainous regions.—*Distr.* Local and scarce in the N. Grampians, Scotland.—*B. M.* Near Loch Callater, Braemar, Aberdeenshire.

13. *R. capitata* Nyl. in Bull. Soc. Linn. sér. 2, vi. p. 258 (1872).—Thallus short, glaucous or pale-green, the laciniae compressed, much branched, especially near the tips, wrinkled longitudinally and lacunose; soralia globose, singly or more on the obtuse apices. Apothecia very rare, terminal or subterminal, the receptacle becoming wrinkled on the under side; spores oblong, straight or slightly curved.—*R. polymorpha* var. *capitata* Ach. Lich. Univ. p. 601 (1810) (incl. var. *strepsilis*); subsp. *capitata* Nyl. ex Cromb. in Grevillea vii. p. 141 (1879); Cromb. Monogr. i. p. 193. *R. polymorpha* Hook. in Sm. Engl. Fl. v. p. 224 (1833) (non Ach.). *Parmelia polymorpha* var. *strepsilis* Ach. Meth. Lich. p. 266 (1803).

Differs from the preceding in the position of the soralia and in the consequent short fronds. The anatomical structure is practically the same; the strong strands of strengthening hyphæ sometimes meet, forming a bridge across the medulla.

Hab. On rocks, in mountainous regions.—*Distr.* Local and scarce in N. England (?) and in the N. Grampians, Scotland.—*B. M.* Benna-board, Aberdeenshire.

42. **USNEA** Dill. Hist. Musc. p. 56 (1741) pro parte; Adans. Fam. Pl. ii. p. 7 (1763). (Pl. 42.)

Thallus filamentous, upright or pendulous, generally cylindrical, variously branched, often scabrid, greyish-green or yellowish, attached at the base by a sheath or by a penetrating holdfast; structure radiate with a firm chondroid central axis, or very rarely hollow, the cortical layer thin. Algal cells *Protococcus*. Apothecia mostly rather large, lateral or terminal, peltate, the disc usually rather light-coloured with a thalline, generally ciliate margin; hypothecium colourless, with underlying gonidia; paraphyses concrete, branched and septate; asci 8-spored; spores small, ellipsoid, simple. Spermogones lateral, immersed or slightly protuberant, light or dark coloured with sparingly branched sterigmata and acrogenous spermatia.

Our species of *Usnea* occur chiefly on trees in forests, and the pendulous forms may attain a length of 1 ft. or more; occasionally they grow on rocks. Nearly all are sorediate, and in some species the soredia develop on the parent plant as lateral branchlets. Flesh-coloured tubercles—called pseudo-cephalodia—are frequently formed, and are irregularly scattered over the filaments. They are composed of dense hyphæ which rise from the gonidial tissue; no gonidia are enclosed in these tubercles, which are only abortive apothecia.

1. *U. florida* Web. in Wigg. Prim. Fl. Hols. p. 91 (1780).—Thallus erect, one or several main stalks rising from the base, repeatedly forked, terete, about 1.5 mm. in diameter, finely verruculose, sometimes becoming bare and almost smooth, secondary branches more slender, patent, both primary and secondary generally beset all round with short or elongate horizontal fibrils, and frequently scabrid with soredia, pale-greyish or greyish-green. Apothecia plane, moderate in size or large up to about 1 cm. in diameter, geniculate or apparently terminal, the margins bordered with long slender cilia which are occasionally branched and sparsely fibrillose; spores shortly ellipsoid, 7–11 μ long, 6–7 μ thick.—S. F. Gray Nat. Arr. i. p. 403 (incl. var. *rubiginea*); Hook. Fl. Scot. ii. p. 70 & in Sm. Engl. Fl. v. p. 226; Cromb. in Journ. Linn. Soc. xvii. p. 555 (1880); var. *rubiginea* Ach. Lich. Univ. p. 621 (1810)? *U. ceratina* var. *scabrosa* Ach. Lich. Univ. p. 620 (1810)? Cromb. in Journ. Bot. xx. p. 272 (1882) & Monogr. i. p. 206 pro parte (incl. *f. ferruginascens* Cromb. in Trans. Essex Field Club, iv. p. 60 (1885) pro parte. *U. barbata* var. *florida* Fr. Lich. Eur. p. 18

(1831); Mudd Man. p. 69, t. 1, fig. 15; Cromb. Lich. Brit. p. 23; ff. *florida* and *rubiginosa* Leight. Lich. Fl. pp. 83 & 86 (1871); ed. 3, pp. 75 & 77 pro parte. *U. plicata* var. *florida* Tayl. in Mackay Fl. Hib. ii. p. 86 (1836). *U. intexta* Stirt. in Scott. Nat. v. p. 102 (1880). *U. rubicunda* Stirt. l. c. *U. subflurida* Stirt. l. c. *U. constrictula* Stirt. op. cit. vi. p. 109 (1881). *U. subfloridana* tom. cit. p. 294. *Muscus arboreus cum orbiculis* Dill. in Ray Syn. ed. 3, p. 65, n. 6 (1724). *Usnea vulgatissima tenuior et brevior, cum orbiculis* Dill. Hist. Musc. p. 69, t. 13, fig. 13 (1741). *Lichen floridus* L. Sp. Pl. p. 1154 (1753); Huds. Fl. Angl. p. 463; Lightf. Fl. Scot. ii. p. 897; With. Arr. ed. 3, iv. p. 50; Engl. Bot. t. 872.

Exsicc. Cromb. n. 16; Johns. n. 21; Larb. Lich. Hb. n. 285.

Distinguished by the constantly erect habit, the well-developed apothecia, and by the generally crowded horizontal fibrils; these are mostly smooth, but occasionally they tend to become verrucose like the main stem, and even sorediate, forming a transition to the more constantly sorediate var. *hirta*. Both the species and the variety are occasionally tinged red; a condition indicated in the varieties and forms *rubiginosa*, *ferruginascens* and *rubicunda*. The new British species described in Stirton's papers are based on various chemical reactions.

Hab. On the branches of trees, rarely on rocks, in woods and forests.—*Distr.* General and not uncommon throughout Great Britain, rare in the Channel Islands.—*B. M.* Island of Guernsey; Boulay Bay, Jersey; Bocconnoc and near Penzance, Cornwall; Lydford, near Totnes, Okehampton and Becky Falls, Devon; New Forest, Hants; near Tunbridge Wells and near Hastings, Sussex; near Lydd, Kent; Haslemere, Surrey; Hay Coppice and Whitfield, Herefordshire; Dynevor Castle, Carmarthenshire; Conway Falls, Hafod and Bettws-y-Coed, Carnarvonshire; Anglesea; Gibside Woods, Durham; Ambleside, Westmoreland; New Galloway, Kirkcudbrightshire, Pentland Hills near Edinburgh; Appin and near Inverary, Argyll; Craig Calliach and Stronachlachan Woods, Killin, Perthshire; Durriss Woods, Kincardineshire; Ballochbuie Forest, Braemar and Countesswells Woods, Aberdeenshire; Invermoriston, Invernessshire; Clare Island, Mayo.

Var. *hirta* Ach. Meth. Lich. p. 309 (1803).—Thallus rather short, nearly erect, caespitose, crowdedly branched and fibrillose, the fibrille and secondary branches slender, frequently long, forked and curving, and generally more or less beset with soredia. Apothecia very rare, rather small; spores 6–8 μ long, 4–6 μ thick.—*U. hirta* Hoffm. Deutschl. Fl. p. 133 (1795); Cromb. in Journ. Linn. Soc. xvii. p. 555 (1880) & Monogr. i. p. 203. *U. plicata* var. *hirta* Ach. Lich. Univ. p. 623 (1810); S. F. Gray Nat. Arr. i. p. 404; Hook. Fl. Scot. ii. p. 70 & in Sm. Engl. Fl. v. p. 226; Tayl. in Mackay Fl. Hib. ii. p. 86. *U. barbata* var. *hirta* Fr. Lich. Eur. p. 18 (1831); Mudd Man. p. 69; f. *hirta* Cromb. Lich. Brit. p. 23 (1870); Leight. Lich. Fl. p. 84; ed. 3, p. 76. *U. subpectinata* Stirt. in Scott. Nat. v. p. 108

(1880). *Usnea vulgatissima tenuior et brevior, sine orbiculis* Dill. Hist. Musc. p. 67, t. 13, fig. 12 (1741). *Lichen hirtus* L. Sp. Pl. p. 1155 (1753); Huds. Fl. Angl. p. 462; Lightf. Fl. Scot. ii. p. 895; With. Arr. ed. 3, iv. p. 46.

Æsicc. Leight. n. 1 pro parte; Mudd n. 35.

Smaller and more entangled than the species and more commonly sorediate. It is perhaps more a growth form due to moist conditions than a variety, as though fairly well marked, there are intermediate stages. As in so many sorediate lichens, apothecia are rare. The specimens with reddish tinted thallus belong partly to the species and partly to the variety.

Hab. On old palings and on the branches of trees in wooded neighbourhoods.—*Distr.* General and fairly abundant throughout the British Isles.—*B. M.* Guernsey; Rozel, Jersey; near Penzance and Withiel, Cornwall; Coryton and Becky Falls, Devon; New Forest, Hants; near Ryde, I. of Wight; near Hastings, St. Leonards Forest, near Balcombe, Maplehurst and Haywards Heath, Sussex; near Writtle, Messing and Hainhault Forest, Essex; near Sapperton and near Cirencester, Gloucestershire; Gopsall, Leicestershire; Stiperstones, near Oswestry and Haughmond Hill, Shropshire, Cemnes Road, Montgomeryshire; Nannau, Dolgelly, Merioneth; Conway Falls and Bettws-y-Coed, Carnarvonshire; Anglesea; Ayton and Ingleby, Cleveland, Yorkshire; near Hexham, Northumberland; Ashgill and Calder Abbey, Cumberland; New Galloway, Kirkcudbrightshire; near Moffat, Dumfriesshire; Pentland Hills, near Edinburgh; Inverary and Appin, Argyll; Killin, Perthshire; Rossie Woods, Forfarshire; Muchalls, Kincardineshire; Park, near Aberdeen, and Mar Forest, Braemar, Aberdeenshire; Rothiemurchus Woods, Invernesshire; Lairg, Sutherlandshire; Askew Wood, Kerry; Achill Island, Mayo; near Belfast, Antrim.

Var. *mollis* Hue in Nouv. Arch. Mus. Hist. Nat. Paris sér. 4, i. p. 35 (1899).—Thallus pale-grey, erect, with a stout base, with rather long branchlets and the central axis very slender.—*Usnea mollis* Stirt. in Scott. Nat. vi. p. 109 (1881). Specimen not seen.

Collected near New Galloway, Kirkcudbrightshire; recorded also from Brazil, Japan and Africa.

2. *U. cornuta* Koerb. Parerg. Lich. p. 2 (1859).—Thallus pale, erect, caespitose, stiff, distinctly articulate, scarcely branched, rough with minute papillæ or soralia, the apices sorediate, incurved. Apothecia pallid, small or moderate in size, the margins ciliate; spores small, simple, 9–11 μ long, 7–9 μ thick.—Stirton in Scott. Nat. vi. p. 103 (1880). Specimen not seen.

Hab.—On rocks. Recorded by Stirton from S. England and S. Scotland.

3. *U. plicata* Web. in Wigg. Prim. Fl. Hols. p. 91 (1780).—Thallus suberect, becoming elongate and pendulous, terete, the cortex becoming ringed and verrucose-sorediate, sparingly fibrillose and variously branched, the branches patent, diffuse, often

entangled, verrucose and sparingly fibrillose, pale greenish-grey or yellowish. Apothecia rare, moderate in size or rather large, concolorous, sometimes pruinose, the margins with long cilia; spores 7–9 μ long, 5–7 μ thick.—S. F. Gray Nat. Arr. i. p. 403 (incl. var. *comosa*?); Hook. Fl. Scot. ii. p. 70 & in Sm. Engl. Fl. p. 226. *U. ceratina* Ach. Lich. Univ. p. 619 (1810); Cromb. in Journ. Linn. Soc. xvii. p. 554 (1880) & Monogr. i. p. 205 (incl. var. *scabrosa* pro parte). *U. barbata* var. *plicata* Fr. Lich. Eur. p. 18 (1831); Mudd Man. p. 69; Cromb. Lich. Brit. p. 23 pro parte; f. *plicata* Leight. Lich. Fl. p. 85 (1871); ed. 3, p. 76 pro parte; var. *ceratina* Schær. Lich. Helv. Spicil. p. 505 (1840); Cromb. in Journ. Bot. x. p. 232 (1872); f. *ceratina* Leight. Lich. Fl. p. 85 (1871); ed. 3, p. 77. *U. scabrata* Nyl. in Flora lvi. p. 103 (1875). *U. comosa* Stirt. (? Ach.) & *U. nitida* Stirt. in Scott. Nat. vi. p. 294 (1882)? *U. dasypoga* var. *scabrata* Cromb. in Grevillea xv. p. 48 (1886) & Monogr. i. p. 205. *Muscus arboreus*: *Usnea officinarum* Dill. in Ray Syn. ed. 3, p. 64, n. 1 (1724). *Usnea vulgaris loris longis implexis* Dill. Hist. Musc. p. 56, t. 11, fig. 1 (1741). *Lichen plicatus* L. Sp. Pl. p. 1154 (1753); Huds. Fl. Angl. p. 461; Lightf. Fl. Scot. ii. p. 889; With. Arr. ed. 3, iv. p. 50; Engl. Bot. t. 257?

Exsicc. Johns. n. 20; Leight. n. 1 pro parte; Mudd nos. 34, 36.

U. plicata is synonymous with *U. ceratina* and includes forms partly upright and others entirely pendulous. It is characterized chiefly by the long frequently entangled branches and branchlets which soon begin to hang down, and by the fewer and more scattered fibrils than in the previous species. The annular breaks in the cortex and the coarsely verrucose character of the thallus though generally evident are not sufficiently or obviously typical, hence the varying and conflicting descriptions of this plant.

Hab. On the trunks and branches of trees, occasionally on rocks.—*Distr.* General and somewhat common throughout Great Britain.—*B. M.* Annets Island, Scilly; Roughton and Boconnoc, Cornwall; Ivy Bridge, Arton, Lydford, near Totnes, near Becky Falls and Hunter's Tor, Dartmoor, Devon; I. of Wight; Woodcote Wood and Lyndhurst, New Forest, Hants; Ardingly and Bexhill, Sussex; Lydd, Kent; near Malvern, Worcestershire; Haughmond Hill, Shropshire; Nannau, near Dolgelly and Harlech, Merioneth; Hafod, Cardiganshire; Anglesea; Ayton Moor and Ingleby Park, Cleveland, Yorkshire; Ashgill and Lamplough, Cumberland; New Galloway, Kirkeudbrightshire; Appin, Argyll; Stronachlachan Woods and Ben Lawers, Perthshire; Ballochbuie Forest, Braemar, Aberdeenshire; Rothiemurchus, Invernesshire; Cawdor Woods, Nairn, Elginshire.

4. *U. barbata* Web. in Wigg. Prim. Fl. Hols. p. 91 (1780).—Thallus rather slender, pendulous, elongate, branched, scabrous with minute verruce, the branches long, divergent, generally with short patent crowded fibrils, greenish or pale-greyish. Apothecia rare, usually small, pale or flesh-coloured with ciliate margins;

spores ellipsoid, 9–11 μ long, 6–7 μ thick.—S. F. Gray Nat. Arr. i. p. 404 pro parte; Hook. Fl. Scot. ii. p. 70 pro parte; var. *dasopoga* Schær. Enum. p. 4 (1850); Mudd Man. p. 69; f. *dasyppoga* Cromb. Lich. Brit. p. 23 (1870); Leight. Lich. Fl. p. 84 (1871); ed. 3, p. 76. *U. plicata* var. *dasopoga* Ach. Meth. Lich. p. 312 (1803). *U. dasyppoga* Stiz. in Verh. St. Gall. Nat. Ges. p. 202 (1876); Cromb. in Journ. Linn. Soc. xvii. p. 555 (1880) & Monogr. i. p. 203. *Usnea barbata, loris tenuibus fibrosis* Dill. Hist. Musc. p. 63, t. 12, fig. 6 (1741). *Lichen barbatus* L. Sp. Pl. p. 1155 (1753)? Huds. Fl. Angl. p. 461 (1762); Lightf. Fl. Scot. ii. p. 890. *L. articulatus* Sm. Engl. Bot. t. 258, fig. 2 (1795).

Exsicc. Johns. n. 219.

Distinguished among pendulous species by the more slender minutely scabrous branches and by the crowded horizontal fibrils on the older parts of the thallus.

Hab. On the trunks of trees, chiefly firs, in wooded upland regions.—*Distr.* Rather rare in England, commoner among the Grampians, Scotland.—*B. M.* Rhewgreidden, Merioneth; Teesdale Forest, Durham; Ingleby, Cleveland, Yorkshire; Stronachlachan, Killin and Ben Lawers, Perthshire; Deerhill Wood, Forfarshire; Mar Forest, Aberdeenshire; Rothiemurchus Woods, Invernesshire.

Var. *pendula* Heb. Howe Class. Fam. Usn. Amér. Nord. Paris, p. 14 (1912).—Thallus smooth, irregularly branched, the branches very sparingly or not fibrillose, the ultimate branches very slender.—*U. plicata* Ach. Lich. Univ. p. 622 (1810); Tayl. in Mackay Fl. Hib. ii. p. 86. *U. barbata* var. *plicata* f. *pendula* Schær. Enum. p. 4 (1850). *U. dasyppoga* var. *plicata* Cromb. in Grevillea xv. p. 48 (1886) & Monogr. i. p. 204 pro parte. *Lichen plicatus* Ach. Lich. Suec. Prodr. p. 225 (1798) (non Linn.); Engl. Bot. t. 257.

A variety somewhat doubtfully referred to this species, owing to the rather dense branches which are, however, almost destitute of horizontal fibrils. The references of English authors refer partly to this variety and partly to *Usnea plicata*, under which they are quoted.

Hab. On the branches of trees, chiefly larch, in wooded mountainous regions.—*Distr.* Rare in Wales, N. England.—*B. M.* Craig Calliach, Perthshire; near Corriemulzie, Braemar, Aberdeenshire; Dulcie by the Findhorn, Elginshire.

5. *U. articulata* Hoffm. Deutschl. Fl. ii. p. 133 (1795).—Thallus pendulous, elongate, nearly smooth, flaccid, much branched, the older primary filaments constricted at intervals, the articulations variously inflated, sometimes very large, and apart on the central axis, the branchlets slender, sparsely and finely fibrillose and entangled, occasionally sorediate, pale greyish-green or pale tawny-yellow. Apothecia rare, small, pale,

sparingly ciliate; spores 8–10 μ long, 5–6 μ thick.—Cromb. in Journ. Linn. Soc. xvii. p. 554 (1880). *U. barbata* var. *articulata* Ach. Meth. Lich. p. 313 (1803); S. F. Gray Nat. Arr. i. p. 404 (1821); Hook. Fl. Scot. ii. p. 70 & in Sm. Engl. Fl. v. p. 227; Mudd Man. p. 69; f. *articulata* Cromb. Lich. Brit. p. 23 (1870); Leight. Lich. Fl. p. 85; ed. 3, p. 77; var. *intestiniiformis* Ach. Lich. Univ. p. 625 (1810); f. *intestiniiformis* Cromb. in Grevillea xv. p. 48 (1886) & Monogr. i. p. 207. *U. barbata* Hook. in Sm. Engl. Fl. v. p. 226 (1833) pro parte. *U. constrictula* Stirt. in Scott. Nat. v. p. 109 (1880)? *Muscus arboreus nodosus* Dill. in Ray Syn. ed. 3, p. 65, n. 4 (1724). *Usnea capillacea et nodosa* Dill. Hist. Musc. p. 60, t. 11, fig. 4 (1741). *Lichen articulatus* L. Sp. Pl. p. 1156 (1753); Huds. Fl. Angl. p. 462; With. Arr. ed. 3, iv. p. 48, incl. var. *barbatus*; Engl. Bot. t. 258, fig. 1.

Exsicc. Cromb. n. 17; Dicks. Hort. Sicc. fasc. 14, n. 24.

Distinguished by the ringed and constricted inflations of the cortex of the primary branches. In form *intestiniiformis* these are slightly exaggerated in size. Apothecia have not been found in this country, though abortive fruits are occasionally produced.

Hab. On the trunks of old trees in shady woods and forests in upland districts.—*Distr.* Fairly general though becoming local and scarce with the disappearance of the old forests.—*B. M.* Liskeard, Cornwall; Exmouth Warren, near Exeter, Arton, Braunton Down and Becky Falls, Devon; Appuldurcomb and Ventnor, I. of Wight; Boldrewood and Lyndhurst, New Forest, Hants; Charlton Forest, Sussex; Enfield Chace, Herts; near Stokenchurch, Oxford; Cwm Bychan, near Barmouth, Merioneth; Denbighshire; Hafod, Cardiganshire; Burnley, Lancashire; Stronachlachan Woods, Killin and Brachlin Falls, Perthshire; Deerhill Woods, Forfarshire; Portmar-nock, near Dublin.

43. **ALECTORIA** Ach. Lich. Univ. p. 592 (1810) pro parte; emend. A. Zahlbr. in Engler & Prantl Pflanzenf. i. 1*, p. 219 (1907). (Pl. 43.)

Thallus filamentous, erect or pendulous, branched, cylindrical or partly compressed, attached by a basal sheath; structure radiate, the medulla of loose hyphæ or partly hollow, the cortical layer fibrous, formed of hyphæ parallel with the long axis of the plant. Algal cells *Protococcus*. Apothecia lateral on bent or straight branches, marginate, the margin rarely ciliate, the disc brown or blackish; hypothecium colourless with underlying gonidia; paraphyses branched; spores 4–8 in the ascus, ellipsoid, simple, colourless or brownish. Spermogones in small lateral tubercles; sterigmata sparsely branched, with pleurogenous short spermatia slightly thickened at each end.

A genus of upland or mountain plants. Occasionally the thallus becomes free from the substratum by decay of the lower part of the thallus, growth still continuing at the tips.

Thallus mostly light in colour.

1. *A. ochroleuca* Nyl. in Mém. Soc. Sci. Nat. Cherb. v. p. 98 (1857).—Thallus erect, cæspitose, the main branches stoutish, rather flattened, soraliolate and impressed-lacunose, the ultimate branchlets numerous, spreading, more cylindrical, slender and attenuate, ochroleucous or whitish straw-coloured, the apices recurved and usually blackish (Kf \pm yellowish, CaCl $-$). Apothecia rare, rather large, sessile, brownish-red or blackish, the margin stoutish and inflexed or almost excluded; spores becoming brown, 28–42 μ long, 14–24 μ thick.—Mudd Man. p. 70; Cromb. Lich. Brit. p. 24; Leight. Lich. Fl. p. 87; ed. 3, p. 79. *Lichen ochroleucus* Ehrh. Beitr. iii. p. 82 (1788); Dicks. Pl. Crypt. fasc. iii. p. 19; With. Arr. ed. 3, iv. p. 46 pro parte; Engl. Bot. t. 2374. *Cornicularia ochroleuca* Ach. Lich. Univ. p. 614 (1810); Hook. Fl. Scot. ii. p. 69 & in Sm. Engl. Fl. v. p. 228.

Æsicc. Cromb. n. 126.

The dark colour is confined to the apices in British specimens, though in the Arctic regions it extends over the greater part of the thallus. Apothecia are borne on the thicker branches.

Hab. Among mosses and gravelly soil in alpine places.—*Distr.* Confined to the higher Grampians, on or near their summits.—*B. M.* Cairngorm and Cairntoul, Braemar, Aberdeenshire; Clova Mts., Forfarshire.

Form *tenuior* Cromb. in Journ. Bot. x. p. 232 (1872).—Thallus smaller, decumbent, the branches more slender and somewhat entangled. Apothecia small, pale reddish-brown.—Leight. Lich. Fl. ed. 3, p. 79. *Lichen sarmentosus* Sm. Engl. Bot. t. 2040 (smaller fig.) fide Crombie.

This form has been considered by Crombie as belonging to the above species rather than to *A. sarmentosa*. In one single specimen there is only a slight trace of dark colour at the apices. It is not to be confused with *A. crinalis* Leight. which is a synonym of *A. ochroleuca* var. *cincinnata*.

Hab. On sterile ground in alpine places.—*B. M.* Ben Luighal, Sutherlandshire, the only locality.

Var. *cincinnata* Th. Fr. Lich. Arct. p. 27 (1860).—Thallus decumbent, sparingly branched, entangled, cylindrical or unequally compressed, impressed-lacunose, pale greenish sulphur-coloured, generally with an apical tuft of slender branchlets which are sparingly blackish, the whole thallus often tinged here and there bluish-black.—Leight. Lich. Fl. p. 88; ed. 3, p. 79; f. *cincinnata* Cromb. Lich. Brit. p. 24 (1870); var. *sarmentosa* Cromb. Lich. Brit. p. 24 (1870); var. *crinalis* Leight. Lich. Fl. p. 88 (1871). *A. sarmentosa* S. F. Gray Nat. Arr. i. p. 408 (1821); Hook. Fl. Scot. ii. p. 68 & in Sm. Engl. Fl. v. p. 227; Mudd Man. p. 70; var. *cincinnata* Nyl. in Flora lii. p. 444 (1869); Cromb. in Grevillea xv. p. 79 (1886) & Monogr. i. p. 209. *Lichen ochroleucus*

With. Arr. ed. 3, iv. p. 46 (1796) pro parte. *L. sarmentosus* Sm
Engl. Bot. t. 2040 (1809) (larger figure).

Exsicc. Croall n. 398; Cromb. n. 18.

More closely akin to *A. ochroleuca* than to *A. sarmentosa* in the colouration and in the type of branching, though of more straggling habit than the species.

Hab. On the ground in alpine places creeping loosely over mosses, etc.—*Distr.* Local though plentiful on the higher Grampians, Scotland.—*B. M.* Summit of Morne, Ben-naboord, Ben Macdhui, Cairngorm, Morrone and Invercauld, Braemar, Aberdeenshire; Ben Luighal, Sutherlandshire.

2. *A. sarmentosa* Ach. Lich. Univ. p. 595 (1810).—Thallus pendulous or decumbent, remotely branched and entangled, more or less impressed-lacunose, compressed at the axils, the apices long and attenuate, whitish straw-coloured. Apothecia small, lateral, the disc dark reddish-brown; spores 2 to 4 in the ascus, becoming brown, 15–36 μ long, 14–30 μ thick.—Cromb. in Journ. Bot. xiii. p. 140 (1875). *A. ochroleuca* var. *sarmentosa* Nyl. Syn. Lich. i. p. 282 (1860); Leight. Lich. Fl. ed. 3, p. 79. *Usnea loris longis dichotomis, extremitatibus tenuioribus* Dill. Hist. Musc. p. 59, t. 11, fig. 2 (1741)? *Lichen sarmentosus* Ach. in Vet. Akad. Handl. 1795, p. 212, t. 8, fig. 2.

The thallus of this species is long and straggling and without the tufted apical branches of the preceding species, from which it also differs in the uniformly light colour.

Hab. Among mosses on the ground.—*B. M.* Cairngorm, Braemar, Aberdeenshire.

3. *A. thrausta* Ach. Lich. Univ. p. 596 (1810).—Thallus slender, pendulous or prostrate, subcylindrical, occasionally compressed, especially at the axils, smooth, shining, pale straw-coloured; branching frequent, the branchlets slender, tapering, often soraliate at the tips (medulla K—). Apothecia unknown.—*Ramalina calicaris* var. *thrausta* Fr. Lich. Eur. p. 30 (1831); Mudd Man. p. 73? subsp. *thrausta* Cromb. Lich. Brit. p. 25 pro parte; f. *thrausta* Leight. Lich. Fl. p. 94 (1871). *R. thrausta* Nyl. in Bull. Soc. Linn. Norm. sér. 2, iv. p. 116 (1870); Leight. Lich. Fl. ed. 2, p. 470; ed. 3, p. 83 & in Ann. Mag. Nat. Hist. sér. 4, ix. p. 126 (1872); Cromb. in Journ. Bot. x. p. 71 (1872) & Monogr. i. p. 187.

Of uncertain systematic position in the absence of apothecia, but the structure of the cortex is that of *Alectoria*, being composed of thick-walled branching hyphæ parallel to the long axis of the plant. The algæ lie in groups.

Hab. On trees or on rocks or sandy soil in northern regions or high altitudes.—*B. M.* Bay of Nigg, Kincardineshire, the only British locality but now extinct.

4. *A. implexa* Nyl. ex Norrl. in Med. Soc. Faun. & Fl. Fenn. i. p. 14 (1876).—Thallus pendulous, elongate, slender, much branched and entangled, greyish-yellow or greyish, soralia very rare (K ±, CaCl—). Apothecia and spores as in *A. jubata*, very rare.—*A. jubata* var. *cana* Ach. Lich. Univ. p. 593 (1810). *A. cana* Leight. Lich. Fl. p. 88 (1871). *A. capillaris* Cromb. in Journ. Bot. x. p. 233 (1872); Leight. Lich. Fl. ed. 3, p. 79. *Usnea implexa* Hoffm. Deutschl. Fl. ii. p. 134 (1795). *Parmelia jubata* var. *capillaris* Ach. Meth. Lich. p. 273 (1803).

Similar in habit to *A. jubata*, but more slender and of a lighter colour and with a positive reaction with potash. British specimens are sterile.

Hab. On the trunks of old firs in mountainous districts.—*Distr.* Local and rare in N. England and the Grampians, Scotland.—*B. M.* Killin, Perthshire; Deerhill Wood, Forfar; Glen Derrie, Braemar, Aberdeenshire; Rothiemurchus Woods, Invernessshire.

Thallus mostly dark in colour.

5. *A. nigricans* Nyl. Lich. Scand. p. 71 (1861).—Thallus cæspitose, rigid, erect or ascending, cylindrical or somewhat compressed, dichotomously and intricately branched, impressed-lacunose at the axils, and more or less deflexed and slender at the tips, rather dull chestnut-black, paler towards the base (K + medulla yellow at base, CaCl + medulla reddish). Apothecia lateral, rather large, chestnut-brown, the margin thin, at length excluded; spores colourless, 21–35 μ long, 15–20 μ thick.—Carroll in Journ. Bot. iii. p. 287 (1865); Cromb. Lich. Brit. p. 24; Leight. Lich. Fl. p. 87; ed. 3, p. 78. *Cornicularia ochroleuca* var. *nigricans* Ach. Lich. Univ. p. 615 (1810).

Esicc. Cromb. n. 19.

Similar in habit to *A. ochroleuca*, but differs in colour. Herbarium specimens are generally easily recognized by the reddish tinge given to the paper on which they are mounted. Spermogones occur towards the apices, but apothecia have been found only in Labrador and Arctic America. A specimen in the Sowerby Herbarium is said to have been collected by Harriman at Teesdale, Durham.

Hab. Among mosses on the ground and on rocks in alpine and subalpine localities.—*Distr.* Somewhat local, but usually plentiful on the higher Grampians, Scotland; very rare in Wales, doubtful in N. England.—*B. M.* Cwm Bychan, Merioneth; The Glyders, Carnarvonshire; Teesdale, Durham? Ben Lawers, Mael Girdy, Ben-y-Gloe and Cairn Gowar, Blair Athole, Perthshire; Ben-naboord and Ben Macdhuì. Braemar, Aberdeenshire; Ben Nevis, Invernessshire.

6. *A. bicolor* Nyl. in Act. Soc. Linn. Bord. sér. 3, i. p. 291 (1856).—Thallus cæspitose, erect, cylindrical, irregularly and densely branched and intricate, the branchlets patent, short, slender or subfibrillose, the apices usually somewhat curved, black or brownish-black. Apothecia lateral, small, very rare, blackish;

spores ellipsoid, colourless, small, 7–8 μ long, 5–6 μ thick.—Mudd Man. p. 70; Cromb. Lich. Brit. p. 23; Leight. Lich. Fl. p. 86; ed. 3, p. 78. *Muscus coralloides lanæ nigræ instar saxis adhærens* Dill. in Ray Syn. ed. 3, p. 65, n. 3 (1724). *Usnea lanæ nigræ instar saxis adhærens* Dill. Hist. Musc. p. 66, t. 13, fig. 8 (1741). *Lichen bicolor* Ehrh. Beitr. iii. p. 82 (1788); Engl. Bot. t. 1853. *L. lanatus* Huds. Fl. Angl. p. 461 (1762) (non L.); Lightf. Fl. Scot. ii. p. 892; With. Arr. ed. 3, iv. p. 47. *Cornicularia bicolor* Ach. Meth. Lich. p. 304 (1803); S. F. Gray Nat. Arr. i. p. 405; Hook. Fl. Scot. ii. p. 69 & in Sm. Engl. Fl. v. p. 228.

Exsicc. Cromb. n. 127; Mudd n. 39.

Allied to *A. jubata*, but differs in the persistently darker colour and generally saxicolous erect or prostrate habit. The apothecia have been gathered only in the Himalayan Mts. The spermogones are minute, with spermatia 8 μ long, .05 μ thick.

Hab. On rocks and boulders among mosses in upland and sub-alpine regions.—*Distr.* Frequent and sometimes abundant in hilly regions of W. and N. England, N. Wales and the Highlands of Scotland, rare in N.E. Ireland.—*B. M.* Helmington, Cornwall; Hay Tor, Bovey Tracey, Dartmoor, Lustleigh Cleeve and Walkington. Devon; Capel Arthog, Llyn Bodlyn and Cader Idris, Merioneth; Anglesea; Farnedale, Yorkshire; Teesdale, Durhan; Kentmere, Westmoreland; New Galloway, Kirkcudbrightshire; Ben-A'an, near Taymouth, Corrie, Uachlar, Ben Lawers, Ben More and Rannoch, Perthshire; Canlochan, Forfarshire; Lochnagar, Aberdeenshire; Craigellachie, Banffshire; Ben Luighal, Sutherlandshire; Antrim.

7. *A. divergens* Nyl. Syn. Lich. p. 278 (1860) pro parte: Lich. Scand. p. 71 (1861).—Thallus rigid, erect or prostrate, frequently branched, cylindrical or subangular, shining, brownish chestnut-coloured, the branches dichotomous, diverging (K—, CaCl medulla + red). Apothecia very rare, bright-brown, the margin usually crenulate or rough; spores 8 in the ascus, colourless, ellipsoid, small, 8–10 μ long, 4.5–5.5 μ thick.—Cromb. in Journ. Bot. xi. p. 133 (1873); Leight. Lich. Fl. ed. 3, p. 78. *Cornicularia divergens* Ach. Meth. Lich. p. 303, t. 6, fig. 1 (1803).

Not unlike *Cetraria aculeata* in outward appearance, but the thallus is generally stouter and never spinulose. It reaches its highest development in Arctic regions. Apothecia have not been found on British specimens; they are recorded only from N.E. Asia.

Hab. On the ground among mosses in alpine places.—*B. M.* Cairngorm, Braemar, Aberdeenshire, the only British locality.

8. *A. jubata* Ach. Lich. Univ. p. 592 (1810) pro parte.—Thallus filiform, pendulous, subcylindrical, slightly compressed at the axils, smooth, much branched, more or less soraliolate, olive-brown or brownish-grey to black, the branches wavy, entangled. Apothecia rare, small, innate, plane or convex, the

margin entire, at length excluded, the disc dull subfuscous; spores small, colourless, 6–9 μ long, 4–5 μ thick.—S. F. Gray Nat. Arr. i. p. 408; Hook. Fl. Scot. ii. p. 67 & in Sm. Engl. Fl. v. p. 227; Tayl. in Mackay Fl. Hib. ii. p. 86; Mudd Man. p. 70 pro parte; Cromb. Lich. Brit. p. 24; Leight. Lich. Fl. p. 88; ed. 3, p. 80. *Muscus corallinus saxatilis fœniculaceus* Dill. in Ray Syn. ed. 3, p. 65 (1724). *Usnea jubata nigricans* Dill. Hist. Musc. p. 64, t. 12, fig. 7 (1741). *Lichen jubatus* L. Sp. Pl. p. 1155 (1753) pro parte; Huds. Fl. Angl. p. 461 pro parte; Lightf. Fl. Scot. ii. p. 891 pro parte; With. Arr. ed. 3, iv. p. 46; Engl. Bot. t. 1880 pro parte.

Exsicc. Bohl. n. 83; Croall n. 397; Cromb. n. 128; Johns. n. 247; Leight. n. 72; Mudd n. 37.

Erect when young, but becoming pendulous and often very much tangled. The colour varies very considerably. Small prominent rimmed soralia are frequent on the stouter branches. Spermogones are rare; they are enclosed in scattered thalline tubercles; the spermatia minute, 6–7 μ long, .05 μ thick.

Hab. On the trunks and branches of old trees, chiefly pine and larch, more rarely on boulders among mosses, in wooded upland and subalpine regions.—*Distr.* General and sometimes abundant in hilly and mountainous regions—*B. M.* Roughton, Cornwall; Hay Tor and Vixen Tor, Dartmoor, Devon; New Forest, Hants; Tunbridge Wells, St. Leonards, Balscombe and Pond Leigh, Sussex; Charnwood Forest, Leicestershire; Rhewgreidden, Dolgelly and near Barmouth, Merioneth; Anglesea; near Kingley, Warwickshire; near Oswestry, Shropshire; Malvern, Worcestershire; Chatsworth, Derbyshire; Baysdale and near Great Ayton, Yorkshire; Teesdale, Durham; Keswick and Alston, Cumberland; The Cheviots, Northumberland; New Galloway, Kirkcudbrightshire; Beld Craig, Moffat, Dumfriesshire; Pentland Hills, near Edinburgh; Appin, Argyll; Glen Falloch, Killin, Ben Lawers and Knock of Crieff, Perthshire; Deerhill Wood and Rossie Moor, Forfarshire; Ballochbuie Forest, Ballater, Craig Cluny, Mar Forest and Morrone, Braemar and Countesswells Wood, Aberdeenshire; Rothiemurchus Woods, Glen Nevis and Glen Moriston, Invernesshire; Cawdor, Nairnshire; Lairg, Sutherland.

Var. *lanestris* Ach. Lich. Univ. p. 593 (1810).—Thallus smaller, decumbent, rather soft, sparingly soraliolate, the branches numerous, short, slender, densely entangled.—Form *lanestris* Cromb. in Journ. Bot. x. p. 233 (1872); f. *tenerrima* Cromb. in Grevillea xv. p. 48 (1886).

A small prostrate variety to which Crombie has referred the upper figure in Engl. Bot. t. 1880. Form *tenerrima* is still shorter and more tangled, somewhat resembling *Ephebe* in appearance. No fructification has been observed.

Hab. On fir palings and trunks of birch trees.—*Distr.* Rare in upland districts.—*B. M.* Helsby Hill, Cheshire; Killin, Perthshire; Ballochbuie Forest and Morrone, Braemar, Aberdeenshire.

Subsp. *subcana* Nyl. ex Cromb. in Journ. Bot. xiv. p. 360 (1876).—Thallus pendulous, slender, of moderate length, much

branched, greyish; soralia numerous, rather prominent. Apothecia not seen.

More slender and less entangled than the species, and of a lighter colour. The numerous soralia and the absence of reaction with potash distinguish it from *A. implexa*.

Hab. On the branches of old firs in wooded mountainous regions.—*Distr.* Local and rare among the Grampians, Scotland—*B. M.* Ben Lawers, Perthshire.

Subsp. *chalybeiformis* Th. Fr. Lich. Scand. p. 25 (1871).—Thallus decumbent, flexuose, stouter and more rigid than the species, olive- or brownish-black, the branches short, remote sometimes a little paler at the apices; soralia rather rare. Apothecia not seen.—Cromb. in Grevillea xv. p. 48 (1886). Var. *chalybeiformis* Ach. Lich. Univ. p. 593 (1810); Hook. Fl. Scot. ii. p. 57 & in Sm. Engl. Fl. v. p. 227; Mudd Man. p. 70; Cromb. Lich. Brit. p. 24; Leight. Lich. Fl. p. 89; ed. 3, p. 80. *A. chalybeiformis* S. F. Gray Nat. Arr. i. p. 408 (1821). *Muscus caule rigido, instar fili chalibeii* Dill. in Ray Syn. ed. 3, p. 65 n. 2 (1724). *Usnea rigida horsum vorsum extensa* Dill. Hist. Musc. p. 66, t. 13, fig. 10 (1741). *Lichen chalybeiformis* L. Sp. Pl. p. 1155 (1753); Huds. Fl. Angl. p. 462; Lightf. Fl. Scot. ii. p. 892; With. Arr. ed. 3, iv. p. 47.

Exsicc. Larb. Lich. Hb. n. 245 & Lich. Cantab. n. 7; Mudd n. 38.

Sometimes regarded as a species, but too closely akin to *Alectoria jubata* to be worthy of separate specific rank. Neither apothecia nor spermogones have been found on British specimens. *A. jubata* generally grows on trees, while this subspecies is uniformly a rock plant.

Hab. Among mosses on rocks and boulders in upland and mountainous districts.—*Distr.* General and not uncommon in England and N. Wales, plentiful among the Grampians, Scotland; not recorded from Ireland.—*B. M.* Templemore, Devon; Eridge rocks near Tunbridge Wells, and Ardingly rocks, Sussex; Herefordshire Beacon near Malvern; Cader Idris, Merioneth; Snowdon, Carnarvonshire; Anglesea; Thetford Warren, Norfolk; Battersby Cleveland, Yorkshire; Gateshead Fell, Durham; Suddale, Westmoreland; Ben Cruachan, Argyll; Ben More and Ben Lawers, Perthshire; Clova Mts., Forfarshire; Craig Coinnoch, Glen Cluny, Lochnagar, Ben-naboord, Craig Guie and Morrone, Braemar, Aberdeenshire; Ben Nevis and Loch Ennich, Invernesshire; Hoy, Orkney.

44. **CERANIA** S. F. Gray Nat. Arr. i. p. 413 (1821). *Thamnolia* Ach. in litt. ex Schar. Enum. p. 243 (1850). (Pl. 44.)

Thallus of upright stalk-like fronds, cylindrical, sparingly branched, tapering upwards; the cortex of small cells; medulla of parallel hyphae, hollow in the centre. Algal cells *Pleurococcus*. Apothecia not rightly known. Spermogones immersed, in small

warts, with pleurogenous short cylindrical straight or slightly bent spermatia.

The position of the genus is uncertain in the absence of definite knowledge as to the reproduction of the plant. Massalongo (in Flora xxxix. p. 232) and Th. Fr. (Lich. Arct. p. 161) represent the apothecia as terminal and immarginate somewhat like those of *Cladonia*, with simple colourless spores. According to Minks (in Flora lvii. p. 337) the fruits are pyrenocarpous and are united in lateral stromata.

1. *C. vermicularis* S. F. Gray l. c.—Thallus erect or mostly prostrate, fronds simple or sparingly branched, smooth or somewhat grooved, somewhat solitary or in dense tufts, chalky-white (K + yellow). Apothecia doubtful.—*Thamnotia vermicularis* Schær. Enum. p. 243 (1850); Mudd Man. p. 68; Cromb. Lich. Brit. p. 23; Leight. Lich. Fl. p. 83; ed. 3, p. 75. *Lichen vermicularis* Swartz in Linn. fil. Meth. Musc. p. 37 (1781); Dicks. Pl. Crypt. fasc. ii. p. 23, t. 6, fig. 10; With. Arr. ed. 3, iv. p. 41; Engl. Bot. t. 2029. *Cladonia vermicularis* DC. Fl. Franc. ii. p. 355 (1805); Hook. in Sm. Engl. Fl. v. p. 234; Mudd Brit. Clad. p. 34. *Cenomyce vermicularis* Ach. Lich. Univ. p. 566 (1810); Hook. Fl. Scot. ii. p. 65.

Exsicc Croall n. 399; Cromb. n. 13.

Easily recognized by the form and habit resembling small white worms. The pycnidia are very rare with spermatia, 4-5 μ long, 1 μ thick.

Hab. On the ground among mosses and heaths in alpine and mountainous regions.—*Distr.* Very local and rare on the mountains of N. Wales, N. England and Scotland.—*B. M.* Cader Idris, Merioneth; Skiddaw, Cumberland; Ben Lawers, Craig Calliach and Ben Vrackie, Perthshire; Clova Mts. and Canlochan, Forfarshire; Lochnagar, Morrone, Miltoyn of Invercauld, Ben-naboord and Cairntoul Braemar, Aberdeenshire; Ben Nevis, Invernessshire; Hills of Applecross, Rossshire.

Var. *taurica* A. L. Sm.—Thallus more turgid, suberect recurved, cornute and pointed at the apices.—*Lichen tauricus* Wulf. in Jacq. Coll. ii. p. 177, t. 12, fig. 2 (1788). *Thamnotia vermicularis* var. *taurica* Schær. Enum. p. 244 (1850); Cromb. in Journ. Bot. xxiii. p. 195 (1885) & Monogr. i. p. 185.

Differs from the species in the stouter thallus.

Hab. On the ground in alpine places.—*B. M.* Near the summit of Cairngorm, Braemar, Aberdeenshire.

ORDER XII. PHYSIACEÆ.

Thallus fruticose, foliose, squamulose or crustaceous, yellow-coloured, grey or brown. Structure various. Algal cells *Protococcus*. Apothecia discoid, marginate or rarely immarginate;

spores colourless or brown, 1-septate, with thick outer walls and septum, the latter generally pierced by a longitudinal canal (polarilocular), rarely simple or 3-septate. Spermogones chambered, the sterigmata cellular (arthrosterigmata), with short pleurogenous spermatia.

The genera in this order are distinguished in most cases by the peculiarly septate spores. The median septum develops by an ingrowth from the outer wall, and though occasionally a narrow band, it sometimes broadens to such an extent that the lumen of the cells is reduced to a small space. A few species with simple or with 3-septate spores are included in the genera, owing to other typical characters, such as the form of the spermogones, &c.

Parietin, a yellow acid which yields an immediate purple or crimson colouration on the application of potash, is characteristic of several of the genera: of all those with yellow-coloured thalli except *Candelariella*. The latter genus is however included in the order as the spores, though mostly simple, often become septate and polarilocular.

The British genera are:—

Parietin present (yellow lichen acid coloured crimson or purple with potash).

Spores colourless, usually 1-septate.

- | | |
|---|---------------------------|
| Thallus fruticose, yellow | 45. <i>Teloschistes</i> . |
| Thallus foliose, yellow | 46. <i>Xanthoria</i> . |
| Thallus squamulose or crustaceous,
mostly yellow | 47. <i>Placodium</i> . |

Parietin not present.

Spores colourless, at first simple, often many in the ascus.

- | | |
|---------------------------|----------------------------|
| Thallus crustaceous | 48. <i>Candelariella</i> . |
|---------------------------|----------------------------|

Spores brown, usually 1-septate. Colour various.

- | | |
|---|-----------------------|
| Thallus foliose, rarely fruticose or sub-fruticose..... | 49. <i>Physcia</i> . |
| Thallus squamulose or crustaceous | 50. <i>Rinodina</i> . |

45. **TELOCHISTES** Norm. in Nyl. Mag. Naturvid. Christ. vii. p. 228 (1852) excl. *Phyllohallæ* &c. *Borrera* Ach. Syn. Lich. p. 220 (1814) pro parte; S. F. Gray Nat. Arr. i. p. 434 pro parte; Hook. Fl. Scot. ii. p. 56 & in Sm. Engl. Fl. v. p. 222 pro parte. *Physcia* Schreb. Gen. Pl. ed. 8, ii. p. 768 (1791) pro parte; Mudd Man. p. 111 pro parte; Cromb. Lich. Brit. p. 37 & Monogr. i. p. 294 pro parte; Leight. Lich. Fl. p. 141; ed. 3, p. 130 pro parte. (Pl. 45.)

Thallus fruticose, brightly coloured, yellow, upright or partly decumbent, the fronds branched, cylindrical or compressed, attached at the base; structure radiate, the cortex of longitudinal hyphæ (fibrous). Algal cells *Protooccus*. Apothecia

discoid, with a thalline margin; hypothecium colourless; paraphyses simple, or shortly branched at the apices, septate; spores 8 in the ascus, colourless, polarilocular, 1-septate, rarely more-septate.

This and the following genus have been included in *Physcia* by recent British authors. It is distinguished by the fruticose character of the thallus, and by the colour of the spores; the fibrous cortex gives the necessary support to the fronds.

1. *T. flavicans* Norm. l. c.—Thallus erect or almost decumbent, yellow or orange-yellow, the fronds narrow, cylindrical or somewhat compressed, branched and entangled, often minutely nodulose, and fibrillose at the apices; yellowish-white soralia frequent ($K \pm$ ^{purplish}). Apothecia lateral, moderate in size, becoming plane or convex, reddish-yellow, the margin thin, subcrenulate; spores polarilocular, 12–18 μ long, 7–11 μ thick.—*Muscus arboreus aureus segmentis capillaceus brevibus* Buddle Hort. Sicc. fol. 9, n. 7 in Herb. Sloane. *Muscus aureus tenuissimus* Dill. in Ray Syn. ed. 3, p. 65, n. 8 (1724). *Usnea capillacea citrina, fruticuli specie* Dill. Hist. Musc. p. 73, t. 13, f. 16 (1741). *Lichen vulpinus* Huds. Fl. Angl. p. 462 (1762) non Linn.; Lightf. Fl. Scot. ii. p. 896; With. Arr. ed. 3, iv. p. 49. *L. flavicans* Swartz Fl. Ind. Occid. iii. p. 1908 (1788); Engl. Bot. t. 2113. *Parmelia flavicans* Ach. Meth. Lich. p. 268 (1803); Tayl. in Mackay Fl. Hib. ii. p. 147. *Borrera flavicans* Ach. Lich. Univ. p. 504 (1810); Hook. Fl. Scot. ii. p. 57 & in Sm. Engl. Fl. v. p. 224; var. *læta* Ach. Syn. Lich. p. 225 (1814). *Physcia flavicans* DC. Fl. Fr. vi. p. 189 (1815); Mudd Man. p. 112, t. 2, f. 33; Cromb. Lich. Brit. p. 37; Leight. Lich. Fl. p. 141; ed. 3, p. 130. *Borrera læta* S. F. Gray Nat. Arr. i. p. 435 (1821).

Exsicc. Carroll Lich. Hib. nos. 5, 6; Cromb. n. 48; Larb. Cæsar. n. 21; Leight. n. 169; Mudd n. 84.

Though usually of a beautiful golden colour, it varies in becoming a dull green in the shade and is sometimes paler on one surface. The apothecia are very rare in British specimens; the spermatogones are more frequent.

Hab. On trees and shrubs, sometimes on rocks or walls, chiefly in maritime districts.—*Distr.* Usually plentiful where it occurs, in S. and W. Scotland, N. Wales, S. Ireland and formerly in S.W. Scotland (Ailsa Craig).—*B.* M. Sark; Alderney; Guernsey; Jersey; Bournemouth, Penzance, Withiel and Bede, Cornwall; near Totnes, Dartmoor, Becky Falls, Lydford, Widdicombe, South Brent and Torquay, Devon; Boldrewood and Brockenhurst, New Forest, Hants; near Ventnor, Shanklin. Appuldurcombe and Ryde, I. of Wight; Ardingly, Up Park, St. Leonards Forest, near Hastings, Fairlight Glen and Lewes, Sussex; Dungeness and Lydd, Kent; Malvern Hills, Worcestershire; Aberdovey and Barmouth, Merioneth; Holyhead, Anglesea; Killarney, Kerry; Whiting Bay, Waterford; near Cork. Castlebernard Park, Bandon and Cape Clear, Cork; Lambay Island, Dublin.

2. *T. chrysophthalmus* Th. Fr. Gen. Heterolich. Eur. p. 51 (1861).—Thallus short, rigid, growing in tufts, bright greenish-yellow, the fronds narrow, compressed, plane or channelled, much-branched and fibrillose at the tips and sometimes on the margins ($K \pm$ ^{purplish}). Apothecia rather large, terminal or sub-terminal, concave then almost plane, deep orange-coloured with a ciliate or sometimes entire margin; spores 11–17 μ long, 6–10 μ thick.—*Lichenoides pulmonarius minimus subluteus, receptaculis florum coronatis, mali aurantii coloris* Dill. Hist. Musc. p. 74, t. 13, f. 17 (1741). *Lichen chrysophthalmus* L. Mant. ii. p. 311 (1771); Engl. Bot. t. 1088. *Borrera chrysophthalma* Ach. Lich. Univ. p. 502 (1810); S. F. Gray Nat. Arr. i. p. 435; Hook. in Sm. Engl. Fl. v. p. 223; Mudd Man. p. 112, t. 2, fig. 34 (incl. var. *Dickieana*). *Physcia chrysophthalma* DC. Fl. Fr. ii. p. 401 (1805); Cromb. Lich. Brit. p. 37 (incl. var. *Dickieana*) & Monogr. i. p. 296 (incl. f. *Dickieana*); Leight. Lich. Fl. p. 141; ed. 3, p. 131 (incl. f. *Dickieana*). *P. villosa* var. *Dickieana* Linds. in Trans. Roy. Soc. Edin. xxii. p. 254 (1859).

Exsicc. Bohl. n. 122; Carroll Lich. Hib. n. 3; Larb. Cæsar. n. 22; Leight. n. 394.

Easily distinguished from the preceding by the shorter, more strap-like fronds. The thallus is often greyish-green and sometimes almost white (var. *Dickieana*), an effect of habitat and degree of exposure to light, &c. Apothecia are usually abundant.

Hab. On trees, rarely on old palings, in maritime districts.—*Distr.* Rather local and scarce in the Channel Islands, S. England, W. Scotland and S. and N. Ireland.—*B. M.* Rozel and St. Peter's Valley, Jersey; Sark; Guernsey; near Torquay, Devon; near Ryde, I. of Wight; near Brighton, Shoreham and Lewes, Sussex; Kilbride and near Cork; Mucrone, Kerry; Newcastle, Down.

46. *XANTHORIA* Th. Fr. Lich. Arct. p. 66 (1860); emend. Lich. Scand. p. 144 (1871) (excl. *X. concolor*). *Physcia* Schreb. Gen. Pl. ed. 8, ii. p. 768 (1791) pro parte; Mudd Man. p. 111 pro parte; Cromb. Lich. Brit. p. 37 & Monogr. i. p. 294 pro parte; Leight. Lich. Fl. p. 141; ed. 3, p. 130 pro parte. (Pl. 46.)

Thallus foliose, horizontal, or partly ascending, lobate, brightly coloured, sometimes sorediate, beneath more or less rhizinose and generally paler; cortex on both surfaces of plectenchyma. Apothecia scattered, discoid, moderate in size, with a thalline margin; hypothecium colourless; paraphyses discrete, septate, shortly branched at the clavate apices; spores 8 in the ascus, 1-septate, polarilocular.

Differing from *Teloschistes* in the character of the thallus and in the cortical structure.

1. *X. parietina* Th. Fr. Lich. Arct. p. 67 (1860) pro parte & Lich. Scand. p. 145 (1871).—Thallus suborbicular in outline, yellow, the lobes appressed imbricate, somewhat wrinkled,

rounded and crenulate at the circumference (K + violet-purple). Apothecia moderate in size, numerous and crowded towards the centre of the thallus, concave, becoming plane, subconcolorous, with a thin entire margin; spores 12–16 μ long, 7–9 μ thick.—*Lichenoides crusta foliosa scutellata, flavescens* Dill. in Ray Syn. ed. 3, p. 72, n. 59 (1724). *Lichenoides vulgare sinuosum foliis et scutellis luteis* Dill. Hist. Musc. p. 180, t. 24, fig. 76 (1741). *Lichen parietinus* L. Sp. Pl. p. 1143 (1753); Huds. Fl. Angl. p. 447; Lightf. Fl. Scot. ii. p. 822; Engl. Bot. t. 194; With. Arr. ed. 3, iv. p. 34; Relh. Fl. Cantab. p. 428. *L. juniperinus* Huds. Fl. Angl. p. 452 (1762) (non Linn.); Lightf. Fl. Scot. ii. p. 836. *Parmelia parietina* Ach. Meth. Lich. p. 213 (1803); S. F. Gray Nat. Arr. i. p. 438; Hook. Fl. Scot. ii. p. 52 & in Sm. Engl. Fl. v. p. 204; Tayl. in Mackay Fl. Hib. ii. p. 141. *Physcia parietina* De Not. in Mem. R. Accad. Torino ser. 2, x. p. 387 (1849); Mudd Man. p. 113; Cromb. Lich. Brit. p. 38 & Monogr. i. p. 297 (incl. ff. *virescens* & *cinerascens*, p. 298); Leight. Lich. Fl. p. 142; ed. 3, p. 131 (incl. var. *polycarpa* f. *cinerascens*); f. *viridescens* Cromb. in Journ. Linn. Soc. xvii. p. 572 (1880).

Exsicc. Bohl. n. 12; Johns. n. 84; Larb. Lich. Hb. n. 9 & Lich. Cantab. n. 10; Leight. n. 10; Mudd n. 85.

A brilliantly coloured lichen where illumination is good, but green or grey when shaded from direct light. The change in colour has given rise to the forms *virescens* and *cinerascens* (now included in the species), which also give a fainter reaction with potash owing to the small production of the colouring crystals of parietin. In such specimens there are always some traces of brighter colour in the thallus, and the apothecial discs are more or less orange.

Hab. On trees, palings, walls and rocks, sometimes on peaty soil, most frequently in maritime districts.—*Distr.* General and plentiful in the British Isles.—*B. M.* Ilsham Valley, Torquay, Devon; Lymington, Hants; Appuldurcombe. I. of Wight; Brighton, Lancing, St. Leonards and Lewes, Sussex; Lydd, near Dover and Higham, near Gravesend, Kent; Haling, near Croydon, Surrey; Gosfield Hall, Essex; Edgware, Middlesex; Windsor, Berks; Cirencester, Gloucestershire; near Worcester and Malvern, Worcestershire; Harboro' Magna, Warwickshire; Grimsbury Green, Northamptonshire; Twycross, Leicestershire; Matlock, Buxton and Haddon Hall, Derbyshire; near Shrewsbury and Craven Arms, Shropshire; Madingley, Cambridgeshire; Bury St. Edmunds, Suffolk; Cleveland, Yorkshire; Levens, Westmoreland; Swinhope, East Allendale, Northumberland; New Galloway, Kirkcudbrightshire; near Stirling; Finlarig, Killin, Perthshire; near Montrose and Auchterhouse, Forfarshire; Drum and Castleton of Braemar, Aberdeenshire; Carrigaloe, Cork; Muckross, Killarney, Kerry; Achill Island and The Bills, Mayo.

Var. aureola Th. Fr. Lich. Arct. p. 67 (1860).—Thallus orbicular, centrifugally plicate-wrinkled, sometimes granular, especially towards the centre, the lobes dilated and plicate-crenate at the apices, generally deep golden-yellow. Apothecial margin becoming crenulate.—*Parmelia aureola* Ach. Lich. Univ.

p. 487 (1810). *Physcia parietina* var. *aureola* Nyl. Syn. i. p. 411 (1860); Mudd Man. p. 113; Leight. Lich. Fl. p. 143; ed. 3, p. 132 (incl. var. *polycarpa* f. *tumida*, p. 133); Cromb. Monogr. i. p. 298 (incl. f. *congranulata*); subvar. *tumida* Wedd. in Bull. Soc. Bot. xvi. p. 198 (1869); f. *congranulata* Cromb. in Grevillea xv. p. 78 (1887).

Exsicc. Johns. n. 85; Larb. Lich. Hb. n. 212.

Distinguished by the submonophyllous wrinkled thallus, which is often more or less granular. Thallus and apothecia are generally deeply coloured. Form *congranulata* is more densely granular.

Hab. On trees and walls in maritime and upland districts.—*Distr.* Rather rare throughout England, S. Wales and in E. Scotland.—*B. M.* St. Minver and Withiel, Cornwall; near Ryde, I. of Wight; Ulting, Essex; Twycross, Leicestershire; Tenby, Pembrokeshire; Great Comberton, Worcestershire; Buxton, Derbyshire; near King's Lynn, Norfolk; Kendal, Westmoreland; Harris Moor, near Whitehaven, Cumberland; Weardale, Durham; Swinhope, East Allendale, Northumberland; Cramond, near Edinburgh; near Cove and Portlethen, Kincardineshire; near Aberdeen.

Var. *ectanea* Oliv. Lich. L'Orne, p. 83 (1882).—Thallus of narrower imbricate lobes, plane or unequal, with raised margins; deep tawny- or reddish-yellow. Apothecia small or moderate in size, the margin generally entire.—*Muscus crusta* . . . *adnascens flavus* Buddle Hort. Sicc. ii. fol. 6, n. 4 in Herb. Sloane. *Parmelia parietina* var. *ectanea* Ach. Lich. Univ. p. 464 (1810). *Physcia parietina* var. *ectanea* Nyl. in Act. Soc. Linn. Bord. sér. 3, i. p. 306 (1856); Mudd Man. p. 113; Leight. Lich. Fl. p. 143; ed. 3, p. 132; Cromb. Monogr. i. p. 299; var. *aureola* Cromb. Lich. Brit. p. 38 (1870) (non Nyl.).

Exsicc. Johns. n. 86; Larb. Lich. Cæsar. n. 67.

Closely approaching the species, though more irregular in outline, more broken up, and generally more deeply coloured. Crombie (Monogr. i. p. 299) suggests that *Lichen fulvus* Dicks. (Pl. Crypt. fasc. iii. p. 16 (1793)) may be referable to this variety.

Hab. On dry rocks in maritime, rarely in mountainous districts.—*Distr.* Local, though plentiful where it occurs in S.W. and N. England, S. and N. Wales, E. Scotland and S.W. Ireland.—*B. M.* Jersey; Sark; Guernsey; Penzance, Cornwall; Bolt Head, Devon; Tenby, Pembrokeshire; King's Stanley, Gloucestershire; Llanymynech, Montgomeryshire; Barmouth, Merioneth; I. of Man; St. Bees, Cumberland; Fern Islands, Northumberland; Cramond, near Edinburgh; Portlethen, Kincardineshire; Peterhead and near Braemar, Aberdeenshire; near Blackwater Bridge, Kerry.

2. *X. polycarpa* Oliv. in Rev. Bot. xii. p. 96 (1894).—Thallus effuse or in small conglomerate masses, the lobes short, crenulate at the margins, sometimes almost crustaceous, greenish-yellow (K + purple). Apothecia numerous, crowded, almost covering the thallus, rather small, with turgid entire margin; spores

11–15 μ long, 6–8 μ thick.—*Lichen polycarpus* Ehrh. Exs. n. 136 (1791) nomen; Sm. Engl. Bot. n. 1795 (1807). *Psoroma polycarpum* S. F. Gray Nat. Arr. i. p. 445 (1821). *Lecanora candelaria* var. *polycarpa* Hook. Fl. Scot. ii. p. 51 (1821). *Squamaria candelaria* var. *polycarpa* Hook. in Sm. Engl. Fl. v. p. 194 (1833). *Physcia parietina* var. *polycarpa* Mudd Man. p. 113 (1861); Cromb. Lich. Brit. p. 38; Leight. Lich. Fl. p. 144; ed. 3, p. 133. *P. polycarpa* Nyl. ex Lamy in Bull. Soc. Bot. Fr. xxv. p. 381 (1878).

Exsicc. Johns. n. 87; Larb. Lich. Hb. n. 47 & Lich. Cantab. n. 11; Leight. n. 265; Mudd n. 86 pro parte.

The thallus is much less developed than in the previous species, and the spores rather smaller. It frequently occurs in roundish pulvinate patches.

Hab. On palings and trees, chiefly larch, in maritime and upland districts.—*Distr.* Here and there throughout England and Scotland, not recorded for Ireland.—*B. M.* St. Leonard's Forest, Sussex; Kemble, Wilts; Langford, Essex; Cherry Hinton and Gogmagog Hills, Cambridgeshire; Twycross, Leicestershire; near Oswestry, Shropshire; Redcar, Cleveland, Yorkshire; near Hexham, Northumberland; Finlarig and near Lawers Inn, Killin, Perthshire; Durriss, Kincardineshire.

Form *lobulata* A. L. Sm.—Thallus reduced, effuse, lobes short, roundly crenate. Apothecia numerous, small; spores as in the species. *Lecanora lobulata* Flörke Deutsche Lich. i. p. 10 (1815). *Physcia parietina* var. *lobulata* Mudd Man. p. 113 (1861); Cromb. Lich. Brit. p. 38. *Physcia polycarpa* f. *lobulata* Cromb. in Grevillea xv. p. 78 (1887) & Monogr. i. p. 300.

Exsicc. Johns. n. 88; Mudd n. 86 pro parte.

Considered by Crombie to be possibly only a depauperate form of the species with which it often grows associated.

Hab. On palings in upland districts.—*Distr.* Rare in N. England and in the S. and N.E. Grampians, Scotland.—*B. M.* Redcar, Cleveland, Yorkshire; Wark-on-Tyne, Northumberland; near Killin, Perthshire; Durriss, Kincardineshire.

3. *X. lichnea* Th. Fr. Lich. Scand. i. p. 146 (1871).—Thallus spreading, lobate, the lobes small, crowded, plane and imbricate or ascending, deeply cut, with upturned granular-pulverulent margins, orange- or tawny-yellow; beneath paler (K \pm violet-purplish). Apothecia moderate in size, rather rare, scattered, concolorous, the margin entire or crenate; spores 11–17 μ long, 7–11 μ thick.—*Lichen concolor* Dicks. fasc. iii. p. 18, t. ix. f. 8 (1793) pro minore parte. *L. candelarius* Sm. Engl. Bot. t. 1794 (1807) pro minore parte. *Parmelia candelaria* var. *lichnea* Ach. Meth. p. 187 (1803). *Physcia parietina* var. *lichnea* Mudd Man. p. 114; Leight. Lich. Fl. p. 143; ed. 3, p. 132; subsp. *lichnea*

Cromb. Lich. Brit. p. 38 (1870). *Physcia lychnea* Nyl. ex Carroll in Journ. Bot. iii. p. 288 (1865); Cromb. Monogr. i. p. 300.

Exsicc. Johns. n. 89; Larb. Lich. Hb. n. 162; Leight. n. 11.

The generally upright lobes with pulverulent margins distinguish this species from the two preceding. It is generally sterile, and the apothecia when present are more plane and less crowded than in *X. polycarpa*.

Hab. On trees, palings, rocks and walls in maritime and upland districts.—*Distr.* Rather rare throughout Great Britain and Ireland.—*B. M.*—Near Penzance and St. Austell, Cornwall; Cirencester, Gloucestershire, Windsor Park, Berks; Wheatfield Park, Oxfordshire; Colwall, Herefordshire; near Shrewsbury, Shropshire; Malvern, Worcestershire; Wark-on-Tyne, Northumberland; Teesdale and Redworth, Durham; Blackford Hill, Edinburgh; Ben Lawers, Perthshire; Findhaven Hill, Forfarshire; Durris, Kincardineshire; Lairg, Sutherlandshire.

Var. perfusa Oliv. Exp. Syst. i. p. 171 (1897).—Thallus of very minute crowded laciniae. Apothecia rather small, scattered.—*Physcia lychnea* f. *perfusa* Nyl. ex Lamy in Bull. Soc. Bot. Fr. xxv. p. 382 (1878); Cromb. Monogr. i. p. 301.

The laciniae are packed so closely that the thallus has the appearance of a granular crust.

Hab. On granite walls in maritime and upland districts.—*Distr.* Rare among the N. Grampians and in N.E. Scotland.—*B. M.* Portlethen, Kincardineshire; Crathie, Braemar, Aberdeenshire.

Var. pygmæa Oliv. Lich. L'Orne, p. 83 (1882).—Thallus small, in determinate patches, the laciniae erect, narrowly divided or rounded. Apothecia moderate in size; spores 10–14 μ long, 7–9 μ thick.—*Borrera pygmæa* Bory ex Fr. Lich. Eur. p. 73 (1831). *Physcia parietina* subsp. *lychnea* f. *pygmæa* Nyl. Lich. Scand. p. 108 (1861). *Physcia lychnea* var. *pygmæa* Cromb. Monogr. i. p. 301 (1894).

Differs from the species in the scattered almost nodular thallus, otherwise not easily distinguished.

Hab. On exposed granite walls in an upland district.—*B. M.* Ben Lawers, Perthshire, the only British locality.

17. **PLACODIUM** DC. Fl. Fr. ii. p. 377 (1805) pro parte; emend. Hepp Flecht. Eur. n. 71 &c. (1853); S. F. Gray Nat. Arr. i. p. 446 pro parte; Mudd Man. p. 130 pro parte; Cromb. Brit. Lich. p. 45 pro parte; Leight. Lich. Fl. p. 175; ed. 3, p. 160 pro parte; *Collopisma* De Not. in Mem. Real. Acad. Sci. Torino, ser. 2, x. p. 388 (1849); Mudd Man. p. 130 pro parte. *Lecanora* subg. *Placodium* Nyl. in Not. Sällsk. Faun. & Fl. Fenn. v. p. 126 (1866) pro parte; Cromb. Monogr. i. p. 357 pro parte. (Pl. 47.)

Thallus squamulose with a definite somewhat circular outline (effigurate) and corticate above (rarely also below), or crustaceous

and effuse, the prevailing colour yellow, but also whitish, greyish or very dark-grey. Algal cells *Protococcus*. Apothecia brightly, rarely dark coloured, generally with a thalline margin, in some species with the margin excluded or with a proper margin only; paraphyses slender, nearly always broader and septate and often shortly branched at the tips, the epithecium generally deeply suffused with parietin granules; spores 8 in the ascus, colourless, 1-septate (very rarely simple), polarilocular.

The lichen acid parietin is produced in more or less abundance in the thallus of most of the species of this genus, and in the apothecia of all except *Pl. refellens*, which is probably an impoverished form. The spores are polarilocular in nearly all; they are simple in *Pl. rupestre* and imperfectly polarilocular in a few others.

The name *Placodium* was given by Hill (History of Plants, p. 96 (1751)) to a varied series of lichens, some of which are undoubted *Placodium* species as now understood. De Candolle limited the genus to species with a squamulose effigurate thallus. It was further limited by Hepp to species with polarilocular spores (*Euplacodium*), and at the same time extended to those with a crustaceous thallus having the same type of spores (*Callopisma*) and to biatorine species—i.e. apothecia without a thalline margin (*Blastenia*). The same comprehensive view of the genus is taken by modern continental lichenologists, who have however generally adopted the more recent name *Caloplaca* (Th. Fr. Lich. Arct. p. 118 (1860); emend. Lich. Scand. p. 167 (1871)).

The species are arranged in three sections, the more highly developed being placed first:—

Apothecia with a thalline margin.

Thallus squamulose..... i. EUPLACODIUM.

Thallus crustaceous..... ii. CALLOPISMA.

Apothecia without a thalline margin.

Thallus crustaceous..... iii. BLASTENIA.

§ i. EUPLACODIUM Stizenb. in St. Gall. Ber. Nat. Ges. iii. p. 172 (1862).

Thallus squamulose and more or less effigurate or partly crustaceous, yellow-coloured; the spores are polarilocular except in *Placodium fulgens*.

Spores simple or imperfectly septate.

1. *Pl. fulgens* S. F. Gray Nat. Arr. i. p. 447 (1821).—Thallus orbicular, radiating, submonophyllous or imbricate at the centre, often tuberculose, pale- or citrine-yellow, somewhat pulverulent, the lacinia crenate, deeply cut and convex at the margins, closely appressed to the substratum (K + deep violet). Apothecia small, generally plane, the thalline margin thin, disappearing, deep orange-coloured; paraphyses slender, concrete, simple or forked upwards, interspersed with yellow granules; spores ellipsoid-ovate, simple, with the contents massed towards the

poles, 7–13 μ long, 3–5 μ thick.—Mudd Man. p. 131; Cromb. Lich. Brit. p. 45; Leight. Lich. Fl. p. 178; ed. 3, p. 164. *Lichen fulgens* Swartz Nov. Act. Upsal. iv. p. 246 (1784); Dicks. Pl. Crypt. fasc. iv. p. 24; Engl. Bot. t. 1667. *Lecanora fulgens* Ach. Lich. Univ. p. 437 (1810); Cromb. Monogr. i. p. 357. *Squamaria fulgens* Hook. in Sm. Engl. Fl. v. p. 195 (1833).

Exsicc. Cromb. n. 155; Larb. Lich. Caesar. n. 27 & Lich. Hb. n. 296.

The spores of the species are simple, but they appear to be poorly developed; there is sometimes an appearance of septation, with guttule at each pole. The thallus resembles other *Placodia* in the presence of parietin, which gives the yellow colour to the thallus. When dry it is whitish suffused, becoming more brightly coloured when moistened. The spermogones are like others of the order with spermatia 3 μ long, 1 μ thick.

Hab. Creeping over the mosses of calcareous soil, shell-sand and crevices of rocks in maritime districts.—*Distr.* Not uncommon in a few localities of the Channel Islands, S. England and S. Wales.—*B. M.* Quenvais, Jersey; Guernsey; Bray Hill, St. Minver and Withiel, Cornwall; Freshwater Bay, I. of Wight; Newhaven and Rottingdean Cliffs, Sussex; Stackpole Court and Lydstep, Pembrokeshire.

Spores polarilocular.

Thallus entirely lobate.

2. *Pl. callopismum* Mér. Nouv. Fl. Env. Paris, ed. 2, i. p. 184 (1821). Thallus orbicular, radiate-stellate, closely adnate, the lobes of the circumference dilated, contiguous, plane, light- or orange-yellow, more or less pruinose, the centre cracked-areolate, often deeper in colour or brown (K + purplish). Apothecia plane, becoming convex, the disc reddish-yellow, the margin paler, flexuose or subcrenulate; spores very wide, lemon-shaped, 10–16 μ long, 6–10 μ thick.—Mudd Man. p. 133, t. 2, fig. 42; Cromb. Lich. Brit. p. 45; Leight. Lich. Fl. p. 176; ed. 3, p. 162. *Lichen candelarius* β . Lightf. Fl. Scot. ii. p. 811 (1777)? *L. murorum* Sm. Engl. Bot. t. 2157 (upper fig.) (1810). *Lecanora callopisma* Ach. Lich. Univ. p. 437 (1810) (non Hoffm.); Cromb. Monogr. i. p. 362 (excl. subsp. *sympagea*).

Exsicc. Johns. n. 405; Larb. Lich. Hb. n. 164; Leight. n. 113.

Well marked by the thin flat lobes of the circumference, frequently there is a white zone near the edge. It is also distinguished by the broad citriform spores.

Hab. On rocks and the mortar of walls in maritime and inland districts.—*Distr.* Not frequent throughout the British Isles.—*B. M.* Guernsey; Plymouth and near Torquay, Devon; near Cirencester, Gloucestershire; Bathampton Downs, Somerset; Great Orme's Head, Carnarvonshire; near Bonsall, Long Priory and Ilanymynech Hill, Shropshire; Quy Churchyard, Cambridgeshire; Blair Athole, Perthshire; near Aberdeen.

Var. *brevilobatum* A. L. Sm.—Differs from the species in the reduced thallus, the lobes of the circumference being short, rather scattered or absent, the centre cracked-areolate or verrucose. Apothecia and spores as in the species.—*Lecanora brevilobata* Nyl. in Flora lxvi. p. 99 (1883). *Lecanora callopisma* subsp. *sympagea* var. *brevilobata* Cromb. Monogr. i. p. 363 (1894).

Hab. On schistose rocks in maritime and inland districts.—*Distr.* Very rare in N.W. England and N.E. Scotland.—*B. M.* Near Alston, Cumberland; Portlethen, Kincardineshire.

3. *Pl. flavescens* A. L. Sm.—Thallus orbicular, closely adnate, bright-yellow, shining, pruinose or naked, the lobes of the circumference narrow, turgid, crenulate (K + purplish). Apothecia concolorous or brownish-red, the margin entire, disappearing; spores very wide at the septum, lemon-shaped, 8–14 μ long, 6–10 μ thick.—*Pl. callopismum* var. *plicatum* Leight. Lich. Fl. p. 177 (1871); ed. 3, p. 163. *Lichenoides crustosum, orbiculis et scutellis flavis* Dill. Hist. Musc. p. 136, t. 18, fig. A. *Lichen flavescens* Huds. Fl. Angl. p. 445 (1762) pro maj. parte. *Amphilonia Heppianum* Müll.-Arg. in Mém. Soc. Phys. Hist. Nat. Gen. xvi. p. 379 (1862). *Lecanora murorum* var. *plicatum* Wedd. in Bull. Soc. Bot. Fr. xvi. p. 200 (1869). *L. callopisma* var. *sympagea* Nyl. in Bull. Soc. Linn. Norm. sér. 2, vi. p. 304 (1872) (non Ach.); subsp. *sympagea* Cromb. in Grevillea xviii. p. 45 (1889) & Monogr. i. p. 362.

Exsicc. Johns. n. 31; Larb. Lich. Hb. n. 15; Mudd nos. 94, 96.

Closely allied to the preceding, there being slight connecting stages though distinct in the extreme forms, in which the laciniae are turgid and convex like those of *Pl. murorum*. Two other names have been used for the plant, based on *Lichen aurantius* Pers. (Ust. Ann. Bot. xi. p. 14 (1794)), and *L. sympageus* Ach. (Lich. Suec. Prodr. p. 105 (1798)), but both those plants are probably only forms of *Pl. callopismum*, as the laciniae are described as plane.

The Dillenian description refers to four species, which have been verified after examination as follows:—those under fig. 18A are *Pl. flavescens*; under 18B *Pl. citrinum* and *Candelaria concolor*; under 18C *Pl. murorum*.

Hab. On rocks and mortar of walls, chiefly in maritime, but also in inland districts.—*Distr.* Not uncommon throughout the British Isles.—*B. M.* Vale Castle, Guernsey; Alderney; St. Austell and St. Maws, Cornwall; Torquay and North Lynton, Devon; near Ryde, I. of Wight; Glynde and Peasemars, Sussex; Manorbeer, near Tenby, Pembrokeshire; near Southerndown, Glamorganshire; Aberdovey, Merioneth; Llanynynech Hill, Shropshire; Buxton and Cromford, Derbyshire; Bilsdale, Cleveland, Yorkshire; near Hartlepool, Durham; Arnbarrow, Westmoreland; St. Bees, Cumberland; I. of Lismore and Barcaldine, Argyll; West Water, Fifeshire; Blair Athole, Perthshire; Portlethen, Kincardineshire; near Aberdeen; Dunkerron, Kerry; Cleghan, Connemara, Galway; Castlebar, Mayo.

4. *Pl. elegans* DC. Fl. Fr. ii. p. 379 (1805).—Thallus radiate-stellate and normally orbicular, formed of subdiscrete narrow elongate laciniae, branched, torulose and crenate at the apices, orange or dark orange-red, paler below (K + purplish). Apothecia rather small, nearly plane, concolorous, the margin entire; spores ellipsoid or ovoid, 11–16 μ long, 6–9 μ thick.—Mudd Man. p. 131, t. 2, fig. 41; Cromb. Lich. Brit. p. 45; Leight. Lich. Fl. p. 178; ed. 3, p. 163. *Lichen elegans* Link in Ann. Naturg. i. p. 37 (1791). *Lecanora elegans* Ach. Lich. Univ. p. 435 (1810); Hook. Fl. Scot. ii. p. 50; Cromb. in Grevillea xviii. p. 44 (1889) & Monogr. i. p. 358. *Squamaria elegans* Hook. in Sm. Engl. Fl. v. p. 195 (1833) pro parte.

Distinguished by the non-contiguous narrow deeply coloured laciniae. It is an alpine or northern plant very rare in this country; the British citations may possibly refer to some other species. The thallus is corticate on both surfaces and loosely affixed, so that it is easily detached. The spores vary from being broadly ovoid to ellipsoid.

Hab. On granite rocks in alpine situations.—*Distr.* Sparingly among the Grampians, Scotland.—*B. M.* Loch-na-gar and Cairngorm, Aberdeenshire.

Var. *tenue* Nyl. Lich. Scand. p. 137 (1861).—Thallus much reduced, the laciniae narrow and scattered. Apothecia small.—Var. *discreta* Mudd Man. p. 131 (1861). *Lichenoides tenuissimum, scutellis exiguis miniatis* Dill. Hist. Musc. p. 175, t. 24, fig. 68 (1741). *Lichen elegans* var. *tenuis* Wahlenb. Fl. Lapp. p. 417 (1812). *Lecanora elegans* var. *tenuis* Ach. Syn. Lich. p. 183 (1814); Cromb. Monogr. i. p. 358. *Parmelia elegans* var. *discreta* Schær. Enum. p. 52 (1850).

Hab. On calcareous and other rocks in subalpine situations.—*Distr.* Rare in S. Wales, N. England and the Grampians, Scotland.—*B. M.* Whimbold Rocks, near Radnor; East Allendale, Northumberland; Craig Guic, Braemar, Aberdeenshire.

5. *Pl. dissidens* Nyl. in Flora lviii. p. 298 (1875).—Thallus orbicular, moderate in size, stellate-radiate, the laciniae convex, narrow, often free at the circumference, crenate at the tips, dull reddish-yellow (K + purplish). Apothecia numerous, concolorous, the thalline margin crenulate; spores 9–16 μ long, 5–7 μ thick.—*Pl. murorum* f. *dissidens* Leight. Lich. Fl. ed. 3, p. 161 (1879). *Lichen flavicans* With. Arr. ed. 3, iv. p. 25 (1796) pro parte (non Swartz). *L. elegans* Sm. Engl. Bot. t. 2181 (1810) (right-hand fig.) (non Link). *Lecanora dissidens* Nyl. in Flora lviii. p. 298 (1875); Cromb. in Grevillea iv. p. 180 (1876) & Monogr. i. p. 361.

Essicr. Johns. n. 257.

Agreeing in outline and colour with states of *Xanthoria parietina*. The laciniae are somewhat similar in form to those of the preceding species, but it differs in the colour, in the regular form and in

the crenulate margin of the apothecia. The thallus is corticate on both surfaces, and, though closely appressed, is easily detached.

Hab. On slate roofs and on brick walls in inland districts.—*Distr.* Found only here and there in England, probably overlooked.—*B. M.* Near Groombridge, Sussex; near Stroud and King's Stanley, Gloucestershire; Gopsall, Leicestershire; Ayton, Cleveland, Yorkshire; Brigsteer, Westmoreland.

6. *Pl. murorum* DC. Fl. Fr. ii. p. 378 (1805).—Thallus orbicular, stellate-radiate, the laciniae closely adnate, continuous from the centre, contiguous and somewhat turgid and crenate at the circumference, egg-yellow or citrine, usually whitish-suffused (K + purplish). Apothecia concolorous, plane, becoming convex. the thalline margin entire; spores ellipsoid or ovoid, 9–15 μ long, 4–7 μ thick.—S. F. Gray Nat. Arr. i. p. 447 pro parte; Mudd Man. p. 132 pro parte; Cromb. Lich. Brit. p. 45 pro parte; Leight. Lich. Fl. p. 175; ed. 3, p. 160 pro parte. *Lichenoides crustosum, orbiculis et scutellis flavis* Dill. Hist. Musc. p. 136, t. 18, fig. 18 c (1741). *Lichen flavescens* Huds. Fl. Angl. p. 445 (1762) pro minore parte. *L. murorum* Hoffm. Enum. Lich. p. 63 (1784); Engl. Bot. t. 2157 (lower fig.). *Lecanora murorum* Ach. Lich. Univ. p. 433 (1810); Hook. Fl. Scot. ii. p. 50 pro parte; Tayl. in Mackay Fl. Hib. ii. p. 140 pro parte; Cromb. Monogr. i. p. 359.

Exsicc. Johns. nos. 97, 405.

Distinguished from allied species by the turgid laciniae, by the more continuous lobate centre, which is often brown-coloured, and to some extent by the white pruina. It has frequently been confused by older writers with *Pl. callopismum*, a species well defined by spore characters. Though normally in flat orbicular rosettes effigurate at the circumference, it may be considerably broken up and occur in stunted crowded lobulate patches (*Physcia murorum* var. *pulvinata* Massal. Symm. Lich. p. 13 (1855)).

Hab. On calcareous rocks and mortar of walls in maritime and inland districts.—*Distr.* Probably general throughout the British Isles.—*B. M.* Anstey's Cove, Torquay, Devon; Glynde, Sussex; near Cirencester, Gloucestershire; Anglesea; Great Orme's Head, Carnarvonshire; Teesdale, Durham; Warkworth Castle, Northumberland; Morningside near Edinburgh; Appin, Argyll; near Aberdeen; Clare Island, Mayo.

Form *corticicolum* Oliv. Lich. Eur. p. 90 (1909).—Thallus in pulvinate patches, reddish-yellow or greyish-green. Apothecia numerous, crowded.—*Lecanora murorum* var. *corticicolum* Nyl. in Bull. Soc. Bot. Fr. xiii. p. 366 (1866); Cromb. in Grevillea xviii. p. 44 (1889) & Monogr. i. p. 359.

Exsicc. Larb. Lich. Hb. n. 52.

Hab. On trunks of trees or on old timber in inland districts. *Distr.* Apparently rare in S. and E. England—*B. M.* Windsor Great Park, Berks; Great Wilbraham, Cambridgeshire.

Var. *pusillum* Flag. Lich. Fr.-Comté p. 231 (1886).—Thallus smaller, the laciniae short, plicate-radiate at the circumference, often absent, more broken up into lobules or separate small squamules at the centre, naked or white-suffused, vitelline or pale-yellow. Apothecia small, becoming plane or convex, concolorous; spores as in the species or somewhat smaller.—*Placodium miniatum* Leight. Lich. Fl. ed. 3, p. 162 (1879) pro parte. *Pl. murorum* var. *miniatum* Mudd Man. p. 134 (1861) pro parte; Cromb. Lich. Brit. p. 45 (1870) pro parte; Leight. Lich. Fl. p. 175. *Lichen miniatus* Hoffm. Enum. Lich. p. 63 (1784)? *L. tegularis* Ehrh. Exs. n. 304 (1785) nomen nudum. *L. elegans* Sm. Engl. Bot. t. 2181 (two left-hand figs.) (1810) (non Link). *Squamaria miniata* Hook. in Sm. Engl. Fl. v. p. 195 (1833)? pro parte. *Physcia pusilla* Massal. in Flora xxxv. p. 567 (1852). *Lecanora obliterascens* Nyl. in Flora lxvi. p. 99 (1883); Cromb. in Journ. Bot. xxiii. p. 195 (1885). *L. murorum* subsp. *tegularis* Nyl. in tom. cit. p. 106; Cromb. Monogr. i. p. 360 (incl. var. *obliterascens*).

Esicv. Johns. nos. 71, 98; Larb. Lich. Hb. n. 51; Leight n. 207; Mudd n. 95.

With a non-radiate less developed thallus than the species, and closely approaching the pulvinate form; the lobate character is constant. The colour varies from citrine-yellow to brownish-red, hence the ambiguous term *miniatum*. The apothecia are generally crowded, and tend to become convex, with the thalline margin disappearing (var. *obliterascens*).

Hab. On rocks and walls, rarely on old timber, in maritime and inland situations.—*Distr.* Rather rare throughout Great Britain and the Channel Islands.—*B. M.* Rozel, Jersey; near Glynde, Sussex; Kemble, Gloucestershire; Weston, Oxfordshire; Lungmynnech Hill, Shropshire; Ayton, Cleveland, Yorkshire; Broughton Castle, Westmoreland; Bassenthwaite, Cumberland; near Callander, the Trossachs and Craig Tulloch, Perthshire; Will's Braes, Forfarshire; Cove, Kincardineshire.

Form *Arnoldi* A. L. Sm.—Thallus very small, the thalline lobules scattered or contiguous, not radiate, cinnabarine. Apothecia minute, concolorous.—*Placodium murorum* var. *pusillum* Cromb. in Journ. Bot. viii. p. 97 (1870)? (non Massal.). *Lecanora miniata* Tayl. in Mackay Fl. Hib. ii. p. 140 (1836) (? Hoffm.). *L. Arnoldi* Wedd. in Bull. Soc. Bot. Fr. xxiii. p. 96 (1876). *L. murorum* subsp. *tegularis* f. *Arnoldi* Cromb. in Grevillea xviii. p. 45 (1889) & Monogr. i. p. 361.

Scarcely differing from the variety except in the minute thallus and apothecia and in the constantly cinnabarine colour.

Hab. On dry calcareous rocks in inland districts.—*Distr.* Rare in N.E. England, the Grampians, Scotland and S.W. Ireland.—*B. M.* Hartlepool, Durham; Morrone, Braemar, Aberdeenshire; Dunkerron, Kerry.

Thallus granular in the centre, sometimes sorediate.

7. *Pl. granulosum* Hepp Flecht. Eur. n. 908 (1867).—Thallus normally orbicular or sometimes spreading, closely adnate, stellate-radiate, the laciniae of the circumference oblong, narrow, convex, rugulose, the centre granular-areolate, composed of upright separate isidiose-like granules, sometimes divided or crenulate, deep reddish-yellow (K + purplish). Apothecia rare, small, concolorous, the thalline margin entire, becoming sub-crenulate; spores 10–16 μ long, 6–8 μ thick.—*Amphiloma granulosum* Müll.-Arg. in Mém. Soc. Phys. Hist. Nat. Genève xvi. p. 380 (1862). *Lecanora granulosa* Wedd. in Bull. Soc. Bot. Fr. xxiii. p. 98 (1876); Cromb. in Grevillea xviii. p. 45 (1889) & Monogr. i. p. 365.

Exsicc. Johns. n. 258.

Not unlike *Pl. cirrochroum*, but the central granules are more compact and not sorediate. The thallus of the specimen in Hb. Johns. has no radiate laciniae.

Hab. On rocks, chiefly calcareous, in maritime and inland districts.—*Distr.* Not common in W. England and E. Ireland.—*B. M.* Cheddar Cliffs, Somersetshire; St. Bees, Cumberland; Howth near Dublin.

8. *Pl. scopulare* Oliv. Lich. Eur. p. 96 (1909).—Thallus orbicular, rather small, closely adnate, stellate-radiate, the laciniae narrow, contiguous, convex, warted-areolate in the centre, reddish-yellow (K + purplish). Apothecia small, numerous, plane, the thalline margin entire; spores 9–17 μ long, 5–7 μ thick. *Lecanora scopularis* Nyl. in Flora lxvi. p. 105 (1883); Cromb. in Journ. Bot. xxiii. p. 195 (1885) & Monogr. i. p. 364.

Hab. On schistose rocks in a maritime district.—*B. M.* Portlithen, Kincardineshire.

9. *Pl. decipiens* Leight. Lich. Fl. p. 176 (1871).—Thallus normally orbicular, often irregularly developed, laciniolate-radiate at the circumference, the laciniae rather narrow, turgid, contiguous, incised-crenate at the tips, the centre granulate-areolate, generally furfuraceous, yellow, or citrine, with concolorous soredia (K + purplish). Apothecia small, the thalline margin becoming subcrenate; spores oblong-ellipsoid, sometimes slightly curved, 10–16 μ long, 4–8 μ thick.—Leight. Lich. Fl. ed. 3, p. 161. *Physcia decipiens* Arn. in Flora l. p. 562 (1867). *Lecanora murorum* subsp. *decipiens* Nyl. in Flora lii. p. 81 (note) (1869); Martind. in Naturalist 1887, p. 359; Cromb. Monogr. i. p. 359.

Exsicc. Johns. n. 256; Larb. Lich. Hb. n. 90 (as var. *camboricum*).

Differs from *Pl. murorum* in the somewhat narrower laciniae and in the granular sorediate centre of the thallus. Nylander has

suggested (Flora lxvi. p. 106) that this plant may be the original *Lichen murorum* Hoffm.

Hab. On walls in lowland districts.—*Distr.* Local in S.W. and E. England.—*B. M.* Shoreham, Kent; near Cirencester, Gloucestershire; Milton Church, Cambridgeshire; Anglesea.

10. *Pl. cirrochroum* Hepp *Flecht. Eur. n.* 398 (1857).—Thallus small, orbicular, closely adnate, often imperfect, radiate-stellate, the laciniae narrow and convex or somewhat wider and more contiguous, crenulate at the tips, bright orange-yellow, crustaceous-areolate and sometimes darker and poorly developed at the centre, bright orange-yellow, citrine within and dotted with citrine soralia (K + purplish). Apothecia minute, orange-yellow, the thalline margin subentire; spores oblong-ellipsoid, 13–18 μ long, 5–6 μ thick.—Cromb. in *Journ. Bot.* xii. p. 147 (1874); Leight. *Lich. Fl. ed.* 3, p. 161. *Lecanora cirrochroa* Ach. *Syn. Lich.* p. 181 (1814); Cromb. *Monogr. i.* p. 363. *L. linearis* Tayl. in Mackay *Fl. Hib. ii.* p. 260 (1836) (young state?).

Exsicc. Johns. n. 99.

Characterized by the small round citrine soralia dotted over the thallus. The British plants are sterile. The spores are long in relation to their width, though I have not been able to see any up to 18 μ . The paraphyses are slender, but more or less clavate and septate at the tips.

Hab. On rocks, mostly calcareous, in maritime and inland districts.—*Distr.* Rather rare throughout the British Isles, though commoner in western districts.—*B. M.* Anstey's Cove, Torquay and Sidmouth, Devon; Yatton and Weston-super-Mare, Somerset; Great Orme's Head, Carnarvonshire; Silverdale, Lancashire; Dovedale, Derbyshire; Arnbarrow, near Kendal and Milnthorpe, Westmoreland; Alston, Cumberland; I. of Lismore, Argyll; Craig Tulloch, Blair Athole, Perthshire; Dunkerron, Kerry.

Var. *obliterans* A. L. Sm.—Thallus smaller, less distinctly radiate, or the laciniae sometimes obsolete, varying in colour from ochraceous to deep tawny-yellow, the soredia citrine or somewhat tawny-yellow, less effuse than in the species.—*Placodium obliterans* Nyl. in *Flora lvii.* p. 7 (1874). Specimen not seen.

Nylander has suggested the varietal affinity of this plant. It agrees with the species in the presence of soredia, a rather unusual character in this genus.

Hab. On schistose rocks, Caithness.

Thallus orbicular, entirely leprose.

11. *Pl. xantholytum* Nyl. *Lich. Env. Paris,* p. 46 (1896).—Thallus orbicular, continuous, crenate at the circumference, everywhere leprose, golden-yellow or greenish-yellow, white within (K + rose-crimson). Apothecia and spermogones unknown.—

Lecanora xantholyta Nyl. in Flora lxii. p. 361 (1879); Cromb. in Grevillea viii. p. 112 (1880) & Monogr. i. p. 366.

Exsicc. Johns. n. 407.

A leprose condition of *Placodium*. Nylander suggested affinity with *Pl. cirrochroum*, but Crombie (l. c.) points out that it differs from that species in being internally white.

Hab. On shady calcareous rocks in maritime and upland districts.—*Distr.* Local though plentiful where it occurs in S.W., Central and N. England, N. Wales and the Central Highlands, Scotland.—*B. M.* Sidmouth and Anstey's Cove, Torquay, Devon; Bathampton Downs, Somerset; View Edge, Stokesay, Shropshire; Great Orme's Head, Carnarvonshire; Silverdale, Lancashire; Scout Sear, Westmoreland; Craig Tulloch, Blair Athole, Perthshire.

Thallus not effigurate, effuse.

12. *Pl. lobulatum* A. L. Sm.—Thallus effuse, irregular, thin, smooth, sub-areolate, or composed of minute contiguous slightly convex lobules, occasionally with small laciniaë at the circumference, bright-yellow or orange-red (K + purplish). Apothecia small, numerous, plane or convex, concolorous, the margin entire: spores ellipsoid, 10–14 μ long, 5–6 μ thick.—*Pl. murorum* var. *lobulatum* Hepp Flecht. Eur. n. 71 (1853); Mudd Man. p. 132; Cromb. Lich. Brit. p. 45; var. *obliteratum* Leight. Lich. Fl. p. 176 (1871); ed. 3, p. 161. *Lichen obliteratus* Pers. in Ust. Ann. Bot. xi. p. 15 (1794)? *Lecanora lobulata* Sommerf. Suppl. Fl. Lapp. p. 87 (1826); Cromb. in Grevillea xviii. p. 45 & Monogr. i. p. 363.

Exsicc. Cromb. n. 156; Johns. n. 72; Lerb. Cæsar. n. 74 & Lich. Hb. n. 295; Leight. n. 268.

A brightly coloured maritime species, which differs from *Pl. murorum* in the almost complete absence of peripheral radii. It may occur in small or orbicular patches, but is more often irregular and wide spreading. Persoon's species, *Lichen obliteratus*, is of prior date, but its identity is doubtful; it was collected on calcareous rocks and is not recorded as maritime.

Hab. On rocks in maritime districts.—*Distr.* Rather common round the coasts of the British Isles.—*B. M.* Jersey; Guernsey; Alderney; St. Maws, Cornwall; Ilsham, and Meadfoot, Torquay, Devon; North Cliff, Tenby, Pembrokeshire; Southern Down, Glamorganshire; Barmouth, Merioneth; Great Orme's Head, Carnarvonshire; Anglesea; Douglas, Isle of Man; Arbarrow, Westmoreland; St. Bees, Cumberland; Appin, Argyll; Portlethen, Kincardineshire; Peterhead, Aberdeenshire; Applecross, Rossshire; Upper Lake, Killarney, Kerry; Achill Island and Clare Island, Mayo; Ardglass, Down.

13. *Pl. miniatum* Oliv. Lich. Eur. p. 92 (1909).—Thallus irregular, plane, thin, closely adnate, cracked-areolate, sparingly radiate-stellate, deep tawny-vermilion-coloured (K + purplish). Apothecia minute, concolorous, the thalline margin entire;

spores small, broadly ellipsoid, 7-10 μ long, 4-5 μ thick. *Lecanora miniatula* Nyl. in Flora lxvi. p. 98 (1883); Cromb. in Journ. Bot. xxiii. p. 195 (1883) & Monogr. i. p. 364.

The thallus forms a thin expansion following the inequalities of the rock; the radiate laciniae are only scanty. Nylander has suggested that it may only be a variety of *Pl. murorum* var. *pusillum*, but the apothecia and spores are smaller.

Hab. On quartzose rocks in a subalpine district.—*B. M.* Morrone, Braemar, Aberdeenshire.

§ ii. CALLOPISMA A. L. Sm. *Callopisma* (as genus) De Not in Mem. Reale Acad. Sci. Torino, ser. 2, x. p. 388 (1849) pro parte; Mudd Man. p. 134 pro parte.

Thallus entirely crustaceous; apothecia with a thalline margin, sometimes disappearing; spores polarilocular except in *Pl. nivale*, in which they are simply septate.

Thallus yellow or greenish-yellow (K + purple).

14. *Pl. citrinum* Hepp Flecht. Eur. n. 394 (1857).—Thallus effuse, furfuraceous, granular-areolate, citrine- or greenish-yellow (K + purplish). Apothecia orange-yellow, plane, sometimes becoming convex, with the thin thalline margin disappearing; spores ellipsoid, often rather wide at the centre, 10-15 μ long, 5-8 μ thick.—Leight. Lich. Fl. p. 177; ed. 3, p. 163. *Pl. murorum* var. *citrinum* Flot. in Uebers. Schles. Ges. Vat. Cult. 1849, p. 119; Mudd Man. p. 132 (incl. var. *steropeum* ?); subsp. *citrinum* Cromb. Lich. Brit. p. 45 (1870). *Lichenoides crustosum, orbiculis et scutellis flavis* Dill. Hist. Musc. p. 136, t. 18, fig. 18 B. *Lichen candelarius* Huds. Fl. Angl. p. 444 (1762) pro parte (? Linn.); With. Arr. ed. 3, iv. p. 27 pro parte. *L. citrinus* Ach. Lich. Suec. Prodr. p. 73 (1798); Engl. Bot. t. 1793 (three lower figs.). *Verrucaria citrina* Hoffm. Deutschl. Fl. ii. p. 198 (1795). *Parmelia murorum* var. *steropea* Ach. Meth. Lich. p. 196 (1813). *Lecanora citrina* Ach. Lich. Univ. p. 402 (1810); Hook. in Sm. Engl. Fl. v. p. 192; Tayl. in Mackay Fl. Hib. ii. p. 138; Cromb. Monogr. i. p. 371.

Esicc. Johns. n. 73; Larb. Lich. Hb. n. 129; Leight. n. 86.

The furfuraceous thallus spreads extensively, covering mortar, mosses, etc.; it is often sterile, though generally well fertile. The colour varies from bright citrine-yellow to greenish or greenish-yellow, the changes being due to light or shade conditions.

Hab. On mortar of walls, more rarely on rocks, trees, mosses, etc., chiefly about towns and villages in maritime and inland localities.—*Distr.* General and mostly common throughout the British Isles.—*B. M.* Jersey; Alderney; Sark; Withiel, Cornwall; Torquay, Devon; near Taunton, Somerset; Bonchurch and St. Lawrence, I. of Wight; Rottingdean, Brighton and near Lewes, Sussex; Stansted Mount-fitchet and Beeleigh Abbey, Maldon, Essex; near Windsor, Berks; near Monmouth; Cirencester, Gloucestershire; Llanymynech, near

Oswestry and near Shrewsbury, Shropshire; Llanfairfechan, Carnarvonshire; Anglesea; Twycross, Leicestershire; Wimpole Park, Cambridgeshire; Norwich, Norfolk; near Ayton, Cleveland, Yorkshire; Brougham Castle, Westmoreland; Lamplough, Cumberland; Hexham, Northumberland; near Edinburgh; Gourrock, Renfrewshire; Cupar, Fife; King's Park, Stirling; Will's Braes, Forfarshire; Nigg, Kincardineshire; near Aberdeen; Dunkerron, Kerry; Clare Island and Achill Sound, Mayo.

Form *flavocitrinum* A. L. Sm.—Thallus indeterminate, minutely squamulose, thinnish, the squamules more or less pulverulent.—*Lecanora flavocitrina* Nyl. in Flora Ixix. p. 461 (1886) & Cromb. Monogr. i. p. 372. Specimen not seen.

Determined by Bouly de Lesdain (Lich. Dunk. p. 130 (1910)) as a form of *Caloplaca citrina* var. *maritima*, the squamulose character being due to the attacks of acarinae and molluscs. He proved the identity of his new plants with an original specimen from Staveley, Westmoreland.

Hab. On schistose walls in an upland situation, Staveley near Kendal, Westmoreland.

Form *depauperatum* A. L. Sm.—Thallus effuse, the granules minute, scattered. Apothecia small, otherwise as in the type.—*Lecanora citrina* f. *depauperata* Cromb. in Grevillea xviii. p. 45 (1889) & Monogr. i. 372.

Exsicc. Johns. n. 408; Larb. Lich. Hb. n. 128.

A very poorly developed condition of the species.

Hab. On granitic rocks in maritime regions.—*Distr.* Rare in the Channel Islands, N.E. and N.W. England and W. Ireland.—*B. M.* Alderney; Kylemore, Connemara, Galway.

15. *Pl. phloginum* A. L. Sm.—Thallus effuse, thin, minutely granular-leprose, in crowded areolate masses or sparsely scattered, citrine or greenish-yellow (K + purplish). Apothecia small, plane, becoming convex, golden-yellow at first, with a scarcely perceptible thalline margin (K + crimson); spores ellipsoid-oblong, 11–15 μ long, 5–9 μ wide (usually about 10 \times 5 μ). *Parmelia citrina* var. *phlogina* Ach. Meth. Lich. p. 180 (1803). *Lecanora phlogina* Nyl. in Mém. Soc. Sci. Nat. Cherb. v. p. 112 (1857); Cromb. in Journ. Bot. ix. p. 178 (1871) & Monogr. i. p. 386; Leight. Lich. Fl. 223; ed. 3, p. 213.

Exsicc. Johns. n. 75; Larb. Lich. Hb. n. 57 & Cantab. n. 7.

Differs in habitat from *Pl. citrinum*, with which it might be easily confused. The thallus is however less brightly coloured and less luxuriant, and the apothecia smaller, with the thalline margin thin and becoming excluded.

Hab. On the trunks of old trees, generally ash or elm, rarely on old wood in maritime or inland districts.—*Distr.* Rare in the Channel Islands and throughout England.—*B. M.* St. Clement's Bay, Jersey; Penzance, Cornwall; near Hastings, Sussex; Windsor Great Park, Berks; near Worcester; Pampisford and Great Wilbraham, Cambridgeshire; Alston, Cumberland.

Form *luteum* A. L. Sm.—Thallus very thin, pulverulent, pale greenish-yellow or grey. Apothecia minute, orange coloured. *Lecidea epixantha* var. *lutea* Ach. Lich. Univ. p. 209 (1810). *Lecanora phlogina* var. *lutea* Nyl. Lich. Scand. p. 142 (1861); Cromb. Monogr. i. p. 386.

Differing in the generally more reduced growth, which is probably due to the substratum.

Hab. On vegetable detritus in maritime districts.—*Distr.* Rare in S. England and S.W. Highlands of Scotland.—*B. M.* Lucombe Cove, I. of Wight; Rottingdean, Sussex; Airs, Appin, Argyll.

16. *Pl. incrustans* A. L. Sm.—Thallus effuse, crustaceous, thickish, areolate or reduced to scattered granules, pale- or greenish-yellow (K + purplish). Apothecia plane or slightly convex, orange-yellow, sometimes pruinose, the thalline margin entire or becoming crenulate; spores ellipsoid, polarilocular, 8–13(–18) μ long, 4–8 μ thick.—*Lecanora incrustans* Ach. Lich. Univ. p. 405 (1810); Cromb. in Grevillea xviii. p. 45 (1889) & Monogr. i. p. 372.

Sometimes regarded as a variety of *Pl. murorum*; the paraphyses are branched above and often capitate, and their septation upwards well-marked as in those of that species. The description is partly taken from Bouly de Lesdain (Lich. Dunk. p. 133), who gives spore length up to 18 μ .

Hab. On schistose walls in a maritime district.—*B. M.* Portlethen, Kincardineshire.

17. *Pl. aurantiacum* Hepp Flecht. Eur. n. 198 (1853).—Thallus subdeterminate, thickish, or sometimes very thin, with a spreading grey hypothallus not always visible, thinly membranaceous, continuous or areolate, pale citrine, greyish- or greenish-yellow (K + purplish). Apothecia small or moderate in size, plane, with a thin entire or crenulate margin, becoming convex and immarginate, deep orange or reddish; paraphyses clavate, septate and branched upwards; spores broadly ellipsoid, varying in size and development of septum, 11–16 μ long, 6–9 μ thick. *Lichen flavorubescens* Huds. Fl. Angl. p. 443 (1762)?; With. Arr. ed. 3, iv. p. 15? *L. aurantiacus* Lightf. Fl. Scot. ii. p. 810 (1777) pro parte. *L. salicinus* Schrad. Spicil. Fl. Germ. p. 82 (1794); Engl. Bot. t. 1305 (1804). *Lecidea aurantiaca* Ach. Meth. Lich. p. 69 (1803); S. F. Gray Nat. Arr. i. p. 476; Tayl. in Mackay Fl. Hib. ii. p. 129. *Rinodina salicina* S. F. Gray tom. cit. p. 456 (1821) (incl. var. *microthelia*). *Lecanora aurantiaca* Hook. in Sm. Engl. Fl. v. p. 186 (1833); Leight. Lich. Fl. p. 217; ed. 3, p. 206 (incl. var. *salicina*); Cromb. Lich. Brit. p. 46 & Monogr. i. p. 373. *Calloposma aurantiacum* Massal. Monogr. Lich. Blast. p. 70 (1853); Mudd Man. p. 137 (incl. var. *salicinum*).

Exsicc. Bohl. n. 118; Carroll Lich. Hib. n. 37; Johns. n. 322; Leight. n. 212; Mudd n. 99.

A variable lichen in the form and colour of the thallus and in the form of the spores. The apothecia are numerous and chiefly central. Spermogones are frequent, especially in the absence of apothecia: they occupy the tips of papillæ (*Parmelia microthelia* Ach. Meth. Lich. p. 176 (1803)). Hudson's plant is somewhat doubtful, as it has only a greenish leprose thallus. Lightfoot's description refers to var. *flavovirescens* as well as to this plant, as he gives habitat "sometimes upon rocks."

Hab. On the trunks of trees, chiefly poplars, willows and ash, and on old palings in maritime lowland and upland situations.—*Distr.* General throughout the British Isles.—*B. M.* Guernsey; Cornwall; near Plymouth and Ilsham Valley, Torquay, Devon; St. Helen's and Bembridge, I. of Wight; Buckhurst Park, Willingham, Eridge Park, Frant and Woolstonbury, Sussex; Halstead, Kent; Stansted Mountfitchet Park, Mark's Hall and Walthamstow, Essex; Windsor Great Park, Berks; Malvern and near Crowle, Worcestershire; Oswestry and Shrewsbury, Shropshire; Garn, Denbighshire; Anglesea; Twycross and Gopsall Park, Leicestershire; Ayton and Cleveland, Yorkshire; Levens, Westmoreland; Newton Riggs, Cumberland; Teesdale, Durham; Hexham and Wansbeck, Northumberland; New Galloway, Kirkcudbrightshire; Largs, Ayrshire; near Edinburgh; near Inverary and Connel Ferry, Argyll; Finlarig, Killin, Perthshire; Abergeldie, Braemar, Aberdeenshire; Clonmel, Tipperary; Ballynegard, Limerick; near Belfast, Antrim.

Var. *flavovirescens* Hepp l. c.—Thallus effuse, thin, plane and areolate, or in minute lobulate granules, greenish- or orange-yellow (K + crimson). Apothecia generally rather small, plane, with a thin thalline entire, rarely crenulate, margin, becoming convex, the disc orange-yellow, the margin lighter coloured.—*L. flavovirescens* Wulf. in Schrift. Ges. Naturf. Fr. p. 122 (1788). *L. erythrellus* Ach. Lich. Succ. Prodr. p. 43 (1798); Engl. Bot. t. 1993. *Lecanora erythrella* Ach. Lich. Univ. p. 401 (1810); Hook. Fl. Scot. ii. p. 49 & in Sm. Engl. Fl. v. p. 186. *L. aurantiaca* var. *erythrella* Nyl. in Act. Soc. Linn. Bord. sér. 3, i. p. 322 (1856); Cromb. Lich. Brit. p. 46; Leight. Lich. Fl. p. 217; ed. 3, p. 207; subsp. *erythrella* Nyl. ex Cromb. in Grevillea xviii. p. 45 (1889) & Monogr. i. p. 374. *Rinodina erythrella* S. F. Gray Nat. Arr. i. p. 456 (1821). *Lecidea erythrella* Tayl. in Mackay Fl. Hib. ii. p. 130 (1836). *Calloposma aurantiacum* var. *flavovirescens* Massal. Monogr. Lich. Blast. p. 70 (1853); Mudd Man. p. 137.

Exsicc. Larb. Lich. Hb. n. 20; Mudd n. 100; Johns. nos. 74, 102, 103.

Differing from the species in the habitat and generally in the more brightly coloured thallus and smaller apothecia.

Hab. On rocks and old walls in maritime and inland localities.—*Distr.* Fairly general throughout Great Britain, rare in Ireland.—*B. M.* Near Penzance, Cornwall; Valley of Rocks, Lynton, Devon:

Hastings, Sussex; North Hill, Malvern, Worcestershire; Black Mount, Abergavenny, Monmouthshire; Craig-y-Rhiw, Oswestry and Llanywnech Hill, Shropshire; Snowdon and Beddgelert, Carnarvonshire; Roseberry, Cleveland, Yorkshire; Brigsteer, Westmoreland; Alston and Egremont, Cumberland; Appin and Glen Orchy, Argyll; Killin, Ben Lawers, Kinnoul Hill and Blair Athole, Perthshire; Lundie Craigs, Forfarshire; Castleton of Braemar and Morrone, Aberdeenshire; Kylemore Lake, Connemara, Galway.

Var. *inalpinum* Anzi Catal. Lich. Sondr. p. 42 (1860).—Thallus thin, pale-yellow or whitish. Apothecia reddish, generally convex, otherwise as in the species.—*Lecanora inalpina* Ach. Lich. Univ. p. 388 (1810). *L. aurantiaca* var. *inalpina* Cromb. Lich. Brit. p. 46 (1870); Leight. Lich. Fl. p. 218 pro parte; ed. 3, p. 207 pro parte; var. *rubescens* Leight. ll. c.: subsp. *erythrella* var. *inalpina* Cromb. in Grevillea xviii. p. 45 (1889) & Monogr. i. p. 374 (incl. f. *rubescens*). *Lecidea aurantiaca* var. *rubescens* Ach. Meth. Lich. p. 69 (1803). *Callophisma aurantiacum* var. *inalpinum* Mudd Man. p. 137 (1861).

Exsicc. Johns. n. 101.

Distinguished by the thinner thallus and the deeply coloured apothecia.

Hab. On schistose rocks in upland districts.—*Distr.* Rare in N.W. England and the S. Grampians, Scotland.—*B. M.* Harris Moor, Whitehaven, Cumberland; Glen Lochay and Ben Lawers, Scotland.

Subsp. *irrubescens* A. J. Sm.—Thallus effuse, thin, scattered, tawny-yellow. Apothecia minute, becoming convex and immarginate, concolorous with the thallus.—*Lecidea erythrella* var. *rubescens* Schar. Lich. Helv. Spicil. p. 185 (1833) (non Ach.). *L. picta* Tayl. in Mackay Fl. Hib. ii. p. 130 (1836)? *Lecanora aurantiaca* subsp. *irrubescens* Nyl. in Flora lvii. p. 318 (1874): Cromb. in Grevillea xix. p. 60 & Monogr. i. p. 375.

The only British specimen (in Hb. Salwey) is similar to Anzi's specimen n. 135 in Lich. min. rar. Ital. on which Nylander based this subspecies. The thallus consists of minute scattered red scales. The specimen was wrongly named *Lecidea picta* Tayl. by Salwey (cf. *Placodium pyraccum* f. *pictum*).

Hab. On schistose rocks. — *B. M.* Near Barmouth, Merioneth.

18. Pl. *crenulatellum* A. L. Sm.—Thallus effuse, thin, unequal, cracked, at times almost obsolete, citrine-yellow (K + purple). Apothecia moderate in size, plane, with a thick proper margin, and finely crenulate thalline margin, concolorous with the thallus (K + purple): spores ellipsoid, 15–20 μ long, 5–9 μ thick.—*Lecanora crenulatella* Nyl. in Flora lxix. p. 461 (1886); Cromb. in Grevillea xviii. p. 45 (1889) & Monogr. i. p. 375.

Exsicc. Johns. n. 365.

Considered by Nylander as near to *Pl. aurantiacum* var. *flavovirescens*, but differs in the form of the apothecium (zeorine). It was originally collected at Arnside, Westmoreland, on quartzose rocks.

Hab. On rocks in maritime and inland districts.—*Distr.* Rare in N.W. England.—*B. M.* Cumberland (on limestone).

Thallus greyish-white (*K* + purple).

19. *Pl. cerinum* Hepp Flecht. Eur. n. 203 (1853).—Thallus thin, scurfy or granular, greyish-white, a bluish-black hypothallus sometimes visible (*Kf* + crimson). Apothecia numerous, often crowded, moderate in size or rather large, up to 2 mm. across, bright- or dull-yellow, with an entire persistent whitish thalline margin (*K* + crimson); paraphyses slender, knobby and septate and sometimes branched at the tips; spores generally small, subglobose to ellipsoid, 8–16 μ long, 5–9 μ thick, polarilocular, but the central tube indistinct.—*Lichen cerinus* Hedw. Laub-Moose ii. p. 77, t. 21, B (1788); Dicks. Pl. Crypt. fasc. iii. p. 14 (1793); With. Arr. ed. 3, iv. p. 24; Engl. Bot. t. 627. *Patellaria cerina* var. *cyanolepra* DC. Fl. Fr. ii. p. 360 (1805). *Lecanora cerina* Ach. Lich. Univ. p. 390 (1810); Hook. in Sm. Engl. Fl. v. p. 190; Tayl. in Mackay Fl. Hib. ii. p. 136; Cromb. Lich. Brit. p. 147 & Monogr. i. 380 (incl. ff. *cyanolepra* & *albiseda*); Leight. Lich. Fl. p. 220; ed. 3, p. 209 (incl. var. *fusca* & f. *cyanolepra*); ff. *cyanolepra* & *albiseda* Nyl. Lich. Scand. p. 144 (1861). *Rinodina cerina* S. F. Gray Nat. Arr. i. p. 456 (1821). *Calloporisma cerina* De Not. in Mem. Reale Acad. Sci. Torino ser. 2, x. p. 389 (1849); Mudd Man. p. 133; var. *fuscum* Massal. Sched. Crit. Lich. p. 130 (1855).

Exsicc. Cromb. n. 60; Johns. n. 34; Larb. Lich. Hb. nos. 21, 167; Leight. n. 83; Mudd n. 97.

A varied species as to the development of the thallus; it is sometimes almost evanescent, though the apothecial margin always persists. Occasionally the hypothallus is predominant (f. *cyanolepra*), so that the thallus is represented by a blackish stain, rarely it is almost white (f. *albiseda*), the apothecial margin also being white. A number of varieties have been recognized depending on colour changes in apothecia and thallus.

Hab. On the trunks of trees and on old palings, etc., in maritime, inland and upland districts.—*Distr.* General and fairly common throughout the British Isles.—*B. M.* Jersey; Guernsey; Sark; Tregawn. Withiel and Truro, Cornwall; Plymouth and Exeter, Devon; near Shanklin, I. of Wight; New Forest, Hants; Hassocks Gate and Lewes, Sussex; Maidstone, Kent; near Colchester, Ulting and Widdington, Essex; near Cirencester, Gloucestershire; Oswestry and near Shrewsbury, Shropshire; Anglesea; Cherry Hinton and near Quy, Cambridgeshire; Bilsdale, Yorkshire; Derwent Water and Gainford, Durham; Wansbeck, Northumberland; near Kendal, Westmoreland; Largs, Ayrshire; Blair Drummond and Craig Tulloch, Blair Athole, Perthshire; near Cork; Dunkerron and Killarney, Kerry; Adare, Limerick.

Var. *stilicidiorum* Hepp Flecht. Eur. n. 406 (1857).—Thallus very thin, leprose, greyish-white; hypothallus not visible. Apothecia rather small, the disc greyish, or dark olive-green and pruinose, the margin greyish-white, often flexuose.—*Lichen stilicidiorum* Hornem. in Fl. Dan. t. 1063, fig. 2 (1792). *L. chloroleucus* Sm. Engl. Bot. t. 1373 (1805). *Lecanora chloroleuca* Ach. Syn. Lich. p. 160 (1814); Hook. Fl. Scot. ii. p. 48 & in Sm. Engl. Fl. v. p. 190. *L. cerina* var. *stilicidiorum* Nyl. in Mem. Soc. Sci. Nat. Cherb. v. p. 112 (1857); Cromb. Lich. Brit. p. 47 & Monogr. i. p. 381; Leight. Lich. Fl. p. 221; ed. 3, p. 210. *Rinodina stilicidiorum* S. F. Gray Nat. Arr. i. p. 456 (1821). *Callopisma cerinum* var. *stilicidiorum* Massal. Monogr. Lich. Blast. p. 86 (1853); Mudd Man. p. 136.

Exsicc. Johns. n. 107.

Differs from the species in the habitat, the leprose thallus, colour of apothecia, etc.

Hab. Incrusting mosses on calcareous rocks in inland and upland situations.—*Distr.* Somewhat common in Great Britain, not recorded from Ireland.—*B. M.* Dartmoor, Devon; Dovedale, Derbyshire; Egglestone, Durham; Cunswick Scar, Westmoreland; near Stretton, Cumberland; Achosragan Hill, Appin, Argyll; Ben Lawers and Craig Tulloch, Perthshire; Craig Guie and Morrone, Braemar, Aberdeenshire.

Var. *chlorinum* Anzi Catal. Lich. Sondr. p. 41 (1860).—Thallus effuse, granular, areolate, dull dirty-green. Apothecia dull-orange, the margin greyish-white.—*Zeora cerina* var. *chlorina* Flot. in Uebers. Schles. Ges. Vat. Cult. p. 126 (1850). *Callopisma cerinum* var. *chlorinum* Mudd Man. p. 136 (1861). *Lecanora cerina* var. *chlorina* Leight. Lich. Fl. p. 221 (1871); ed. 3, p. 210; supsp. *chlorina* Lamy in Bull. Soc. Bot. Fr. xxv. p. 505 (1878); Cromb. in Grevillea xviii. p. 46 & Monogr. i. p. 381.

Exsicc. Johns. n. 192; Larb. Lich. Hb. n. 22.

Distinguished from the species by the thicker and darker thallus.

Hab. On shady rocks in upland situations.—*Distr.* Rare in N. England and W. Ireland.—*B. M.* Newton, Cleveland; Levens Park, Westmoreland; Chollerford, Northumberland; Lough Corrib, Galway.

Form *cyanopolium* A. L. Sm.—Thallus subleprose, thickish, coarsely areolate, dull-grey or bluish-grey. Apothecia moderate in size, the disc orange, the margin bluish-grey, flexuose, at length excluded.—*Lecanora cerina* f. *cyanopolia* Nyl. in Not. Sillsk. Faun. & Fl. Fenn. Förh. n. ser. v. p. 128 (1866); Leight. Lich. Fl. ed. 3, p. 211; Cromb. Monogr. i. p. 382.

Almost exactly similar to the variety, but with slight differences in thallus and apothecia.

Hab. On wet stones in upland districts.—*Distr.* Rare in N. England and W. Ireland.—*B. M.* Chollerford, Northumberland; between Lough Feagh and Lough Muck, Connemara, Galway.

20. *Pl. pyraceum* Anzi Anal. Lich. p. 10 (1858).—Thallus effuse, thin, granular-leprose or -areolate, greyish-white, with a whitish hypothallus, often disappearing (Kf + reddish). Apothecia numerous, generally very small, orange-yellow (K + crimson), with a thalline margin, becoming plane, with only the paler proper margin prominent; paraphyses clavate, sometimes branched and septate at the tips, the cells thick-walled; spores oblong-ellipsoid, 11–16 μ long, 5–7 μ thick. *Parmelia cerina* var. *pyracea* Ach. Meth. Lich. p. 176 (1803). *Lecanora pyracea* Nyl. in Not. Sällsk. Faun. & Fl. Fenn. Förh. n. ser. v. p. 129 (1866); Cromb. Lich. Brit. p. 47 pro parte & Monogr. i. p. 383; Leight. Lich. Fl. p. 221; ed. 3, p. 211 pro parte.

Esicc. Johns. n. 108; Leight. n. 118; Mudd n. 101.

Allied to *Pl. cerinum*, but differs in the more scanty thallus and smaller apothecia, which scarcely show a thalline margin. It is constantly associated with other crustaceous species, and may seem to have a thallus different from its own.

Hab. On rocks and stones, rarely (in our country) on trees in maritime and upland regions.—*Distr.* Here and there throughout the British Isles, probably often overlooked.—*B. M.* St. Merryn, Cornwall; near Bovey Tracey; near Ryde, I. of Wight; Hastings, the South Downs and Beeding Downs, Sussex; near Cirencester, Gloucestershire; Barmouth, Merioneth; near Newton, Ingleborough, Langbraugh and near Easby, Cleveland, Yorkshire; Wark-on-Tyne and Chollerford, Northumberland; Staveley near Kendal, Westmoreland; Ballachulish, Argyll; Ben Lawers, Perthshire; near Fort William, Invernessshire; Ballynahinch, Connemara, Galway; Westport, Mayo.

Form *submersum* A. L. Sm.—Thallus thin, dark, becoming coarsely areolate, otherwise resembling the species.—*Lecanora pyracea* f. *submersa* Nyl. in Flora lxviii. p. 43 (1885); Cromb. Monogr. i. p. 384. Specimen not seen.

Hab. On stones in streams.—*Distr.* Found only in W. Ireland (near Kylemore, Connemara, Galway).

Var. *pyrithromum* A. L. Sm.—Thallus paler, generally obsolete. Apothecia more convex, deep-yellow or rusty-red; spores oblong or broadly ellipsoid, 10–13 μ long, 4–10 μ thick.—*Lecidea rupestris* var. *pyrithroma* Ach. Lich. Univ. p. 206 (1810). *Lecanora pyracea* f. *pyrithroma* Nyl. in Bull. Soc. Bot. Fr. xiii. p. 367 (1866); Cromb. Lich. Brit. p. 47; var. *pyrithroma* Cromb. in Grevillea xviii. p. 46 (1889) & Monogr. i. p. 384 (non Leight.).

Esicc. Larb. Lich. Hb. n. 335 & Lich. Cantab. n. 25.

Differs chiefly in the absence of thallus and in the shorter, sometimes broader spores. It is generally mixed up with other lichens with the apothecia parasitic on their thallus.

Hab. On rocks, walls and flints in lowland and upland regions.—*Distr.* Rare from E. and N. England, the Grampians and N.E.

Scotland and W. Ireland.—*B. M.* Thetford Warren, Norfolk; Kildale, Cleveland, Yorkshire; Craig Tulloch, Blair Athole, Perthshire; Craig Guic, Braemar and Park, Aberdeenshire; Lough Inagh, Connemara, Galway.

f. *pictum* A. L. Sm.—Thallus thin, greyish, evanescent. Apothecia brightly yellow-pruinose, with a thickish reflexed proper margin.—*Lecidea picta* Tayl. in Mackay Fl. Hib. ii. p. 130 (1836). *Lecanora pyracea* var. *pyrithroma* Leight. Lich. Fl. p. 22 (1871) (non Ach.); ed. 3, p. 212; f. *picta* Cromb. in Grevillea xviii. p. 46 (1889) & Monogr. i. p. 384.

Esicc. Johns. n. 366; *Larb. Lich. Hb.* n. 55.

Distinguished by the bright-yellow pruina of the apothecia, which, however, tends to disappear in herbaria.

Hab. On schistose rocks in mountainous regions.—*Distr.* Rare in N. Wales, the Scottish Grampians and in W. Ireland.—*B. M.* Garth Road, Anglesea; Ben Lawers and Craig Calliach, Perthshire; Craig Mt., Kerry; Lettermore and Lough Inagh, Connemara, Galway.

Var. *lacteum* A. L. Sm.—Thallus thin, chalky-white. Apothecia small, orange-red, becoming convex.—*Callopisma luteoalbum* var. *lacteum* Massal. Sched. Crit. Lich. p. 133 (1855). *Lecanora pyracea* var. *lactea* Stizenb. Lich. Helv. p. 98 (1882); Cromb. Monogr. i. p. 384.

Esicc. Johns. n. 409.

Distinguished by the whitish thallus. The apothecia are congregate in small groups in our specimens.

Hab. On calcareous rocks in maritime districts.—*Distr.* Very rare in N.E. and N.W. England.—*B. M.* Hartlepool, Durham; Egremont, Cumberland.

Var. *holocarpum* Anzi l. c.—Thallus scanty, greyish, or obsolete. Apothecia crowded, orange-yellow; spores broadly ellipsoid, 10–14 μ long, 6–10 μ thick.—*Lichen holocarpus* Ehrh. *Esicc.* n. 284 (1793) nomen nudum; Ach. Lich. Suec. Prodr. p. 73 (1798). *Callopisma luteoalbum* var. *holocarpum* Mudd Man. p. 137 (1861) pro parte *Lecanora cerina* subsp. *holocarpa* Nyl. Lich. Scand. p. 145 (1861); *L. pyracea* subsp. *holocarpa* Cromb. Lich. Brit. p. 47 pro parte; var. *holocarpa* Leight. Lich. Fl. p. 222 (1871) pro parte; ed. 3, p. 211 pro parte.

Esicc. Johns. n. 35; *Larb. Lich. Hb.* n. 132.

Crombie and others hold that the grey thallus does not belong to the lichen; the apothecia in that case would be saprophytic on the timber, etc., or on other lichens.

Hab. On old timber, rarely on rocks, generally in upland situations.—*Distr.* Rather rare in N. England and in the Highlands of Scotland. *B. M.* Near Cambridge; near Loftus (saxicolous) and near Ayton, Cleveland, Yorkshire; Morpeth and Chollerford, Northumberland; Achmore, Killin, Perthshire; Rothiemurchus, Invernesshire.

21. *Pl. chalybæum* Naeg. ex Hepp Flecht. Eur. n. 204 (1853).—Thallus thickish, spreading, or tending towards a definite outline, closely adnate, deeply cracked-areolate, whitish or greyish-lead coloured, the outer areolations sometimes crenulate, generally limited by a black hypothallus (K + pale-violet). Apothecia small or moderate in size, immersed or adnate, plane, the disc black, dull-brown when moist, naked (or pruinose?), the thalline margin, when visible, entire, whitish (K + slightly pale-violet in section); paraphyses clavate, branched and septate upwards, brown at the tips; spores ellipsoid, 11–15 μ long, 6–8 μ thick, polarilocular.—Mudd Man. p. 134; Cromb. Lich. Brit. p. 46; Leight. Lich. Fl. p. 179; ed. 3, p. 165. *Parmelia chalybæa* Fr. Lich. Eur. p. 125 (1831). *Lecanora chalybæa* Schær. Enum. p. 60 (1850); Cromb. in Grevillea xviii. p. 46 (1889) & Monogr. i. p. 390.

Exsicc. Cromb. n. 59; Johns. n. 314.

Easily recognized by the colour and by the regular deep areolation of the limited thallus. There is only a very faint violet reaction in the apothecium with potash, but spores and paraphyses are characteristic of *Placodium*.

Hab. On calcareous rocks in maritime and hilly regions.—*Distr.* Rare in S.W. and N. England, N. Wales and the Grampians, Scotland.—*B. M.* Babbicombe, Devon; Llanymynech Hill, Shropshire; Great Orme's Head, Carnarvonshire; Penhill, Yorkshire; Burnhope, Weardale, Durham; Whitbarrow, Westmoreland; Craig Tulloch, Blair Athole, Perthshire.

22. *Pl. variable* Nyl. Lich. Scand. p. 138 (1861).—Thallus thinnish, determinate, limited by a black hypothallus, cracked-areolate, dark- or brownish-grey (K + pale-violet). Apothecia somewhat prominent, rather small, plane or convex, the disc brown or blackish, generally densely bluish-grey pruinose, the thalline margin prominent, entire, whitish; paraphyses subclavate, septate upwards; spores ellipsoid, 13–16 μ long, 7–10 μ thick (epithecium K + pale-violet).—Cromb. in Journ. Bot. viii. p. 97 (1870); Leight. Lich. Fl. p. 179; ed. 3, p. 165. *Lichen variabilis* Pers. in Ust. Ann. Bot. vii. p. 26 (1794). *Lecanora variabilis* Ach. Lich. Univ. p. 369 (1810); Cromb. Monogr. i. p. 391.

Closely allied to the preceding, of which it might be only a variety. It differs in the darker colour of the thallus, the superficial apothecia and the pruinose disc.

Hab. On calcareous rocks in hilly districts.—*Distr.* Rather rare in W. and Central England and in W. Ireland.—*B. M.* Bathampton Downs, Somerset; Ablington and Grove Lane, Cirencester, Gloucestershire; Buckingham; Ampthill, Bedfordshire; Llanymynech Hill Shropshire; Cuning Dale, Buxton, Derbyshire.

Var. *ecrustaceum* Nyl. tom. cit. p. 139. —Thallus immersed in the rock, scarcely visible. Apothecia small, subinnate, the

thalline margin thin, disappearing, otherwise like the species.—*Pl. Agardhianum* Hepp Flecht. Eur. n. 407 (1857) (non Ach.); Leight. Lich. Fl. ed. 3, p. 165. *Lecanora variabilis* var. *crustacea* Nyl. ex Cromb. in Grevillea xviii. p. 46 (1889) & Monogr. i. p. 391.

Esicc. Johns. n. 131.

Owing to the scanty development of the superficial thallus the apothecia are almost non-marginate. They are less covered with pruina than in the species, and are sometimes semi-immersed.

Hab. On calcareous rocks in maritime and upland districts.—*Distr.* Rare in S.W. and N.W. England and S. Wales.—*B. M.* Anstey's Cove, Torquay; Bathampton Downs, Somerset; Tenby, Pembrokeshire; Silverdale, Lancashire; Lamplugh, Cumberland.

Thallus greyish-white (K—).

23. *Pl. phæocarpellum* A. L. Sm.—Thallus effuse, thin, greyish-white, often evanescent (K—). Apothecia small, plane, with a thin proper margin, or convex, the disc brown or dark-brown (K + crimson becoming purple); paraphyses slender, branched upwards and septate at the tips; spores ellipsoid, 14–18 μ long, 6–11 μ thick.—*Lecanora phæocarpella* Nyl. in Flora lxiii. p. 388 (1880); Cromb. in Grevillea xix. p. 60 (1890) & Monogr. i. p. 378. *L. nigricans* Cromb. in Grevillea xviii. p. 45 (1889) (non Tuckerm.).

The colours of the apothecia distinguish this species from all others. The epithecium is crowded with small cells budded off from the paraphyses, and deeply suffused with brown lichen-acid, which becomes crimson with potash.

Hab. On the trunk of a tree in a mountainous region.—*B. M.* Craig Cluny, Braemar, Aberdeenshire.

24. *Pl. refellens* A. L. Sm.—Thallus thin, unequal, continuous or furfuraceous, greyish (K—). Apothecia small, plane, pale-reddish, with a thin thalline margin, somewhat pulverulent, at length disappearing (K—); paraphyses thickish, slightly clavate and septate upwards; spores distinctly polarilocular with central canal, ellipsoid, 9–11 μ long, 5–7 μ thick.—*Lecanora refellens* Nyl. in Flora lx. p. 458 (1877); Cromb. in Grevillea vi. p. 111 (1878) & Monogr. i. p. 389; Leight. Lich. Fl. ed. 3, p. 213.

Esicc. Larb. Lich. Hb. n. 24.

An abnormal species lacking the presence of parietin both in thallus and apothecia. It is possibly an impoverished development of *Pl. cerinum*.

Hab. On the trunks of poplars.—*B. M.* Cleghan, Connemara, Galway (the only locality).

25. *Pl. erythrocarpum* A. L. Sm. Thallus subdeterminate, crustaceous, thin, furfuraceous, granular and areolate or some-

times imperfectly lobed or crenate at the circumference, bluish-grey or greyish-white (K -). Apothecia plane, round or irregular in form, orange- or tawny-red (K + deep purple), the thalline margin thickish, sometimes flexuose; spores broadly ellipsoid, 12-16 μ long, 8-9 μ thick.—*Lichen arenarius* Pers. in Ust. Ann. Bot. vii. p. 27 (1794) (non Retz.); Dicks. Pl. Crypt. fasc. iv. p. 23, t. 12, fig. 2. *L. cæsiorufus* Sm. Engl. Bot. n. 1040 (1802) (non Schrad.). *Patellaria erythrocarpa* Pers. in Ann. Wett. Ges. ii. p. 12 (1810). *Lecidea erythrocarpia* Ach. Lich. Univ. p. 205 (1810). *Lecanora teicholyta* Ach. tom. cit. p. 425; Cromb. in Grevillea xviii. p. 45 (1889) & Monogr. i. p. 365. *L. rubricosa* Ach. Syn. p. 162 (1814) pro parte. *Lecanora arenaria* Cromb. Lich. Brit. p. 46 (1870); Leight. Lich. Fl. p. 233; ed. 3, p. 212. *Rinodina rubricosa* S. F. Gray Nat. Arr. i. p. 452 (1821). *Callopisma arenarium* Mudd Man. p. 138 (1861).

Exsicc. Larb. Lich. Hb. n. 96.

Distinguished by the thick furfuraceous thallus and by the habitat. Often confused with *Pl. cæsiorufum*, but differs, among other characters, in the absence of thalline reaction with potash.

Hab. On sandstone rocks and walls, rarely on bricks in maritime and inland districts.—*Distr.* Rather rare in the Channel Islands, S.E. and W. England and in S. Wales.—*B. M.* Jersey; I. of Wight; Shoreham, Fairlight near Hastings, Pulborough and Midhurst. Sussex; near Hereford; near Monmouth; near Lyndstep. Pembroke-shire; Bury St. Edmund's, Suffolk; Strumpshaw, Norfolk; Wisbech and Waterbeach, Cambridgeshire.

Thallus whitish; reaction with potash various.

26. *Pl. Lallavei* Oliv. Lich. Eur. p. 99 (1909).—Thallus determinate, thickish, smooth, tartareous, cracked-areolate, chalky-white (K -). Apothecia subinnate, with a thin thalline margin, becoming immarginate, bright-rusty or blood-red (K + dark crimson); spores ellipsoid-oblong, 8-12 μ long, 4-7 μ thick.—*Lecidea Lallavei* Clem. Ensayo, p. 295 (1807). *Lecanora Lallavei* Nyl. in Mém. Soc. Sci. Nat. Cherb. v. p. 112 (1857); Cromb. Lich. Brit. p. 46 & Monogr. i. p. 366; Leight. Lich. Fl. p. 223; ed. 3, p. 212 pro parte.

Allied to the preceding species, but differs in the structure of the thallus, innate apothecia and smaller spores.

Hab. On calcareous rocks and walls in maritime districts.—*Distr.* Rare in S.W. and S. England and S.E. Ireland.—*B. M.* I. of Wight; Lower Glanmire Road, Cork.

27. *Pl. albolutescens* A. L. Sm.—Thallus thin and furfuraceous, or thickish and areolate, whitish, or evanescent (K -). Apothecia moderate in size or small, dark-orange, with a paler prominent persistent proper margin (K + crimson); paraphyses branched and thickly septate towards the tips; spores broadly

ellipsoid, 15–18 μ long, 7–10 μ thick.—*Lecanora albolutescens* Nyl. in Flora lxiv. p. 177 (1881); Cromb. in Grevillea x. p. 22 (1881) & Monogr. i. p. 379.

Ersicc. Johns. nos. 129, 130 (as form *ecrustacea*).

The apothecia are sometimes large and irregular in form; they are sublecanorine, gonidia being present below the hypothecium. The thallus also sometimes spreads upwards round the outside. The spores vary in form, the polar loculi may be fairly small, or very large, with the median septum correspondingly thin.

Hab. On granitic rocks in upland regions.—*Distr.* Very sparingly in N. England.—*B. M.* Tyneside, Bywell, Northumberland; Scalegill, Cumberland.

28. *Pl. nivale* Tuckerm. Syn. N. Amer. Lich. i. p. 176 (1882).—Thallus effuse, minutely granular, whitish or greyish (K + purplish). Apothecia small, adnate, at first plane with entire proper margin, becoming convex, orange-coloured or brownish (K + crimson); paraphyses septate at the tips; spores oblong-fusiform, simple, becoming septate, 24–38 μ long, 5–7 μ thick.—*Zeora nivalis* Koerb. in Denkschr. Schles. Ges. Vat. Kult. p. 231, fig. 2 (1853). *Lecanora nivalis* Carroll in Journ. Bot. iii. p. 288 (1865); Cromb. Lich. Brit. p. 48 & Monogr. i. p. 388; Leight. Lich. Fl. p. 226; ed. 3, p. 217. *Lecanora fuscoluteolina* Mudd Man. p. 153 (1861).

Generally described as having a thin thalline margin, but that is scarcely visible at any stage; in sections there is a strong band of gonidia abutting on the lower part of the proper margin. In some of the spores there is a distinct thickening of the median septum, which, combined with the presence of parietin, places it in this genus. The apothecia are numerous and crowded.

Hab. On decayed mosses on rocks and boulders in alpine localities.—*Distr.* Sparingly among the S. Grampians, Scotland.—*B. M.* Ben Lawers and Ben Cruachan, Perthshire.

Thallus dark-coloured; *reaction* with potash various.

29. *Pl. hæmatites* A. L. Sm.—Thallus subeffuse or determinate, continuous and wrinkled, or areolate, dark-grey, with a bluish hypothallus (K + crimson). Apothecia moderate or small, the disc rusty-red, the thalline margin greyish-white, persistent; paraphyses slender, rarely branched and septate upwards; spores oblong- or broadly-ellipsoid, 12–18 μ long, 6–11 μ thick.—*Lecanora hæmatites* Chaub. in St. Amans Flor. Agen. p. 492 (1821); Leight. Lich. Fl. ed. 3, p. 212. *L. cerina* subsp. *hæmatites* Nyl. in Mém. Soc. Sci. Nat. Cherb. v. p. 112 (1857); Cromb. Monogr. i. p. 382.

Ersicc. Lerb. Lich. Hb. n. 56 & Cantab. n. 22.

Distinct not only in the colour of thallus and apothecia, but in the habitat. The apothecia are generally crowded; the spore loculi are very small.

Hab. On smooth bark.—*Distr.* Rare in S.E. and W. England.—*B. M.* Ilsham, Torquay; Cherry Hinton and Bottisham, Cambridgeshire; near Worcester.

30. *Pl. cæsiorufum* A. L. Sm.—Thallus crustaceous, thickish, cracked-areolate, light- or dark-grey (Kf + purplish). Apothecia moderate in size, often crowded, becoming plane, rusty-red (K + purple), the proper margin prominent, lighter-coloured, often flexuose and subcrenulate; paraphyses rather stout and the hypothecium dense, with a layer of gonidia beneath; spores ellipsoid, 14–17 μ long, 7–9 μ thick.—*Lichen cæsiorufus* Ach. *Lich. Suec. Prodr.* p. 45 (1798). *Lecidea cæsiorufa* Ach. *Meth. Lich.* p. 71 (1803); S. F. Gray *Nat. Arr. i.* p. 478 (?). *Lecanora cæsiorufa* Nyl. in *Flora lxiii.* p. 388 (1880); *Cromb. in Journ. Bot. xx.* p. 273 (1882) & *Monogr. i.* p. 378.

Esicc. Johns. n. 323 (as var. *grandis*).

Somewhat similar to *Pl. ferrugineum* in appearance, but differing in the structure of the hypothecium, which is of small-celled somewhat obscure plectenchyma and with an underlayer of gonidia. The thallus is generally rather thick and dark-coloured.

Hab. On siliceous rocks in maritime and inland districts.—*Distr.* Rare throughout the British Isles, perhaps not often identified.—*B. M.* La Moye, Jersey; Chateau Point, Sark; The Lizard, Cornwall; near Malvern, Worcestershire; Chollerford, Northumberland; St. Bees and near Penrith, Cumberland; Ayton, Cleveland, Yorkshire; Renwick, Kirkcudbrightshire; near Edinburgh; I. of Lismore, Argyll; Kilkee, Clare; Achil Island, Mayo.

31. *Pl. fuscoatrum* A. L. Sm.—Thallus effuse, blackish, cracked-areolate (K + purple). Apothecia very small, dark rusty-red, with a distinct entire thalline margin; paraphyses slender, branched, septate and capitate at the tips; spores ellipsoid, 12–15 μ long, 6–9 μ thick.—*Biatora ferruginea* var. *fuscoatra* Bayrh. *Uebers.* p. 82 (1849). *Lecanora ferruginea* var. *fuscoatra* *Cromb. Lich. Brit.* p. 47 (1870); *Leight. Lich. Fl.* p. 220; ed. 3, p. 209. *L. fuscoatra* Nyl. in *Bull. Soc. Linn. Norm. sér. 2, vi.* p. 260 (1872); *Cromb. Monogr. i.* p. 377.

A rare lichen, but well distinguished by the dark thallus and the structure of the apothecium.

Hab. On schistose rocks.—*Distr.* Rare in N.W. England, S.W. Highlands and N.E. Scotland.—*B. M.* North of Douglas, I. of Man; Barcaldine, Argyll.

32. *Pl. concilians* A. L. Sm.—Thallus subeffuse, thickish, coarsely areolate, dark-grey or blackish (K -). Apothecia moderate in size, with a thalline margin, becoming plane or convex, and the margin disappearing, brownish black when dry, dark rusty-red when moist (K + dark-purplish); paraphyses branched and septate at the tips, forming a dense epithecium; spores ellipsoid, 12–17 μ long, 6–9 μ thick.—*Lecanora ferruginea*

f. *concilians* Nyl. Lich. Scand. p. 143 (1861); var. *concilians* Cromb. in Journ. Bot. viii. p. 97 (1870); Leight. Lich. Fl. p. 220; ed. 3, p. 209. *Lecanora diphyodes* Cromb. in Journ. Bot. xi. p. 133 (1873) (non Nyl.); Leight. Lich. Fl. ed. 3, p. 213. *L. concilians* Nyl. in Flora lxiii. p. 388 (1880); Cromb. Monogr. i. p. 377.

Distinguished by the very dark thallus and apothecia. Gonidia are abundant beneath the hypothecium and in the margin of the apothecium.

Hab. On schistose rocks in a maritime region.—*B. M.* Near Portlethen. Kincardineshire.

§ iii. *BLASTENIA* Stizenb. in St. Gall. Ber. Nat. Ges. iii. p. 171 (1862) pro parte; *Blastenia* Massal. in Flora xxxv. p. 573 (1852) (as genus).

Thallus crustaceous: apothecia without a thalline margin; spores polarilocular except in *Pl. rupestre*.

Thallus yellowish (K + purple).

33. *Pl. ochraceum* Anzi Catal. Lich. Sondr. p. 44 (1860).—Thallus determinate, thinly felted, continuous, ochraceous-yellow (K + crimson). Apothecia small, sessile, concave then plane, tawny-saffron or orange-yellow, the proper (?) margin ochraceous, thin, prominent; spores variable, ellipsoid or elongate, 1-septate, usually polarilocular, 12–15 μ long, 5–7 μ thick.—*Lecidea ochracea* Schær. in Nat. Anz. 1818, p. 11. *L. icterica* Tayl. in Lond. Journ. Bot. vi. p. 150 (1847) fide Leighton. *Callopisma ochraceum* Massal. Monogr. Lich. Blast. p. 89 (1853); Mudd Man. p. 138, t. 2, fig. 43 (1861). *Lecanora ochracea* Nyl. ex Cromb. Lich. Brit. p. 46 (1870) & Monogr. i. p. 375; Leight. Lich. Fl. p. 218; ed. 3, p. 208.

The margin of the apothecium is practically without algæ, so that it is more biatorine than lecanorine. Apt to be confused with the following species.

Hab. On calcareous rocks in maritime and inland districts.—*Distr.* Rare in S.W. England, S. Wales, S.W. Highlands of Scotland and possibly from S.W. Ireland.—*B. M.* Hope Cove, near Kingsbridge, Devon; I. of Lismore, Argyll.

34. *Pl. tetrastichum* A. L. Sm.—Thallus subdeterminate, thinly felted, continuous, rarely areolate, ochraceous-yellow or yellowish-grey (K + crimson). Apothecia small, sessile, concave then plane, tawny-saffron or orange-yellow, the proper (?) margin lighter in colour, prominent (K + purplish); spores broadly ellipsoid or oblong, 1-septate, polarilocular, the cell-contents massed in the polar loculi, and drawn out in a wide tube almost to the septum, or broken up into four portions, 14–20 μ long, 6–10 μ thick.—*Lecanora tetrasticha* Nyl. in Flora lvii. p. 307 (1874); Cromb.

in Journ. Bot. xiv. p. 360 (1876) & Monogr. i. p. 389; Leight. Lich. Fl. ed. 3, p. 224.

Closely allied to the preceding, of which it may only be a form, but with larger, peculiarly developing spores. They are, however, truly polarilocular, and careful examination has failed to establish the 4-celled condition. Considered by Nylander to be related to *Lecanora Brebissonii*, a S. American plant.

Hab. On calcareous rocks in maritime and inland situations.—*Distr.* Rare throughout England and S.W. Highlands of Scotland. *B. M.* Near Plymouth, Chudleigh, Ilsham and above Anstey's Cove, Devon; Cuning Dale, Buxton and near Bonsall, Derbyshire; Malham Tarn, Yorkshire; Levens, Westmoreland; I. of Lismore, Argyll.

35. *Pl. vitellinum* A. L. Sm.—Thallus effuse, thin, sometimes faintly areolate, yellowish (Kf + purplish). Apothecia very small, numerous, orange-yellow (K + crimson), the proper margin prominent or at length excluded; spores oblong-ellipsoid, small, 9–12 μ long, 4–6 μ thick.—*Lecanora vitellinula* Nyl. in Flora xlv. p. 305 (1863); Cromb. in Journ. Bot. xx. p. 273 (1882) & Monogr. i. p. 385.

Distinguished by the colour of the thallus and by the small spores. The paraphyses are slender, but often two or more large cells are separated off at the tips.

Hab. On calcareous rocks in maritime and hilly districts.—*Distr.* Rather rare, but widely distributed throughout the British Isles.—*B. M.* Noirmont, Jersey; Sidmouth, Devon; Yatton, Somerset; Beethwaite, Westmoreland; Overend, Egremont, Cumberland; Lismore, Argyll; Carrigunnel, Limerick.

Thallus greyish-white; reaction with potash various.

36. *Pl. ferrugineum* Hepp Flecht. Eur. n. 400 (1857).—Thallus effuse, very thin or thickish, and unequal or areolate, greyish or whitish, sometimes evanescent (K + purplish). Apothecia small or moderate in size, plane, becoming convex, bright rusty-red (K + purple), the proper margin thin, rather lighter in colour, prominent, sometimes flexuose; paraphyses septate and branched upwards, and capitate; spores broadly ellipsoid, 11–16 μ long, 6–11 μ thick.—*Lichenoides leprosum, tuberculis fuscis et ferrugineis* Dill. Hist. Musc. p. 126, t. 18, fig. 4 (1741) pro parte. *Lichen ferrugineus* Huds. Fl. Angl. p. 444 (1762); Engl. Bot. t. 1650. *L. vernalis* Lightf. Fl. Scot. ii. p. 805 pro parte. *Lecanora ferruginea* Nyl. in Act. Soc. Linn. Bord. sér. 3, i. p. 322 (1856); Cromb. Lich. Brit. p. 46 (corticulous) & Monogr. i. p. 376; Leight. Lich. Fl. p. 219; ed. 3, p. 208 (corticulous). *Callospisma ferrugineum* Mudd Man. p. 139 (1861).

Esicc. Bohl. n. 108; Larb. Lich. Hb. n. 95.

The thallus is variable, but the species is well distinguished by the persistent rusty-red colour of the apothecia. Occasionally the thallus

grows up around the apothecia, so that they almost appear to have a thalline margin.

Hab. On trunks of trees in maritime and inland districts.—*Distr.* General in wooded districts of most parts of the British Isles.—*B. M.* Guernsey; Boconnoc, Cornwall; near Plymouth, Devon; New Forest, Hants; Shanklin and near Ryde, I. of Wight; Hurst, St. Leonard's Forest, Lewes, Brighton, Shoreham, Newhaven, Haywards Heath, Wakehurst and Denny, Sussex; Epping Forest, Widdington, Langford, Stansted and Mountfitchet, Essex; Cirencester, Gloucestershire; Oswestry, Shropshire; Barmouth, Merioneth; Trefriw, Carnarvonshire; Anglesea; Cleveland, Yorkshire; Teesdale, Durham; Levens and Windermere, Westmoreland; Largs, Ayrshire; near Stirling; Finlarig, Kenmore and Aberfeldy, Perthshire; Cork; Kenmare and Glenmore Lake, Kerry; Kylemore, Connemara.

Var. festivum A. L. Sm. —Thallus thin, continuous or areolate, light- or dark-grey, often evanescent. Apothecia small, often convex, the proper margin becoming flexuose and crenulate or disappearing.—*Lichen crenularius* With. Arr. ed. 3, iv. p. 405 (errore *L. crenulatus*, p. 22) pro parte. *Lecidea cæsiio-rufa* var. *festiva* Ach. Syn. Lich. p. 44 (1814). *Lecanora ferruginea* var. *festiva* Nyl. Lich. Scand. p. 143 (1861); var. *crenularia* & f. *festiva* Cromb. Lich. Brit. p. 47 (1870); ff. *savicola*, *festiva* Leight. Lich. Fl. pp. 219, 220 (1871); ed. 3, pp. 208, 209. *Callopisma ferrugineum* var. *festivum* Mudd Man. p. 139 (1861).

Exsicc. Johns. nos. 104, 312; Larb. Lich. Hb. n. 165; Leight. n. 85; Mudd n. 102.

Differs chiefly in habitat from the species. The thallus gives very little reaction with potash, and when dark-grey gives none at all. The apothecia may be scattered or very crowded. Withering's name *L. crenularius* refers to a plant on trees as well as rocks.

Hab. On rocks, chiefly siliceous, in maritime and upland districts.—*Distr.* Somewhat general throughout the British Isles.—*B. M.* Jersey; Alderney; Sark; St. Austell, St. Minver and near Penzance, Cornwall; Kingsbridge and Torquay, Devon; Beeding, Sussex; Haughmond Hill, Shropshire; Llandyssil, Cardiganshire; Aberdovey, Merioneth; Holyhead Mt., Anglesea, Bettws-y-Coed, Carnarvonshire; Malvern, Worcestershire; near Roseberry, Cleveland, Yorkshire; Egglestone and Teesdale, Durham; Chollerford, Northumberland; Whitehaven and St. Bees, Cumberland; Barcaldine, Argyll; The Trossachs, Perthshire; Lundie Craigs and West Water, Forfarshire; Portlethen, Kincardineshire; near Ballater, Aberdeenshire; near Inniscarra, Cork; Saltees, Wexford; Kilkee, Clare; Kylemore, Galway; Clare Island and Achill, Mayo; Glenarm, Antrim.

Form ferruginascens A. L. Sm. Thallus effuse, whitish, thin or evanescent. Apothecia very small, plane and with a proper margin, becoming convex, tawny-ferruginous (K + purple); spores as in the species.—*Lecanora ferruginascens* Nyl. in Bull. Soc. Linn. Norm. sér. 2, vi. p. 260 (1872); Cromb. in Grevillea xviii. p. 45 (1889) & Monogr. i. p. 377.

Exsicc. Johns. n. 105.

Though made a species by Nylander, it is very closely related to var. *festivum*. The spores of our specimens are very distinctly polarilocular and measure about $15\ \mu$ long and $7\ \mu$ thick. As in the variety the thallus gives little or no reaction with potash.

Hab. On schistose rocks in an upland situation.—*B. M.* Near Kendal, Westmoreland.

37. *Pl. cerinellum* A. L. Sm.—Thallus thin, sordid-greyish, scarcely visible (K + yellowish). Apothecia minute, subbiatorine, bright-yellow (K + purplish): spores 8, 12 or 16 in the ascus, ellipsoid, polarilocular, small, $9\text{--}12\ \mu$ long, $5\text{--}6\ \mu$ thick.—*Lecanora cerinella* Nyl. in Bull. Soc. Bot. Fr. xiii. p. 370 (1866) & in Bull. Soc. Linn. Norm. sér. 2, vi. p. 260 (1872); Cromb. in Journ. Bot. xx. p. 273 (1882) & Monogr. i. p. 382. Specimen not seen.

Described by Nylander as resembling a minute *Pl. cerinum*, but it differs in the number of spores in the ascus. It has been frequently recorded on the Continent.

On branches of trees in lowland districts.—*Distr.* E. England, near Cambridge.

38. *Pl. luteoalbum* Hepp Flecht. Eur. n. 202 (1853).—Thallus effuse, thin, furfuraceous, greyish-white, sometimes evanescent (K +). Apothecia generally numerous and crowded, small, at first innate, then superficial and plane, with a thin paler proper margin, becoming convex, deep orange-yellow (K + crimson); hymenium rather narrow; paraphyses slender, septate and rather swollen at the tips, sometimes distinctly capitate; spores ellipsoid, small, the polar loculi very distinct, but the median septum thin, $9\text{--}11\ \mu$ long, $4\text{--}5\ \mu$ thick.—*Lichen luteoalbus* Turn. in Trans. Linn. Soc. vii. p. 92, t. 8, fig. 3 (1804); Engl. Bot. t. 1426. *Patellaria ulmicola* DC. Fl. Fr. ii. p. 358 (1805). *Lecidea luteoalba* Ach. Lich. Univ. p. 207 (1810); S. F. Gray Nat. Arr. i. p. 475; Hook. Fl. Scot. ii. p. 40. *L. ulmicola* Borr. ex Hook. in Sm. Engl. Fl. v. p. 185 (1833). *Calloposma luteoalbum* Massal. Monogr. Lich. Blast. p. 80 (1853); Mudd Man. p. 136. *Lecanora pyracea* var. *ulmicola* Leight. Lich. Fl. p. 222 (1871); ed. 3, p. 211. *L. luteoalba* Nyl. ex Lamy in Bull. Soc. Bot. Fr. xxv. p. 398 (1878); Cromb. Monogr. i. p. 385.

Exsicc. Bohl. n. 76; Cromb. n. 61; Larb. Lich. Hb. n. 168 & Cantab. n. 19; Leight. n. 84; Mudd n. 98.

Often associated with *Pl. pyracea*, but differing in the deeper colour of the apothecia and in the spore characters. Gonidia are present in a broad band below the hypothecium, but not in the margin.

Hab. On trees, chiefly elm, and on old wood.—*Distr.* Fairly general throughout the British Isles.—*B. M.* Near Ventnor and near Shanklin, I. of Wight; Lewes, Glynde, Washington, Danny Park and Woodmancote, Sussex; Eynsford, Kent; near Mill Hill, Middlesex; Elstree, Herts; Stowe Park, Bucks; Windsor Great Park, Berks; Epping Forest, Stansted Mountfitchet and Great Waltham, Essex;

Bedfordshire; near Cirencester, Gloucestershire; near Worcester and North Malvern, Worcestershire; Wimpole Park and Madingley, Cambridgeshire; Twycross, Leicestershire; near Masham, Yorkshire; Levens Bridge, Westmoreland; Meldon Park, Wansbeck Valley, Northumberland; Doune Castle, Stirlingshire; Pitfour, Aberdeenshire; Rostellan, Cork; Innisfallen, Killarney, Kerry; Castle Connell, Limerick.

Form rupestre A. L. Sm.—Thallus whitish, greyish or obsolete, generally in scattered granules. Apothecia minute, scattered or crowded.—*Lecidea ulmicola* Tayl. in Mackay Fl. Hib. ii. p. 129 (1836). *Lecanora cerina* subsp. *pyracea* f. *rupestris* Nyl. Lich. Scand. p. 145 (1861). *L. luteoalba* f. *rupestris* Cromb. Monogr. i. p. 386 (1894).

Esicc. Johns. n. 313; Leight. n. 213; Mudd n. 146.

The structure of the apothecium, spores, etc., is similar to that of the species; it differs chiefly in the habitat which has influenced the appearance of the thallus. It is synonymous with f. *calcicola* Arn.

Hab. On limestone, mortar or arenaceous stones mostly in upland districts.—*Distr.* Rare in S. and N. England and S.W. Ireland.—*B. M.* Newton Abbot, Devon; Ingleby, Cleveland, Yorkshire; Bolam, Durham; Dunkerron, Kerry.

39. **Pl. rupestre** Branth & Rostr. in Bot. Tidskr. iii. p. 206 (1869).—Thallus thin, determinate, cracked-areolate, dirty-whitish or greyish (K -). Apothecia adnate, small or moderate in size, plane or convex, not marginate, yellowish- or dull-red (K + purple); paraphyses slender, swollen and septate at the tips, conglutinate; spores ellipsoid or ovoid, simple, 9-15 μ long, 5-8 μ thick.—*Lichen rupestris* Scop. Fl. Carn. ed. 2, ii. p. 363 (1772); Engl. Bot. t. 2245. *L. viridiflavescens* Wulf. in Jacq. Coll. iii. p. 101, t. 2, fig. 1 (1789). *Verrucaria rufescens* Hoffm. Pl. Lich. i. p. 80, t. 17, fig. 1 (1790). *Lecidea rupestris* var. *irrubata* Ach. Lich. Univ. p. 206 (1810); var. *viridiflavescens* Mudd Man. p. 194 (1861). *L. irrubata* Ach. Syn. Lich. p. 40 (1814); Hook. in Sm. Engl. Fl. v. p. 183; Tayl. in Mackay Fl. Hib. ii. p. 128. *Lecanora calva* var. *irrubata* Cromb. Lich. Brit. p. 47 (1870). *L. rupestris* Leight. Lich. Fl. p. 190 (1871) (incl. f. *rufescens* and f. *viridiflavescens*); ed. 3, p. 204. *L. irrubata* Nyl. ex Norrl. in Medd. Sällsk. Faun. & Fl. Fenn. i. p. 22 (1876); Cromb. Monogr. i. p. 387.

Esicc. Johns. nos. 194, 268 (?), 410; Larb. Lich. Hb. n. 100; Leight. n. 119; Mudd n. 161.

Generally classified under *Lecidea* Sect. *Biatora*, on account of the simple spores, but belongs to *Placodium* (Sect. *Blastenia*), not only on account of the spermogones, which have septate sterigmata and pleurogenous spermatia, but also the presence of parietin, the lichen acid which is present only in lichens of this order. It can easily be recognized and placed by the reaction with potash. The apothecia becomes a darker red with age (f. *rufescens*), and the spores have generally thickened walls, though rarely any indication of central

septation. Johnson's *Ersicc.* n. 268, seems to belong here, but our specimen is imperfectly developed.

Hab. On calcareous rocks, mortar, sandstones, etc., in maritime and inland localities.—*Distr.* Not uncommon throughout Great Britain and Ireland.—*B. M.* Near Penzance, Cornwall; Anstey's Cove, Torquay and Cornworthy, Devon; Beachy Head, Duncton and Beeding Downs, Sussex; Shiere, Surrey; Windsor Great Park, Berks; Bathampton Downs, Somerset; Norton, near Worcester; Llanymynech and Whitcliff Rocks, near Ludlow, Shropshire; Bilsdale and near Carlton, Cleveland, Yorkshire; Beamish, Durham; Leven's Park, Westmoreland; Chollerford, Northumberland; Appin, Argyll; Craig Tulloch, Perthshire; Kirkland, Fife; Killarney, Kerry; Ben Bulbin, Sligo; near Kylemore, Connemara, Galway; Mallaranny, Achill Sound and Clare Island, Mayo.

Var. *calvum* A. L. Sm.—Thallus effuse or determinate, thickish or immersed in the stone, whitish. Apothecia small or moderate in size, subimmersed in the thallus or in the rock, reddish-yellow (K + purple); paraphyses thickish.—*Lichen calvus* Dicks. Pl. Crypt. fasc. ii. p. 18, t. 6, fig. 4 (1790); With. Arr. ed. 3, iv. p. 14; Engl. Bot. t. 948. *Lecidea rupestris* Ach. Lich. Univ. p. 206 (1810); S. F. Gray Nat. Arr. i. p. 472; Hook. Fl. Scot. ii. p. 39 & in Sm. Engl. Fl. v. p. 183; Tayl. in Mackay Fl. Hib. ii. p. 128; Mudd Man. p. 193. *Lecanora calva* Nyl. Lich. Scand. p. 147 (1861); Cromb. Lich. Brit. p. 47. *Lecanora rupestris* f. *calva* Leight. Lich. Fl. p. 191; ed. 3, p. 203; Cromb. in Grevillea xii. p. 58. *Lecanora irrubata* subsp. *calva* Lamy in Bull. Soc. Bot. Fr. xxx. p. 378 (1883); Cromb. Monogr. i. p. 387.

Ersicc. Bohl. n. 73 (drawing only); Johns. n. 195.

Differs from the species in the thallus, which is not areolate, and in the apothecia immersed at the base and leaving pits in the rock (foveolate). They are generally larger than in the species.

Hab. On calcareous rocks, rarely on flints in maritime and mountainous districts.—*Distr.* More restricted than the species though common where it occurs in Great Britain, not seen from Ireland.—*B. M.* I. of Wight; Peasemars, near Lewes and Beeding Downs, Sussex; Lydd Beach, Kent; Reigate, Surrey; Compton Bishop, Somerset; Craig-y-Rhiw, Oswestry, Shropshire; Llangollen, Denbighshire; Anglesea; Egglestone, Durham; Leven's Park, Westmoreland; Bywell, Northumberland; King's Park, Edinburgh; Achosragan Hill, Appin and near Ben Cruachan, Argyll; Craig Tulloch, Perthshire; Craig Guie and Morrone, Braemar, Aberdeenshire.

Form *incrustans* A. L. Sm.—Thallus thin, white, mostly immersed in the rock. Apothecia small, plane or slightly convex, immersed.—*Patellaria incrustans* DC. Fl. Fr. ii. p. 361 (1805). *Lecidea rupestris* var. *incrustans* Schær. Lich. Helv. Spicil. p. 181 (1833); Mudd Man. p. 194. *Lecanora rupestris* f. *incrustans* Leight. Lich. Fl. p. 191 (1871); ed. 3, p. 203. *L. irrubata* subsp. *calva* f. *incrustans* Cromb. in Grevillea xviii. p. 46 (1889) & Monogr. i. p. 388.

Differs from the variety only in the somewhat smaller apothecia, which sometimes remain entirely immersed (foveolate), though other fruits in the specimen become prominent.

Hab. On calcareous rocks in maritime and inland regions.—*Distr.* Rare in S.W. England, the Grampians and W. Scotland.—*B. M.* Bathampton Downs, Somerset; Lismore, Argyll.

Subsp. *Siebenhaarianum* A. L. Sm.—Thallus effuse, thickish, in small patches, cracked-areolate or of scattered granules. Apothecia rather large, adnate, convex, at first orange-coloured becoming dark-olive or blackish; hypothecium yellowish-brown; spores as in the species.—*Biatora Siebenhaariana* Koerb. Syst. Lich. Germ. p. 207 (1855). *Lecanora irrubata* subsp. *Siebenhaariana* Cromb. in Journ. Bot. xxiii. p. 195 (1885) & Monogr. i. p. 388.

An alpine lichen, distinguished by the dark apothecia. Th. Fries (Lich. Scand. p. 425) says that the hypothecium is in young stages violet-rose in colour, becoming more and more brown. I have been unable to verify that on our specimens; the hypothecium is some shade of yellow in the younger fruits.

Hab. On mica-schist rocks.—*Distr.* Rare in the S. Grampians, Scotland.—*B. M.* Summits of Ben Lawers and Craig Calliach, Perthshire.

Thallus blackish; reaction with potash, crimson-purple or none.

40. *Pl. atroflavum* A. L. Sm.—Thallus effuse or determinate, blackish, very thin or with small raised smooth warts on a black hypothallus (K -). Apothecia small, plane, becoming convex, shining, reddish-yellow, the proper margin rather lighter coloured (K + crimson): paraphyses slightly thicker and branched and septate at the tips; spores ellipsoid, 9-11 μ long, 5-6 μ thick.—*Lecidea atroflava* Turn. in Trans. Linn. Soc. ix. p. 142, t. 11, fig. 2 (1808); Hook. in Sm. Engl. Fl. v. p. 185. *Lichen atroflavus* Sm. Engl. Bot. t. 2009 (1809). *Lecanora scotoplaca* Nyl. in Flora lix. p. 232 (1876). *L. ferruginea* f. *scotoplaca* Leight. Lich. Fl. ed. 3, p. 209 (1879). *L. atroflava* Nyl. ex Zwackh Lich. Heidelb. p. 83 (1883); Cromb. Monogr. i. p. 379.

Distinguished by the very dark thin smooth thallus, which is however sometimes obsolete. The apothecia are sometimes very crowded, suggesting *Pl. pyraccum* var. *holocarpum*.

Hab. On siliceous rocks, usually exposed flints, mostly in maritime regions.—*Distr.* Local and scarce in S. and E. England, N. Wales and N.W. Ireland.—*B. M.* Ryde, I. of Wight; Beachy Head and the Downs, Sussex; Lydd Beach, Kent; Barmouth, Merioneth; Kylemore, Connemara, Galway.

41. *Pl. Turnerianum* A. L. Sm.—Thallus thin or thickish, warted or areolate, dark-grey or blackish (Kf + purplish in thin

section). Apothecia small or moderate in size, with a proper margin, flexuose in the larger apothecia, orange-reddish or brown. the margin lighter in colour (K + crimson); paraphyses slender. branched and septate at the tips; spores broadly ellipsoid, 11–16 μ long, 7–10 μ thick.—*Lecidea Turneriana* Ach. Lich. Univ. p. 206 (1810). *Lecanora Turneriana* Nyl. ex Cromb. in Journ. Bot. xiv. p. 360 (1876) & Monogr. i. p. 379.

Exsicc. Johns. n. 106; Larb. Lich. Hb. (without a number).

Allied to *Pl. atroflavum*, but with a thicker thallus; the spores are sometimes almost globose. perhaps owing to compression in the ascus.

Hab. On rocks in maritime districts.—*Distr.* Rare in S. Wales. N.W. England and W. Ireland.—*B. M.* St. David's, Pembrokeshire; Barrowmouth, Cumberland; Killery Bay, Connemara, Galway.

48. **CANDELARIELLA** Müll.-Arg. in Bull. Herb. Boiss. ii. App. i. p. 47 (1894). *Lecanora* subgen. *Candelaria* Nyl. in Flora lxiv. p. 454 (1881) pro parte; Cromb. Monogr. i. p. 366. (Pl. 48.)

Thallus crustaceous, granular, sometimes lobed at the circumference, yellow-coloured (K-). Algal cells *Protococcus*. Apothecia sessile, yellow, with a thalline margin (K-); hypothecium colourless; paraphyses unbranched, occasionally septate. and wider towards the apex; spores 8 or many in the ascus, colourless, ellipsoid, simple or 1-septate. Spermogones minute, with septate forked or branched sterigmata and arogenous spermatia.

The yellow thallus characteristic of the species in this genus contains no parietin, but though in that and in other respects resembling *Lecanora*, there are undoubted affinities with the Physiaceæ, as the spores tend to become septate and, occasionally, polarilocular. It has been suggested that this genus may form the base of the polarilocular series. There is also affinity with the genus *Candelaria* (Parmeliaceæ).

Thallus lobate at the circumference.

1. **C. crenata** A. L. Sm.—Thallus orbicular, the lobes of the circumference effigurate, short, divided and crenate, convex. yellow (K-). Apothecia moderate in size, plane, citrine- or livid yellow, the thalline margin granular-crenate; spores many in the ascus, ellipsoid-oblong, simple or obscurely septate, 9–15 μ long, 4–7 μ thick.—*Lichen murorum* var. *crenulatus* Wahlenb. Fl. Lapp. p. 416 (1812) (non Dicks.). *Lecanora crenata* Nyl. in Not. Sällsk. Faun. & Fl. Fenn. Förh. v. p. 130 (1866); Leight. Lich. Fl. p. 180; ed. 3, p. 166; Cromb. Monogr. i. p. 367.

Not unlike *Placodium murorum* in the form of the thallus, but differing in the absence of parietin and in the spore characters. A

specimen recorded from Anglesea has 8 spores in the ascus and belongs to *C. medians*.

Hab. On rocks in a maritime district.—*B. M.* Portlethen, Kincardineshire.

2. *C. medians* A. L. Sm.—Thallus orbicular, often irregular, lobate at the circumference, the lobes rather flattened or narrow and convex, the centre granular-areolate, orange- or citrine-yellow, or greyish in the centre (K—). Apothecia rather small, dull-brown or yellow, the thalline margin entire or crenulate; spores 8 in the ascus, oblong-ellipsoid, occasionally 1-septate, 11–17 μ long, 4–6 μ thick.—*Parmelia parietina* var. *granulata* Schær. Enum. p. 50 (1850). *Placodium medians* Nyl. in Bull. Soc. Bot. Fr. ix. p. 262 (1862). *Lecanora medians* Nyl. in Bull. Soc. Bot. Fr. xiii. p. 367 (1866); Leight. Lich. Fl. p. 205; ed. 3, p. 189; Cromb. Monogr. i. p. 370.

Exsicc. Larb. Lich. Hb. n. 59.

The lobes of the circumference resemble those of *Placodium murorum*, but it is easily distinguished by the absence of reaction with potash.

Hab. On calcareous rocks and walls in lowland and upland districts.—*Distr.* Rare in Central and W. England.—*B. M.* Pimbury Park, Cirencester, Gloucestershire; Llanymynech Hill, Shropshire; Denny Abbey, Cambridgeshire; Beaumaris, Anglesea.

Thallus granular.

3. *C. vitellina* Müll.-Arg. l. c.—Thallus effuse, thickish, granular, the granules small, roundish, crowded, divided into areolæ, bright or dull orange-yellow (vitelline). Apothecia sessile, plane, tawny- or dull-yellow, the thalline margin entire or granular-crenulate; spores many in the ascus (12–24–32), ellipsoid-oblong, sometimes slightly curved, becoming 2-celled, sometimes obscurely polarilocular, 8–15 μ long, 4–6 μ thick.—*Lichen vitellinus* Ehrh. Exs. n. 155 (1785); Dicks. Pl. Crypt. fasc. iv. p. 23 (1801); Engl. Bot. t. 1792. *Patellaria vitellina* Hoffm. Pl. Lich. ii. p. 5, t. 26, fig. 2 (1794). *Lecanora vitellina* Ach. Lich. Univ. p. 403 (1810) (incl. var. *corruscans*); Hook. Fl. Scot. ii. p. 49 & in Sm. Engl. Fl. v. p. 192; Tayl. in Mackay Fl. Hib. ii. p. 138; Cromb. Lich. Brit. p. 48 (incl. var. *corruscans*) & Monogr. i. p. 368; Leight. Lich. Fl. p. 180; ed. 3, p. 166 (incl. var. *corruscans*).

Exsicc. Bohl. n. 78; Johns. n. 32; Larb. Lich. Hb. nos. 214, 297, 298.

The thallus forms a dense crust of fine granules divided into areolæ by deep cracks. The thalline margin of the apothecia is often granular-crenulate (var. *corruscans*). Crombie states that maritime specimens give a brownish-red reaction with potash, the result probably of being sprayed with sea-water.

Hab. On rocks, walls and earth, also on trees and old palings.—*Distr.*—General and common throughout the British Isles.—*B. M.* Jersey; Guernsey; Sark; Launceston and St. Minver, Cornwall; Lustleigh Cleeve, Devon; Broomfield, Beeleigh and Walthamstow, Essex; Madingley, Cambridgeshire; Ankerdine Hill and Malvern, Worcestershire; Longmynd, Shropshire; Barmouth, Merioneth; Anglesea; Buxton, Derbyshire; near Ayton, Cleveland, Yorkshire; Stocksfield and Swinhope, East Allendale, Northumberland; near Kendal, Westmoreland; Alston, Cumberland; Craigleith, near Edinburgh; Appin, Argyll; Killin, Ben Lawers and Craig Tulloch, Blair Athole, Perthshire; Will's Braes, Forfarshire; Portlethen, Kincardineshire; Bridge of Gairn, Ballater, Aberdeenshire; Rothiemurchus, Invernesshire; Kylemore, Connemara, Galway.

Var. *aurella* A. L. Sm.—Granules of the thallus scattered, often almost disappearing. Apothecia minute, otherwise like the species.—*Verrucaria aurella* Hoffm. Fl. Deutschl. ii. p. 197 (1795). *Lecanora vitellina* var. *aurella* Ach. Lich. Univ. p. 404 (1810); Cromb. Lich. Brit. p. 48 & Monogr. i. p. 369; Leight. Lich. Fl. p. 181; ed. 3, p. 167.

Exsicc. Johns. n. 100.

Hab. On rocks and walls in maritime and upland districts.—*Distr.* Rare in the Channel Islands, N. England and Highlands of Scotland.—*B. M.* Sark; East Allendale, Northumberland; Appin, Argyll; Killin, Perthshire.

Var. *xanthostigma* A. L. Sm.—Thallus thin, more leprose than in the species, sometimes very scanty. Apothecia minute.—*Lichen citrinus* Sm. Engl. Bot. t. 1793 (1807) (non Ach.) fide Crombie. *Lecanora citrina* var. *xanthostigma* Pers. ex. Ach. Lich. Univ. p. 493 (1810). *L. vitellina* subsp. *xanthostigma* Nyl. in Not. Sällsk. Faun. & Fl. Fenn. Förh. v. p. 130 (1866); Cromb. Monogr. i. p. 369. *L. xanthostigma* Cromb. in Journ. Bot. xx. p. 273 (1882).

Hab. On the trunks of old trees in wooded districts.—*Distr.* Only recorded from S. and E. England.—*B. M.* Glynde, Sussex; Walthamstow, Essex; near Bradford, Wilts; Windsor Great Park, Berks.

4. *C. epixantha* A. L. Sm.—Thallus effuse, thin, granulose, scanty or almost disappearing, orange-yellow or greyish (K—). Apothecia numerous, small, with a thin pale-yellow subrenulate margin, plane, becoming convex; spores 8 in the ascus, oblong or ellipsoid, simple, sometimes becoming septate and polarilocular, 12–21 μ long, 5–7 μ thick.—*Lecidea epixantha* Ach. Lich. Univ. p. 208 (1810). *Callopsisma vitellinum* Mudd Man. p. 135 (1861). *Lecanora epixantha* Nyl. in Act. Soc. Linn. Bord. xxv. p. 62 (1864); Cromb. in Grevillea xviii. p. 45 & Monogr. i. p. 370; Leight. Lich. Fl. p. 206; ed. 3, p. 213. *L. vitellina* var. *epixantha* Cromb. Lich. Brit. p. 48 (1870) (incl. var. *octospora*); Leight. Lich. Fl. p. 181; ed. 3, p. 167.

The thallus is much more scanty than in *C. vitellina* and the apothecia smaller with less prominent margins; but the species

chiefly differs in the number of the spores with and their more pronounced polarilocular character.

Hab. On rocks and walls in maritime and upland situations.—*Distr.* Rare in S. England, Wales and S. Ireland.—*B. M.* Hastings, Sussex; Cheddar, Somerset; Llandyssil, Cardiganshire; Giant's Stairs, Cork.

49. **PHYSICIA** Schreb. Gen. Pl. ed. 8, ii. p. 768 (1791); emend Th. Fr. Lich. Arct. p. 60 (1860). *Borrera* Ach. Lich. Univ. p. 496 (1810) pro parte; S. F. Gray Nat. Arr. i. p. 434 pro parte; Hook. Fl. Scot. ii. p. 56 pro parte; Mudd Man. p. 103. (Pl. 49.)

Thallus rarely ascending and fruticose, more generally foliose and horizontal, greyish, whitish or brown, attached by haptera or by rhizoids. Structure various, radiate, subradiate or dorsiventral. Apothecia discoid, sessile or shortly stalked, with a thalline margin, the disc dark; hypothecium colourless, brownish-yellow or dark; paraphyses septate, simple or branched near the apices and tipped with brown; spores 8 in the ascus, dark-brown, more or less distinctly polarilocular.

There is considerable variation in the thallus; a few species are wholly surrounded by a cortex which is formed of hyphæ parallel with the long axis of the frond, termed *fibrous*. This type of cortex in some is confined to the upper surface, in others to the lower; while in others again it is replaced by a cortex of plectenchyma. Those species with a fibrous upper cortex have been placed by some authors in a separate genus *Anaptychia* (Koerb. Syst. Lich. Germ. p. 49 (1855)). The spores have nearly always a well-marked polarilocular structure, but the apices of the spores rather than the septa are the most thickened portions, and the cell-lumens are thus placed near the median wall.

A. *Cortex fibrous above or on both surfaces.*

Thallus fruticose or partly ascending.

1. **Ph. intricata** Schær. Enum. p. 11 (1850).—Thallus fruticose subascending (2 to 3 cm. high), branched and tangled, with rooting hyphæ, but generally becoming free from the substratum at the base: fronds narrow, rather compressed and channelled, pubescent and uneven, connected together by haptera, the ultimate branchlets often shortly fimbriate, greyish-glaucous (K—). Apothecia rare, lateral, sessile, rather small, convex, with a thin entire grey margin; spores dark-brown, 18–26 μ long, 11–15 μ thick.—Cromb. Lich. Brit. p. 37; Leight. Lich. Fl. p. 144; ed. 3, p. 133. *Lichenoides subhirsutum teres, scutellis parvis nigris* Dill. Hist. Musc. p. 157, t. 21, f. 51 (1741). *Lichen intricatus* Desf. Fl. Atl. ii. p. 420, t. 258, f. 3 (1800). *L. atlanticus* Sm. Engl. Bot. t. 1715 (1807). *Borrera atlantica* Ach. Lich. Univ. p. 502 (1810); S. F. Gray Nat. Arr. i. p. 435;

Hook. in Sm. Engl. Fl. v. p. 223. *B. intricata* Mudd Man. p. 104 (1861).

Exsicc. Cromb. n. 49, Mudd n. 76.

The only British species of the genus that has a radiate structure and wholly fruticose habit. The cortex is composed of filaments parallel with the long axis (fibrous); these hyphæ send out short branches on the surface which give the plant a soft pubescent appearance. It somewhat resembles *Ph. villosa*, a southern lichen, but is not hairy and differs in the apothecia.

Hab. On rocks, sand and trunks of old trees in maritime districts.—*Distr.* Local in S. England.—*B. M.* Bracklesham near Selsey, near Portfield and near Chichester and Barnham and cliffs near Hastings, Sussex.

2. *Ph. ciliaris* DC. Fl. Fr. ii. p. 396 (1805).—Thallus spreading, of elongate rather narrow branching imbricate laciniae, subsascending or generally decumbent, greenish-grey or dark-coloured, the under surface pale, hollowed out, the margins beset with long grey or partly brown fibrils or cilia which often form haptera at the tips, attaching the frond to other parts of the lichen and to the substratum (K—). Apothecia large, stalked, the disc brownish-black, often bluish-grey-pruinose, the margin prominent, entire or generally crenate, becoming proliferous; spores oblong, 30–50 μ long, 18–24 μ thick.—Cromb. Lich. Brit. p. 38; Leight. Lich. Fl. p. 144; ed. 3, p. 133 (incl. ff. *actinota* and *verrucosa*). *Lichenoides arboreum foliosum cinereum, scutellis nigris, foliorum extremitatibus hispidis et pilosis* Dill. in Ray Syn. ed. 3, p. 73, n. 67 (1724). *Lichenoides hispidum majus et rigidius, scutellis nigris* Dill. Hist. Musc. p. 150, t. 20, f. 45 (1741). *Lichen ciliaris* L. Sp. Pl. p. 1144 (1753); Huds. Fl. Angl. p. 448; Lightf. Fl. Scot. ii. p. 828; With. Arr. ed. 3, iv. p. 55; Engl. Bot. t. 1352. *Parmelia ciliaris* Ach. Meth. Lich. p. 255 (1803) (incl. var. *actinota*). *Borrera ciliaris* Ach. Lich. Univ. p. 496 (1810) (incl. vars. *actinota* and *verrucosa*); S. F. Gray Nat. Arr. i. p. 434; Hook. Fl. Scot. ii. p. 56; Hook. in Sm. Engl. Fl. v. p. 222; Mudd Man. p. 105.

Exsicc. Bohl. n. 38; Cromb. n. 50; Dicks. Hort. Sicc. fasc. vii. n. 24; Johns. nos. 90, 91; Larb. Cæsar. n. 68 & Lich. Hb. n. 125; Leight. n. 364; Mudd n. 77.

The thallus of the upper surface and slightly round the edge is corticate, the cortex being composed of long parallel hyphæ which branch out from the margin at intervals to form the stout cilia; the under surface is non-corticate. The colour varies with the habitat, but is constantly greenish when moist and often whitish- or greyish-pulverulent when dry. The apothecia are generally abundant; the denticulations of the margin may grow out into short laciniae (f. *actinota*). The spermogones are often very prominent (f. *verrucosa*); the spermatia are cylindrical, 4–5 μ long, 1 μ thick.

Hab. On trunks of old trees, chiefly oaks and elms in cultivated districts.—*Distr.* General and plentiful in England, scarcer elsewhere throughout the British Isles.—*B. M.* Jersey; Sark; Guernsey; Elburton and Newton Bushell, Devon; Winchester, Hants; near Ryde, I. of Wight; Hurstpierpoint, Danny and Glynde, Sussex; Tooting Common and Dorking, Surrey; Hythe, Kent; Ulting, near Colchester and Walthamstow, Essex; near Farringdon and Windsor, Berks; near Swindon, Wilts; near Cirencester, Gloucestershire; Twycross, Leicestershire; Overthorpe, Northamptonshire; Malvern and Broadwas, Worcestershire; Moor Park, Herefordshire; Clungunford, Shropshire; Hopton, Cheshire; Anglesea; Suffolk; Scoulton Mere and Norwich, Norfolk; near Ayton, Cleveland and Dalby, Yorkshire; Middleton, Teesdale, Durham; near Hexham and Wark, Northumberland; near Kendal, Westmoreland; Rosslyn Woods, Midlothian; Blackness, Linlithgowshire; Finlarig, Killin, Perthshire; Foulis, Baldovan, Auldbar and Melgund Castle, Forfarshire; Midmar Castle, Aberdeenshire; Oakpark near Carlow.

Form *melanostieta* Oliv. Exp. Syst. Lich. i. p. 175 (1897).—Thallus frequently wide-spreading; laciniae narrower, more appressed, greenish or dark-brown, with dark cilia. Apothecia not pruinose.—*Physcia ciliaris* var. *saxicola* Nyl. in Mém. Soc. Sci. Nat. Cherb. v. p. 106 (1857) & Syn. Lich. i. p. 414 (1860); Carroll in Journ. Bot. v. p. 254 (1867); Cromb. Lich. Brit. p. 38 & Monogr. i. p. 303; form *saxicola* Leight. Lich. Fl. p. 146 (1871); ed. 3, p. 134. *Parmelia ciliaris* var. *melanostieta* Ach. Meth. Lich. p. 255 (1803). *Borreria ciliaris* var. *saxicola* Mudd Man. p. 105.

Distinguished by the colour of the thallus and by the habitat. There are connecting stages with the species.

Hab. On rocks and walls, rarely on sandy soil in maritime and mountainous regions.—*Distr.* Local and scarce throughout the British Isles.—*B. M.* Quenvais and St. Brelade's, Jersey; Withiel, Cornwall; near Malvern, Worcestershire; Buxton, Derbyshire; Holyhead, Anglesea; near Langbraugh, Cleveland, Yorkshire; Craig Tulloch, Blair Athole, Perthshire; Morrone, Braemar, Aberdeenshire; Sybil Head, Kerry.

3. *Ph. leucomela* Mich. Fl. Bor.-Amer. ii. p. 326 (1803).—Thallus spreading, with narrow branching laciniae, tapering or forked at the apex, white or greyish-white and smooth, the margins beset with long slender frequently branching black cilia which attach the plant to the substratum by coiling round grass, moss, etc., or by haptera; beneath white, and furfuraceous (K + yellow, CaCl + yellow). Apothecia (not seen in British specimens) lateral, pedicellate, rather large, plane, bluish-grey-pruinose, the margin denticulate or proliferous, the laciniate outgrowths also sometimes black-ciliate; spores large, oblong-ellipsoid, 35–60 μ long, 18–25 μ thick. Cromb. Lich. Brit. p. 38; Leight. Lich. Fl. p. 149; ed. 3, p. 138. *Lichenoides angustifolium planum*, *crinibus nigris* Dill. Hist. Muse. p. 156, t. 21, f. 50 (1741). *Borreria leucomela* Ach. Lich. Univ. p. 499 (1810);

S. F. Gray Nat. Arr. i. p. 434; Hook. in Sm. Engl. Fl. v. p. 223; Mudd Man. p. 104. *Lichen leucomelas* L. Sp. Pl. ed. 2, p. 1613 (1763); Engl. Bot. t. 2548.

Essicc. Carroll Lich. Hib. n. 2; Cromb. n. 150; Johns. n. 402; Larb. Cæsar. n. 69; Leight. n. 168.

Distinguished from *Ph. ciliaris* by the more straggling thinner thallus and by the longer black cilia. The fronds are always dorsiventral; the upper cortex is composed of hyphæ parallel with the long axis of the fronds, the under surface is non-corticate. It is a continental plant which only reaches the Southern Coast.

Hab. On the ground among mosses and short grasses, rarely on mossy trunks of trees in or near maritime districts.—*Distr.* S. England and Channel Islands.—*B. M.* Quenvais, St. Brelade's and St. Owen's Bay, Jersey; Sark; Alderney; Bryer and Trescoe Islands, Scilly; The Lizard and Kynance Cove, Cornwall; Dartmoor. Bolt Head, Torquay and Babbicombe, Devon; Bathwick Down, Somerset; Ballard Down, Swanage, Dorset; St. Leonards Forest, Sussex; Ballycotton and Cape Clear Island, Cork.

Thallus horizontal.

4. *Ph. fusca* A. L. Sm.—Thallus suborbicular, flat, the laciniae narrow, irregularly branched and imbricate, appressed, becoming wider, digitate and more spreading at the circumference, with the tips somewhat crenate, chestnut-brown: beneath paler with sparsely scattered greyish or blackish rhizinae (K—). Apothecia small to moderate in size, often numerous and crowded, the disc blackish, the margin prominent, crenate; spores oblong, brown, 30–44 μ long, 18–25 μ thick.—*Physcia aquila* Nyl. in Act. Soc. Linn. Bord. sér. 3, i. p. 309 (1856); Cromb. Lich. Brit. p. 39 & Monogr. i. p. 310; Leight. Lich. Fl. p. 153; ed. 3, p. 142. *Lichenoïdes angustifolium fuscum, scutellis pullis* Dill. Hist. Musc. p. 175, t. 24, f. 69 (1741). *Lichen pullus* Lightf. Fl. Scot. ii. p. 825 (1777) (non Schreb.); Engl. Bot. t. 982. *L. fuscus* Huds. Fl. Angl. ed. 2, p. 533 (1778). *L. obscurus* With. Arr. ed. 3, iv. p. 28 (1796). *L. aquilus* Ach. Lich. Suec. Prodr. p. 109 (1798). *Parmelia aquila* Ach. Meth. Lich. p. 201 (1803); S. F. Gray Nat. Arr. i. p. 441; Hook. Fl. Scot. ii. p. 54 & in Sm. Engl. Bot. v. p. 203; Tayl. in Mackay Fl. Hib. ii. p. 143.

Essicc. Bohl. n. 111; Dicks. Hort. Sicc. fasc. v. n. 25; Johns. n. 29; Larb. Cæsar. n. 23; Leight. n. 144.

A well-marked species both in form and colour. The branches at the circumference sometimes grow out in a straggling manner or they may be partly corroded (var. *stippæa* Ach. l. c.). The cortical structure differs from that of the previous species in being irregularly fibrous on both surfaces.

Hab. On rocks in maritime districts, rarely on hills some distance from the sea.—*Distr.* General and fairly common on most of the rocky coasts of the British Isles; especially abundant in N.E.

Scotland.—*B. M.* Jersey; Guernsey; near Lawannick, Newlyn, Penzance, Temple Moor, Stoneyford, Roche Rocks and Helminton, Cornwall; Torquay, Bolt Head, Hay Tor, Dartmoor, near the Teign, near Okehampton and Ilfracombe, Devon; Tilgate, Sussex; Stonehenge, Wilts; near Oswestry, Shropshire; near Tenby, Pembrokeshire; Barmouth and Harlech Castle, Merionethshire; Llanberis and Pwllheli, Carnarvonshire; Holyhead, Anglesea; Douglas Head, Isle of Man; Barrowmouth, Cumberland; Holy Island, Northumberland; New Galloway, Kirkcudbrightshire; King's Park and Turfin Hill near Edinburgh; Barcaldine, Argyll; Glen Tilt, Perthshire; Montrose, Forfarshire; Cove and Portlethen, Kincardineshire; near Peterhead, Aberdeenshire; Ballycotton and Mizen Head, Cork; Kennmare River, Kerry; Ardglass, Down.

5. *Ph. speciosa* Nyl. in Act. Soc. Linn. Bord. sér. 3, i. p. 307 (1856).—Thallus laciniate-lobed, somewhat digitate, spreading, the laciniae blunt and retuse at the apices or often with raised apical soralia, occasionally whitish- or blackish-ciliate; beneath whitish to bluish-grey towards the base, adhering by stout whitish or black rhizinae or by cilia (K + yellow). Apothecia rare, sessile, moderate in size or rather large, brown, the margin incurved, entire or sometimes crenate; spores oblong, large, 25–36 μ long, 12–19 μ thick.—Cromb. Lich. Brit. p. 38; Leight. Lich. Fl. p. 151; ed. 3, p. 138. *Lichen speciosus* Wulf. in Jacq. Coll. iii. p. 119, t. 7 (1789); Engl. Bot. t. 1979 (upper fig.). *Parmelia speciosa* Ach. Meth. Lich. p. 198 (1803); S. F. Gray Nat. Arr. i. p. 442; Hook. Fl. Scot. ii. p. 55 & in Sm. Engl. Fl. v. p. 201; Tayl. in Mackay Fl. Hib. ii. p. 149 pro parte. *Borrera speciosa* Mudd Man. p. 107.

Distinguished by the apical soralia and ciliate margins. The lobes may be closely crowded and imbricate or scattered, especially if growing among mosses. Though apothecia are sometimes present in continental specimens, they have not been found in Britain. The cortex of both surfaces is composed of hyphae more or less parallel with the long axis of the laciniae.

Hab. On mosses, rocks and trees, chiefly in maritime districts.—*Distr.* Rather rare in the Channel Islands, S. and W. England, W. Scotland and S.W. and N. Ireland.—*B. M.* Rozel, Jersey; Alderney; Guernsey; The Lizard, Kynance Cove, Bodmin and Roughton, Cornwall; Bolt Head, Valley of the Rocks and Lynton, Devon; St. Leonards Forest, Sussex; Barmouth, Cwm Bychan and Llyn Bodlyn, Merioneth; near Inverary, Appin, Barcaldine and Ballachulish, Argyll; Glen Falloch, Perthshire; Cloghane, Dunkerron and Killarney, Kerry.

Var. *hypoleuca* Nyl. Syn. i. p. 417 (1860).—Thallus appressed, compact, the marginal cilia grey or black, beneath whitish, with densely branching rhizinae. Apothecia rather large, with thickly laciniate-sorediate margins; spores rather larger than in the species, fusiform.—Cromb. in Grevillea xv. p. 78 (1887). *Lichen speciosus* Sm. Engl. Bot. t. 1979 (lower fig.). *Parmelia speciosa*

var. *hypoleuca* Ach. Syn. Lich. p. 211 (1814): Tayl. l. c. pro parte.

An exotic variety, sometimes given specific rank, which has become naturalized in S.W. Ireland. The apothecia when present are crowded and rather large.

Hab. On rocks in shady situations.—*B. M.* Dunkerron, Kerry.

B. Cortex fibrous on lower surface, plectenchymatous above.

6. *Ph. pulverulenta* Nyl. in Act. Soc. Linn. Bord. sér. 3, i. p. 308 (1856).—Thallus suborbicular, of appressed somewhat stellate contiguous multifid firm opaque laciniae, obtuse and incised-crenate, pale-greyish or greyish-brown, greenish when moist, more or less white-pruinose; beneath black, covered with rather long stiff black rhizinae which bristle with short branchlets (K -). Apothecia sessile, moderate in size or becoming large, the disc brownish-black, greyish-pruinose or naked, the margin thick, entire, sometimes crenate or scantily proliferous: spores large, 20–36 μ long, 12–20 μ thick.—Cromb. Lich. Brit. p. 38: Leight. Lich. Fl. p. 146; ed. 3, p. 135; f. *panniformis* Cromb. in Journ. Linn. Soc. xvii. p. 571 (1880) & Monogr. i. p. 306; f. *deminuta* Cromb. in Journ. Bot. xx. p. 273 (1882) & Monogr. i. p. 306. *Muscus licheniformis viridis* &c. Buddle Hort. Sicc. ii. fol. 6, n. 10 in Herb. Sloane. *Lichenoides arboreum, crusta foliosa virescente* &c. Dill. in Ray Syn. ed. 3, p. 74, n. 73 (1724). *Lichenoides glaucum orbiculare, segmentis latiusculis, scutellis nigris* Dill. Hist. Musc. p. 177, t. 24, fig. 71 A, D (1741) pro parte. *Lichen pulverulentus* Schreb. Spic. Fl. Lips. p. 128 (1771). *Lichen stellaris* var. Huds. Fl. Angl. p. 448 (1762); With. Arr. ed. 3, iv. p. 31. *Parmelia pulverulenta* Ach. Meth. Lich. p. 210 (1803): S. F. Gray Nat. Arr. i. p. 443; Hook. Fl. Scot. ii. p. 55 & in Sm. Engl. Fl. v. p. 201; Tayl. in Mackay Fl. Hib. ii. p. 141. *Borrera pulverulenta* Mudd Man. p. 110 (1861).

Exsicc. Bohl. n. 69; Johns. nos. 127, 404; Larb. Lich. Hb. n. 10 & Lich. Cantab. n. 12; Leight. n. 49; Mudd n. 82.

Generally recognized by the white pruina on the thallus and apothecia which is chiefly visible in the dry condition; the laciniae are rather thick and of a dull green when moist. Both thallus and apothecia are variable; the laciniae are appressed and contiguous at the circumference, but towards the centre are often imbricate with minute proliferations mostly from the edges of the lobes. The allied forms *panniformis* and *deminuta* have small apothecia and small lobes, crowded and imbricate in the former, rather sparsely scattered in the latter, evidently growth conditions. The upper cortex is indistinctly plectenchymatous and granulose, the lower is fibrous, of dark-brown hyphae parallel with the long axis of the lobes.

Hab. On trunks and branches of trees and on palings, rarely on stone walls, chiefly in cultivated lowland and upland districts.—*Distr.* General and usually common throughout the British Isles.—*B. M.* Guernsey; near Withiel, Cornwall; near Torquay, Moreton

Hampstead and Wembury. Devon: Appuldurcombe, Shanklin and near Ryde, I. of Wight; Glynde, Shoreham, Hurstpierpoint and Lewes, Sussex; Penshurst, Kent; Ulting, Essex; Sapperton, near Cirencester, Gloucestershire; Milton, Oxfordshire; Moor Park, Herefordshire; Crowle, Worcestershire; Clungunford, Lyth Bank and near Shrewsbury, Shropshire; Bourn and Madingley, Cambridgeshire; Dolgelly and Aberdovey, Merioneth; Harboro' Magna, Warwickshire; Twycross, Leicestershire; Anglesea; Ayton and Cleveland, Yorkshire; Brougham Castle and Kendal, Westmoreland; Middleton, Teesdale, Durham; Creetown, Kirkeudbrightshire; Largs, Ayrshire; near Edinburgh; Appin, Argyll; Killin and Craig Tulloch, Blair Athole, Perthshire; Montrose, Strathmartin, Camperdown and Baldovan, Forfarshire; Cults and Abergeldie Castle, Aberdeenshire; Applecross, Rossshire; Carrigaloe and Aghada, Cork; Ballynegarde, Limerick; Dunkerron, Kerry; Westport, Mayo.

Form *argyphaea* Cromb. in Journ. Linn. Soc. Bot. xvii. p. 571 (1880).—Thallus and apothecia entirely white pruinose, the laciniae rather dilated at the circumference; margins of apothecia sometimes crenulate.—Dill. l. c. t. 71, d. *Parmelia pulverulenta* var. *argyphaea* Ach. Lich. Univ. p. 474 (1810).

Ersicc. Johns. n. 405.

The abundant pruina gives a white velvety appearance to the thallus.

Hab. On trunks of trees in maritime and upland districts.—*Distr.* Rare in N. England (Johnson *Ersicc.*), the central Grampians, Scotland, and S.W. Ireland.—*B. M.* Craig Tulloch, Blair Athole, Perthshire; Adare, Limerick.

Var. *subpapillosa* Cromb. in Journ. Bot. xx. p. 273 (1882).—Thallus densely unequally papillate, greyish- or brownish-pruinose. Apothecia pruinose with turgid subpapillate margins.

Hab. On trunks of trees.—*Distr.* Rare in E. and N.E. England.—*B. M.* Bury St. Edmunds, Suffolk; Bellingham, Northumberland.

Var. *angustata* Schaer. Enum. p. 38 (1850).—Thallus lobes narrow, sometimes rather spreading, brownish, scarcely pruinose, beneath densely rhizinose. Apothecia small, with stoutish margins, pruinose or naked.—Cromb. Lich. p. 38; f. *angustata* Leight. Lich. Fl. p. 147 (1871); ed. 3, p. 135. *Lichen angustatus* Hoffm. Enum. p. 77, t. 11, fig. 2 (1784). *Borreria pulverulenta* var. *angustata* Mudd Man. p. 110 (1861).

The narrow discrete laciniae are in some specimens very long, in others short and more crowded.

Hab. On the trunks of trees in upland districts.—*Distr.* Rare in S. and N. England, and in S.W. Scotland.—*B. M.* Wembury, Devon; Appuldurcombe, I. of Wight; Glynde and St. Leonards Forest, Sussex; Kildale and Ayton, Cleveland, Yorkshire; near Wansbeck, Northumberland; Creetown, Kirkeudbrightshire.

Var. *muscigena* Nyl. Syn. Lich. i. p. 420 (1860).—Thallus very much flattened at the circumference, brownish, but white

with the pruina. Apothecia rare, the margin crenate.—Leight. Lich. Fl. ed. 2, p. 479; ed. 3, p. 136 (form); subsp. *muscigena* Cromb. in Grevillea xv. p. 78 (1887) & Monogr. i. p. 309. *Parmelia muscigena* Ach. Lich. Univ. p. 472 (1810).

A very rare variety in this country, only one imperfect specimen having been gathered. The habitat rather suggests that the form of the lacinia may be due to the more moist conditions. The spores are on the whole smaller than in the species, measuring 24–30 μ long, 11–15 μ thick.

Hab. On decayed mosses on the ground.—*B. M.* Craig Tulloch, Blair Athole, Perthshire.

Var. *venusta* Oliv. Exp. Syst. Lich. p. 179 (1897).—Thallus of somewhat narrow incised lobes, brown- or brownish-grey, slightly or not pruinose. Apothecia with proliferous margins.—Cromb. Lich. Brit. p. 39; f. *venusta* Leight. Lich. Fl. p. 147 (1871) (excl. Syn. Engl. Bot.); ed. 3, p. 136; subsp. *venusta* Nyl. ex Lamy in Bull. Soc. Bot. xxv. p. 383 (1878); Cromb. in Grevillea xv. p. 78 & Monogr. i. p. 308. *Parmelia venusta* Ach. Meth. Lich. p. 211, t. 8, fig. 5 (1803).

Differs chiefly in the less pruinose or naked thallus and in the coronate apothecia. The latter character is sometimes absent, and very occasionally is present in the species.

Hab. On trunks of old trees in wooded situations.—*Distr.* Rare in the northern districts of England and S.W. Scotland and Ireland.—*B. M.* Near Ayton, Cleveland, Yorkshire; New Galloway, Kirkcudbrightshire; Kenmore, Perthshire; near Fort William, Invernessshire; Carrigaloe, Cork; Ballynagarde, Limerick.

Form *subvenusta* Oliv. l. c.—Similar to var. *venusta* but with the thallus more distinctly pruinose.—*Physcia pulverulenta* var. *laciniolata* Cromb. in Journ. Bot. x. p. 358 (1872). *Lichenoides arboreum* . . . *scutellis limbo cinereo crispo cinctis* Dill. in Ray Syn. ed. 3, p. 75, n. 75 (1724). *Lichen stellaris* var. Lightf. Fl. Scot. ii. p. 824; Huds. Fl. Angl. ed. 2, p. 534; With. Arr. ed. 3, iv. p. 31. *L. pulverulentus* Sm. Engl. Bot. t. 2063 (1809) (non Schreb.).

Æsicc. Johns. n. 250.

Similar to var. *venusta* but generally pruinose; as in the variety, some of the apothecia have occasionally entire margins.

Hab. On the trunks of old trees in maritime and upland districts.—*Distr.* Local and rare in England, Scotland and Ireland.—*B. M.* Respring and Penzance, Cornwall; Henfield and Glynde, Sussex; Kemble, Wilts; Windsor Great Park, Berks; Milton, Oxfordshire; Oswestry, Shropshire; near Cambridge; Levens, Westmoreland; New Galloway, Kirkcudbrightshire; Ravelrig, near Edinburgh; Finlarig, Killin, Perthshire.

7. *Ph. grisea* A. Zahlbr. in Ann. K. K. Naturhist. Hofmus. Wien xxvi. p. 177 (1912).—Thallus spreading, appressed and

adnate, wrinkled, laciniate, crenate at the circumference, greyish-pruinose, greyish-white or light-brownish, densely sorediate on the margins, especially towards the centre of the thallus; beneath dark and rhizinose (K-). Apothecia small or moderate in size, the margins becoming lacerate-sorediate; spores 24-28 μ long, 15-18 μ thick.—*Ph. pulverulenta* var. *pityrea* Cromb. Lich. Brit. p. 39; Leight. Lich. Fl. p. 146; ed. 3, p. 135; subsp. *pityrea* Nyl. ex Lamy in Bull. Soc. Bot. Fr. xxv. p. 383 (1878); Cromb. in Grevillea xv. p. 78 & Monogr. i. p. 308. *Lichenoides glaucum orbiculare, segmentis latiusculis, scutellis nigris* Dill. Hist. Musc. p. 177, t. 24, fig. 71 c (1741). *Lichen griseus* Lamarck Encycl. Méth. iii. p. 480 (1789). *L. pityreus* Ach. Lich. Suec. Prodr. p. 124 (1798); Engl. Bot. t. 2064. *Parmelia pityrea* Ach. Lich. Univ. p. 483 (1810); Hook. in Sm. Engl. Fl. v. p. 201. *Borrera pulverulenta* var. *grisea* Mudd Man. p. 111 (1861).

Exsicc. Cromb. n. 51; Johns. n. 128; Larb. Lich. Hb. n. 48; Leight. n. 370; Mudd n. 83.

Similar to *Ph. pulverulenta* in the pruinose thallus, but thinner in texture, and along with the margins of the apothecia, densely sorediate. The soredia, which at first line the margins of the lobes, sometimes spread over almost the whole centre of the thallus.

Hab.—On the trunks of trees, rarely on old walls, in maritime, lowland and upland districts.—*Distr.* General and common in England, rarer in the Channel Islands and Scotland, not yet recorded from Ireland. —*B. M.* Guernsey; Basingstoke and Lymington, Hants; Ryde and Appuldurcombe, I. of Wight; Shoreham, Glynde, Wakehurst Park and Wolstonbury, Sussex; Hythe, Kent; Edgware and Harefield, Middlesex; Epping Forest and Braxted Park, Essex; near Elstree, Herts; near Cheltenham, near Cirencester and Bourton-on-the-Water, Gloucestershire; Windsor, Berks; Milton, Oxfordshire; Malvern and near Kempsey, Worcestershire; Harboro' Magna, Warwickshire; Ludlow Park, Shropshire; Aberdovey, Merioneth; Carlton, Cleveland, Yorkshire; Windermere, Westmoreland; Appin, Argyll; Blairdrummond near Stirling; Glen Ample, Perthshire; Drum near Aberdeen.

8. *Ph. stellaris* Nyl. in Act. Soc. Linn. Bord. sér. 3, i. p. 307 (1856) (excl. vars. *leptalea* and *tenella*).—Thallus orbicular-stellate, appressed, compact or sometimes imbricate in the centre, the lobes at the circumference contiguous, somewhat convex, more or less deeply incised and crenate, greyish or greyish-white, generally darker towards the centre; beneath whitish, with grey or dark-coloured much-branched rhizinae (K \pm yellow). Apothecia rather small, sessile, the disc blackish, greyish-pruinose or naked, the margin entire or crenulate; spores 16-24 μ long, 8-11 μ thick.—Cromb. in Grevillea xv. p. 78 (1887) pro parte. *Ph. retrogressa* Stirton in Trans. Glasg. Soc. Nat. p. 85 (1875); Leight. Lich. Fl. ed. 3, p. 138. *Lichen stellaris* L. Sp. Pl. p. 1144 (1753). *Parmelia stellaris* Ach. Lich. Univ. p. 476

(1810); Hook. Fl. Scot. ii. p. 55 & in Sm. Engl. Fl. v. p. 201. *Borrera obscura* var. *chlorantha* Mudd Man. p. 110 (non Ach.).

Exsicc. Mudd n. 81.

A variable plant, but distinguished by the absence of pruina on the thallus and by the light-coloured under surface. The cortex of the upper surface is somewhat obscurely plectenchymatous, with small cells; that of the lower is fibrous. The rhizinae vary from light grey to black; generally they are greyish or brownish.

Hab. On trees by roadsides, etc., in lowland and upland districts.—*Distr.* Seen only from a few localities in N. England and the Grampians, Scotland.—*B. M.* Near Ayton, Cleveland, Yorkshire; Achmore, Killin and Ben Lawers, Perthshire; Monaltrie House, Ballater and Countesswells, Aberdeenshire.

Var. *aipolia* Nyl. Lich. Scand. p. 111 (1861).—Lacinia of the circumference more plane than in the species, beneath whitish or grey (K+yellow).—*Physcia aipolia* Nyl. in Flora liii. p. 58 (1870); Cromb. in Journ. Bot. viii. p. 97 (1870), in Journ. Linn. Soc. Bot. xvii. p. 571 (1880) (incl. f. *acrita*) & Monogr. i. p. 313. *Ph. stellaris* var. *acrita* Cromb. Lich. Brit. p. 39 (1870). *Lichenoides cinereum*, *segmentis argutis stellatis*, *scutellis nigris* Dill. Hist. Musc. p. 176, t. 24, f. 70 A, B (1761). *Lichen stellaris* Huds. Fl. Angl. p. 448 (1762) (non L.) fide Crombie. *L. aipolius* Ach. Lich. Suec. Prodr. p. 112 (1798).

Exsicc. Croall. n. 592.

Distinguished from the species by the more flattened thallus, which in age becomes wrinkled in the centre; but chiefly by the reaction of the medulla with potash, which gives a faint-lemon yellow.

Hab. On trees, rarely on calcareous walls, in maritime and inland districts.—*Distr.* Rather rare throughout the British Isles.—*B. M.* Penzance, Cornwall; Ilsham Valley, Torquay, and Linton, Devon; Shanklin, I. of Wight; near Lewes, Sussex; Hafod, Cardiganshire; Dolgelly, Merioneth; near Kendal, Westmoreland; Appin, Argyll; Killin and Ben Lawers, Perthshire; Castleton of Braemar, Aberdeenshire; Applecross, Rossshire; Kylemore and Loch Inagh, Connemara, Galway.

Form *anthelina* Nyl. Lich. Scand. p. 111 (1861).—Thallus with narrower lacinia which are more apart, long, rather convex, and with more developed black rhizinae, beneath greyish-brown (K±yellow).—*Ph. aipolia* var. *anthelina* Cromb. in Grevillea xv. p. 78 (1887). *Lichen anthelinus* Ach. Lich. Suec. Prodr. p. 111 (1798).

This form is identical with *Lichen ambiguus* Ehrh. Pl. Crypt. n. 207 (1785) nomen nudum, the name adopted by continental lichenologists. Here as in species and varieties the margin of the apothecium becomes crenulate with age. The reaction with potash allies it with var. *aipolia*.

Hab. On trees in maritime and inland districts.—*Distr.* Rare in S. England and S.W. Ireland.—*B. M.* Ilsham Valley, Torquay, Devon; near Ryde, I. of Wight; Henfield, Sussex; Muckruss Demesne, Killarney, Kerry.

Var. *cercidia* Th. Fr. Lich. Scand. i. p. 139 (1871).—Thallus greyish-white, the laciniae short, contiguous, somewhat convex or wrinkled, crowded and partly imbricate in the centre, broader at the circumference. Apothecia mostly pruinose, sometimes larger.—*Physcia stellaris* Cromb. Lich. Brit. p. 39 (1870) pro parte; Leight. Lich. Fl. p. 151; ed. 3, p. 140. *Ph. aipolia* var. *cercidia* Nyl. ex Lamy in Bull. Soc. Bot. Fr. xxv. p. 384 (1878); Cromb. in Grevillea xv. p. 78 (1887). *Lichen stellaris* Lightf. Fl. Scot. ii. p. 824 (1777); With. Arr. ed. 3, iv. p. 31 pro parte. *Parmelia aipolia* var. *cercidia* Ach. Lich. Univ. p. 478 (1810). *P. stellaris* Tayl. in Mackay Fl. Hib. ii. p. 142 (1839) (? Ach.). *Borrera stellaris* Mudd Man. p. 109 (1861).

Æsicc. Carroll Lich. Hib. n. 7; Johns. n. 251; Larb. Lich. Hb. n. 161 & Lich. Cantab. n. 13; Leight. n. 6; Mudd n. 79.

A coarser plant than the species, resembling *Ph. pulverulenta* in the irregular difform wrinkled growth. The short rhizinae are crowded, much branched and become darker in colour. The apothecia are often numerous and crowded.

Hab. On old trees, rarely on calcareous walls, in cultivated districts.—*Distr.* General and plentiful in most parts of the British Isles.—*B. M.* Guernsey; Withiel and Penzance, Cornwall; near Ryde, I. of Wight; Glynde, Fairlight near Hastings, and Henfield, Sussex; Reigate, Surrey; Edgware, Middlesex; Elstree, Herts; Windsor, Berks; Uting, Essex; near Nailsworth, Gloucestershire; Pixham and North Malvern, Worcestershire; Llandrindod, Radnorshire; Llanymynech, Clungunford and near Shrewsbury, Shropshire; Aberdovey, Merioneth; Malew, I. of Man; Madingley Park, Cambridge-shire; Twycross, Leicestershire; near Ayton, Cleveland, Yorkshire; near Hexham, Northumberland; Kendal and Windermere, Westmoreland; Alston, Cumberland; New Galloway, Kirkcudbrightshire; near Melrose, Roxburghshire; near Edinburgh; near Inverary and Appin, Argyll; Blair Drummond, near Stirling; Finlarig, Killin, Perthshire; Camperdown, Forfarshire; Cults and Castletown of Braemar, Aberdeenshire; Fort William, Invernessshire; Applecross, Rossshire; near Cork; Dunkerron, Kerry.

9. *Ph. melops* Duf. ex Nyl. in Flora Ivii. p. 16 (1874).—Thallus normally orbicular-stellate, appressed, more or less bluish-grey with narrow contiguous convex laciniae; beneath brownish (K + yellow). Apothecia and spores as in *Ph. stellaris*.—Cromb. in Journ. Bot. xxiii. p. 195 (1885).

The thallus of our single specimen is of scattered almost isolated branching laciniae, and recalls var. *aipolia* f. *anthelina* of the preceding species, but differs from it in habitat. According to Nylander (l. c.) it is a widely spread species in the mountainous districts of Europe.

Hab. On a calcareous wall among mosses.—*B. M.* Appin, Argyll. the only British locality.

10. *Ph. hispida* Tuckerm. Syn. N. Amer. Lich. i. p. 75 (1882).—Thallus spreading, formed of narrow branching hori-

zontal or ascending straggling lacinia, beset with marginal grey or brownish cilia, generally pale-grey, becoming darker, whitish beneath, with few grey rhizinae ($K \pm$ ^{yellowish}). Apothecia small or moderate in size, the disc pruinose or naked, the margin entire, sometimes becoming crenulate; spores oblong, 15–23 μ long, 8–11 μ thick.—*Ph. stellaris* var. *tenella* Nyl. in Mém. Soc. Sci. Nat. Cherb. v. p. 107 (1857); Cromb. Lich. Brit. p. 39; Leight. Lich. Fl. p. 151; ed. 3, p. 141; var. *leptalea* Nyl. Syn. Lich. p. 425 (1860); Cromb. Lich. Brit. p. 39 & Monogr. i. p. 311; Leight. Lich. Fl. p. 151; ed. 3, p. 140; subsp. *tenella* Nyl. ex Cromb. in Grevillea xv. p. 78 (1887) & Monogr. i. p. 312. *Muscus parvus cinereus marginibus pilosis* Buddle Hort. Sicc. ii. fol. 6, n. 7 in Herb. Sloane. *Lichenoides hispidum minus et tenerius, scutellis nigris* Dill. Hist. Musc. p. 152, t. 20, f. 46 (1741). *Lichen hispidus* Schreb. Spic. Fl. Lips. p. 126 (1771). *L. tenellus* Scop. Fl. Carn. ed. 2, ii. p. 394 (1772); With. Arr. ed. 3, iv. p. 56; Engl. Bot. t. 1351. *L. ciliaris* var. Lightf. Fl. Scot. ii. p. 828 (1777); Huds. Fl. Angl. ed. 2, p. 538. *L. leptaleus* Ach. Lich. Suec. Prodr. p. 108 (1798). *Parmelia tenella* Ach. Meth. Lich. p. 250 (1803); Tayl. in Mackay Fl. Hib. ii. p. 147. *Borreria tenella* Ach. Lich. Univ. p. 498 (1810); S. F. Gray Nat. Arr. i. p. 434; Hook. Fl. Scot. ii. p. 56 & in Sm. Engl. Fl. v. p. 222. *B. hispida* Mudd Man. p. 106 (1861) (incl. var. *tenella*).

Esicc. Bohl. n. 20; Carroll Lich. Hib. n. 8; Cromb. n. 151; Johns. n. 92; Larb. Lich. Hb. n. 330; Leight. n. 174; Mudd n. 78.

Somewhat similar in habit and appearance to *Ph. ciliaris*, but of slighter structure throughout. The two plants, *Lichen tenellus* and *L. leptaleus*, now united under *Ph. hispida*, do not differ except in the hooded tips, frequently soresiate, of the lacinia in subsp. *tenella*. These are caused by a mite which eats away the cortex and stimulates a formation of gonidial tissue (Bouly de Lesdain, Lich. Dunk. p. 68). The upper cortex is plectenchymatous and densely granuloë; the lower cortex is fibrous with here and there rhizinae; the lacinia are mainly attached by the cilia.

Hab. On trees, rarely on oid walls or boulders in maritime and inland districts.—*Distr.* Common throughout the British Isles.—*B. M.* La Moye, Jersey; Guernsey; Penzance, Withiel and St. Minver, Cornwall; Bolt Head and Plymouth, Devon; Lymington, Hants; Shanklin and Brading, I. of Wight; St. Leonards Forest, Wolstonbury, Bolney and Hurstpierpoint, Sussex; Holmwood, Surrey; Ulting and Walthamstow, Essex; near Cirencester, Gloucestershire; Twycross and Bardon Hill, Leicestershire; Grimsbury Green, Northamptonshire; Malvern, Worcestershire; Llanymynech and Oswestry, Shropshire; Tenby, Penbrokeshire; Aberdovey and Dolgelly, Merioneth; Anglesea; Bury St. Edmunds, Suffolk; Eaton and Earsham, Norfolk; Buxton, Matlock, Darley, Eyam and Cromford, Derbyshire; Ayton, Stokesley and Kildale, Cleveland, Yorkshire; Gainsford, Durham; Holy Island, Northumberland; Croft Head, Westmoreland; near Asby, Cumberland; New Galloway, Kirkeudbrightshire; Swanston

Wood and near Edinburgh; Wormit Bay, Fife; Appin, Argyll; Ben Lawers, Killin and Blair Drummond, Perthshire; Tealing, Auchterhouse and Montrose, Forfarshire; Castleton of Braemar and Cults, Aberdeenshire; Carrigaloe, Cork; Dromoreland, Clare; Cushleeka and Dugort, Achill Island, Mayo.

Form *exempta* A. L. Sm.—Laciniae shorter and broader, sometimes crowded and imbricate, sparingly and shortly ciliate. —*Physcia stellaris* subsp. *tenella* f. *exempta* Cromb. Monogr. i. p. 313 (1894). *Borreria tenella* var. *exempta* Ach. Lich. Univ. p. 499 (1810). *Parmelia tenella* var. *exempta* Tayl. in Mackay Fl. Hib. ii. p. 147 (1836).

Exsicc. Johns. n. 93.

Hab. On the trunks of trees and on palings.—*Distr.* Rare in N. England and S.W. Ireland, probably overlooked.—*B. M.* Wark-on-Tyne, Northumberland; Ballynegarde, Limerick.

Form *subobscura* A. L. Sm.—Thallus rather darker and cilia darker.—*Ph. stellaris* var. *subobscura* Nyl. in Bidr. Finl. Nat. iv. p. 239 (1859); Cromb. in Grevillea xv. p. 78 (1887) & Monogr. i. p. 311; Leight. Lich. Fl. ed. 3, p. 141.

Exsicc. Larb. Lich. Hb. (without a number).

The darker colour of thallus and cilia may possibly be due to the exposed habitat of the form.

Hab. On rocks and wall-tops.—*Distr.* Rare in the Channel Islands, N. England, Highlands of Scotland and W. Ireland.—*B. M.* La Moye, Jersey; Kildale, Cleveland, Yorkshire; Craig Tulloch, Blair Athole, Perthshire; Leenane, Galway.

11. *Ph. astroidea* Nyl. in Act. Soc. Linn. Bord. sér. 3, i. p. 308 (1856).—Thallus irregularly orbicular, thin, closely appressed, the laciniae of the periphery narrow or rather broad, crenate at the tips, the centre of the thallus granular, isidiose or becoming wholly pulverulent-sorediose, glaucous- or whitish-grey; beneath whitish, with numerous short slightly brownish rhizinae (K + yellow, CaCl + yellow). Apothecia rare, small, the disc brownish-black, naked or pruinose, the margin inflexed, becoming crenulate; spores ellipsoid-oblong, 17–20 μ long, 8–11 μ thick.—Carroll in Journ. Bot. iii. p. 288 (1865); Cromb. Lich. Brit. p. 39; Leight. Lich. Fl. p. 153; ed. 3, p. 139. *Parmelia astroidea* Clem. Ensayo, p. 302 (1807). *P. Clementi* Turn. in Trans. Linn. Soc. ix. p. 146, t. 13, fig. 1 (1808). *P. Clementiana* Ach. Lich. Univ. p. 483 (1810); S. F. Gray Nat. Arr. i. p. 439; Tayl. in Mackay Fl. Hib. ii. p. 147. *P. colummaris* Tayl. tom. cit. p. 144 (1836). *Lichen Clementi* Sm. Engl. Bot. t. 1779 (1807). *Squamaria Clementi* Hook. in Sm. Engl. Fl. p. 196 (1833). *Borreria astroidea* Mudd Man. p. 108, t. 2, fig. 32 (1861) (incl. var. *Clementi*)

Exsicc. Leight. n. 324.

A southern species first discovered in Spain and rarely fruiting in our country. The thallus is extremely variable, but generally dis-

tinguished by the extensive soredial development, the whole centre of the thallus frequently becoming leprose; occasionally it is more isidiose (*Parmelia columnaris*). The upper cortex is plectenchymatous, the lower is indistinctly fibrous, being formed of rather thick-walled branching hyphæ subparallel to the long axis of the lobes.

Hab. On the trunks of trees, often in orchards, and on tiled roofs in maritime and inland districts.—*Distr.* Somewhat rare in the Channel Islands, S. and Central England, N. Wales, S. and W. Ireland, not seen from Scotland.—*B. M.* Rozel and St. Martin's, Jersey; Guernsey; Penzance, Cornwall; near Plymouth, Devon; near Southampton, Hants; Ryde, I. of Wight; Brighton, Henfield, Sedlescombe, Glynde, near Lewes and Hurstpierpoint, Sussex; near Maidstone and Tunbridge Wells, Kent; Saffron Walden and Epping Forest, Essex; West Haddon and Buckley Folly, Northamptonshire; Twycross, Leicestershire; Barmouth, Merioneth; Carigaline near Cork; Dunkerron, Kerry; Tervoe, Limerick; Kylemore Lake, Connemara, Galway.

Form *elegans* Cromb. Monogr. i. p. 317 (1894).—Thallus glaucous-white, the laciniae long and narrow, branched and spreading, frequently isidiose at the margins.—Var. *elegans* Nyl. ex Leight. Lich. Fl. ed. 3, p. 139 (1879).

Essicc. Larb. Lich. Hb. n. 88.

Hab. On rocks in a maritime district.—*B. M.* S. of Kylemore Lake, Connemara, Galway (the only British locality).

12. *Ph. cæsia* Nyl. in Act. Soc. Linn. Bord. sér. 3, i. p. 308 (1856).—Thallus normally orbicular-stellate, closely adnate, formed of narrow dividing radiating laciniae, convex, contiguous, and spreading at the tips, light- or dark-grey, sprinkled with round whitish-grey soralia; beneath pale, with brown rhizinae (K + yellow). Apothecia rare, chiefly central, rather small, naked or pruinose, the margin prominent, entire or crenulate; spores oblong, 16–23 μ long, 9–13 μ thick.—Cromb. Lich. Brit. p. 39. *Ph. stellaris* var. *cæsia* Leight. Lich. Fl. p. 152 (1871); ed. 3, p. 141. *Lichenoides cinereum, segmentis argutis stellatis, scutellis nigris* Dill. Hist. Musc. p. 176, t. 24, fig. 70 c (1741). *Lichen cæsius* Hoffm. Enum. Lich. p. 65, t. 12, fig. 1 (1784); Engl. Bot. t. 1052. *Lichen Psora* Dicks. Pl. Crypt. fasc. iii. p. 17 (1793); With. Arr. ed. 3, iv. p. 26. *Parmelia cæsia* Ach. Meth. Lich. p. 197 (1803); S. F. Gray Nat. Arr. i. p. 443; Tayl. in Mackay Fl. Hib. ii. p. 147. *Squamaria cæsia* Hook. in Sm. Engl. Fl. v. p. 196 (1833). *Borrera cæsia* Mudd Man. p. 107 (1861).

Essicc. Johns. n. 252; Leight. n. 323.

Distinguished by the stellate outline and by the presence of soralia, though in some specimens one or other of these characters is obscure. The lower cortex is fibrous formed of brownish irregularly parallel hyphæ, with occasional cell formation.

Hab. On walls, roofs and boulders in lowland and upland districts.—*Distr.* General though not common throughout the British Isles,

—*B. M.* Guernsey; Withiel and near Penzance, Cornwall; Porchester, Hants; Chestham and Hurstpierpoint, Sussex; Richmond House, Surrey; Uting and Walthamstow, Essex; near Oxford and Calthorpe, Oxfordshire; near Harboro' Magna, Warwickshire; Twycross and Bardon Hill, Leicestershire; near Oswestry, Shropshire; Barmouth, Merioneth; Buxton, Derbyshire; Ayton, Cleveland, Yorkshire; Teesdale, Durham; near Hexham, Northumberland; near Kendal, Westmoreland; New Galloway, Kirkeudbrightshire; Kirkfield, Lanarkshire; near Edinburgh; Appin, Argyll; Dunblane, Ben Lawers and Craig Tulloch, Blair Athole, Perthshire; Crathie, Braemar, Aberdeenshire.

Form *teretiuscula* Cromb. Monogr. i. p. 318 (1894).—Lacinia narrower and somewhat convex, less contiguous but crowded and partly imbricate.—*Parmelia cæsia* var. *teretiuscula* Ach. Lich. Univ. p. 479 (1810).

Distinguished only by the characters of the lacinia; intermediate states are not wanting. British specimens are sterile.

Hab. On rocks in maritime and inland districts.—*Distr.* Collected only in W. England and S.W. Ireland.—*B. M.* Penzance, Cornwall; Malvern, Worcestershire; Dunkerron, Kerry.

13. *Ph. elæina* A. L. Sm.—Thallus rather small, thin, orbicular, of narrow imbricate-stellate lacinia, multifid at the circumference, dull greenish-grey, closely adhering to the substratum, frequently breaking up in the older parts and becoming roughened or leprose or sorediate; beneath light-coloured or brownish, attached by few delicate rhizina (K—). Apothecia rather rare, small, the disc brownish-black, the margin entire, prominent; spores ellipsoid, 14–21 μ long, 8–10 μ thick, or smaller.—*Ph. adglutinata* Nyl. in Flora xlv. p. 355 (1862); Cromb. Lich. Brit. p. 40 & Monogr. i. p. 320; Leight. Lich. Fl. ed. 3, p. 137. *Ph. obscura* var. *adglutinata* Leight. Lich. Fl. p. 149 (1871). *Lichen elæinus* Sm. Engl. Bot. t. 2158 (1810). *Lecanora adglutinata* Floerke Deutsche Lich. iv. p. 7 (1819), Tayl. in Mackay Fl. Hib. ii. p. 146. *Parmelia elæina* Wahlenb. ex Ach. Meth. Lich. Suppl. p. 46 (1803); S. F. Gray Nat. Arr. i. p. 439. *Squamaria elæina* Hook. in Sm. Engl. Fl. v. p. 197 (1833).

Ersicc. Cromb. n. 152; Larb. Lich. Hb. n. 49.

The thallus is extremely thin, and is closely agglutinate to the support. The lower cortex is formed of a narrow band of hyphae parallel to the long axis from which hyphae singly, or in rhizinose strands, pass out and attach it to the bark. Crombie draws attention to the unusual spermogones which are olive-brown with acicular spermatia, about 18 μ long, and scarcely 1 μ thick.

Hab. On the trunks of trees, rarely on walls in maritime and inland districts.—*Distr.* Probably not uncommon in England and W. Ireland, rare in the Channel Islands; not recorded from Scotland.

—*B. M.* Guernsey; Penzance, Cornwall; Lymington, Hants; Glynde, Hurstpierpoint and near Henfield, Sussex; Walthamstow,

Essex; near Cirencester, Gloucestershire; Gamlingay, Cambridgeshire; Ayton, Cleveland, Yorkshire; near Kendal, Westmoreland; Killaloe, Clare; near Letterfrack, Connemara, Galway.

Form *sorediata* A. L. Sm.—Laciniae broader, dilated at the tips, closely appressed, the margins and centre almost entirely leprose-sorediate, greyish-glaucous. Apothecia not seen. *Ph. adglutinata* f. *sorediata* Nyl. ex Leight. Lich. Fl. ed. 3, p. 138 (1879); Cromb. Monogr. i. p. 321.

Essicc. Larb. Lich. Hb. n. 127.

Paler in colour than the species, and more entirely sorediate.

Hab. On walls and trees in upland districts.—*Distr.* Rare in W. Ireland.—*B. M.* Letterfrack and Mweelan, Connemara, Galway.

C. *Cortex plectenchymatous on both surfaces.*

14. *Ph. erosa* Leight. Lich. Fl. p. 152 (1871).—Thallus suborbicular, moderate in size, composed of mostly short crowded imbricate laciniae, minutely crenate or notched, as if eroded at the margins, light-grey, often ascending and powdery-sorediate, beneath whitish-yellow, sparingly rhizinose (K + yellow, CaCl + yellow). Apothecia rather small, dark-brown, pruinose or naked, the margin subentire; spores oblong-ellipsoid, 14–20 μ long, 7–10 μ thick.—Cromb. in Journ. Bot. x. p. 358 (1872); Leight. Lich. Fl. ed. 3, p. 139. *Ph. cæsia* var. *albinea* Cromb. Lich. Brit. p. 39 (1870) (non Ach.). *Squamaria erosa* Borr. Engl. Bot. Suppl. t. 2807 (1807). *S. tribacia* Hook. in Sm. Engl. Fl. v. p. 194 (1833). *Borreria cæsia* var. *albinea* Mudd Man. p. 108, t. 2, fig. 31 (1861) (non Ach.).

Essicc. Larb. Cæsar. n. 24 & Lich. Hb. n. 294; Leight. n. 266.

Closely allied to *Ph. tribacia*, but differing in the more delicate texture and with fewer rhizinae. In both species the cortex of the lower surface, like the upper, is of small-celled indistinct plectenchyma.

Hab. On trees, walls and rocks in maritime and upland districts.—*Distr.* Not general nor common throughout the British Islands.—*B. M.* St. Mary's, Scilly; Rozel, St. Ouen's and La Moye, Jersey; Jerbourg and Moulin Huet, Guernsey; Penzance and Withiel, Cornwall; Plymouth and Wembury, Devon; Porchester, Hants; Bexhill and Washington, Sussex; near Swindon, Wilts; Kingston, Somerset; Malvern, Worcestershire; Nannau, Dolgelly, Barnouth and Aberdovey, Merioneth; near Ayton, Cleveland, Yorkshire; near Staveley, Westmoreland; New Galloway, Kirkcudbrightshire; Barmaldine, Argyll; Invermoriston, Invernesshire.

15. *Ph. tribacia* Nyl. in Flora Ivii. p. 307 (1874).—Thallus moderate in size, irregularly orbicular, the lobes short, partly imbricate, crenate at the edges, greyish-white, sprinkled with small subglobose concolorous soralia which may coalesce into sorediate pustules; beneath brownish-white, with few concolorous rhizinae. Apothecia moderate in size, blackish, the thalline

margin subentire or crenulate; spores oblong, 15–20 μ long, 8–11 μ thick.—Cromb. in Grevillea xv. p. 78 (1887). *Ph. tribacoides* Nyl. l. c.; Cromb. in Grevillea iii. p. 22 (1874) & Monogr. i. p. 315; Leight. Lich. Fl. ed. 3, p. 140. *Lecanora tribacia* Ach. Lich. Univ. p. 415 (1810). *Psoroma tribacium* S. F. Gray Nat. Arr. i. p. 445 (1821). *Borrera cæsia* var. *tribacia* Mudd Man. p. 107 (1861).

Ph. tribacoides is similar to *Ph. tribacia* except in the reaction with potash; both turn yellow in the cortex and soredia, but the former gives a somewhat stronger colour in the medulla. Apothecia are extremely rare; there are none present in any of our specimens; the description of spores, etc., is taken from Crombie (Monogr. i. p. 315).

Hab. On trees in maritime districts.—*Distr.* Local and rare in the Channel Islands and S. England.—*B. M.* St. John's and St. Martin's, Jersey; near Penzance, Cornwall; Lympington, Hants.

16. *Ph. subdetersa* Nyl. in Flora lxi. p. 344 (1878) (note).—Thallus spreading, formed of rather wide appressed lobes, pale greenish-brown, sparingly sorediate on the surface of the lobes, the soredia and medulla yellowish (medulla K + slightly yellow); beneath brown, rhizinose. Apothecia unknown.

Distinguished by the colour of the medulla and soredia. Upper and lower cortices are plectenchymatous.

Hab. Among mosses on rocks in subalpine regions.—*Distr.* Very rare in W. England and S. Grampians, Scotland.—*B. M.* North Hill, Malvern, Worcestershire; Ben Lawers, Perthshire.

17. *Ph. orbicularis* Dalla Torre & Sarnth. Die Flechten Tirol, etc. p. 165 (1902).—Thallus spreading, closely appressed, cracked and almost crustaceous or lacinate, the laciniae narrow, often overlapping, spreading in all directions, subrenate or entire at the tips, dark- or greyish-brown; beneath very black, with crowded short simple or branched rhizinae (K–, CaCl–). Apothecia rather small, generally numerous, the disc blackish-brown, the margin prominent, entire; spores ellipsoid-oblong, 15–25 μ long, 8–12 μ thick.—*Ph. obscura* Nyl. in Act. Soc. Linn. Bord. sér. 3, i. p. 309 (1856). Cromb. Lich. Brit. p. 39 (incl. var. *chloantha*, excl. var. *ulothrix*); Leight. Lich. Fl. p. 148 pro parte, ed. 3, p. 136 pro parte (incl. var. *chloantha*). *Lichen orbicularis* Neck. Meth. Muse. p. 88 (1771). *L. obscurus* Ehrh. Pl. Crypt. n. 177 (1785) nomen nudum. *L. cyclostelis* Ach. Lich. Suec. Prodr. p. 113 (1798); Engl. Bot. t. 1942. *Parmelia cyclostelis* Ach. Meth. Lich. p. 199 (1803); S. F. Gray Nat. Arr. i. p. 444 pro parte; Hook. in Sm. Engl. Fl. v. p. 202 pro parte. *Borrera obscura* Mudd Man. p. 109 (1861) pro parte. *Exsicc.* Lich. Hb. n. 252 & Lich. Cantab. n. 14.

A dull-coloured plant with an orbicular or irregular outline, frequently sprinkled with sorediate-like dots, which seem to be

nibbled or abraded portions; occasionally the rhizinae grow horizontally from the margins of the laciniae. The lower cortex is a rather broad layer of very dark plectenchyma. Apothecia are fairly frequent; spermatogones are still more numerous with spermatia. $3\ \mu$ long, about $1\ \mu$ thick. The variety (*Parmelia chloantha* Ach. Syn. Lich. p. 217 (1814)), distinguished by a lighter-coloured thallus, does not occur in the British Isles.

Hab. On trunks of trees in inland districts.—*Dist.* Rare in England and the S. Grampians, Scotland.—*B. M.* Brockenhurst, New Forest, Hants; Beeding, Sussex; near Ledbury, Herefordshire; Malvern, Worcestershire; Newmarket, Cambridgeshire; Penylan, Denbighshire; Finlarig, Killin, Perthshire.

Var. *ciliata* Dalla Torre & Sarnth. Die Flechten Tirol, etc. p. 166 (1902).—Thallus similar to that of the species; beneath dark-rhizinose, the rhizinae frequently growing straight from the margin of the lobes, like rigid cilia. Apothecia rather larger, numerous, the under side frequently furnished with stiff grey or dark cilia.—*Physcia ulothrix* Nyl. in Flora Iviii. p. 360 (1875); Cromb. in Journ. Linn. Soc. xxii. p. 571 (1880) & Monogr. i. p. 319. *Ph. obscura* var. *ulothrix* Cromb. Lich. Brit. p. 39; Leight. Lich. Fl. p. 149; ed. 3, p. 137. *Lichenoides viride, segmentis angustis distortis, scutellis pullis* Dill. Hist. Musc. p. 178, t. 24, fig. 72 A (1741). *Lichen ciliatus* Hoffm. Enum. Lich. p. 69, t. 14, fig. 1 (1784); Dicks. Pl. Crypt. fasc. iii. p. 16? With. Arr. ed. 3, iv. p. 30. *L. stellaris* var. 4 With. tom. cit. p. 31 (1796). *L. ulothrix* Ach. Lich. Suec. Prodr. p. 113 (1798). *L. virellus* Sm. Engl. Bot. t. 1696 (1807) lower fig. *Parmelia ulothrix* Ach. Meth. Lich. p. 200 (1803); Tayl. in Mackay Fl. Hib. ii. p. 146. *Borrera obscura* var. *ulothrix* Mudd Man. p. 110 (1861).

Exsicc. Johns. n. 210; Leight. n. 80.

Though given specific rank by Acharius, Crombie and others, this lichen can only be considered a variety, as the ciliate character of the lobes, due to the horizontal rhizinae of the margin, is also a feature of the species, though to a less marked extent, and the brush-like cilia of the apothecia are not constant even in the same specimen. The cortex of the under surface is like that of the species. The identity of *Lichen ciliatus* with *Physcia ulothrix* was determined by Wainio (Medd. Soc. Faun. & Fl. Fenn. xiv. p. 14 (1886)).

Hab. On the trunks of trees, rarely on palings and walls in maritime and upland districts.—*Distr.* Rather uncommon throughout Great Britain and Ireland.—*B. M.* Near Penzance, Cornwall; Torquay, Devon; Bolney, Brighton and Aldbourne, Sussex; Ūlting, Essex; Cirencester, Gloucestershire; Gopsall, Leicestershire; near Worcester; Buxton, Derbyshire; Ashgill, Cumberland; New Galloway, Kirkeudbrightshire; Appin, Argyll; Finlarig, Killin and Glen Fender, Blair Athole, Perthshire; Carrigaloe, Cork.

Var. *virella* Dalla Torre & Sarnth. Die Flechten Tirol, etc. p. 166 (1902).—Thallus spreading, pale greyish-green, sometimes

dotted with small roundish soralia. Apothecia small or moderate in size, rarely ciliate on the under side.—*Physcia obscura* var. *virella* Leight. Lich. Fl. p. 148 (1871); ed. 3, p. 137. *Ph. endococcina* Cromb. in Journ. Bot. x. p. 359 (1872) (non. Koerb.): Leight. Lich. Fl. ed. 3, p. 142. *Ph. ulothrix* var. *virella* Cromb. in Grevillea xv. p. 78 (1887) & Monogr. i. p. 320; Dill. l. c. fig. 72 b. *Lichen virellus* Ach. Lich. Suec. Prodr. p. 108 (1798): Engl. Bot. t. 1696, two upper figs. *Parmelia virella* Ach. Meth. Lich. p. 201 (1803); Hook. in Sm. Engl. Fl. v. p. 202. *Borreria obscura* var. *virella* Mudd Man. p. 110 (1861).

Essicc. Larb. Lich. Hb. n. 126 & Lich. Cantab. n. 15; Mudd n. 80.

Distinguished by the lighter colour, bright-green when wet, light-brown when dry. Some of the specimens like those of the species are dotted with small abraded or nibbled spots, others are abundantly sorediate. The lobes are rhizinose-ciliate and occasionally the apothecia. Both species and varieties, more especially var. *virella*, are frequently associated with *Xanthoria parietina*, and are thus liable to be suffused with parietin, which give a yellow tone of colour to the whole thallus (*Ph. endococcina* Cromb.).

Hab. On trunks of old trees, rarely on walls in maritime and inland districts.—*Distr.* Not uncommon in England, rarer in Wales, Scotland and Ireland.—*B. M.* Near Penzance, Cornwall; Ilsham, Torquay, Devon; Ryde, I. of Wight; near Brighton, Henfield and Danny, Sussex; Epping Forest and Ulting, Essex; near Cirencester and Honeybourne, Gloucestershire; Broadwas and Norton, Worcestershire; Gogmagog Hills and near Newmarket, Cambridgeshire; Aberdovey, Merioneth; Darley, Derbyshire; Ayton, Cleveland, Yorkshire; Airds, Appin, Argyll; Finlarig, Killin and Glen Fender, Perthshire; Killaloe, Cork; Lyons near Dublin.

18. *Ph. lithotea* Nyl. in Flora lx. p. 354 (1877).—Thallus sub-orbicular, composed of short plane subimbricate multifid laciniæ, light- or generally dark-brown, beneath black, the rhizinae black, numerous, occasionally extending from the margins (K —, CaCl —). Apothecia rare “central, blackish; spores as in the preceding species or slightly smaller.”—*Ph. obscura* subsp. *lithotea* Cromb. in Grevillea xv. p. 78 (1887); var. *chloantha* f. *lithotea* Leight. Lich. Fl. ed. 3, p. 137 (1879). *Parmelia cyclosetis* var. *lithotea* Ach. Meth. Lich. p. 199 (1803).

Essicc. Larb. Lich. Hb. (without a number).

Resembles the preceding species and varieties in the structure of the thallus, the upper cortex being plectenchymatous, the lower also of plectenchyma very deeply impregnated with a dark brown pigment. The older specimens become roughly furfuraceous.

Hab. In depressions of rocks by the sea and by lakes and streams in mountainous districts.—*Distr.* Local and scarce in N. England, N. Wales, S. Grampians, Scotland, and N.W. Ireland.—*B. M.* Near Newton, Cleveland, Yorkshire; Teesdale, Durham; Loch Tay, Perthshire; Connemara, Galway.

50. **RINODINA** S. F. Gray Nat. Arr. i. p. 448 (1821) pro minima parte; emend. Massal. Ric. Lich. Crost. p. 14 (1852); Mudd Man. p. 142. *Lecanora* sect. *Rinodina* Ach. Lich. Univ. p. 344 (1810) pro minore parte. (Pl. 50.)

Thallus crustaceous, rarely squamulose, non-corticate except in highly developed species. Algal cells *Protococcus*. Apothecia dark-coloured, generally with a prominent thalline margin: paraphyses slender, broader, septate, brown and often shortly branched at the tips; spores 8 in the ascus (rarely more) 1-septate, more or less distinctly polarilocular, brown.

The spores of this genus, as in *Physcia*, are nearly always distinctly polarilocular with the cell-lumens rather near the median wall. The thallus in most species is coloured some tinge of grey, in others it becomes very dark. The genus is distinguished from *Buellia* by the thalline margin of the apothecium and also by the more or less distinctly polarilocular spores. The same type of spores occurs in *Buellia discolor*, *B. interpolata*, *B. biloculata* and *B. polyspora* (Brit. Lich. ii. p. 168). The first two species have a colourless hypothecium, and are clearly allied to *Rinodina*; the two latter having a dark hypothecium are more truly lecidine.

Thallus isidioid-squamulose.

1. **R. isidioides** Oliv. Lich. Eur. fasc. 2, p. 186 (1909).—Thallus effuse, consisting of somewhat coralloid isidia-like processes, scattered or rarely united into a squamulose structure, simple or sometimes divided unevenly, cylindrical or slightly compressed, whitish or pale greyish-green (K + yellowish, CaCl -). Apothecia small or moderate in size, plane, the disc blackish, the thalline margin entire or crenulate-isidioid; paraphyses slightly clavate, septate and brown at the tips; spores fusiform-ellipsoid, sometimes constricted in the middle, colourless then dark-brown, large, 26–30 μ long, 12–15 μ thick.—*Parmelia isidioides* Borr. Engl. Bot. Suppl. t. 2808 (1837). *Lecanora isidioides* Nyl. in Mém. Soc. Sci. Nat. Cherb. v. p. 115 (1857); Cromb. Lich. Brit. p. 49 & Monogr. i. p. 402; Leight. Lich. Fl. p. 224; ed. 3, p. 214. *Borreria isidioides* Mudd Man. p. 106 (1861).

An endemic species well characterized by the peculiar thallus; it has recently been rediscovered in the New Forest by R. Paulson. The structure of the minute "radiate" thallus is almost wholly cellular with the gonidia massed towards the centre; there is no definite cortex.

Hab. On mossy and naked trunks of trees in inland or upland districts.—*Distr.* Rare in N. Wales and S. England.—*B. M.* Cadnam, New Forest, Hants; Cwm Bychan and Dolymellynen, Merioneth.

Thallus crustaceous, grey or whitish.

On trees or wood.

2. **R. polyspora** Th. Fr. Lich. Arct. p. 126 (1860).—Thallus very thin, smooth or granulate-verrucose, whitish or greyish

(K —, CaCl —). Apothecia minute, adnate, the disc brownish or blackish, at first plane and then with a thin rather paler margin, becoming convex and immarginate; paraphyses somewhat conglutinate, slightly thicker, knobbed and brown at the tips, and often shortly branched and septate; spores 12–24 in the ascus, oblong-ellipsoid, straight or slightly curved, 13–16 μ long, 5–8 μ thick.—*R. sophodes* Massal. Ric. Lich. Crost. p. 14 (1852) (non Ach.); Mudd Man. p. 142. *Lecanora polyspora* Nyl. in Not. Sällsk. Faun. & Fl. Fenn. Förh. n. ser. viii. p. 182 (1871); Cromb. in Grevillea xviii. p. 47 (1889) & Monogr. i. p. 402.

Distinguished by the number of spores in the ascus. There is no British specimen in the herbarium.

Hab. On smooth bark of trees in mountainous regions.—*Distr.* Only very sparingly at Craig Calliach, Perthshire.

3. *R. sophodes* Th. Fr. Lich. Arct. p. 125 (1860) (non Massal.).—Thallus determinate or subdeterminate, often sub-orbicular, rather thin, verrucose-areolate, grey or greyish-brown, with a black hypothallus (K —). Apothecia small, usually crowded in roundish patches, brownish-black, the thalline margin entire, sometimes becoming crenulate; spores ellipsoid, 12–20 μ long, 6–8 (or 10) μ thick.—*Rinodina exigua* var. *horiza* Mudd Man. p. 143 (1861). *Lichen sophodes* Ach. Lich. Suec. Prodr. p. 67 (1798); Engl. Bot. t. 1791. *Lecanora sophodes* Ach. Lich. Univ. p. 356 (1810); S. F. Gray Nat. Arr. i. p. 450 pro parte; Hook. in Sm. Engl. Fl. v. p. 188 pro parte; Cromb. Lich. Brit. p. 49 pro parte & Monogr. i. p. 394; Leight. Lich. Fl. p. 224; ed. 3, p. 214 pro parte. *Lecanora subfusca* var. *horiza* Ach. Lich. Univ. p. 394 (1810)?

Exsic. Mudd n. 109.

The thallus, though mostly circumscribed by the black line of the hypothallus, is sometimes effuse, and generally crowded with apothecia. These owe the dark colour of the disc to the paraphyses, which are brown over the tips; they are slightly wider and septate upwards, sometimes ending in several short branchlets. The spores have thickened walls, each cell with a restricted lumen, which shows frequently a projection towards the median septum. Massalongo's species has asci 14–20-spored, and evidently refers to *R. polyspora*.

Hab. On trunks of trees, especially ash, in wooded localities.

Distr. Local and rare in S.W. and N. England and S. Wales.—*B. M.* Near Anstey's Cove, Torquay, Devon; near Lyndhurst, New Forest, Hants; near Cuckmere, Sussex; Kemble, Wilts; Llanymynech, Shropshire; St. Donats, Glamorganshire; Ayton, Cleveland, Yorkshire.

Var. *malangica* Th. Fr. Lich. Scand. p. 200 (1871).—Thallus effuse, coarsely areolate, furfuraceous on the surface, dark greenish-olive or blackish.—*Rinodina leprosa* subsp. *malangica* Norm. in K. Norsk. Vid. Selsk. Skrift. v. p. 313 (1868). *Lecanora*

sophodes f. *malangica* Leight. Lich. Fl. p. 215 (1879); var. *malangica* Cromb. in Grevillea xviii. p. 46 (1889) & Monogr. i. p. 394. Specimen not seen.

The B. M. specimen recorded as var. *malangica* is *Buellia myriocarpa*. It was collected by Leighton on Haughmond Hill, Shropshire.

Hab.—On trunks of trees.—*Distr.* Sparingly in W. England?

4. *R. exigua* S. F. Gray Nat. Arr. i. p. 450 (1821).—Thallus effuse, thin, membranaceous and continuous or areolate, often granular and scattered, whitish or pale- to dark-grey, hypothallus black, but rarely distinct (K—). Apothecia small, plane, the disc blackish, with a thin thalline margin, entire or crenulate, becoming convex with the margin excluded; paraphyses narrowly clavate, septate and brown at the tips; spores fusiform-ellipsoid, 11–18 μ long, 6–8 μ thick.—Mudd Man. p. 142 pro parte (incl. var. *periclea*). *R. periclea* S. F. Gray Nat. Arr. i. p. 449 (1821) pro parte. *Lichen exiguus* Ach. Lich. Succ. Prodr. p. 69 (1798); Engl. Bot. t. 1849 pro parte. *L. pericleus* Sm. Engl. Bot. t. 1850 (1808) (non Ach.). *Lecanora periclea* Hook. in Sm. Engl. Bot. v. p. 187 (1833); Tayl. in Mackay Fl. Hib. ii. p. 133. *L. exigua* Hook. in Sm. Engl. Fl. v. p. 187 (1833) pro parte; Cromb. Monogr. i. p. 395 pro parte. *L. sophodes* var. *exigua* Cromb. Lich. Brit. p. 49 (1870); f. *exigua* Leight. Lich. Fl. p. 224 (1871); ed. 3, p. 214.

Exsicc. Lich. Hb. nos. 169, 262.

Not easily distinguished from *R. sophodes*, but the thallus is usually more spreading and thinner, and the apothecia are smaller and less persistently marginate; the spores also are slightly smaller.

Hab. On trees, or more frequently on palings in maritime and inland districts.—*Dist.* Fairly common throughout the Channel Islands and England, evidently rare in Scotland and Ireland.—*B. M.* Noirmont, Jersey; Lyndhurst, New Forest, Hants; Hurstpierpoint, Sussex; Epping Forest, Essex; near Bristol, Somerset; Weston, Oxfordshire; near Morda, Oswestry, Shropshire; near Worcester; Suffolk; Yarmouth, Norfolk; Ayton, Cleveland, Yorkshire.

Var. *lecideoides* Th. Fr. Lich. Scand. p. 203 (1871).—Thallus grey, scanty or absent. Apothecia small, thin, plane, with a greyish thalline margin becoming crenulate or disappearing; spores oblong, 16–20 μ long, 8–11 μ thick.—*Lecanora sophodes* var. *lecideoides* Nyl. Lich. Scand. p. 149 (1861); f. *lecideoides* Leight. Lich. Fl. p. 225 (1871); ed. 3, p. 215 pro parte. *L. exigua* var. *lecideoides* Cromb. in Grevillea xviii. p. 46 (1889) & Monogr. i. p. 396.

Though with somewhat larger spores, resembles *R. exigua* in the habitat and in the subentire margin of the apothecium, which generally becomes excluded.

Hab. On old palings in inland districts.—*Dist.* Rare in S. England and Central Scotland.—*B. M.* Lyndhurst, New Forest, Hants; Glen Lochay, Killin, Perthshire.

5. *R. roboris* Arn. in Flora lxiv. p. 197 (1881); Oliv. Exp. Syst. Lich. p. 252 (1897).—Thallus determinate or subeffuse, thinish, continuous and somewhat wrinkled or superficially areolate or furfuraceous, whitish or greyish-white (K + yellow); hypothallus black, visible only occasionally as a narrow black line. Apothecia moderate in size or rather large, prominent, thickly scattered, the disc blackish, the margin persistent, becoming crenulate; paraphyses septate, irregularly branched and brown upwards; spores ellipsoid, 15–18 μ long, 6–9 μ thick.—*Lecanora roboris* Duf. ex Nyl. in Mém. Soc. Sci. Nat. Cherb. ii. p. 326 (1854); Cromb. in Grevillea xviii. p. 46 (1889) & Monogr. i. p. 397. *L. sophodes* var. *roboris* Nyl. Lich. Scand. p. 149 (1861); f. *roboris* Leight. Lich. Fl. p. 225 (1871); ed. 3, p. 215.

Essicc. Johns. n. 36; Larb. Lich. Hb. n. 260.

Distinguished by the more developed lighter-coloured thallus, by the reaction with potash, and by the whitish-margined apothecia.

Hab. On trunks of trees with rugged bark, rarely on stems of heather in maritime and inland localities.—*Dist.* Rather common in the British Isles except Scotland, where it has not yet been reported.—*B.* M. East Coast of Jersey; D'Ixcart, Sark; Launceston and Penzance, Cornwall; Ilsham, Torquay, Devon; New Forest, Hants; Tilgate and Danny, Sussex; Epping Forest, Langford, Maldon, Danbury and Thorndon Hall, Brentford, Essex; Savernake Forest, Wilts; Harboro' Magna, Warwickshire; near Worcester; Charnwood Forest, Leicestershire; Yarmouth, Suffolk; Cwm Bychan, Merioneth; Trefriw, Carnarvonshire; Teesdale, Durham; Felton Woods, Northumberland; Leven's Park, Westmoreland; Calder Abbey, Cumberland; Carrigaloe, near Cork; Doughruagh Mt., Connemara, Galway.

On rocks, slates, tiles, etc.

6. *R. confragosa* Koerb. Syst. Lich. Germ. p. 125 (1855).—Thallus effuse, generally thickish, warted-areolate, the tubercles sometimes rather sparse, greyish or dirty-white (K + yellow), hypothallus black, often not visible. Apothecia moderate in size or rather small, the disc blackish, the thalline margin prominent, becoming crenulate; paraphyses slender, septate and brown at the tips, and slightly enlarged; spores ellipsoid, 12–23 μ long, 7–13 μ thick.—*Parmelia confragosa* Ach. Meth. Lich. Suppl. p. 33 (1803). *Lecanora sophodes* var. *confragosa* Cromb. Lich. Brit. p. 49 (1870). *L. confragosa* Nyl. ex Lamy in Bull. Soc. Bot. Fr. xxv. p. 404 (1878); Leight. Lich. Fl. ed. 3, p. 222; Cromb. Monogr. i. p. 397.

Essicc. Larb. Caesar. n. 28 & Lich. Hb. n. 301.

Nearly allied to *R. roboris*, but with a generally thicker, duller thallus. The apothecia are numerous and prominent. The plant from Fairlight, Hastings, determined by Larbalestier as *Lecanora mougeotiioides* (A. L. Sm. Monogr. ii. p. 352), is identical with this species, as shown by Larbalestier's specimen lent by R. Paulson.

Hab. On granitic and schistose rocks in maritime and inland localities.—*Dist.* Rare throughout the British Isles.—*B. M.* La Coupe, Jersey; The Lizard, Cornwall; near Hastings, Sussex; Portlethen, Kincardineshire; near Crookhaven, Cork; Doughruagh Mt., Kylemore and Dawros River, Connemara, Galway; Ardglass, Down.

7. *R. atrocineræa* Koerb. Syst. Lich. Germ. p. 125 (1855).—Thallus effuse or determinate, thickish, whitish- or dark-grey, generally of rounded smooth verrucæ, continuous and crowded or scattered, with a black hypothallus (K + yellow, CaCl + reddish). Apothecia at first minute and innate in the verrucæ, becoming plane, at length convex, the disc dark-brown or blackish, the thalline margin rather thin, entire, becoming obliterated; spores ellipsoid, 17–25 μ long, 10–12 μ thick.—Mudd Man. p. 144, t. 2, fig. 49. *Lichen atrocineræus* Dicks. Pl. Crypt. fasc. iii. p. 14, t. 9, fig. 2 (1793); With. Arr. ed. 3, iv. p. 19; Engl. Bot. t. 2096. *Lecidea atrocineræa* Hook. in Sm. Engl. Fl. v. p. 174 (1833). *Lecanora milvina* Tayl. in Mackay Fl. Hib. ii. p. 134 (1836) pro parte (non Wahl.). *L. atrocineræa* Nyl. in Flora liii. p. 38 (1870); Cromb. in Journ. Bot. viii. p. 97 (1870) & Monogr. i. p. 398; Leight. Lich. Fl. p. 226; ed. 3, p. 216.

Exsicc. Leight. n. 146.

Differs from allied species in the reaction with CaCl; but the light-coloured verrucæ on the black hypothallus also give a distinctive tessellated appearance to this plant. Crombie has given spore sizes up to 30 μ long and 16 μ thick, but I have not been able to verify these large measurements. Spermogones are not infrequent with spermatia 7–9 μ long, 1–2 μ thick.

Hab. On rocks in maritime and upland districts.—*Dist.* Here and there throughout the British Isles.—*B. M.* Guernsey; near Penzance, Cornwall; Crown Hill, Plympton, Devon; Lyth Hill, Shropshire; Barmouth, Merioneth; Holyhead, Anglesea; Barcaldine, Argyll; Portlethen, Kincardineshire; near Cork; Cliffs of Moher, Clare; Dunkerron and Carig Mt., Kerry.

8. *R. subexigua* Oliv. Lich. Eur. fasc. 2, p. 181 (1909).—Thallus effuse, smooth, cracked-areolate, pale-greyish or dull-yellowish (K –). Apothecia minute, plane, the disc blackish, the thalline margin thick, entire, persistent; paraphyses slender, sometimes branched, knobbed and brown at the tips; spores ellipsoid, rather narrow at the ends, 12–18 μ long, 6–10 μ thick.—*Lecanora subexigua* Nyl. in Flora lvii. p. 308 (1874); Cromb. in Grevillea iii. p. 22 & Monogr. i. p. 396; Leight. Lich. Fl. ed. 3, p. 220.

The thallus is somewhat thicker than in *R. exigua*. The spores vary, but do not differ in size.

Hab. On granitic rocks in maritime districts.—*Dist.* Rare in S.W. England and E. Ireland.—*B. M.* Near Penzance, Cornwall.

9. *R. demissa* Arn. in Flora iv. p. 34 (1872).—Thallus thin, effuse, granulate or leprose or almost wanting, brownish or dull-grey, with a concolorous or darker hypothallus. Apothecia numerous, crowded or scattered, minute, the disc blackish, becoming convex and prominent, the thalline margin thin, entire, persistent or disappearing; paraphyses clavate, septate and brown at the tips; spores oblong-ellipsoid, sometimes constricted in the middle, 12–16 μ long, 5–9 μ thick.—*Lichen exiguus* Sm. Engl. Bot. t. 1849 (1808) pro parte (non Ach.). *R. metabolica* var. *demissa* Koerb. Syst. Lich. Germ. p. 124 (1855). *Lecanora exigua* f. *demissa* Stiz. in St. Gall. Nat. Ges. 1881, p. 359; Cromb. in Grevillea xviii. p. 46 (1889) & Monogr. i. p. 396. *L. sophodes* var. *laevigata* Cromb. Lich. Brit. p. 49 (1870) (non Ach.); f. *laevigata* Leight. Lich. Fl. ed. 3, p. 215 (1879); subsp. *laevigata* Cromb. in Grevillea xviii. p. 46 (1889) (non Stiz.) & Monogr. i. p. 395.

Exsicc. Johns. nos. 196, 367; Larb. Lich. Hb. n. 261; Mudd n. 107.

Under this species have been grouped the specimens that were regarded as saxicolous forms of *L. exigua*. It is distinct in habitat and in the dark, sometimes very scant or absent thallus, also in the more convex development of the apothecium.

Hab. On various rocks, sandstone, granitic, slate, etc., in maritime and inland districts.—*Dist.* Not uncommon throughout the British Isles.—*B. M.* Chateau Point, Jersey; Vale, Guernsey; Luccombe and Shanklin, I. of Wight; Henfield, Sussex; Ulting, Essex; near Cirencester and Charfield, Gloucestershire; Barmouth, Merioneth; near Brandon, Suffolk; Aber-Ty-Glyn, N. Wales; near Ayton, Cleveland, Yorkshire; Port Soderick, I. of Man; St. Bees, Cumberland; I. of Lismore, Argyll; Portlethen, Kincardineshire; Carrigaloe, Cork; Portmarnock, Dublin; Cleghan, Connemara, Galway.

10. *R. æquata* Oliv. Lich. Eur. fasc. 2, p. 177 (1909).—Thallus effuse, thin, smooth, greyish-white, often scarcely visible or obsolete (Kf + yellow). Apothecia small, thinly marginate, becoming convex, blackish or dark-brown, whitish within; spores broadly ellipsoid, 16–20 μ long, 10–11 μ thick; hymenial gelatine deep blue with iodine.—*Lecidea conioips* var. *æquata* Ach. Lich. Univ. p. 171 (1810). *L. æquata* Nyl. ex Cromb. in Journ. Bot. xii. p. 149 (1874). *Lecanora æquata* Nyl. in Flora lxvii. p. 392 (1884); Cromb. Monogr. i. p. 401.

The above description is taken from Crombie. The only specimen named *L. æquata* in the herbarium of the British Museum agrees outwardly with the description, but the apothecia are truly lecidine into which no gonidia have entered, and with a dark-brown hypothecium; the spores also are much smaller, about 12 μ long and 5 μ thick. It is a *Buellia*, similar to *Buellia micraspis* Anzi Exs. Lang. n. 197. That species has been cited by Th. Fr. (Lich. Scand. p. 601) as synonymous with *B. saratilis*; but the latter has a much more

developed thallus. It may however be a depauperate condition of that species.

Hab. On granitic rocks in maritime and inland regions.

11. *R. Bischoffii* Koerb. *Parerg. Lich.* p. 75 (1859).—Thallus thin, effuse, continuous and farinose or thinly areolate, greyish or brownish, often indistinct (K -). Apothecia very small, plane, with a thin entire thalline margin, becoming convex and immarginate, dark-brown; paraphyses with clavate branched septate and brown apices; spores broadly ellipsoid, 15–20 μ long, 7–12 μ thick.—*Psora Bischoffii* Hepp *Flecht. Eur.* n. 81 (1853). *Lecanora Bischoffii* Cromb. in *Journ. Bot.* xiii. p. 141 (1875) & *Monogr.* i. p. 399; *Leight. Lich. Fl.* ed. 3, p. 220.

Distinguished by the minute plane apothecia and the thin scurfy thallus.

Hab. On calcareous rocks in upland situations.—*Distr.* Rare in W. England and the Central Grampians, Scotland.—*B. M.* Rodmarton, Gloucestershire; Ennerdale, Cumberland; Craig Tulloch, Blair Athole, Perthshire.

Var. *immersa* Koerb. l. c.—Thallus immersed in the rock, visible as whitish spots. Apothecia immersed-foveolate, minute, the brown thalline margin somewhat prominent, otherwise as in the species.—*Lecanora Bischoffii* var. *immersa* Cromb. in *Journ. Bot.* xiv. p. 360 (1876) & *Monogr.* i. p. 400; *Leight. Lich. Fl.* ed. 3, p. 221. *Lecidea alociza* Cromb. in *Journ. Bot.* ix. p. 178 (1871) (non Massal.) pro parte; *Leight. Lich. Fl.* p. 310 pro parte. *Lecidea alocizoides* *Leight. Lich. Fl.* ed. 3, p. 325 (1879) pro parte. *Buellia alocizoides* A. L. Sm. *Monogr.* ii. p. 167 (1911) pro parte.

Confused with another minute lichen *Buellia alocizoides*, as the thalline margin is obscure and the spore-characters are not always well marked.

Hab. On calcareous rocks and walls in maritime and upland districts.—*Distr.* Rare in S.W. and N. England and in Wales.—*B. M.* Torquay, Devon; Yatton and Weston-super-Mare, Somerset; Eglwyseg rocks, Denbighshire; Buxton, Derbyshire.

12. *R. subarenaria* A. L. Sm.—Thallus thin, smooth, continuous and somewhat uneven or of scattered minute areolæ: hypothallus blackish-brown, underlying the areolæ or bordering the thallus. Apothecia minute, about 0.3–0.4 mm. in diameter, adnate, plane or concave with a prominent proper margin, the thalline margin not visible, but a gonidial layer present below the colourless hypothecium; paraphyses slender, clavate, septate, brown and often branched at the tips; asci clavate; spores 8 in the ascus often undeveloped, broadly ellipsoid, polarilocular, and sometimes swollen in the middle, the two loculi

near the centre and generally connected, large, mostly about $27\ \mu$ long and $12\ \mu$ thick, but also $30\ \mu$ long and $15\ \mu$ thick.

Allied to *Rinodina arenaria* Fr. a northern or mountainous continental species, but differing in the form of the spores and in other characteristics. The spores are frequently shrivelled and of small proportions, which may be due to inundation of the specimens, but there is no indication that they were collected in or near water.

Hab. On hard rocks.—*Distr.* Rare in S. and W. Ireland—*B. M.* Near Cork; Lettermore, Connemara, Galway.

Thallus dark-grey or blackish.

On trees.

13. *R. colobina* Th. Fr. Lich. Scand. p. 205 (1871).—Thallus effuse, thin, pulverulent, grey or greyish-black (K + purplish). Apothecia minute, plane, the disc blackish; the thalline margin thickish, entire, light-grey; paraphyses slender, septate, slightly thicker or capitate and bluish-brown at the tips (epithecium K + deep violet); spores ellipsoid, sometimes slightly constricted, $16\text{--}20\ \mu$ long, $7\text{--}9\ \mu$ thick.—*Lecanora colobina* Ach. Lich. Univ. p. 358 (1810); *Cromb.* in *Journ. Bot.* xx. p. 273 (1882) & *Monogr.* i. p. 400.

Essee. *Larb. Lich. Hb.* n. 91.

Distinguished by the bluish epithecium and the unusual reactions with potash.

Hab. On the trunks of old trees.—*B. M.* Entrance to Ickworth Park, Suffolk (the only British locality).

On rocks, walls, etc.

14. *R. teichophila* Jatta Syll. Lich. Ital. p. 276 (1900).—Thallus subdeterminate, thickish or sometimes rather thin, granular, deeply cracked-areolate, dark greenish-grey (K -). Apothecia numerous, rather small, plane, black, the thalline margin thickish, mostly entire, not prominent, paler than the thallus; spores ellipsoid, blunt at the ends, $18\text{--}27\ \mu$ long, $11\text{--}16\ \mu$ thick.—*R. exigua* var. *metabolica* Mudd *Man.* p. 143 (1861) (non Ach.). *Lecanora sophodes* var. *teichophila* Nyl. in *Bull. Soc. Bot. Fr.* xiii. p. 367 (1866); f. *metabolica* Leight. *Lich. Fl.* p. 225 (1871); ed. 3, p. 215. *L. teichophila* Nyl. ex Lamy in *Bull. Soc. Bot. Fr.* xxv. p. 405 (1878); *Cromb. Monogr.* i. p. 399.

Essee. Johns. n. 235; Mudd n. 108.

Very variable but distinguished by the large thick spores, and also by the dark deeply cracked thallus.

Hab.—On rocks and walls in maritime and upland situations.—*Distr.* Widely distributed but rare in England, also found in the Scottish Grampians and in W. Ireland.—*B. M.* Ulting, Essex; Bathampton Downs, Somerset; Cirencester, Gloucestershire; Holly

Bush Hill, Malvern, Worcestershire; near Ayton, Cleveland, Yorkshire; St. Bees, Cumberland; The Trossachs, Perthshire; Connemara, Galway.

15. *R. milvina* Th. Fries Lich. Arct. p. 124 (1860).—Thallus effuse, thickish, granular- or warted-areolate, unequal, brownish, or dark-coloured (K-); hypothallus thin, black. Apothecia rather small, plane, the disc brownish-black, the thalline margin entire; spores ellipsoid, 14–20 μ long, 7–12 μ thick.—*Parmelia milvina* Wahlenb. ex Ach. Meth. Lich. Suppl. p. 34 (1803). *Lecanora milvina* Ach. Lich. Univ. p. 358 (1810); Borr. Engl. Bot. Suppl. t. 2662, fig. 1; Hook. in Sm. Engl. Fl. v. p. 187; Mudd Man. p. 144; Leight. Lich. Fl. ed. 3, p. 216 pro parte; Cromb. Monogr. i. p. 398.

Exsicc. Larb. Lich. Hb. n. 25; Johns. n. 197.

Marked by the dark thallus and the small flat apothecia sometimes obscurely margined.

Hab. On rocks in maritime and upland districts.—*Distr.* Rare in the Channel Islands, S.W. and N.E. England, S.W. Highlands and N.E. Scotland.—*B. M.* Vale Castle, Guernsey; near Penzance, Cornwall; Barcaldine, Argyll; S. of Bay of Nigg, Kincardineshire; Maam Turk Mts., Galway.

16. *R. umbrinofusca* Oliv. Lich. Eur. fasc. 2, p. 187 (1909).—Thallus determinate, thinly crustaceous, continuous or areolate, purplish-brown or -black, with a radiating dendroid blackish hypothallus (K-). Apothecia minute, plane, adnate, black, the margin brownish, obscure; paraphyses clavate, septate and brown at the tips; spores small, shortly ellipsoid, blunt, 10–11 μ long, 6–7 μ thick.—*Lecanora umbrinofusca* Nyl. in Flora lxiii. p. 389 (1880); Cromb. in Grevillea x. p. 23 (1881) & Monogr. i. p. 401.

In outward appearance very like a *Lecidea* species, but the structure of the apothecium is wholly lecanorine. The spores only occasionally show the characters associated with *Rinodina*. It forms small dark spots on the white flint; it was considered by Nylander to approach *Lecanora griseo-fusca*, a Finland plant.

Hab. On flints in an inland district.—*B. M.* Thetford Warren, Norfolk, the only locality.

17. *R. coniopta* A. L. Sm.—Thallus thick, smooth, unequal, deeply cracked-areolate, purplish-grey or dark-purple-brown (K-, K(CaCl) + reddish). Apothecia moderate in size, at first plane, with a thin thalline margin, the disc dark-brown, becoming convex and immarginate, white within; paraphyses thickish, slightly thickened, septate, knobby and brown at the extreme tips, rarely shortly branched; spores ellipsoid, dark-brown, 15–20 μ long, 8–10 μ thick.—*Lecanora coniopta* Nyl. in

Flora lvi. p. 19 (1873); Cromb. in Grevillea i. p. 141 & Monogr. i. p. 399; Leight. Lich. Fl. ed. 3, p. 216.

Essicc. Cromb. n. 158.

Included by several systematists in *Buellia*, but the apothecium is rather more lecanorine than lecideine in structure: there are traces of the thallus enclosing the apothecium and the subhymenial layer is very thick and colourless and contains a few scattered gonidia; the spores are of the *Rinodina* type with contracted contents, though that character seems also to occur in some *Buellia* specimens. Generally compared with *Buellia coniops*, but the thallus more nearly resembles some states of *Lecidea rivulosa*.

Hab. On siliceous rocks in maritime districts.—*Distr.* Here and there on the coasts of the British Isles.—*B. M.* Jersey; Alderney; Sark; St. Merryn and near Penzance, Cornwall; near Portlethen, Kincardineshire; Kinsale, Cork; Connemara, Galway.

On turf, etc.

18. *R. Conradi* Koerb. Syst. Lich. Germ. p. 123 (1855).—Thallus effuse, thin, granular-leprose or minutely warted, grey or greyish-brown (K -). Apothecia small, plane, dark-brown, the thalline margin entire or somewhat wrinkled; paraphyses confluent, slightly clavate, branched, septate and brown at the tips; spores ellipsoid-fusiform, 1-septate, but the two loculi frequently constricted in the middle giving the appearance of septation, or their cell contents much broken up, dark-brown, large, 20–35 μ long, 10–15 μ thick.—*Lecanora pyreniospora* Nyl. in Vet. Ak. Förh. 1860, p. 297, note? Cromb. Lich. Brit. p. 49; Leight. Lich. Fl. p. 230; ed. 3, p. 222. *L. diplinthia* Nyl. in Act. Soc. Sci. Fenn. vii. p. 444 (1863)? Leight. ll. c.; Cromb. Monogr. i. p. 401. *L. Conradi* Nyl. in Not. Sällsk. Faun. et Fl. Fenn. Förh. xi. p. 182 (1871); Cromb. Monogr. i. p. 400.

Essicc. Larb. Cesar. n. 78 & Lich. Hb. nos. 263, 302.

Distinguished by the habitat and by the large and somewhat peculiar spores. They have been described as 4-celled, but it is merely that the lumen of each cell is constricted in the middle. Our specimens of *Lecanora diplinthia* agree with the above; I have not seen Nylander's plant.

Hab. On decayed turf, on mossy ground, on excrements of sheep, etc., in maritime and inland districts.—*Distr.* Rare in Channel Islands, E. England and S. Wales.—*B. M.* La Moye, Jersey; Eperquerie, Sark; Brandon Park, Suffolk; Thetford Warren, Norfolk.

ORDER XIII. LECANORACEÆ.

Thallus crustaceous or squamulose, variously coloured. Structure more or less stratose, corticate above or non-corticate, attached by hyphæ to the substratum. Algal cells Chlorophyceæ. Apothecia superficial or at first immersed in the thallus, discoid,

normally with a prominent thalline margin; spores usually 8, rarely many in the ascus, colourless, simple or variously septate.

Of world-wide distribution. Distinguished from the somewhat parallel Order, Lecideaceæ, by the character of the apothecia, in the development of which the thallus takes part, and forms a protective margin round the disc.

Phialopsis (*Lecanora rubra* Ach.) belongs to *Gyalecta*, and the species of *Lecanora* sect. *Sarcogyne* have been placed in *Biatorella* (see Appendix). *Psoroma* is placed under Pannariaceæ (p. 89).

The following British genera are included in the Order:—

Spores simple.

Spores 8 or few in the ascus..... 51. *Lecanora*.

Spores many in the ascus..... 52. *Acarospora*.

Spores septate.

Spores elongate-ellipsoid, 1-2-septate..... 53. *Lecania*.

Spores elongate-fusiform, 1-3-septate 54. *Icmadophilus*

Spores elongate-acicular, pluri-septate 55. *Hæmatomma*.

51. **LECANORA** Ach. Lich. Univ. p. 77 (1810) pro parte. (Pl. 51.)

Thallus squamulose or variously crustaceous, rarely somewhat minutely fruticose, mostly of stratosse structure, the cortex of the upper surface of decomposed hyphæ, or wanting. Algal cells, *Protococcus*. Apothecia generally superficial, sometimes immersed at first; spores usually 8 in the ascus, colourless, simple, mostly ellipsoid. Spermogones with acrogenous or rarely pleurogenous spermatia.

In the genus, as here understood, are included the species with simple colourless spores, generally 8 in the ascus (up to 32 in *L. Sambuci*). The sections *Ochrolechia* and *Aspicilia* are frequently regarded as distinct genera, the former on account of differences in paraphyses and spores, the latter because of the late development of the thalline margin. The species are grouped in the following sections:—

Thallus squamulose..... § i. SQUAMARIA.

Thallus crustaceous or indistinctly squamulose.

Apothecia superficial from the first.

Spores small or moderate in size (less than 40 μ in length) § ii. EULECANORA.

Spores very large, with a thick epispore § iii. OCHROLECHIA.

Apothecia immersed at first § iv. ASPICILIA.

§ i. SQUAMARIA DC. Fl. Franc. ii. p. 374 (1805) pro parte (as the genus *Squammaria*); Hook. in Sm. Engl. Fl. v. p. 192; Mudd Man. p. 127; Cromb. Lich. Brit. p. 44; Leight. Lich. Fl. p. 171; ed. 3, p. 157. *Lecanora* subg. *Squamaria* Nyl. in Not. Sällsk. Faun. & Fl. Fenn. Förh. v. p. 125 (1866); Cromb. Monogr. i. p. 350. *Squamaria* subg. *Placopsis* Nyl. in Ann. Sci. Nat. xv. p. 376 (1861). *Lecanora* subg. *Placopsis* Cromb. Monogr. i. p. 355 (1894).

Thallus squamulose, the squamules imbricate, or appressed and more or less effigurate at the circumference. Apothecia superficial; spores moderate in size or rather small.

Thallus of imbricate squamules.

1. *L. cartilaginea* A. L. Sm. (non Ach.).—Thallus squamulose, the squamules thickish, cartilaginous, imbricate or loosely appressed to the substratum, roundly crenate, pale- or dark-brown, corticate above, beneath non-corticate, dark-coloured, attached by stoutish roughened hyphæ (K —). Apothecia moderate in size, concave or plane, becoming irregularly convex, reddish-brown, the margin thinnish, almost entire, disappearing; paraphyses conglutinate, slender, septate and slightly widened upwards, the epithecium of dark-brown granules; spores oblong-ellipsoid, 11–15 μ long, 4–6 μ thick.—*L. crassa* Ach. Lich. Univ. p. 413 (1810); Hook. Fl. Scot. ii. p. 51; Cromb. Monogr. i. p. 351; var. *melaloma* Ach. tom. cit. p. 414; f. *melaloma* Cromb. in Grevillea xviii. p. 44 (1889) & Monogr. i. p. 352. *Lichenoides cartilagineum, scutellis fulvis planis* Dill. Hist. Musc. p. 179, t. 24, fig. 74 (1741). *Lichen cartilagineus* Lightf. Fl. Scot. ii. p. 815 (1777); With. Arr. ed. 3, iv. p. 29. *L. crassus* Huds. Fl. Angl. ed. 2, p. 530 (1778); Engl. Bot. t. 1893. *Squamaria crassa* DC. Fl. Fr. ii. p. 375 (1805); Hook. in Sm. Engl. Fl. v. p. 193; Mudd Man. p. 127; Cromb. Lich. Brit. p. 44; Leight. Lich. Fl. p. 171; ed. 3, p. 157. *Psoroma crassum* S. F. Gray Nat. Arr. i. p. 444 (1821).

Ecsicc. Bohl. n. 2; Cromb. n. 157; Dieks. Hort. Sicc. fasc. vi. n. 24; Larb. Cæsar. n. 73 & Lich. Hb. n. 333; Leight. n. 5; Mudd n. 91.

Not unlike *Lecidca (Psora) lurida*, but distinguished when sterile by the larger lighter-coloured squamules; they vary from glaucous-green to chestnut-brown, often white-edged, and occasionally white-pruinose. The apothecia are abundant, scattered over the squamules. The form *melaloma* differs only in the dark edges of the squamules.

Lightfoot's name *Lichen cartilagineus* has priority, though *L. crassus* has been almost universally adopted; it must not be confused with *Lichen cartilagineus* Ach., which refers to the following plant.

Hab. On the ground, spreading over mosses, etc., and on rocks, chiefly calcareous, in maritime and inland districts.—*Distr.* General and common throughout the British Isles, more especially in the southern counties.—*B. M.* Quenvais, Jersey; Herm; Guernsey; St. Merryn, Cornwall; Berry Head and Babbicombe, Devon; near Needles, I. of Wight; Newhaven Cliffs, Bignor, and Hurstpierpoint, Sussex; Cleeve Hill and Cheddar Cliffs, Somerset; Durdham Down, Leigh Woods, and St. Vincent's Rocks, Bristol, Gloucestershire; Port Eynon, Glamorganshire; near Tenby and Stackpole Court, Pembrokeshire; Aberdovey, Merioneth; Snowdon and Great Orme's Head, Carnarvonshire; Ilangollen, Denbighshire; Puffin Island, Anglesea; Oswestry, Shropshire; near Buxton and Dovedale, Derbyshire; Ulverston,

Lancashire; Ingleborough, Clapham, Yorks; Egglestone, Durham; Whitbarrow, Westmoreland; Arthur's Seat, Edinburgh; Black Isle and Lismore, Appin, Argyll; Mornington, Meath; Killarney, Kerry.

2. *L. Achariana* A. L. Sm.—Thallus spreading or pulvinate, the squamules rather narrow, or dilated and deeply crenate at the circumference, somewhat shining, pale greenish-yellow; beneath whitish (K—). Apothecia numerous, concave, then rather large and plane, and irregularly lobed, reddish-flesh-coloured, the margin entire or crenulate; spores oblong or ellipsoid, 11–16 μ long, 5–6 μ thick.—*L. cartilaginea* Ach. Lich. Univ. p. 415 (1810); Cromb. in Grevillea xviii. p. 44 & Monogr. i. p. 553. *Lichen cartilagineus* Ach. in Vet. Acad. Handl. xvi. p. 133, t. 5, fig. 4 (1795) (non Lightf.). *Squamaria cartilaginea* DC. Fl. Franc. ii. p. 376 (1805); Borr. Engl. Bot. Suppl. t. 2802; Mudd Man. p. 128; Cromb. Lich. Brit. p. 44; Leight. Lich. Fl. p. 172; ed. 3, p. 158.

A rare British lichen, differing from *L. cartilaginea* (Lightf.) in the form of the squamules and in the colour. It is a northern plant.

Hab. On rocks in maritime and upland localities.—*B. M.* Above Barmouth, Merioneth. Reported by Leighton (l. c.) from Yorkshire.

Thallus appressed, radiate-effigurate at the circumference.

3. *L. lentigera* Ach. Lich. Univ. p. 423 (1810).—Thallus orbicular, of thickish closely appressed coherent squamules, wrinkled and tuberculose over the surface, undulate, crenate and effigurate at the circumference, whitish or very pale brownish-green, subpruinose, white beneath (K—). Apothecia rather small, crowded, the disc pale brown, concave then convex, the thalline margin entire, thickish, becoming thinner; paraphyses slender, concrete, slightly clavate; spores ellipsoid, 9–12 μ long, about 5 μ thick.—Cromb. in Grevillea xii. p. 61 (1882) & Monogr. i. p. 352. *Lichen lentigerus* Web. Spicil. Fl. Gœtt. p. 192 (1778); Relh. Fl. Cantab. p. 435 with fig.; Dicks. Pl. Crypt. fasc. i. p. 11; Engl. Bot. t. 871; With. Arr. ed. 3, iv. p. 27. *Squamaria lentigera* DC. Fl. Fr. ii. p. 376 (1805); Hook. in Sm. Engl. Fl. v. p. 195; Mudd Man. p. 128, t. 2, fig. 40; Cromb. Lich. Brit. p. 44; Leight. Lich. Fl. p. 172; ed. 3, p. 157. *Placodium lentigerum* S. F. Gray Nat. Arr. i. p. 447.

Exsicc. Larb. Lich. Cantab. n. 27.

Smaller, more appressed and lighter in colour than *L. cartilaginea*.

Hab. On cretaceous soil in maritime and inland places.—*Distr.* Sparingly in S., E. and Central England.—*B. M.* I. of Wight; Newhaven, Sussex; Thetford Warren, Suffolk; Gogmagog Hills and Newmarket Heath, Cambridge.

4. *L. chrysoleuca* Ach. Lich. Univ. p. 411 (1810).—Thallus thickish, almost continuous, wrinkled and crenate-lobate at the

circumference or of imbricate squamules, pale-yellowish straw-coloured; sometimes pruinose; beneath pale towards the centre, bluish-black towards the edges (K -). Apothecia moderate in size, the disc reddish-flesh-coloured, the margin thin, entire or becoming crenate and flexuose; spores ellipsoid, 9-12 μ long, 4-6 μ thick.—Cromb. Monogr. i. p. 352. *Lichen chrysoleucus* Sm. in Trans. Linn. Soc. i. p. 82, t. 4, fig. 5 (1791). *Squamaria chrysoleuca* Leight. Lich. Fl. ed. 3, p. 158.

Considered by Crombie as doubtfully British; it has not again been collected at Ben Brecht. It occurs both in Scandinavia and the Alps.

Hab. On granite and schistose rocks in alpine districts.—*Distr.* Recorded by Leighton (l. c.) from Ben Brecht, Argyll.

5. *L. pruinosa* Chaub. in St. Am. Fl. Agen. p. 495 (1821).—Thallus orbicular, continuous, effigurate at the circumference, whitish and subfarinaceous, the outer squamules plicate and crenate (CaCl + red). Apothecia small, the disc brownish and grey-pruinose, the thalline margins prominent, entire or sub-crenulate; spores ellipsoid, 10-13 μ long, 5-6 μ thick.—*L. pruinifera* Nyl. in Bull. Soc. Bot. Fr. xiii. p. 368 (1866) note; Cromb. in Journ. Bot. xx. p. 274 (1882) & Monogr. i. p. 355.

Differs from *L. lentigera* in the farinaceous surface and in the pruinose apothecia. The surface "powder" is largely composed of crystals of oxalate of lime.

Hab. On calcareous rocks.—*B. M.* Cleve Hill, Somersetshire (the only British locality).

6. *L. gelida* Ach. Lich. Univ. p. 428 (1810).—Thallus normally orbicular, up to 5 cm. or more in diameter, often somewhat irregular, closely appressed, cartilaginous, areolate in the centre, sometimes with greenish soredia, effigurate at the circumference, the radii narrow, branched, widening outwards and crenate at the tips, dull-white to cinerous-grey (K + yellow, CaCl + red), cephalodiiferous, the cephalodia forming small brownish or flesh-coloured orbicular radiate patches scattered over the thallus. Apothecia moderate in size, adnate, the disc flesh-coloured, the margin thick, entire; paraphyses slender, branched and septate at the tips; spores ellipsoid, 14-18 μ long, 6-8 μ thick.—Hook. Fl. Scot. ii. p. 50; Tayl. in Mackay Fl. Hib. ii. p. 140; Cromb. Monogr. i. p. 355. *Lichen gelidus* L. Mant. p. 133 (1767); Dicks. Pl. Crypt. fasc. ii. p. 19; With. Arr. ed. 3, iv. p. 26; Engl. Bot. t. 699. *Placodium gelidum* S. F. Gray Nat. Arr. i. p. 448 (1821). *Squamaria gelida* Hook. in Sm. Engl. Fl. v. p. 195 (1833); Mudd Man. p. 129; Cromb. Lich. Brit. p. 45; Leight. Lich. Fl. p. 176; ed. 3, p. 159 (incl. *f. dispersa*).

Exsicc. Dicks. Hort. Sicc. fasc. vii. n. 25; Larb. Lich. Hb. n. 50.

Owing to the presence of cephalodia placed in *Squamaria* subg. *Placopsis* by Nylander in Ann. Sci. Nat. xv. p. 376 (1861). *Lecanora* subg. *Placopsis* Cromb. Monogr. i. p. 355 (1894).

Often sterile, but well marked by the prominent cephalodia, which contain *Stigonema* and *Nostoc* algae. A young stage with scattered thalli and small cephalodia has been described as f. *dispersa* Cromb. in *Grevillea* i. p. 171 (1873).

Hab. On siliceous rocks in maritime, upland and subalpine districts.—*Distr.* In the rocky or hilly regions of England, Scotland and Ireland.—*B. M.* St. Austell, Cornwall; Cader Idris, Dolgelly and Llyn Bodlyn, Merioneth; Nant Ffrancon and Cwm Glyders, Carnarvonshire; Egglestone and Teesdale, Durham; near Kendal, Westmoreland; Knock Morton Screes, Cumberland, New Galloway, Kirkcudbrightshire; Loch Awe, Argyll; Craig Calliach, Ben Chaluna, Ben Lawers and Craig Tulloch, Perthshire; Clova and Caulochan, Forfarshire; Glen Cluny, Invercauld and Glen Caudlic, Braemar, Aberdeenshire; Rothiemurchus, Ben Nevis and Fort Augustus, Invernesshire; Hills of Applecross, Rossshire; Dunkerron and Connor Cliffs, Dingle, Kerry; Letterfrack and Recess, Connemara, Galway; Belclare and Clare Island, Mayo; Carnlough, Antrim.

7. *L. muralis* Schaer. Enum. Lich. p. 66 (1850).—Thallus normally orbicular, often wide-spreading, pale-brownish or greenish-straw-coloured, appressed, imbricate or areolate-crustaceous in the centre, radiate-squamulose at the circumference, the squamules contiguous, narrow or rather broad, flat or subpubescent, crenate at the apices, sometimes white at the margins. Apothecia up to 2 mm. in diameter, crowded, generally plane, the disc yellowish-brown, the thalline margin thin, flexuous or crenulate, rather light-coloured; paraphyses irregular, slightly thicker upwards, the epithecium a brownish grumous layer; spores ellipsoid, 9–16 μ long, 4–7 μ thick.—*L. saxicola* Ach. Lich. Univ. p. 431 (1810); Tayl. in Mackay Fl. Hib. ii. p. 140; Cromb. Monogr. i. p. 353 (incl. subsp. *albomarginata*); var. *albomarginata* Nyl. ex. Norrl. in Sällsk. Faun. & Fl. Fenn. Förh. viii. p. 181 (1871). *Lichen muralis* Schreb. Spicil. Fl. Lips. p. 130 (1771), fide Arn. in Flora lxvii. p. 311 (1884); Dicks. Pl. Crypt. fasc. i. p. 11; With. Arr. ed. 3, iv. p. 29. *L. saxicola* Poll. Hist. Pl. Pal. p. 225 (1777); Engl. Bot. t. 1695. *Placodium saxicolum* S. F. Gray Nat. Arr. i. p. 447 (1821). *Squamaria saxicola* Hook. in Sm. Engl. Fl. v. p. 197 (1833); Mudd Man. p. 129; Cromb. Lich. Brit. p. 44; Leight. Lich. Fl. p. 173; ed. 3, p. 158 (incl. var. *albomarginata*); subsp. *albomarginata* Cromb. in Journ. Bot. xii. p. 147 (1874).

Exsicc. Bohl. n. 55; Johns. n. 191; Larb. Lich. Hb. n. 213 & Lich. Cantab. n. 24; Leight. n. 145; Mudd n. 92.

A variable plant, which may form very large patches, with the centre often broken away; if sterile the lobes are crowded and imbricate, when fertile the centre of the thallus may be entirely

covered by the apothecia which become irregular from pressure; sometimes the squamules are white-margined in part, or over the whole thallus (subsp. *albomarginata*).

Hab. On rocks, boulders, walls, etc., rarely on oak palings in maritime and inland districts.—*Distr.* General though not common throughout the British Isles.—*B. M.* Fliquet Bay, Jersey; Vale Castle, Guernsey; Sark; near Penzance, Cornwall; near Ryde, I. of Wight; near Lewes and Midhurst, Sussex; Penshurst, Kent; near London, Middlesex; Chelmsford, Essex; Yarmouth, Norfolk; Bedfordshire; Ross, Herefordshire; Malvern Hills, Worcestershire; Bridge of Ludlow, Haughmond Hill, Oswestry and Caer Caradoc, Shropshire; Twycross, Leicestershire; Dolgelly, Barmouth and Cader Idris, Merioneth; Llandyssil, Cardiganshire; Anglesea; Cliff-rigg, Cleveland, Yorkshire; near Egglestone and Teesdale, Durham; near Kendal and Brougham Castle, Westmoreland; Wark and Gunnerton Crags, Northumberland; New Galloway, Kirkcudbrightshire; Arthur's Seat and Dalmahoy Hill, Edinburgh; Kyles of Bute; Burntisland, Fifeshire; near Connel Ferry, Argyll; Ben Lawers, Perthshire; Castleton of Braemar, Aberdeenshire; Kilcully near Cork; near Belfast, Antrim.

Var. diffracta Schær. l. c.—Thallus almost entirely cartilaginous-areolate, greyish-green or generally dark-coloured. Apothecia dark-reddish, with lighter thin disappearing margins.—*L. saxicola* var. *diffracta* Cromb. in *Grevillea* xviii. p. 44 (1889) & *Monogr.* i. p. 354. *Lichen diffractus* Ach. *Lich. Suec. Prodr.* p. 63 (1798). *Squamaria saxicola* var. *diffracta* Nyl. *Lich. Scand.* p. 133 (1861); Cromb. *Lich. Brit.* p. 45; Leight. *Lich. Fl.* p. 173; ed. 3, p. 159. *Var. areolata* Leight. ex Mudd *Man.* p. 129 (1861).

Essicc. Leight. n. 81; Mudd n. 93.

The squamulose character is generally obscure, though the plant is occasionally lobate at the circumference.

Hab. On rocks in upland and subalpine situations.—*Distr.* Local and scarce in England and the Grampians, Scotland.—*B. M.* St. Minver, Cornwall; Haughmond Hill, Shropshire; near Ayton, Cleveland, Yorkshire; Ben Lawers, Perthshire; Craig Guie, Braemar, Aberdeenshire.

Var. versicolor Tuckerm. *Syn. N. Amer. Lich.* p. 185 (1882).—Thallus generally reduced, light-coloured, white-suffused. Apothecia with prominent white crenulate margins.—*L. saxicola* var. *versicolor* Cromb. in *Grevillea* xviii. p. 44 (1889) & *Monogr.* i. p. 354 (incl. f. *dispersa*). *Lichen versicolor* Pers. in *Ust. Ann. Bot.* vii. p. 24 (1794). *Squamaria saxicola* var. *versicolor* Nyl. *Lich. Scand.* p. 133 (1861); Leight. *Lich. Fl.* p. 174; ed. 3, p. 159 (incl. var. *albomarginata* f. *dispersa*).

Essicc. Johns. n. 311.

The thallus may be very reduced and the apothecia scattered or united in pulvinate groups (f. *dispersa*). The powdery-white appearance is most characteristic in the prominent thalline margins of the apothecia.

Hab. On calcareous and schistose rocks in maritime and upland regions.—*Distr.* Rather rare in W. England, Wales and Scotland.—*B. M.* St. David's, Pembrokeshire; Chance's Pitch, Malvern, Worcestershire; Barmouth, Merioneth; Great Orme's Head, Carnarvonshire; I. of Lismore, Argyll; Craig Tulloch, Blair Athole, Perthshire.

8. *L. subimbricata* A. L. Sm.—Thallus orbicular, closely adnate, crustaceous-areolate in the centre, effigurate at the circumference, the outer radii contiguous, narrow and convex, or slightly broadening out and becoming plane and crenate at the tips, whitish or cinerous-grey (K + yellow, then red). Apothecia numerous, rather small, innate, then plane, brown or dark-brown when moist, almost black when dry, the thalline margin thin, entire; paraphyses slender, constricted-septate; spores broadly ellipsoid, 10–15 μ long, 6–8.5 μ thick.—*L. circinata* Ach. Lich. Univ. p. 425 (1810)? Hook. Fl. Scot. ii. p. 50; Cromb. Lich. Brit. p. 49 & Monogr. i. p. 403; Leight. Lich. Fl. p. 195; ed. 3, p. 179; subsp. *subcircinata* Cromb. in Grevillea xviii. p. 47 (1889). *L. subcircinata* Nyl. in Flora lvi. p. 18 (1873). *Lichen subimbricatus* Relh. Fl. Cantab. p. 427, with fig. (1785). *L. circinatus* Pers. in Ust. Ann. Bot. vii. p. 25 (1794?); Engl. Bot. t. 1941. *Placodium circinatum* S. F. Gray, Nat. Arr. i. p. 448 (1821). *Squamaria circinata* Hook. in Sm. Engl. Fl. v. p. 196 (1833); Mudd Man. p. 130.

In this species the paraphyses are septate and constricted, appearing almost like rows of conidia. In this respect both Continental and British species are alike, as is also *L. circinatula*. According to Nylander there is a difference in the reaction to potash between Continental and British specimens, the former failing to give the red colouration. I have found that a Continental specimen turns red, while some of our specimens remain yellow. Nylander did not consider that the reaction in this case was a specific distinction. In some specimens the apothecia and thallus have a reddish tinge (*Parmelia circinata* var. *myrrhina* Fr. Lich. Eur. p. 124 (1831). *Lecanora circinata* f. *myrrhina* Cromb. in Grevillea tom. cit. p. 47). The colour is, however, accidental, being caused by suffusion of peroxide of iron or by urine. Spermata are recorded as 6–7 μ long, 1 μ thick. An old specimen from Clare Hall Bridge, Relhan's original locality, is in the herbarium of the British Museum.

Hab. On rocks and walls, often on bridges, in lowland and upland districts.—*Distr.* Not common in the Channel Islands, England and Wales, reported from S.W. Scotland, not seen from Ireland—*B. M.* Guernsey; near Staple Fitzpaine, Somerset; near Stroud, Gloucestershire; Hale's End, Malvern and Pershore Bridge, Worcestershire; Oversley Bridge, Warwickshire; near Congerstone, Leicestershire; Conway Castle, Denbighshire; Barnard Castle, Egglegstone, and Teesdale, Durham; Kirkby Lonsdale, Westmoreland.

Var. *circinatula* A. L. Sm.—Similar to the species in form, but rather darker and with smaller spores, 7 μ long, 5 μ thick.—*L. circinatula* Nyl. in Flora lxvi. p. 100 (1883); Cromb. in Grevillea xii. p. 89 (1884) & Monogr. i. p. 404.

I have been unable to find spores in our specimens. The darker colour may be due to more direct exposure. Spermatia are recorded as $3\cdot5$ – $4\cdot5$ μ long, $\cdot5$ μ thick.

Hab. On flints in a maritime district.—*B. M.* Beachy Head, Sussex (the only locality).

9. *L. melanaspis* Ach. Lich. Univ. p. 427 (1810).—Thallus suborbicular, adnate, areolate-verrucose in the centre, the lobes of the circumference branched, convex, cinerous-grey and greyish-pruinose (K —, CaCl —). Apothecia rather small, plane, dark-coloured, the thalline margin thickish, entire; spores ellipsoid, 10–14 μ long, 6–10 μ thick; hymenial gelatine bluish then wine-red with iodine.—Leight. Lich. Fl. ed. 3, p. 201; Cromb. Monogr. i. p. 403. *L. alphoplaca* var. *melanaspis* Stirt. Scott. Nat. iv. p. 28 (1877). *Parmelia melanaspis* Ach. Meth. Lich. p. 196 (1803). Specimen not seen.

A rare lichen; it differs from *L. alphoplaca*, a Continental plant, in the absence of any reaction with potash.

Hab. On rocks in a mountainous region. Recorded only from Ben Brecht, Argyll.

10. *L. exomila* Stirton in Scott. Nat. v. p. 217 (1880).—Thallus dull-cinereous or also blackish, squamulose-rugulose (if proper?). Apothecia appressed dark-brown or brownish-black, plane, up to 1 mm. across; the margin prominent, crenate or in a young state somewhat wrinkled, cærulescent or pale cærulescent; hypothecium colourless; paraphyses slender, not well discrete, conglutinate at the brown apices; spores 8 in the ascus, colourless, ellipsoid, simple, often binucleate, 9–11 μ long, 6·5–8 μ thick; hymenial gelatine blue then tawny with iodine. Specimen not seen.

Stirton is not sure if the thallus belongs to this "curious and singular *Lecanora*," as it grows associated with *Bilimbia aromatica*, which has "a thallus of a corresponding character. In every instance the margin is truly cærulescent."

Hab. On rocks. Collected by Stirton at Glas Miel, Perthshire.

§ ii. *EULECANORA* Th. Fr. Lich. Arct. p. 99 (1860), pro parte (as subgenus); Cromb. Monogr. i. p. 371, pro parte (as subgenus).

Thallus variously crustaceous. Apothecia superficial; spores moderate in size or rather small.

For convenience of reference, this large section has been divided into a series of groups marked either by thalline or apothecial characters.

A. *Subfusca* group. — Thallus cinereous-grey or whitish (K + yellowish or yellow). Apothecia moderate in size, the disc reddish-brown, rarely pale brick-red, or brownish-black.

Apothecia reddish-brown.

11. *L. subfusca* Ach. Lich. Univ. p. 393 (1810) pro parte (incl. var. *argentata*).—Thallus thinnish, opaque, developed beneath and above the bark, effuse or determinate, slightly wrinkled, unequal or occasionally granular, whitish or ash-grey (K + yellowish). Apothecia moderate in size, rarely up to 2 mm. across, scattered or crowded, rather prominent and attached by a narrow base, rounded, the disc plane or generally convex, brownish-red, the thalline margin rather thin, not prominent, entire or sometimes slightly crenulate; paraphyses slender, subdiscrete, more or less distinctly septate, straight or flexuose, variously formed at the tips, sometimes slightly clavate or swollen, and tinged with a bright-brown colour or embedded in a brown gelatinous epithecium; spores oblong-ellipsoid, 11–16 μ long, 7–9 μ thick, but occasionally larger; hymenial gelatine blue, the asci dark tawny-coloured, with iodine.—Hook. Fl. Scot. ii. p. 47 pro parte and in Sm. Engl. Fl. p. 189 pro parte; Mudd Man. p. 146 pro parte; Cromb. Lich. Brit. p. 51 pro parte (incl. f. *argentata*) & Monogr. i. p. 409; fig. 65; Leight. Lich. Fl. p. 201; ed. 3, p. 185 (incl. f. *argentata*). *Lichen subfuscus* L. Sp. Pl. p. 1142 (1753) pro parte.

Exsicc. Johns. n. 110; *Larb. Lich. Hb.* n. 217.

The species and varieties are distinguished by the thin thallus, best seen towards the margin, as in time it may become piled up and thickish towards the centre. The apothecia in the species have a prominent disc, the margin is thin and normally entire, but occasionally becomes crenulate. Spermogones in this and allied species are black at the opening, with mostly curved spermatia about 16–20 or –24 μ long.

There is a group of “forms,” “varieties,” or “species” intimately associated with *Lecanora subfusca*, and variously designated by different workers, probably all of them included under *Lichen subfuscus* L. A large series of these from different collections have been examined by Hue (Bull. Soc. Bot. Fr. 1. p. 22), and the results obtained by him have been verified on our British specimens. There are differences among them in the development of the thallus and of the apothecial margin, which are not sufficiently constant to be specific. The microscopic characters are also variable to some extent, but the differences there seem to be largely due to age. They include the form of the tips of the paraphyses which are slender and flexuose in all, and more or less conglutinate, but in some are slightly capitate or clavate, in others of equal width throughout. In the latter case they are colourless; the wider types are often brown, generally the epithecium is a brown gelatinous layer and granulose or non-granulose. Steiner (Verh. K.K. Zool.-Bot. Ges. li.) differentiated the typical species as having capitate paraphyses, but that character appears, though rarely, in several of the forms; he also considered the interspersed granulose condition as specific, but that character also is untrustworthy and seems to be a growth condition. The reaction with iodine, which Nylander relied on to determine species, is practically the same for them all: with a very dilute solution, the hymenium

turns a delicate blue, in more concentrated solution, the asci generally become vinous or tawny-red, and a violet tinge is frequently produced in transition, or remains when the other tints have faded away, depending evidently on the presence of small quantities of the vinous-colouring substance.

In the absence of any true microscopic distinctions, the macroscopic characters have been accepted as of varietal importance. *Pharcidia epicymatia* Wint. is frequently parasitic on the thallus of this and of allied species.

Hab. On trunks of trees, rarely on old palings in maritime and lowland districts.—Rare in E., S. and W. England, though probably overlooked.—*B. M.* Lyndhurst, New Forest, Hants; Churchhill, near Worcester; near Cambridge; N. England.

Form *musciola* Wheld. & Wils. Lich. Perth. p. 37 (1915).—Thallus thin, grey (K + deep yellow, CaCl—). Apothecia moderate in size, concave or plane, shining, deep reddish or blackish brown, the thalline margin entire; spores 12–14 μ long, 7–8 μ thick.

“This form is probably a state due to the peculiar habitat, which is similar to that of *L. epibryon*. It differs from that, which is a more alpine plant, in having a more dusky thallus, apothecia about half the diameter, and shorter spores.”

Hab. Creeping over mosses (*Tortula* and *Grimmia*) on walls, near Pitlochry, Perthshire.

Var. *chlarona* Ach. Syn. Lich. p. 158 (1814); Hue in Bull. Soc. Bot. Fr. 1. p. 72 (1903).—Thallus thin, smoothish or somewhat wrinkled-unequal, or thinly granulate, whitish or greyish. Apothecia rather small, plane or slightly convex, the disc generally flesh-coloured or pale-brown, the thalline margin thicker and more prominent than in the species, entire at first but soon becoming crenulate and the receptacle more or less furrowed; spores rather smaller than the species 9–15 μ (rarely 17 μ) long, 5–9 μ thick.—*L. subfusca* var. *distans* and var. *glabrata* Mudd Man. pp. 146, 147 (1861) (non Ach.); f. *chlarona* Stizenb. in Bot. Zeit. xxvi. p. 898 (1868); Leight. Lich. Fl. p. 203; ed. 3, p. 188. *L. distincta* var. *chlarona* Ach. Lich. Univ. p. 397 (1810). *L. albella* f. *chlarona* Cromb. Lich. Brit. p. 51 (1870). *L. rugosa* subsp. *chlarona* Nyl. in Flora lxvi. p. 107 (1883); Cromb. Monogr. i. p. 413. *L. chlarona* Cromb. in Grevillea xviii. p. 68 (1890). *Lichen distans* Pers. ex Ach. l. c.

Exsicc. Larb. Lich. Hb. n. 257; Leight. n. 115; Mudd n. 112, 113 (pro parte).

In this variety the apothecia are rather small and scattered; it differs from the species in the planer lighter-coloured disc and the more prominent margin, entire at first but soon crenulate. The furrows of the receptacle are not easily seen and they also occur occasionally in other varieties. Wheldon and Wilson (Journ. Linn. Soc. xliii. p. 114 (1915)) have referred a specimen from Chatburn,

S. Lancashire, to *L. chlarona* var. *lecideina* Oliv. Syst. Lich. i. p. 274 (1897), on account of its disappearing margin.

Hab. On smooth bark of trees, occasionally on palings.—*Distr.* Fairly common throughout the British Isles.—*B. M.* Withiel, Cornwall; near Torquay, Devon; near Ryde, I. of Wight; Eridge Park, Henfield, Withyam, near Lewes, and Glynde, Sussex; Holmwood and Shiere, Surrey; Wrotham, Kent; Epping Forest, Gosfield Hall and White Colne, Essex; Hawkridge, Somerset; near Cirencester, Gloucestershire; Ampthill, Bedfordshire; Babraham, Cambridgeshire; Gopsall Park and Twycross, Leicestershire; Aberdovey, Merioneth; Wrekin Hill, Shropshire; Cliffrigg and near Ayton, Cleveland, Yorkshire; Teesdale, Durham; Wastdale, Cumberland; near Glasgow; Appin, Argyll; Finlarig, Killin, Perthshire; Glen Cluny, Braemar and Countesswells Wood, Aberdeenshire; Loch Linnhe, Invernessshire; Upper Lake, Killarney, Kerry; Mallaranny, Dugort and Glandarry, Achill, Mayo.

Form *geographica* Hue in Bull. Soc. Bot. Fr. l. p. 81 (1903).—Thallus similar to that of var. *chlarona*, but limited and dissected by black lines. Apothecia small, the margin at first prominent, entire, then crenulate.—*L. subfusca* var. *geographica* Massal. Ric. Lich. p. 6 (1852). *L. chlarona* var. *geographica* Nyl. ex Cromb. in Grevillea xviii. p. 68 (1890). *L. rugosa* subsp. *chlarona* var. *geographica* Cromb. Monogr. i. p. 414 (1896).

Esicc. Johns. n. 260; Mudd n. 113 pro parte.

Evidently only an accidental form of growth which occurs also in other *Lecanora*. As noted by several observers, the black "geographical" lines are constantly, if not always, due to an accompanying growth of *Lecidea parasema*, though they are occasionally present without any apparent *Lecidea* thallus. In some specimens of var. *chlarona* a dark margin is developed, but it seems to be composed of brown hyphomycetous hyphæ.

Hab. On somewhat smooth bark of trees.—*Distr.* Not common throughout the British Isles.—*B. M.* Ullacombe, near Bovey Tracey, Devon; New Forest, Hants; St. Leonard's Forest, Sussex; near Gravesend, Kent; Bathampton and Hawkridge, Somerset; Desford, Leicestershire; Malvern, Worcestershire; Cliffrigg, Cleveland, Yorkshire; New Galloway, Kirkcudbrightshire; Airds, Appin, Argyll; Finlarig, Killin, Perthshire.

Var. *pinastre* Schær. Enum. p. 74 (1850).—Thallus effuse or subdeterminate, generally thin and subleprose, sometimes rather thicker and finely warted-areolate, greyish-white. Apothecia small, plane or convex, scattered or crowded, the disc reddish or dark-brown, the thalline margin rather prominent, at first entire, becoming slightly crenulate; paraphyses as in the species; spores broadly ellipsoid, 9–15 μ long, generally 7–9 μ thick.—Mudd Man. p. 146. *L. rugosa* subsp. *chlarona* f. *pinastre* Cromb. Monogr. i. p. 413 (1894).

Differing from the species in the more developed margin of the apothecia and in the generally smaller spores. From var. *chlarona* it is separated by the almost constantly entire apothecial margin.

Hab. On firs and fir palings in upland regions.—*Distr.* Rather rare in England, more frequent in Scotland.—*B. M.* Near Penzance, Cornwall; near Leith Hill, Surrey; Buxton, Derbyshire; Ayton Moor, Cleveland, Yorkshire; Staveley, Westmoreland; West Lomond Hill, Fifeshire; Achmore, Killin, Ben Lawers, Blair Athole and Blaeberry Hill, Perthshire; Durrus, Kincardineshire; Countesswells Wood, near Aberdeen; Rothiemurchus, Invernesshire; Applecross, Rossshire.

Var. *allophana* Ach. Lich. Univ. p. 395 (1810); Hue in Bull. Soc. Bot. Fr. 1. p. 55 (1903).—Thallus thin, wrinkled-unequal, or becoming thick and warted at the centre by new growth layers, mostly effuse, sometimes limited, whitish or greyish. Apothecia moderate in size, becoming rather large and irregular in form, scattered or often becoming crowded against each other, and then angular and difform, the disc brownish red, becoming often very dark or almost black, the thalline margin rather thicker than in the species, entire, then irregularly crenulate or furrowed; spores generally about 14–16 μ long and 7–9 μ thick, but varying from 6 μ to 11 μ in width and 10–22 μ in length.—*L. subfusca* var. *atrynea* Mudd Man. p. 147 (1861) pro parte; f. *allophana* Cromb. Lich. Brit. p. 51 (1870); Leight. Lich. Fl. p. 200; ed. 3, p. 185. *L. allophana* Nyl. in Flora lv. p. 250 (1872) note; Cromb. Monogr. i. p. 411. *Lichenoides crustaceum et leprosum scutellis subfuscis* Dill. in Ray Syn. ed. 3, p. 71, n. 45 (1724) pro parte & Hist. Musc. p. 134, t. 18, fig. 16 (1741) (fide Crombie). *Lichen subfuscus* Huds. Fl. Angl. p. 444 (1762); Engl. Bot. t. 2109.

Exsicc. Bohl. n. 35; Johns. nos. 37 pro parte, 317; Larb. Lich. Hb. nos. 256 & Lich. Cantab. nos. 18, 21; Leight. n. 116 pro parte.

Not unlike the previous variety in the early stages, but the thallus becomes thicker towards the centre, the apothecia become large, often densely crowded and lobed and darker in colour; the margin is entire and prominent for some time, then irregularly crenate, and pushed back by the turgid irregular disc. Occasionally only a few of the larger apothecia are left on a thick verrucose thallus.

Hab. On trunks of trees, rarely on old palings.—*Distr.* Not uncommon throughout the British Isles.—*B. M.* Lustleigh, Devon; Lyndhurst, New Forest. Hants; Shanklin and Brading, I. of Wight; Mount Harry, near Lewes, Danny, Glynde and St. Leonard's Forest, Sussex; Ulting and Walthamstow, Essex; Windsor Great Park, Berks; Bourton-on-the-Water, Gloucestershire; Gopsall and Twycross, Leicestershire; Broadwas and near Worcester; near Shrewsbury, Shropshire; Barmouth and Aberdovey, Merioneth; Cherry Hinton, Stapleford and Over, Cambridgeshire; Bury St. Edmunds, Suffolk; Lounsdale and Ayton, Cleveland, Yorkshire; Piercebridge, Durham; Chollerford, Wark-on-Tyne and Wansbeck, Northumberland; Cleator Moor, Cumberland; New Galloway, Kirkcudbrightshire; Inverary, Argyll; Finlarig, Killin, Perthshire; Camperdown Woods, Forfarshire; Tullagreen, Cork; Castle Connel, Limerick; Achill Island, Mayo.

Form *parisiensis* Hue in Bull. Soc. Bot. Fr. l. p. 65 (1903).—Thallus definitely limited, generally somewhat obicular, thin towards the margin, thicker and verrucose towards the centre. Apothecia as in the variety.—*L. subfusca* var. *horiza* Ach. Lich. Univ. p. 394 (1810)?; f. *parisiensis* Leight. Lich. Fl. p. 201 (1871); ed. 3, p. 185. *L. parisiensis* Nyl. in Bull. Soc. Bot. Fr. xiii. p. 368 (1866); Cromb. in Journ. Bot. ix. p. 178 (1871) & Monogr. i. p. 412.

Exsicc. Leight. n. 116 pro parte.

The original description of *L. parisiensis* makes the determinate thallus a distinguishing characteristic of this plant, which does not otherwise differ from the variety. In both, the apothecia tend to become large and turgid with age. The variety *horiza* Ach. is generally classified under *Rinodina sophodes*.

Hab. On trunks of trees in maritime and upland tracts.—*Distr.* Not uncommon in England; rare in Ireland; not recorded for Scotland.—*B. M.* Ilsham, Torquay and near Bovey Tracey, Devon; Lyndhurst, New Forest, Hants; near Worcester; near Shrewsbury, Shropshire; near Ayton, Cleveland, Yorkshire; near Cork.

12. *L. fuscescens* Nyl. in Flora lv. p. 552 (1872) note.—Thallus effuse, of thickly scattered minute greyish granules on a thin blackish hypothallus (K + yellow). Apothecia small or submoderate in size, adnate, plane, brown or blackish, the margin thin, disappearing; paraphyses subdiscrete, slightly widened and brownish at the apices; spores globose-ellipsoid, small, 6–9 μ long, 4–7 μ thick.—Cromb. in Journ. Bot. xiii. p. 141 (1875) & Monogr. i. p. 423; Leight. Lich. Fl. ed. 3, p. 201. *Lecidea fuscescens* Sommerf. Suppl. Fl. Lapp. p. 161 (1826).

Along with the specimens from Morrone there is a second minute lichen, *Bilimbia Nitschkeana*. The apothecia of both are penetrated by the torulose brown hyphæ of a fungus.

Hab. On trunks of birch in mountainous districts.—*B. M.* Morrone, Braemar, Aberdeenshire.

13. *L. rugosa* Nyl. in Flora lv. p. 250 (1872) note.—Thallus generally determinate, thickish up to the margin, wrinkled-granulate or warted, unequal, whitish or grey (K + yellowish). Apothecia scattered or crowded, moderate in size, somewhat prominent, closed then open, the disc brown or reddish-brown the thalline margin thick, crenulate, the receptacle furrowed and wrinkled; paraphyses slender, septate, scarcely thickened upwards, ending in a brown epithecium; spores ellipsoid, generally about 12–15 μ long, 6–8 μ thick, sometimes rather larger; hymenium blue with dilute iodine, the asci dirty wine-red in stronger solutions.—Cromb. in Grevillea xviii. p. 68 (1890) & Monogr. i. p. 412. *L. subfusca* f. *rugosa* Nyl. Lich. Scand. p. 160 (1861); Cromb. Lich. Brit. p. 51; Leight. Lich. Fl. p. 201,

ed. 3, p. 186. *Lichen rugosus* Pers. ex Ach. Lich. Univ. p. 394 (1810) (? Linn.).

Exsicc. Johns. n. 37 pro parte, 111.

Frequently classified as a variety of *L. subfusca*, and closely allied to var. *allophana*, but the thick thallus and thalline margin are distinctive, though the thallus varies somewhat with the condition of the bark on which it grows. The apothecia are usually reddish-brown. *L. rugosum* L. (Sp. Pl. p. 1140) and early British authors is doubtful; Linnæus gives a citation from Dillenius which Crombie has identified with the fungus *Dichæna*.

Hab. On trunks of trees, rarely on old palings.—*Distr.* General and fairly common throughout the British Isles.—*B. M.* Ilsham, Torquay, Devon; Glynde, Sussex; Ulting, Essex; near Cirencester, Gloucestershire; Gopsall, Leicestershire; Hollybush Hill, Malvern, Worcestershire; Bakewell, Derbyshire; Levens Park, Westmoreland; Calder Abbey and Alston, Cumberland; Chollerford, Northumberland; Pennycuik Glen, near Edinburgh; near Glasgow; Barcaldine, Argyll; Blairdrummond, near Stirling; Killin, Perthshire; Rostellan, Cork; Old Dromore and Killarney, Kerry; Tervoe, near Limerick; Derryclare and Lough Inagh, Galway; Westport, Mayo.

14. *L. epibryon* Ach. Syn. Lich. p. 155 (1814).—Thallus subdeterminate, granulose-concretescent or warted, white (K + yellowish). Apothecia moderate in size, plane, scattered or crowded, the disc brown or reddish-brown, the thalline margin thin, entire, rarely flexuose or crenulate; paraphyses slender, indistinctly septate, rather broadly clavate and brown at the tips; spores 14–19 μ long, 6–11 μ thick; hymenial gelatine blue, the asci becoming wine-red, with iodine.—Cromb. in Grevillea xviii. p. 68 & Monogr. i. p. 411. *L. subfusca* var. *epibryon* Mudd Man. p. 147 (1861); f. *epibrya* Cromb. Lich. Brit. p. 51 (1870); Leight. Lich. Fl. p. 203; ed. 3, p. 187. *Lichen hypnorum* Wulf. in Jacq. Coll. iv. p. 233, t. 7, fig. 1 (1790) (non Vahl in Fl. Dan. t. 956 (1787) & non Dicks.). *L. epibryon* Ach. Lich. Suec. Prod. p. 79 (1798).

A northern or alpine plant, characterized by the white granulose continuous thallus, by the constantly larger spores, and by the character of the paraphyses.

Hab. On decayed mosses on the ground in mountainous regions.—*B. M.* Ben Lawers, Perthshire.

15. *L. intumescens* Koerb. Syst. Lich. Germ. p. 143 (1855).—Thallus determinate, thin, smooth or becoming wrinkled, whitish (K + yellowish). Apothecia thickly scattered, prominent, small or moderate in size, the disc light or dark reddish-brown, plane or convex, sometimes slightly dull-pruinose or becoming blackish, the thalline margin thick, inflexed, generally entire, but sometimes flexuose and crenate, white; paraphyses somewhat conglutinate, slender, septate, sometimes branched and irregular towards the tips, colourless, the epithecium of brown

granules ; spores ellipsoid, 12–18 μ long, 6–8 μ thick ; hymenial gelatine blue with iodine.—Cromb. in Grevillea xii. p. 60 (1884) & Monogr. i. p. 417. *L. subfusca* f. *intumescens* Stizenb. in Bot. Zeit. xxvi. p. 893 (1868) ; Leight. Lich. Fl. p. 202 ; ed. 3, p. 186. *Lichen pallidus* Dicks. Pl. Crypt. fasc. ii. p. 19 (1790) (non Schreb.). *Parmelia intumescens* Rehent. Prodr. Fl. Neom. p. 301 (1804).

Exsicc. Dicks. Hort. Sicc. fasc. ix. n. 23 ; Johns. n. 318.

Distinguished chiefly by the tumid white margins of the apothecia. when these are crenulate, they are somewhat like the fruits of *L. rugosa*. Spermogones have the spermatia up to 30 μ long (fide Crombie Monogr. i. p. 417).

Hab. On smooth bark of trees in wooded maritime and inland districts.—*Distr.* Rather rare in England and Scotland and S.W. Ireland.—*B. M.* Ullacombe, Bovey Tracey, Devon ; New Forest, Hants ; Shiere, Surrey ; Cirencester, Gloucestershire ; Rhiwgreiddan, Merioneth ; New Galloway, Kirkcudbrightshire ; Barcaldine, Argyll ; Finlarig, Killin and Craig Calliach, Perthshire ; Morrone, Braemar, Aberdeenshire ; Loch Linnhe, Invernessshire ; Tervoe, Limerick.

16. *L. chlarotera* Nyl. in Flora lv. p. 550 (1872) note.—Thallus determinate or subdeterminate, thickish, finely warted-granulate, sometimes cracked-areolate, whitish or greyish (K + yellow). Apothecia moderate in size or rather large, the disc generally plane or irregular, pale-reddish ; the thalline margin thick, crenulate or flexuose ; paraphyses slender, septate, with long and often bent colourless tips, the epithecium granular, brown ; spores ellipsoid or oblong, small, 9–11 μ long, 7–9 μ thick ; hymenial gelatine blue with iodine.—Leight. Lich. Fl. ed. 3, p. 182 ; Cromb. Monogr. i. p. 417.

Exsicc. Johns. n. 261.

The thickish pale warted thallus and the pale-reddish apothecia distinguish this species from others of the *subfusca* group. In the British specimens the apothecia are rather large and irregular and occasionally pruinose owing to the abjoined tips of the paraphyses.

Hab. On trees in upland districts.—*Distr.* Rare in N.E. England, W. Scotland and S. Ireland.—*B. M.* Northumberland ; Glen Cieran, Barcaldine, Argyll ; Letterfrack, Connemara, Galway.

17. *L. campestris* B. de Lesd. Lich. Dunk. p. 162 (1910). —Thallus often limited by a whitish hypothallus, continuously warted-granulate or granular-areolate, whitish or cinereous-grey (K + yellowish). Apothecia scattered or generally crowded, especially towards the centre of the thallus, moderate in size. plane, becoming somewhat convex, brown or reddish-brown when wet, or darker when dry, the thalline margin thin, mostly entire but sometimes more or less crenulate ; paraphyses more conglutinate in old specimens, slender, distinctly branched and septate, variously clavate and brown at the tips ; spores ellipsoid, 9–15 μ long, 6–8 μ thick ; hymenial gelatine blue, the asci faintly wine-

red, with iodine. *L. subfusca* Hook. Fl. Scot. ii. p. 47 (saxicolous) & in Sm. Engl. Fl. v. p. 189 (saxicolous); var. *campestris* Schær. Enum. p. 75 (1850); Mudd Man. p. 147; Cromb. Monogr. i. p. 410; f. *campestris* Cromb. Lich. Brit. p. 51 (1870); f. *argentata* Leight. Lich. Fl. p. 201 (1871) pro parte (non Ach.); ed. 3, p. 186 pro parte; var. *spodophœoides* Cromb. in Grevillea i. p. 171 (1872). *L. spodophœoides* Nyl. in Flora lv. p. 250 (1872) note; Cromb. Monogr. i. p. 410. *Lichen punctatus* Dicks. Pl. Crypt. fasc. iii. p. 15 (1793)? (? Scop. and others) Engl. Bot. t. 450? With. Arr. ed. 3, iv. p. 19.

Æssicc. Johns. nos. 77, 324; Larb. Lich. Hb. n. 99.

Frequently classified as a saxicolous variety of *Lecanora subfusca*, but differs in the thallus—partly, no doubt, due to the habitat—and also in the paraphyses, which are more constantly clavate than in that species, and brown at the tips. The figures and descriptions of *Lichen punctatus* by authors previous to “English Botany” are, in the absence of specimens, too vague for identification. The “English Botany” specimen is doubtful, so the species name *campestris* has been retained (cf. *L. Prevostii* f. *melanocarpa*).

Hab. On rocks and walls, rarely on the ground, from maritime to upland districts.—*Distr.* General and common throughout the British Isles.—*B. M.* St. Ouen's Bay, Jersey; The Vale, Guernsey; Withiel, near Penzance and Wadebridge, Cornwall; Ilsham Walk, Torquay, Devon; Shanklin, I. of Wight; Hastings, Sussex; Barnsley Park, Cirencester, Gloucestershire; Stormy Down, Glamorganshire; Llandyssil, Cardiganshire; Greeba Mt., I. of Man; Malvern, Worcestershire; near Ayton, Cleveland, Yorkshire; near Kendal and Helsington, Westmoreland; Whitehaven and St. Bees, Cumberland; Ravensworth Fell and Egglestone, Durham; Chollerford, Northumberland; Braid Hills, Edinburgh, West Water, Fife; Achosragan Hill, Appin, Argyll; Glen Almond, Glen Lyon and Glen Fender, Perthshire; Cove, Kincardineshire; near Aberdeen; Cork Harbour and Kinsale, Cork; near Kilkee, Clare; Ballynahinch, Dawros Bridge and Lettermore, Galway; Louisburgh and Achill Island, Mayo.

Apothecia brownish-black or black.

18. *L. coilocarpa* Nyl. ex Norrlin in Medd. Sällsk. Faun. & Fl. Fenn. i. p. 23 (1876).—Thallus subdeterminate, unequal, warted or granular-areolate, whitish or greyish (K + yellowish). Apothecia small or occasionally up to 3 mm. across, the disc concave then plane, brownish-black, the thalline margin entire, often becoming flexuose or crenulate; paraphyses slender, septate scarcely widened upwards, the epithecium dark- or sometimes greenish-brown; spores ellipsoid, 12–18 μ long, 6–9 μ thick; hymenial gelatine blue with iodine.—Cromb. in Grevillea xviii. p. 91 (1890) & Monogr. i. p. 415. *L. subfusca* var. *coilocarpa* Ach. Lich. Univ. p. 393 (1810); var. *lainea* Th. Fr. Lich. Arct. p. 105 (1860); Mudd Man. p. 147; f. *lainea* Cromb. Lich. Brit. p. 51 (1870); f. *coilocarpa* Stizenb. in Bot. Zeit. xxvi. p. 894 (1868); Cromb. l. c.; Leight. Lich. Fl. p. 202; ed. 3, p. 186.

Exsicc. Bohl. n. 59? Johns. n. 325; Larb. Cæsar. n. 77; Leight. n. 52; Mudd n. 111.

In the apothecia of this species there is nearly always a trace of brown, more easily seen when they are moistened. The tips of the paraphyses are also brown, though occasionally there is a trace of dull olive-green, more apparent after treatment with potash. In this and the following species the spermatogones are frequently immersed in the apices of thalline warts. The species was originally described as corticolous, and on the Continent occurs both on trees and on rocks. Our specimens are all saxicolous except f. *pulicaris*.

Hab. On rocks and walls (sometimes on trunks of trees) in maritime and upland districts.—*Distr.* Fairly common throughout the British Isles.—*B. M.* Boulay Bay, Jersey; Helmenton, Cornwall; Meadfoot, Torquay, Devon; Ardingly Rocks, Sussex; Rusthall Common, Kent; Malvern, Worcestershire; Trellick, Monmouthshire; Barmouth, Merioneth; Cwm Ffynnon Llwy, Carnarvonshire; Haughmond Hill, Shropshire; Ayton, Cleveland, Yorkshire; Staveley, Westmoreland; Alston, Cumberland; Dalmahoy Hill, near Edinburgh; Appin, Argyll; The Trossachs, Perthshire; Baldovan, Forfarshire; near Portlethen, Kincardineshire; Hill of Ardo, Aberdeenshire Lambay Island, Dublin.

Form *pulicaris* Cromb. in Grevillea xviii. p. 68 (1890).—Thallus very thin or obsolete, whitish. Apothecia numerous, small, the disc black, plane, becoming convex, the thalline margin thin, entire, becoming crenulate.—Cromb. Monogr. i. p. 416. *L. pulicaris* Ach. Syn. Lich. p. 336 (1814). *Patellaria pulicaris* Pers. in Ann. Wetter. Ges. ii. p. 13 (1810) fide Ach. l. c.

The few British specimens are lignicolous and without a thallus. The epithecium resembles that of the species in the dark brownish-black colour, differing in this respect from *L. subfusca* var. *allophana* and from *L. atrynea*, with which it might be confused.

Hab. On old fir palings in upland districts.—*Distr.* Rare in the Scottish Grampians.—*B. M.* Blair Athole, Perthshire; Crathie, Braemar, Aberdeenshire.

19. *L. gangaleoides* Nyl. in Flora lv. p. 354 (1872).—Thallus subdeterminate, generally thick and coarsely warted-areolate, greyish (K + yellow). Apothecia moderate in size, mostly crowded, the disc plane, black, the thalline margin rather prominent, sometimes inflexed, entire or becoming slightly furrowed or crenulate, occasionally sometimes flexuose; paraphyses slender, septate, scarcely widened upwards though sometimes slightly clavate and coloured at the tips, the epithecium dark- or greenish-brown; spores ellipsoid, 12–17 μ long, 6–9 μ thick, or rather larger; hymenial gelatine blue with iodine.—Cromb. in Journ. Bot. xiv. p. 360 (1876) & Monogr. i. p. 416; Leight. Lich. Fl. ed. 3, p. 189. *L. subfusca* f. *gangalea* Leight. Lich. Fl. p. 202?; ed. 3, p. 187? (non Ach.); f. *melacarpa* Leight. op. cit. ed. 3, p. 187. *L. atrynea* var. *melacarpa* Cromb. in Grevillea i. p. 171

(1873) (? Nyl.) & Monogr. i. p. 415. *L. plymatula* Johns. *Exsicc.* n. 368.

Exsicc. Johns. n. 198, 368 (as *L. plymatula*); *Larb. Lich. Hb.* n. 19.

Very closely allied to the preceding species, but distinguished by the thicker more warted thallus, and by the almost constantly black apothecia, thus resembling *L. atra*; the latter is, however, easily recognized by the violet colour of the hymenium. The paraphyses are more constantly dark-greenish than in *L. coilocarpa*.

Hab. On rocks and walls in maritime or mountainous regions.—*Distr.* Rare in N. England, the Scottish Highlands and W. Ireland.—*B. M.* Llandbedrog, Carnarvonshire; N. Derbyshire; Bearmoor, Northumberland; Wastdale, Cumberland; New Galloway, Kirkcudbrightshire; Achosragan Hill, Appin, Argyll; Craig Tulloch, Blair Athole, Perthshire; Letter Hill and Ballinakill, Connemara, Galway; Belclare near Westport and Clare Island, Mayo.

Subsp. *schistina* Nyl. in *Flora* lv. p. 429 (1872).—Thallus determinate, smooth, wrinkled or areolate, glaucous-white. Apothecia generally rather small, sometimes becoming large and irregular, the disc plane then convex, black; the thalline margin thickish, incurved; spores ellipsoid, 11–14 μ long, 6–8 μ thick.—Cromb. in *Grevillea* xviii. p. 68 & *Monogr.* i. p. 416. *L. schistina* Nyl. ex Cromb. in *Journ. Bot.* xx. p. 274 (1882).

Differs from the species in the less warted thallus. The paraphyses are sometimes stouter and the spores are also persistently smaller.

Hab. On rocks and walls in maritime and upland districts.—*Distr.* Sparingly in the Scottish Highlands and in W. Ireland.—*B. M.* Barcaldine, Argyll; Craig Tulloch, Blair Athole, Perthshire; Clare Island and Achill Island, Mayo.

20. *L. atra* Ach. *Lich. Univ.* p. 344 (1810) (excl. vars. *confragosa* and *expansa*).—Thallus determinate, thickish towards the centre, granulate or of crowded irregular warts, clear grey or greyish-white, with a thin blackish hypothallus (K + yellow). Apothecia moderate in size (up to 2 mm. across or more), crowded, the disc plane, black, the thalline margin prominent, persistent, often flexuose, entire or becoming crenulate; paraphyses coherent, septate, violet in colour, the tips dark-brown, the whole hymenium violet, appearing almost black in a thick section; spores ellipsoid, 10–15 μ long, 6–8 μ thick; hymenial gelatine blue with iodine.—Hook. *Fl. Scot.* ii. p. 47 & in *Sm. Engl. Fl.* v. p. 186; Tayl. in *Mackay Fl. Hib.* ii. p. 133; Mudd *Man.* p. 145 pro parte; Cromb. *Lich. Brit.* p. 54 & *Monogr.* i. p. 450; Leight. *Lich. Fl.* p. 194; ed. 3, p. 177. *Lichenoides crustaceum et leprosum, scutellis nigricantibus majoribus et minoribus* Dill. in *Ray Syn.* ed. 3, p. 71, n. 43 (1724) pro parte & *Hist. Musc.* p. 133, t. 18, fig. 15A (1741). *Lichen ater* Huds. *Fl. Angl.* i. p. 445 (1762); Lightf. *Fl. Scot.*

ii. p. 813; With. Arr. ed. 3, iv. p. 18; Engl. Bot. t. 949. *Rinodina atra* S. F. Gray Nat. Arr. i. p. 449 (1821).

Exsicc. Johns. n. 119; Larb. Lich. Hb. nos. 16, 54.

Distinguished from other *Lecanoræ* with a black disc by the violet paraphyses which tend to become brown with age; the whole hymenium is blackish in thick sections. The apothecia are generally numerous and crowded. Spermogones are frequent with long slender somewhat straight spermatia, 18–26 μ long.

Hab. On rocks, walls and trees from maritime to subalpine regions.—*Distr.* General and common throughout the British Isles.—*B. M.* Sark; St. Minver, Cornwall; Ilsham Walk, Torquay, Devon; New Forest, Hants; Hastings, Sussex; Lydd Beach, Kent; Reigate Hill, Surrey; Langford, Essex; Cirencester, Gloucestershire; Woodfield, Monmouthshire; Tenby, Pembrokeshire; Worcester and Malvern Hills, Worcestershire; Oswestry, Shropshire; Aberdovey and Dolgelly, Merioneth; Anglesea; Cheveley Park and near Newmarket, Cambridgeshire; near Yarmouth, Suffolk; Staveley Head, Westmoreland; St. Bees and Alston, Cumberland; near Glasgow; Barcaldine and Appin, Argyll; West Water and near Balmerino, Fifeshire; Loch Tay, Craig Tulloch and Kinnoul Hill, Perthshire; Denfenella and near Portlethen, Kincardineshire; Hill of Ardo, Aberdeenshire; near Cork; Killaloe, Clare; Dawros, Connemara, Galway; Achill Island and Clare Island, Mayo.

Var. *grumosa* Ach. Lich. Univ. p. 345 (1810).—Thallus more finely granulose and cracked-areolate. Apothecia somewhat sunk in the thallus, small.—Cromb. Monogr. i. p. 451. *Lichen grumosus* Pers. in Ust. Ann. Bot. xiv. p. 36 (1795).

Exsicc. Johns. n. 139.

Differs from the species in the granulose thallus. Another variety (var. *subbyssoides*) also with a granulose thallus has been recorded by Stirton from Blair Athole, Perthshire, in Trans. Glasg. Nat. Hist. Soc. p. 85 (1875). He describes it as having a blackish thallus, effigurate at the circumference, with a white subbyssoid hypothallus. Crombie (Monogr. i. p. 451) suggests that it may be a form of *L. gangaleoides*.

Hab. On rocks and walls in maritime and upland districts.—*Distr.* Rare in S. Wales, N.W. England and probably N.E. Scotland (Cromb. l. c.).—*B. M.* Woodfield, Monmouthshire; Brougham Castle, Westmoreland.

B. *Hageni* group.—Thallus thin or scanty, whitish or greyish (K –). Apothecia small, the disc generally dull- or yellowish-brown; ascus 8- or poly-spored (*L. Sambuci*).

Ascus 8-spored.

21. *L. Hageni* Ach. Lich. Univ. p. 368 (1810).—Thallus effuse, thin, minutely granular, cinereous-white, often scarcely visible (K –). Apothecia mostly small (less than 1 mm. across), often crowded, the disc plane or becoming turgid, pale to dark-brown of a dull tinge, sometimes greyish-pruinose, the thalline

margin rather thin, entire or often crenulate and somewhat prominent, or sometimes almost obliterated by the swollen disc; paraphyses slender or stoutish, irregularly septate and often uneven, colourless, or slightly clavate and brown at the tips, the epithecium of brown granules; spores ellipsoid, 9–12 μ long, 5–6 μ thick.—Leight. Lich. Fl. p. 208; ed. 3, p. 192; Cromb. Monogr. i. p. 425. *L. albella* var. *Hageni* Mudd Man. p. 168 (1861). *L. umbrina* var. *Hageni* Cromb. Lich. Brit. p. 51 (1870). *Lichen Hageni* Ach. Lich. Suec. Prodr. p. 57 (1798).

Essicc. Johns. n. 115; Larb. Lich. Hb. nos. 131, 219 & Lich. Cantab. n. 20.

L. Hageni has been distinguished from *L. umbrina* by Nylander and others (Cromb. Monogr. i. p. 424) on account of the difference in length of the spermatia: those of the former measuring up to 15 μ , the latter 15–22 μ . It is a character that is uncertain and difficult to rely on, as spermatogones are frequently absent. It differs from species of the *L. subfusca* group in the less developed thallus, in the smaller apothecia and spores, the stouter paraphyses, the duller, more amber-brown of the disc, and in the absence of reaction with potash.

Hab. On trees, or often on old palings, linoleum, etc., more rarely on soil or stones.—*Distr.* Not uncommon throughout the British Islands.—*B. M.* St. Aubin's Bay, Jersey; near Penzance; New Forest, Hants; Ryde, I. of Wight; Lydd, Kent; Langford, Hadleigh and Hockley, Essex; Windsor Great Park, Berks; Wellow near Bath, Somerset; Wimpole Park and Bottisham, Cambridgeshire; Brandon and Mendelsham, Suffolk; Ayton, Cleveland, Yorkshire; Ashgill Side and Ennerdale, Cumberland; Inverary, Argyll; Blair Athole and Achmore, Killin, Perthshire; Castlemartyr, Cork; Ballynagarde, Limerick.

Form *Zosteræ* A. L. Sm.—Thallus poorly developed, almost wholly covered by the apothecia. Apothecia generally crowded, rather small, sometimes becoming large and irregular, the disc dull-brown, the thalline margin white prominent, entire or sub-crenulate; paraphyses stoutish, irregularly septate, sometimes bead-like towards the tips or irregularly clavate and brownish; spores as in the species; hymenial gelatine blue with iodine.—*L. subfusca* var. *Zosteræ* Ach. Syn. Lich. p. 158 (1814). *L. umbrina* subsp. *Zosteræ* Cromb. in Journ. Bot. xii. p. 148 (1874); f. *Zosteræ* Leight. Lich. Fl. ed. 3, p. 191 (1879). *L. Zosteræ* Nyl. in Flora lix. p. 577 (1876); Cromb. Monogr. i. p. 425.

Crombic gives spore sizes rather larger than those of the species (11–14 $\mu \times 6-7 \mu$), but I have been unable to find spores so large in our specimens. In a weak solution of iodine the hymenium remains blue. Evidently a transition stage to the following variety.

Hab. On old plants of *Zostera marina*.—*Distr.* Rare in the Channel Islands, S.W. England and S.W. Ireland.—*B. M.* Jersey; Sark; Guernsey; Pentire and the Lizard, Cornwall; Kilkee, Clare.

Var. *marina* Th. Fr. Lich. Arct. p. 106 (1860); Lesd. Lich. Dunk. p. 155 (1910).—Thallus scarcely visible. Apothecia rather

large, generally more than 1 mm. across, crowded and difform, the disc deep purple-brown, with a white prominent persistent margin becoming crenulate.—*Lecanora sarcopsis* var. *marina* Wahlenb. ex Sommerf. Fl. Lapp. Suppl. p. 91 (1826).

Hab. On sea piles, etc.—*B. M.* Mersea Island, Essex (collected by P. Thompson).

Var. **Crombiei** Johns. Exsicc. n. 263 (1897).—Thallus whitish-cinereous, granular, deeply cracked-areolate. Apothecia small, crowded, angular, the margin prominent, entire, becoming crenulate.

Exsicc. Johns. n. 263.

Hab. On a decorticate stump.—*B. M.* Near Bolam, Durham (the only locality).

22. **L. umbrina** Massal. Ric. Lich. Crost. p. 10 (1852) pro parte; Nyl. in Bull. Soc. Bot. xiii. p. 369 (1866).—Thallus effuse, thinnish, granulate, unequal, greyish or dark (K—). Apothecia generally umber- or dark-brown, not pruinose, small, the thalline margin crenulate or entire, persistent; paraphyses slender, coherent, irregularly septate and slightly clavate or capitate, the epithecium of brown granules; spores ellipsoid, 8–12 μ long, 5–6 μ thick.—Carroll in Journ. Bot. v. p. 255 (1867); Cromb. Lich. Brit. p. 51 pro parte & Monogr. i. p. 423; Leight. Lich. Fl. p. 207 pro parte; ed. 3, p. 191 pro parte; f. *subdistans* Nyl. ex Cromb. in Journ. Bot. viii. p. 97 (1870). *L. Hageni* f. *calcigena* Nyl. ex Cromb. in Journ. Bot. xiv. p. 361 (1876) & Monogr. i. p. 426; Leight. Lich. Fl. ed. 3, p. 192. *Lichen umbrinus* Ehrh. Crypt. exs. n. 245 (1793) nomen nudum.

Exsicc. Johns. n. 262 (as f. *subdistans*), 369; Larb. Lich. Hb. (without a number).

Closely allied to *L. Hageni*, differing only in the somewhat stouter more persistent apothecial margins and in the generally saxicolous habitat. The thallus is sometimes very dark owing to the development of dark-brown hypothallic filaments or to the presence of blue-green algæ.

Hab. On siliceous or calcareous rocks, rarely on the ground or on palings.—*Distr.* Wide-spread but less common than the previous species.—*B. M.* La Moye, Jersey; near Penzance, Cornwall; Bannerdown, Wilts; Aberdovey, Merioneth; Ayton, Cleveland, Yorkshire; Wastdale and St. Bees, Cumberland; Ravensmouth, Durham; Barcaldine, Argyll; Bay of Nigg and Portlethen, Kincardineshire; Cliffs of Moher, Clare; Killery Bay and Lettermore, Connemara, Galway.

23. **L. crenulata** Hook. in Sm. Engl. Fl. v. p. 190 (1833); Nyl. in Not. Sällsk. Faun. & Fl. Fenn. Förh. 1866, p. 181.—Thallus very thin, effuse, greyish-white, often scarcely visible (K—). Apothecia small, scattered, the disc yellow- or dull-brown, sometimes pruinose, the thalline margin prominent, becoming deeply crevulate, white; paraphyses coherent, thickish

or slender, septate, colourless, sometimes slightly clavate or capitate at the tips, the epithecium of dense brown granules; spores ellipsoid, 10–16 μ long, 5–7 μ thick (generally about 12 μ long).—Cromb. Monogr. i. p. 424. *L. albella* var. *crenulata* Mudd Man. p. 148 (1861). *L. galactina* var. *disperso-areolata* Mudd tom. cit. p. 149. *L. umbrina* f. *crenulata* Cromb. Lich. Brit. p. 51 (1870); Leight. Lich. Fl. p. 207; ed. 3, p. 191; subsp. *crenulata* Cromb. in Grevillea xii. p. 59 (1883). *Lichen crenulatus* Dicks. Pl. Crypt. fasc. iii. p. 14, t. 9, fig. 1 (1793); Engl. Bot. t. 930; With. Arr. ed. 3, iv. p. 17.

Exsicc. Johns. n. 38; Larb. Lich. Hb. n. 258.

A dainty species allied to *L. Hageni*, and recalling somewhat *L. galactina* subsp. *dispersa* or *L. subluta* var. *perspersa*. The spermatia have been recorded by Nylander (Cromb. Monogr. i. p. 424) as 11–15 μ long, 5 μ thick.

Hab. On calcareous or sandstone rocks.—*Distr.* Rare in S.W. and N. England, the Grampians, Scotland, and N.W. Ireland.—*B. M.* Watcombe Bay, Devon; Alfrick, Worcestershire; near Ayton, Carlton Bank and Bilsdale, Cleveland, Yorkshire; Egglestone, Durham; Lamplugh, Cumberland; Egglestone, Durham; West Water, Fifeshire; Craig Tulloch, Blair Athole, Perthshire; Craig Guie, Braemar, Aberdeenshire; Oughterarde, Galway.

24. *L. conferta* Nyl. in Ann. Sci. Nat. sér. 3, vii. p. 313 (1867) note.—Thallus effuse, thin, scanty, granulate, greyish-white or greenish-grey (K–). Apothecia rather small (.3–.8 mm. across), plane, crowded in small groups and subangular from pressure, pale brick-red, or darker, the thalline margin very thin, sometimes crenulate, disappearing; paraphyses slender, septate, a little wider or sometimes shortly branched and irregular at the tips, the epithecium brownish; spores ellipsoid, 9–15 μ long, 5–7 μ thick; hymenial gelatine blue with iodine.—Cromb. in Grevillea xviii. p. 69 (1890) & Monogr. i. p. 427. *L. umbrina* var. *conferta* Cromb. in Journ. Bot. viii. p. 97 (1870). *L. Hageni* var. *conferta* Leight. Lich. Fl. p. 208 (1871) note; ed. 3, p. 192. *Patellaria conferta* Dub. Bot. Gall. ii. p. 654 (1830).

A rare species allied to *L. Hageni* or to *L. crenulata*. In the solitary specimen in the herbarium the thallus has almost disappeared and the reaction CaCl + saffron-yellow recorded by Hue (Journ. de Bot. v. p. 258) is not to be seen.

Hab. On granitic stones of a wall.—*B. M.* Woodside, near Aberdeen (the only British locality).

25. *L. Agardhiana* Ach. Syn. Lich. p. 152 (1814); Nyl. Lich. Scand. p. 138 (1861).—Thallus effuse, thin, continuous, smooth or furfuraceous, greyish (K–). Apothecia minute, at first innate, the disc brownish-black, the thalline margin thin, whitish, entire soon obliterated, with the disc convex and sometimes slightly pruinose (epithecium HNO₃ + rosaceous); paraphyses thickish, umber-brown at the clavate apices; spores ellipsoid,

about 10–14 μ long, 4–5 μ thick; hymenial gelatine blue with iodine.—Cromb. in *Grevillea* xviii. p. 69 (1890) & *Monogr.* i. p. 426.

Allied to *L. umbrina*, but the apothecia have a less prominent thalline margin; they appear lecideine when mature.

Hab. On calcareous rocks.—*B. M.* Great Orme's Head, Carnarvonshire (the only British record).

Ascus poly-spored.

26. *L. Sambuci* Nyl. *Lich. Scand.* p. 168 (1861).—Thallus effuse, very thin, minutely granulate or pulverulent, or scarcely visible, whitish or greyish (K— or f + yellowish). Apothecia small, congregate or scattered, the disc pale- or reddish-brown, the thalline margin thin, entire or crenulate, persistent; paraphyses subdiscrete, septate, colourless, or brown and capitate at the tips; spores 12, 16 or 32 in the ascus, ellipsoid, 8–12 μ long, 5–7 μ thick; hymenial gelatine blue with iodine.—Carroll in *Journ. Bot.* iv. p. 23 (1866); Cromb. *Lich. Brit.* p. 53 & *Monogr.* i. p. 443; Leight. *Lich. Fl.* p. 186; ed. 3, p. 171.

Exsicc. Johns. n. 417.

Distinguished from allied species by the poly-spored asci.

The small apothecia with white crenulate margins recall *Lecanora crenulata* or *L. Hageni*. There is only a very faint yellow reaction with potash—or none.

Hab. On trees, often poplars or old elders, rarely on wood.—*Distr.* Very rare in N. England and W. Scotland.—*B. M.* Durham; Barcaldine, Argyll.

C. Pallida group.—Thallus whitish, yellowish, or more rarely greyish (reactions various or none). Apothecia more or less pruinose.

Thallus K + yellow.

27. *L. pallida* Schær. *Enum.* p. 78 (1850).—Thallus determinate, thin, smooth or sometimes becoming thicker and granulate, whitish (K + yellow). Apothecia scattered or crowded, moderate or rather small, the disc plane or becoming slightly convex, pale flesh-coloured, generally pruinose (CaCl—), the thalline margin entire, prominent or sometimes excluded by the growth of the disc; paraphyses generally conglutinate, rather slender, sometimes flexuose, septate, not widened nor coloured at the tips, but the epithecium brown, granulose; spores ellipsoid, small, 10–12 μ long, 5–8 μ thick, sometimes larger; hymenial gelatine blue with iodine.—*L. albella* Ach. *Lich. Univ.* p. 369 (1810); Hook. in *Sm. Engl. Fl.* v. p. 191; Mudd *Man.* p. 147; Cromb. *Lich. Brit.* p. 51 pro parte & *Monogr.* i. p. 418 (incl. ff. *peralbella* and *subalbella*); Leight. *Lich. Fl.* ed. 3, p. 206; f. *peralbella* Nyl. ex Cromb. in *Journ. Bot.* xiv. p. 361 (1876); f. *subalbella* Hue in

Rev. Bot. vi. p. 161 (1887-8). *L. subfusca* f. *albella* Leight. Lich. Fl. p. 204 (1871). *L. peralbella* Nyl. in Flora lv. p. 365 (1872); Leight. op. cit. ed. 3, p. 206. *L. subalbella* Nyl. l. c. *Lichen pallidus* Schreb. Spicil. Fl. Lips. p. 133 (1771). *L. albellus* Pers. in Ust. Ann. Bot. xi. p. 18 (1794); Engl. Bot. t. 2154. *L. rosellus* Sm. Engl. Bot. t. 1651 (1806) (non Pers.). *Rinodina albella* S. F. Gray Nat. Arr. i. p. 453 (1821).

Exsicc. Bohl. n. 77; Mudd n. 113.

Distinguished by the whitish determinate thallus which forms orbicular patches on somewhat smooth bark, and also by the light-coloured pruinose apothecia. The spermogones are light-coloured round the ostiole, thus differing from those of *L. subfusca*, which are dark-coloured (fide Hue Add. Nov. p. 84); the spermatia are 16-22 μ long.

Hab. On smooth bark of trees in wooded districts.—*Distr.* Rather rare but widely distributed in the British Isles.—*B. M.* Near Bovey Tracey, Becky Falls, Devon; Netley Abbey and Lyndhurst, New Forest, Hants; Bainbridge, I. of Wight; St. Leonard's Forest, Sussex; Savernake Forest, Wilts; Epping Forest, Hockley and Hadleigh Woods, Essex; Hay Park, Herefordshire; Gopsall Wood, Leicestershire; Cliffrigg, Cleveland, Yorkshire; Barcaldine, Argyll; Morrone, Braemar, Aberdeenshire; Killaloe, Clare; Killery Bay and Ballynahinch, Connemara, Galway.

28. *L. carpinea* Wain. in Medd. Soc. Faun. & Fl. Fenn. xiv. p. 23 (1886).—Thallus determinate, thin, smooth or becoming unequally granulate towards the centre, greyish-white (K + yellow). Apothecia small or moderate in size, scattered or more often crowded and becoming angular, the disc pale-reddish- or dark-brown and more or less whitish-pruinose, plane, then often convex (CaCl + citrine-yellow), the thalline margin thin, generally entire, sometimes crenulate or often excluded; paraphyses somewhat conglutinate, slender, sometimes flexuose, septate, not widened upwards nor coloured at the tips, but the epithecium dark-brown and granulose; spores ellipsoid, generally rather small, 9-16 μ long, 6-7 μ thick; hymenial gelatine blue with iodine.—*L. angulosa* Ach. Lich. Univ. p. 364 (1810); Leight. Lich. Fl. ed. 3, p. 205; Cromb. Monogr. i. p. 419 (excl. var. *chondrotypa*). *L. subfusca* var. *angulosa* Mudd Man. p. 148 (1861); f. *angulosa* Leight. Lich. Fl. p. 204 (1871). *L. albella* subsp. *angulosa* Cromb. Lich. Brit. p. 51 (1870). *Lichen carpineus* L. Sp. Pl. p. 1141 (1753). *L. angulosus* Schreb. Spicil. Fl. Lips. p. 136 (1771).

Exsicc. Johns. nos. 133, 319, 413; Larb. Lich. Cantab. n. 23; Mudd nos. 114, 115.

Closely allied to the preceding species, differing, however, decisively in the yellow reaction of the apothecial disc with chloride of lime. It occurs usually in definite patches, with the apothecia crowded in the centre. The reaction with iodine depends on the solution; under a certain strength there is only a blue colour produced. This refers

equally to *f. subangulosa* Johns. Exs. n. 413 (1810); the change to wine-red is, however, much quicker in some specimens than in others. The specimens recorded under *L. angulosa* var. *chondrotypa* Cromb. Monogr. i. p. 420 (1894) belong to *L. pallida* and not to *L. chondrotypa* Ach. (Lich. Univ. p. 365 (1810)). *Lichen glabratus* Dicks., a herbarium name, is quoted by Nylander (Lich. Scand. p. 162) as synonymous with *L. chondrotypa*. The spermogones are black above with spermatia 14–18 μ long.

Hab. On trunks of trees, rarely on old palings, in maritime and inland districts.—*Distr.* Not uncommon throughout the British Isles.—*B. M.* Ullacombe, Bovey Tracey, Devon; New Forest, Hants; Shermanbury, near Lewes and near Hastings, Sussex; Holmwood, Surrey; Tunbridge Wells, Kent; Epping Forest, Essex; near Cirencester, Gloucestershire; Nesscliff, Shropshire; Kempsey, Worcestershire; Bottisham, Cambridgeshire; between Staithes and Loftus, Ayton, and near Easby, Cleveland, Yorkshire; Catterleean, Cumberland; Appin, Argyll; Finlarig, Killin, Perthshire; Castleconnell, Limerick; near Belfast, Antrim.

29. *L. sordida* Th. Fr. Lich. Arct. p. 115 (1860) (excl. vars.).—Thallus subdeterminate, thickish, continuous, then wrinkled or cracked-areolate, rarely subfarinose, sometimes radiate at the circumference, with a white hypothallus not often visible, whitish or cinereous (K + yellow). Apothecia scattered or crowded, small or large, innate or appressed, the disc plane, often becoming convex, dull-reddish or -brownish, generally bluish-black-pruinose (CaCl + yellow), the thalline margin thin, acute or often deeply crenate and flexuose, or disappearing; paraphyses crowded, slender, colourless, septate, especially towards the apex, the epithecium granular, dull-olive-brown; spores ellipsoid, 10–14 μ long, 6–7 μ thick.—*L. glaucoma* Ach. Lich. Univ. p. 362 (1810): Hook. Fl. Scot. ii. p. 48 & in Sm. Engl. Fl. v. p. 189; Tayl. in Mackay Fl. Hib. ii. p. 135; Mudd Man. p. 153; Cromb. Lich. Brit. p. 50 & Monogr. i. p. 420 (incl. subsp. *subradiosa* Nyl. in Flora lv. p. 549 (1872)); Leight. Lich. Fl. p. 215 (incl. *f. carulata?* and *f. cinereopruinosa*); ed. 3, p. 204 (incl. ff.). *Lichen rupicola* L. Mant. p. 132 (1767)? Lightf. Fl. Scot. ii. p. 806? Huds. Fl. Angl. ed. 2, p. 525? With. Arr. ed. 3, iv. p. 13, t. 31, fig. 2 (1796). *L. sordidus* Pers. in Ust. Ann. Bot. vii. p. 26 (1794). *L. glaucoma* Ach. Lich. Suec. Prodr. p. 56 (1798): Engl. Bot. t. 2156. *Verrucaria glaucoma* Hoffm. Fl. Deutschl. ii. p. 172 (1795). *Rinodina glaucoma* S. F. Gray Nat. Arr. i. p. 453 (1821).

Exsicc. Johns. n. 112; Larb. Lich. Hb. n. 259; Leight. n. 53; Mudd n. 122.

An extremely variable plant, both as regards thallus and apothecia, but the pruinose character of the disc, combined with the reaction to CaCl, is a sure test. The apothecial margin is generally entire but may be deeply indented, with the disc flat or turgid. Spermogones are frequent, and like black points in the thallus. Thallus and apothecia are the hosts of various parasites, the latter of *Arthonia varians*.

Several names have been employed for this plant: *Lichen rimosus* Oed. Fl. Dan. iii. t. 468, fig. 3 (1769) is altogether doubtful, though adopted by Schærer (Enum. p. 71), and Dickson's plant of that name is *Rhizocarpon calcareum*. Withering's figure of *L. rupicola* almost certainly represents the plant, though the description is deficient and the habitat "on calcareous rocks" is wrong; it is antedated by *Lichen sordidus* Pers., which has been generally accepted by competent and critical lichenologists, and of which the diagnosis and habitat accord with this lichen. *L. glaucoma* subsp. *bicincta* Nyl. var. *leccideina* Cromb. Monogr. i. p. 422 (1894) was recorded as *L. subcarnea* var. *leccideina* Cromb. in Grevillea xviii. p. 68 (1890), and belongs to that species. It has a thinner, smoother thallus, gives a red reaction with potash, and no disc reaction with CaCl. *L. glaucoma* f. *cærulata* Leight. seems also to be identical with that form.

Hab. On siliceous rocks, boulders and walls in maritime and upland districts, chiefly mountainous.—*Distr.* General and common probably throughout the British Isles.—*B. M.* Jersey; Guernsey; Sark; St. Minver and Penzance, Cornwall; Bolt Head, Devon; near Folkestone, Kent; Charnwood Forest and Bardon Hill, Leicestershire; Malvern Hills, Worcestershire; Aberdovey and Barmouth, Merioneth; Pwllheli, Carnarvonshire; Anglesea; Long Mynd and Haughmond Hill, Shropshire; Ayton and Cliffrigg, Cleveland and Ribblesdale, Yorkshire; Middleton-in-Teesdale, Durham; Swinhope, East Allendale, Northumberland; near Milnthorpe and Swindale, Westmoreland; Catterleean, Cumberland; New Galloway, Kirkeudbrightshire; Kyles of Bute; Barcaldine, Argyll; Killin, Perthshire; near Dundee, Forfarshire; Portlethen, Kincardineshire; Craig Guie and Castleton of Braemar, Aberdeenshire; Kinsale, Cork; Lambay Island and Howth, Dublin.

Form *decussata* A. L. Sm.—Thallus marked with black lines, probably due to the presence of some other lichen.—*L. glaucoma* f. *decussata* Cromb. in Grevillea xviii. p. 68 (1890) & Monogr. i. p. 421.

Hab. On rocks in maritime and upland districts.—*Distr.* Sparingly in the Channel Islands, N. England and E. Scotland.—*B. M.* Chateau Point, Sark; Gunnerton Crags, Northumberland; near Dundee, Forfarshire.

Form *complanata* A. L. Sm.—Thallus and apothecia in a uniform plane. Apothecia innate.—*L. glaucoma* f. *complanata* Leight. Lich. Fl. ed. 3, p. 205 (1879); Cromb. ll. c.

Exsicc. Johns. n. 113.

Hab. On slate rocks in maritime districts.—*Distr.* Sparingly round the coasts of Great Britain and S. Ireland.—*B. M.* Near Towyn, Pembrokehire; near Berwick-on-Tweed; Ballachulish, Argyll.

Form *distans* A. L. Sm.—Thallus thin, rather smooth, cracked. Apothecia few, scattered, rather small.—*L. glaucoma* f. *distans* Johns. Exs. n. 414 (1910).

Exsicc. Johns. n. 414.

Hab. On quartzose rocks and stones.—*Distr.* Rare in N. England.—*B. M.* Whitehaven, Cumberland.

Var. *Swartzii* A. L. Sm.—Thallus thickish, deeply cracked-areolate, somewhat radiating at the circumference. Apothecia plane or convex, aggregate-conglomerate.—*L. glaucoma* var. *Swartzii* Nyl. Lich. Scand. p. 159 (1861); Cromb. Lich. Brit. p. 50 & Monogr. i. p. 421; Leight. Lich. Fl. p. 216; ed. 3, p. 205. *Lichen Swartzii* Ach. in K. Vet. Acad. Handl. xv. p. 185, t. 1, fig. 2 (1794); Dicks. Pl. Crypt. fasc. iv. p. 23.

Not easily defined in the absence of satisfactory specimens. In the single British specimen, the apothecia are deeply crenate, a character that occurs in the species, and are often turgid and difform and with deeply indented margins. They are much larger than those in the figure by Acharius, which Crombie, however, says is not good.

Hab. On rocks in mountainous districts.—*B. M.* Ben Cruachan, Argyll.

Var. *inflexa* A. L. Sm.—Thallus deeply cracked-areolate. Apothecia generally crowded into cushion-like tubercles, rather large, the margin prominent, strongly crenate or flexuose, white.—*L. glaucoma* var. *inflexa* Johns. ex Cromb. ll. c.

Exsicc. Johns. n. 114.

A well-marked plant, more or less connected with the preceding variety, but the apothecia are more crowded into tuberculate masses, and the thallus is more cinereous.

Hab. On quartzose rocks.—*B. M.* Alston, Cumberland (the only locality).

30. *L. cenisia* Ach. Lich. Univ. p. 361 (1810).—Thallus of warted granules contiguous or scattered, subglobose or forming an areolate crust, whitish or greyish (K + yellow). Apothecia often rather large, up to 2 mm. across, yellowish- or dull-brown becoming darker, sometimes almost black, greyish-pruinose, the thalline margin prominent, entire, then becoming flexuose and crenulate; paraphyses slender, crowded, often undulate, scarcely widened upwards, septate near the tips and colourless, the epithecium brown; spores broadly ellipsoid, 12–19 μ long, 8–10 μ thick; hymenial gelatine blue with iodine.—*L. atrynea* var. *cenisia* Lamy in Bull. Soc. Bot. Fr. xxv. p. 409 (1878); Cromb. in Grevillea xviii. p. 68 (1890) & Monogr. i. p. 415.

Characterized by the warted granules of the thallus and by the pruinose apothecia. The spores of the specimens examined measured only rarely up to 17 μ in length. The apothecium has been described as zeorine, i.e., with a double margin, a character not easily demonstrated in this lichen.

Hab. On schistose rocks in a maritime district.—*B. M.* Near Portlethen, Kincardineshire (the only British record).

Var. *atrynea* Harm. Lich. Fr. v. p. 992 (1913).—Thallus more compact than in the species, granular- or warted areolate, whitish or greyish (K + yellowish). Apothecia generally rather small and scattered or often crowded, the disc brown and scarcely

pruinose, becoming very dark, the brown colour only visible when moist, the thalline margin prominent, crenulate or subentire; paraphyses as in the species, the epithecium tending to become darker and olivaceous-brown; spores as in the species.—*L. subfusca* var. *atrynea* Ach. Lich. Univ. p. 395 (1810); Mudd Man. p. 147 pro parte; f. *atrynea* Cromb. Lich. Brit. p. 51; Leight. Lich. Fl. p. 203; ed. 3, p. 187. *L. atrynea* Nyl. in Flora iv. p. 250 (1872) note; Cromb. Monogr. i. p. 414.

Æsicc. Johns. n. 78.

Commoner than the species, and very closely allied in the specimens with lighter-coloured apothecia. In our specimens they are, however, less pruinose, and become very dark. The specimen from Craig Tulloch recorded as *L. atrynea* var. *melanocarpa* (Cromb. Monogr. i. p. 415) is, as far as can be judged from the single small gathering, identical both in thallus and apothecia with *L. gangaleoides*. No spores are present, but the paraphyses have the dark greenish tips of that species.

Hab. On rocks, rarely on trees or wood, in maritime and inland situations.—*Distr.* Rather rare in Great Britain and Ireland.—*B. M.* Shanklin, I. of Wight; Barmouth, Merioneth; Eastham, Cheshire; Buxton, Derbyshire; Carlton, Cleveland, Yorkshire; Teesdale, Durham; Killin, Perthshire; Cove, Kincardineshire; Dinish Island, Killarney, Kerry.

Thallus K + yellow, then red.

31. *L. subcarnea* Ach. Lich. Univ. p. 365 (1810).—Thallus subdeterminate, with a white hypothallus, thin or thickish smooth and cracked-areolate, or in torn-like fragments, yellowish white (K + yellow, then deep red). Apothecia prominent, scattered or crowded, moderate in size, the disc plane, becoming convex, flesh-coloured, rarely brownish-red, more or less whitish or bluish-pruinose, the thalline margin thin, entire, undulate, or rarely crenulate, then almost excluded; paraphyses stoutish, septate, irregularly bent and knobbed at the tips, the epithecium granulose, dark-brown in section; spores ellipsoid, small, 10–14 μ long, 5–8 μ thick; hymenial gelatine violet-blue with iodine.—Leight. Lich. Fl. p. 216; ed. 3, p. 205; Cromb. Monogr. i. p. 422. *L. glaucoma* var. *subcarnea* Mudd Man. p. 153 (1861); Cromb. Lich. Brit. p. 50. *Lichen subcarneus* Swartz ex Westr. in Vet. Akad. Handl. 1791, p. 126. *L. pallescens* With. Arr. ed. 3, iv. p. 21 (1796) pro parte. *Lecidea subcarnea* Hook. in Sm. Engl. Fl. v. p. 184 (1833).

Differs from the preceding in the flesh-coloured pruinose apothecia, and from *L. sordida* in the lighter coloured thallus. As in *L. pre-postera*, the reaction with potash is not constant. The thallus always turns yellow, but the red reaction does not always follow very decisively. The spermatogones are black, with curved spermatia 20–25 μ long.

Hab. On rocks in maritime and upland districts.—*Distr.* Rather rare in the Channel Islands, N. England, the Grampians and N.E.

Scotland—*B. M.* Boulay Bay, Jersey; Alderney; Valley of Rocks, Lynton, Devon; Barmouth, Merioneth; Keighley and Ayton, Yorkshire; Teesdale, Durham; Craig Tulloch, Blair Athole, Perthshire; Morrone, Braemar, Aberdeenshire.

32. *L. præpostera* Nyl. in Flora lvi. p. 19 (1873).—Thallus whitish or pale yellowish, rather thick, crowdedly tuberculose or smooth and cracked into small areolæ (K + yellow, then red). Apothecia small or moderate in size, at first innate, often poorly developed, the disc brown, becoming dull-blackish, generally white-pruinose, the thalline margin thick, partly wrinkled or crenulate; paraphyses slender, septate, slightly coloured at the tips, but the epithecium dark greenish-brown and granulose; spores rather small, ellipsoid, 9–14 μ long, 5–6 μ thick; hymenial gelatine bluish with iodine.—Cromb. in Grevillea i. p. 141 (1873) & Monogr. i. p. 418; Leight. Lich. Fl. ed. 3, p. 173.

The reaction with potash gives a very distinctive character to this species, though in some of the specimens it is not very pronounced. The thick whitish thallus differentiates it from neighbouring species. Spermogones with straight or slightly curved spermatia about 16 μ long.

Hab. On basaltic rocks.—*Distr.* Local and rare in the Channel Islands.—*B. M.* Jerbourg, Guernsey; Rozel, Jersey.

Thallus K —.

33. *L. galactina* Ach. Lich. Univ. p. 424 (1810).—Thallus suborbicular or spreading widely, crustaceous, areolate, the granules when well developed crenulate and subsquamulose at the circumference, whitish or straw-coloured (K —). Apothecia crowded and often obscuring the thallus, rather small, plane, pale brownish-red, white pruinose or naked, the thalline margin at first thickish, becoming thin, flexuose and crenulate; hymenium interspersed-granulose; paraphyses slender, septate, sometimes wider at the tips; spores ellipsoid, 9–15 μ long, 5–7 μ thick; hymenial gelatine blue with iodine.—Mudd Man. p. 149 (excl. var. *disperso-areolata*); Cromb. Lich. Brit. p. 50 & Monogr. i. p. 404; Leight. Lich. Fl. p. 206; ed. 3, p. 189. *Lichenoides crustosum, orbiculare incanum* Dill. Hist. Musc. p. 135, t. 18, fig. 17 B (1741). *Parmelia galactina* Ach. Meth. Lich. p. 190 (1803).

Exsicc. Johns. n. 236; Larb. Lich. Cantab. n. 26; Leight. n. 400; Mudd n. 116.

A very variable lichen in the grouping of the apothecia and in the appearance of the thallus. The latter begins in small orbicular patches, with the outer granules somewhat spreading and lobate, but it soon spreads and becomes irregular and indeterminate, and is often obscured by the numerous apothecia, which become angular from pressure. It is one of the few lichens that persists in the immediate neighbourhood of large towns.

Hab. On walls and rocks (chiefly calcareous), or rarely in crevices of walls from maritime to upland districts.—*Distr.* General and common in most parts of the British Isles.—*B. M.* Rozel, Jersey; Sark; Newlyn Cliff, Penzance and Withiel, Cornwall; Peasemars, Hastings, Shoreham and Brighton, Sussex; Holloway and Stanmore, Middlesex; Wickham Bishops and Ulting, Essex, Cleve Hill and Bathampton Downs, Somersetshire; Cirencester and Chalford, Gloucestershire; Great Malvern, Worcestershire; Shifnal and Oswestry, Shropshire; Milton, Cambridgeshire; near Matlock, Derbyshire; Anglesea; near Ayton, Cleveland, Yorkshire; Rerrick, Kirkcudbrightshire; King's Park, Stirling; Ben Lawers and Craig Tulloch, Blair Athole, Perthshire; Portlethen, Kincardineshire; Craig Guie, Braemar, Aberdeenshire; near Fort William, Invernesshire; Kylemore Lake, Connemara, Galway.

Form *livida* Leight. Lich. Fl. p. 207 (1871).—Thallus pale or reddish-white, cracked-areolate, the areolæ scale-like. Apothecia sometimes immersed in the thallus, otherwise as in the species.—Leight. op. cit. ed. 3, p. 190. *L. livida* Ach. Lich. Univ. p. 375 (1810); Cromb. Monogr. i. p. 407. *L. galactina* var. *livida* Nyl. ex Cromb. Lich. Brit. p. 50 (1870).

Esicc. Johns. n. 237.

A rare form, differing from the species in the somewhat more developed thallus and immersed apothecia, the latter character occurs sometimes in the species.

Hab. On calcareous walls in upland districts.—*Distr.* Rare in N. England and W. Scotland.—*B. M.* N. England; Appin, Argyll.

Form *verrucosa* Leight. Lich. Fl. ed. 3, p. 190 (1879).—Thallus in white dispersed convex verrucose pulvinuli. Apothecia small, immersed, crowded.—Cromb. in Grevillea xviii. p. 67 & Monogr. i. p. 405. *L. galactina* var. *deminuta* Cromb. in Journ. Bot. xxiii. p. 195 (1885) (non Stenh.).

Esicc. Johns. n. 109.

The form is connected with the continental var. *deminuta*, but differs in the more scattered pulvinate habit.

Hab. On calcareous rocks.—*Distr.* Rare in Wales, N. England and the Grampians, Scotland.—*B. M.* Mumbles, near Swansea, Glamorganshire; Great Orme's Head, Carnarvonshire; Asby, Westmoreland; Craig Guie, Braemar, Aberdeenshire.

Var. *subluta* Nyl. in Flora lix. p. 572 (1876).—Thallus effuse, minutely granulose, whitish (K -). Apothecia small, crowded, difform from pressure, pale yellowish-red, otherwise as in the species.—*L. subluta* Nyl. tom. cit. p. 232; Cromb. in Grevillea v. p. 106 (1877) & Monogr. i. p. 407; Leight. Lich. Fl. ed. 3, p. 190.

In one of the specimens from Dawros River, Connemara, the apothecia are larger and in pulvinate groups, and the thallus very scanty, with a reaction K (CaCl) + reddish-orange.

Hab. On calcareous rocks in upland situations.—*Distr.* Rare among the Grampians, Scotland, and in W. Ireland.—*B. M.* Ben Lawers, Perthshire; Recess and Dawros River, Connemara, Galway.

Form *perspersa* Nyl. tom. cit. p. 572.—Thallus obsolete. Apothecia smaller and scattered, otherwise as in the species.—*L. subluta* f. *perspersa* Cromb. in Grevillea v. p. 106 (1877) & Monogr. i. p. 407; var. *perspersa* Leight. Lich. Fl. ed. 3, p. 190 (1879).

Exsicc. Johns. n. 259.

Hab. On rocks in upland situations.—*B. M.* N. England; Dawros River, Connemara, Galway.

Subsp. *dispersa* Nyl. ex Cromb. in Grevillea xviii. p. 68 (1890) & Monogr. i. p. 406.—Thallus scanty or entirely wanting. Apothecia small, more or less scattered, the disc flesh-coloured to dark-brown, the thalline margin white, entire or becoming crenulate; paraphyses and spores as in the species.—*L. galactina* var. *dispersa* Ach. Lich. Univ. p. 424 (1810); f. *dispersa* Leight. Lich. Fl. p. 206; ed. 3, p. 190. *Lichen dispersus* Pers. in *Üst. Ann. Bot.* vii. p. 27 (1794).

Exsicc. Johns. n. 76.

Differs from the species in the general absence of thallus and in the small well-formed apothecia, usually with an entire margin. The apothecia may be widely and sparsely scattered or rather crowded.

Hab. On rocks and walls in maritime and inland districts.—*Distr.* Rather rare in Great Britain and Ireland.—*B. M.* Ryde beach, I. of Wight; Cirencester, Gloucestershire; near Oswestry, Shropshire; Hartlepool, Durham; Bywell, Northumberland; Cunswick Scar, Westmoreland; Achosragan Hill, Argyll; Craig Tulloch, Blair Athole and Glen Lochay, Killin, Perthshire; Morrone, Braemar, Aberdeenshire; Cliffs of Moher, Clare; Delphi, Connemara, Galway.

Subsp. *dissipata* Nyl. in Bull. Soc. Bot. Fr. xiii. p. 368 (1866).—Thallus in spots or spreading indefinitely, consisting chiefly of a blackish stain-like hypothallus. Apothecia minute, the disc dull-brown or blackish, or slightly whitish-pruinose, the thalline margin whitish, subentire; spores rather smaller than in the species, 8–12 μ long, 4–6 μ thick.—Cromb. in Grevillea xviii. p. 67 (1890) & Monogr. i. p. 405.

Exsicc. Johns. n. 315.

One of the few lichens of the London district, forming ink-like stains, thallus and apothecia being further blackened by smoke. Johnson's plant from Durham has a very distinct hypothallus like that of the London lichens.

Hab. On calcareous rocks, stones, composite walls, etc.—*Distr.* Rather rare in the more open London districts such as S. Kensington, etc., and N. England.—*B. M.* Notting Hill and Camden Town, London; near Brusselton, Durham.

34. *L. urbana* Nyl. ex Cromb. in Journ. Bot. xxiii. p. 195 (1885).—Thallus white, opaque, more or less pruinose or farinose, of rather stout massed granules occasionally flattened and crenu-

late (K-). Apothecia moderate in size, crowded or in pulvinate groups, the disc brownish, white-pruinose, the thalline margin prominent, entire or faintly crenulate; paraphyses stoutish, septate, very slightly widened at the apex; spores ellipsoid, 11-14 μ long, 5.7 μ thick.—Cromb. Monogr. i. p. 406. *L. galactina* subsp. *urbana* Nyl. in Bull. Soc. Bot. Fr. xiii. p. 368 (1866).

Exsicc. Johns. n. 316.

Very closely allied to *L. galactina*, but with a thicker thallus and with slight differences in the apothecia.

Hab. On mortar of old walls near towns in lowland districts.—*Distr.* Rare in England and S. Ireland.—*B. M.* Lewes, Sussex; Folkestone, Kent; Dorking, Surrey; Berwick-on-Tweed; near Cork.

35. *L. Andrewii* B. de Lesd. in Bull. Soc. Bot. Fr. lxi. p. 82 (1914).—Thallus indistinct. Apothecia numerous, crowded, up to 1 mm. across, disc pallid or dull-brown, plane, margin white, thick, subentire or suberenulate, persistent and flexuose (CaCl f + yellow, K(CaCl) + reddish-orange); epithecium yellowish, granular; hypothecium colourless; paraphyses easily separating, slender, simple, scarcely wider above, not septate; asci clavate; spores ellipsoid, 11-13 (15) μ long, 6 μ thick; hymenial gelatine deep blue with iodine.

The description has been taken from de Lesdain, but examination of the co-type specimens shows that the apothecia are sometimes pruinose; the paraphyses are swollen and sometimes divided at the tips, thus differing slightly from those of *L. galactina*. Another peculiar feature is the reaction, which, however, occurs in a specimen of *L. galactina* var. *subluta*.

Hab. On siliceous rocks partly encrusted with lime.—*B. M.* Braid Hills near Edinburgh (the only record; collected by J. McAndrew).

D. *Varia* group.—Thallus greenish-grey (reactions various or none). Apothecia greenish or dull greenish-brown.

36. *L. varia* Ach. Lich. Univ. p. 377 (incl. f. *pleorytis*).—Thallus generally wide-spreading in a thinnish warted granular crust, the small warts rather unequal, crowded or sparse or almost absent, yellowish-green, straw-coloured or greenish-grey (K-). Apothecia numerous and often crowded, obscuring the thallus, generally about 1 mm. in diameter, becoming sometimes larger and irregular in form, the disc dull yellowish-brown or -green, sometimes darker and sometimes slightly pruinose, the thalline margin thin, prominent, persistent, subentire, becoming flexuose and angular; paraphyses slender, somewhat coherent, not distinctly septate, the apices slightly larger or irregular, the epithecium of minute yellowish granules, dark-brown in thick section; spores oblong-ellipsoid, 9-12 μ long, 5-7 μ thick; hymenial gelatine blue with iodine.—Hook. in Sm. Engl. Fl. v.

p. 190; Tayl. in Mackay Fl. Hib. ii. p. 137 pro parte; Mudd Man. p. 149 pro parte; Cromb. Lich. Brit. p. 52 pro parte & Monogr. i. p. 430 (incl. f. *pleorytis*); Leight. Lich. Fl. p. 192; ed. 3, p. 176 pro parte. *Lichen varius* Ehrh. Exs. n. 68 (1785) nomen nudum; Sm. Engl. Bot. t. 1666 (1807). *Patellaria varia* Hoffm. Pl. Lich. i. p. 102 (1790); var. *pleorytis* Ach. Meth. p. 178 (1833). *Rinodina varia* S. F. Gray Nat. Arr. i. p. 452 (1821).

Exsicc. Bohl. n. 107; Johns. nos. 134, 135; Larb. Lich. Hb. n. 215; Leight. n. 51.

Characterized by the smooth rather hard granules, as distinguished from the leprose thallus of *L. farinaria* which is more of a shade lichen. The apothecia are numerous and may be much enlarged with very irregular indented flexuose margins (f. *pleorytis*), a character that appears in many of the apothecia. Spermatia thread-like, 12–22 μ long, 0.75 μ thick.

Hab. On old palings (rarely on trunks of trees, heather, etc.).—*Distr.* General and common throughout the British Islands.—*B. M.* Guernsey; Bovey Tracey, Devon; Lyndhurst, New Forest, Hants; Shermanbury, Hastings and St. Leonard's Forest, Sussex; Penshurst Park, Kent; Shiere, Surrey; Finchley, Middlesex; Walthamstow, Essex; Elstree, Hertfordshire; Gamlingay, Cambridgeshire; Yarmouth, Norfolk; Hay Park, Herefordshire; Battenhall, near Worcester; Harboro' Magna, Warwickshire; Twycross and Gopsall Park, Leicestershire; near Shrewsbury, Shropshire; Barmouth, Merioneth; Ayton, Cleveland and Skipworth, Yorkshire; Wark-on-Tyne and near Hexham, Northumberland; Ben Lawers and Killin, Perthshire; Durris, Kincardineshire; Crathie and Glen Dce, Braemar, Aberdeenshire; Rothiemurchus, Invernessshire; Carrigaline, Cork; Killarney, Kerry.

37. *L. farinaria* Borr. Engl. Bot. Suppl. t. 2727 (1832).—Thallus effuse, thickish, pulverulent-leprose and generally cracked-areolate or subleprose, pale yellowish-green (K + yellow). Apothecia sparsely scattered, pale reddish, becoming brownish or very dark when old, generally rather sunk in the thallus and the margin pulverulent; paraphyses somewhat coherent, sparingly septate, irregular and sometimes divided at the tips; the epithecium a mass of granules, brown in thick section; spores ellipsoid, 10–16 μ long, 4–5 μ thick; hymenial gelatine blue with iodine.—Cromb. in Grevillea vii. p. 142 (1879). *L. expallens* var. *conizæa* Ach. Lich. Univ. p. 374 (1810). *L. varia* var. *conizæa* Cromb. Lich. Brit. p. 52 (1870); Leight. Lich. Fl. p. 193. *L. conizæa* Nyl. in Flora iv. p. 249 (1872); Cromb. in Trans. Essex Field Club iv. p. 64 (1885) & Monogr. i. p. 431. *L. sarcopis* subsp. *homopis* Cromb. in Journ. Bot. xi. p. 133 (1873) (non Nyl.); Leight. Lich. Fl. ed. 3, p. 174. *L. lutescens* Leight. tom. cit. p. 184 (1879) pro parte. *Rinodina conizæa* S. F. Gray Nat. Arr. i. p. 454 (1821).

Exsicc. Cromb. n. 163; Johns. n. 79; Leight. n. 378.

Close to the preceding species but differing in the thicker leprose thallus and in the pulverulent margins of the apothecia. It is frequently sterile, and in most of the specimens there is a yellow reaction with potash, sometimes turning to reddish-brown. As far as observed the spores are similar to those of *L. varia*, those of the latter species are, however, on the whole, larger and better developed.

Hab. On old palings and bark of old trees.—*Distr.* Not uncommon throughout England; rarely recorded from Scotland and not yet for Ireland, but probably overlooked.—*B. M.* Albourne, Sussex; Penhurst, Kent; Finchley, Middlesex; Reigate, Surrey; Epping Forest, Essex; Elstree, Herts; Stableford, Shropshire; Gopsall Park and Twycross, Leicestershire; Hevingham, Norfolk; Buxton, Derbyshire; Paddington near Manchester, Lancashire; Urpeth Valley, Durham; Asby, Cumberland; Corstorphine Hill, Edinburgh.

Var. *conizæoides* A. L. Sm.—Thallus generally less pulverulent than in the species. Apothecia with the margins often crenulate and inflexed but scarcely pulverulent, otherwise as in the species.—*Lecanora conizæoides* Nyl. ex Cromb. in Journ. Bot. xxiii. p. 195 (1885) & Monogr. i. 431.

Essicc. Johns. n. 39.

Akin to *L. farinaria*, though somewhat resembling *L. varia* in the less leprose thallus which is sometimes sparingly developed. The same yellow reaction with potash is present as in *L. farinaria*. The spores are variable but attain the same size as in the species.

Hab. On the bark of old trees (beeches and pines) in wooded upland districts.—*Distr.* Only in a few localities of S., Central and N. England.—*B. M.* New Forest, Hants; near Buxton, Derbyshire; Egremont, Cumberland.

38. *L. sublivescens* A. L. Sm.—Thallus effuse, thickish and granular-areolate or sometimes smooth as if rubbed down, sordid yellowish-green (K + yellowish-brown). Apothecia moderate in size, generally rather crowded when present, the disc dull-brown becoming rather convex and turgid and darker in colour, the thalline margin soon obliterated; paraphyses stoutish, uneven, irregularly septate, often branched, the epithecium of brown granules; spores oblong-ellipsoid, 10–15 μ long, 4–5 μ thick; hymenial gelatine blue with iodine.—*L. varia* var. *symnieta* f. *livescens* Nyl. ex Cromb. in Journ. Bot. vii. p. 50 (1869) & Lich. Brit. p. 52. *L. orosthea* var. *sublivescens* Nyl. in Flora lv. p. 248 (1872); Cromb. Monogr. i. p. 429.

More nearly allied to *Lecanora farinaria* var. *conizæoides* than to *L. orosthea*. It differs from the former chiefly in the apothecial characters.

Hab. On bark of old trees (beech) in wooded districts.—*Distr.* Plentiful in a few localities in S. and E. England.—*B. M.* Near Lyndhurst, New Forest, Hants; Highbeech, Epping Forest, Essex; Windsor Great Park, Hants.

E. Symmicta group.—Thallus pale yellowish-grey, scanty (reactions various, or none). Apothecia generally small, mostly becoming turgid with the margin disappearing, pale, then becoming dark.

Apothecial margin disappearing.

39. *L. symmicta* Ach. Syn. Lich. p. 340 (1814).—Thallus effuse, thin, finely granulate or subleprose, pale yellowish-green or whitish straw-coloured (K + yellow, CaCl + orange). Apothecia small, rather scattered or crowded, the disc soon convex, pale flesh-coloured, becoming darker or sometimes olivaceous, the thalline margin thin, soon disappearing; paraphyses stoutish, subdiscrete, septate, more or less widened and sometimes darker at the tips, the epithecium of brown granules; spores ellipsoid or oblong, 8–14 μ long, 4–5 μ thick.—Leight. Lich. Fl. ed. 3, p. 183 (excl. var. *aitema*); Cromb. Monogr. i. p. 433. *L. varia* var. *symmicta* Ach. Lich. Univ. p. 379 (1810); Mudd Man. p. 150; Cromb. Lich. Brit. p. 52 pro parte; Leight. Lich. Fl. p. 193 pro parte.

Exsicc. Johns. n. 136, pro parte.

This species and the following, *L. symmictera*, are closely allied in habit and structure, the chief difference is in the orange reaction of the thallus with CaCl. Both species tend to occur in pale thin patches, with the apothecia more or less crowded and appressed, frequently turgid and irregular in outline; possibly they might be regarded as growth conditions of one species.

Hab. On old palings and on fir trunks in maritime and inland districts.—*Distr.* Rare in S. and W. England, N. Wales, W. Scotland and S. Ireland.—*B. M.* Lyndhurst, New Forest, Hants; Anglesea; Asby, Cumberland; Appin, Argyll; Great Island, Cork.

Var. *sæpincola* Nyl. in Flora lv. p. 249 (1872).—Thallus similar to that of the species. Apothecia becoming almost blackish; spores larger, 10–17 μ long, 4–5 μ thick.—Leight. Lich. Fl. ed. 3, p. 183; Cromb. Monogr. i. p. 434. *L. varia* var. *sæpincola* Nyl. Lich. Scand. p. 164 (1861); Cromb. Lich. Brit. p. 52; Leight. Lich. Fl. p. 193. *Lecidea sæpincola* Ach. Syn. Lich. p. 35 (1814).

Exsicc. Johns. n. 137.

Distinguished by the darker apothecia and the longer spores, and thus resembling those of *L. symmictera* var. *aitema*. There is an appearance of faint septation in some of the spores, and some are biguttulate.

Hab. On old palings in upland districts.—*Distr.* Rare in N. England and among the Granpians, Scotland.—*B. M.* Hart, Durham; Lamplugh, Cumberland; Killin, Perthshire; Crathie, Braemar, Aberdeenshire.

40. *L. symmictera* Nyl. in Flora lv. p. 249 (1872).—Thallus effuse, finely granulate, sometimes subleprose or almost obsolete,

yellowish or greyish straw-coloured (K + slightly yellow, CaCl -). Apothecia small or moderate in size, numerous, often crowded, irregular and confluent, the disc convex, turgid, pale flesh-coloured or becoming dark, the thalline margin excluded; paraphyses slender, conglutinate, septate, scarcely wider upwards, the epithecium of brown granules; spores oblong, 10-15 μ long, 3-5 μ thick; hymenial gelatine blue then tawny, the tips of the asci blue, with iodine.—Cromb. in Journ. Bot. xi. p. 133 (1873) & Monogr. i. p. 434; Leight. Lich. Fl. ed. 3, p. 200.

Esicc. Johns. n. 415, 136 pro parte; Larb. Lich. Hb. n. 130; Mudd n. 117.

Included by most systematists under *Lecanora*, and here retained in that genus, though in the absence of gonidia from the margin it might seem to belong more to the biatorine *Lecidea*. There is occasionally an appearance of a lighter-coloured margin, but that is due to the darker deposit of granules on the epithecium. The reaction with potash is sometimes scarcely perceptible.

Hab. On old palings and trunks of trees.—*Distr.* General in Great Britain; not reported from Ireland.—*B. M.* Beauport and St. John's, Jersey; near Penzance, Cornwall; near Bovey Tracey, Devon; New Forest, Hants; Henfield and Shermanbury, Sussex; Millhill, Middlesex; Langford, Essex; near Minety, Wilts; Mendlesham, Suffolk; Gamlingay, Cambridgeshire; Thringstone, Leicestershire; Dolgelly, Merioneth; Anglesea; Ballasalla, I. of Man; near Ayton, Cleveland, Yorkshire; Levens, Westmoreland; New Galloway, Kirkcudbrightshire; Blairdrummond near Stirling; Finlarig, Killin and Ben Lawers, Perthshire; Nigg, Kincardineshire; Crathie, Braemar, Aberdeenshire; Louisburgh, Mayo.

Var. *aitmea* Nyl. in Flora lvi. p. 299 (1873).—Thallus slightly more developed than in the species. Apothecia more scattered, the disc blackish; spores similar to the species or rather larger.—Cromb. in Grevillea xviii. p. 69 (1889) & Monogr. i. p. 435. *L. varia* var. *aitmea* Nyl. Lich. Scand. p. 163 (1861); Mudd Man. p. 150 (1861); Cromb. Lich. Brit. p. 52; Leight. Lich. Fl. p. 192; var. *denigrata* Mudd tom. cit. p. 151 (1861) (non Fr.). *L. symnieta* var. *aitmea* Nyl. in Flora lv. p. 249 (1872); Leight. Lich. Fl. ed. 3, p. 183. *L. trabalis* Nyl. in Flora lx. p. 458 (1877); Cromb. Monogr. i. p. 435. *Lecidea aitmea* Ach. Lich. Univ. p. 178 (1810). *L. sæpincola* f. *trabalis* Ach. Syn. Lich. p. 35 (1814)?

Esicc. Cromb. n. 66; Johns. n. 370; Larb. Lich. Hb. n. 255; Mudd n. 118.

Growing frequently in small patches; the apothecial discs are dark-brown or blackish, owing to the dark-brown granules of the epithecium.

Hab. On old palings or on stumps in upland districts.—*Distr.* Rather common in England and Scotland.—*B. M.* Dartmoor, Devon; near Lyndhurst, New Forest, Hants; I. of Wight; near Millhill, Middlesex; near Gamlingay, Cambridgeshire; Battersby, Cleveland, Yorkshire; Stanhope, Weardale, Durham; Alston, Cumberland;

Finlarig, Kenmore and Glen Lyon, Killin, and Glen Fender, Blair Athole, Perthshire; Crathie, Braemar, Aberdeenshire; Rothiemurchus, Invernesshire.

41. *L. subintricata* Th. Fr. Lich. Scand. p. 265 (1871).—Thallus very thin, finely granulose, pale-yellow or dull-greyish, or obsolete (K -). Apothecia small, plane then convex, variable in colour, yellowish, reddish-brown or dark-olive-brown, the thalline margin thin, entire, soon excluded; paraphyses crowded and coherent, slender, branched, septate and scarcely wider upwards; spores ellipsoid, small, 5-10 μ long, 3-4 μ thick.—Cromb. in Journ. Bot. xi. p. 133 (1873) (excl. f. *obscurior*) & Monogr. i. p. 440; Leight. Lich. Fl. ed. 3, p. 177. *L. varia* var. *subintricata* Nyl. in Flora li. p. 478 (1868).

Exsicc. Cromb. n. 162.

Resembling *L. intricata* in the varying colour of the apothecia. Nylander considered this species to be very near to *L. symmicta* var. *sapinicola*, but with much smaller spores. Crombie gives as thalline reaction Kf + yellowish. I have been unable to verify this, but the thallus in the British specimens is very scanty. Crombie also gives "spermatia thinly acicular, slightly arcuate, 6-7 μ long, .5 μ thick."

Hab. On old palings in an upland district.—B. M. Glen Fender, Blair Athole, Perthshire (the only British record).

42. *L. sarcopisioides* A. L. Sm.—Thallus effuse, thin, minutely granular, whitish-grey, often disappearing (K + yellow). Apothecia minute, numerous, sometimes aggregate, at first plane, becoming convex, reddish then dull-brown or blackish, sometimes slightly pruinose, the margin thin, quickly excluded; paraphyses conglutinate, septate, capitate or scarcely widened upwards, often dark over the apex, the epithecium and hymenium coloured dark-brown or blackish, often with a blue tinge; spores oblong, 7-14 μ long, 3-4 μ thick.—*L. metaboloides* Nyl. in Flora lv. p. 250 (1872); Cromb. in Journ. Bot. xx. p. 274 (1882); in Grevillea xviii. p. 69 (1890) (incl. f. *obscurior*) & Monogr. i. p. 437. *Biatora sarcopisioides* Massal. Ric. Lich. p. 128 (1852). *Lecidea minuta* var. *sarcopisioides* Cromb. Lich. Brit. p. 69 (1870); Leight. Lich. Fl. p. 266; ed. 3, p. 264.

Exsicc. Johns. nos. 200, 416.

A well-marked species, but easily mistaken for a *Lecidea*, as the thalline margin is only visible at an early stage. It differs from *L. piniperda* in the character of the thallus and in the colour of the hymenium. The spores vary considerably, but are usually elongate in our specimens as well as in those from Italy in our herbarium, though Jatta records the spore length as only 6 μ \times 2 μ (Fl. Ital. Crypt. iii. p. 316).

Nylander quoted as synonymous with his species (*L. metaboloides*) the one published earlier by Massalongo as *Biatora sarcopisioides*, and cites as typical Anzi Exs. Lich. rar. Venet. n. 61, a specimen with a more evident thallus, probably due to the weathered wood on which it grows. Another specimen, Anzi Exs. Minus rar. Ital. n. 175,

also cited by Nylander (Flora Iv. p. 250), bears less outward resemblance, as the apothecia are larger, more turgid and more persistently light-coloured, though internally it is the same.

At times the thallus is very dark (f. *obscurior*), owing to the presence of brown fungal hyphæ or of blue-green algæ.

Hab. On old palings and on decorticated stumps, rarely on stems of gorse, in maritime and inland wooded regions.—*B. M.* Ennerdale and Ravinglass, Eskdale, Cumberland; Achmore, Kenmore, Glen Falloch, Ben Lawers, Finlarig, Killin, Glen Fender and Pass of Killiecrankie, Perthshire; Glen Lochy, Invernessshire.

43. *L. effusa* Ach. Lich. Univ. p. 386 (1810).—Thallus effuse, granular or subleprose, yellowish-grey or dull-yellow, sometimes almost evanescent (K + yellow). Apothecia numerous, rather small, the disc plane, often becoming convex, brownish-red, the thalline margin thin, becoming subpulverulent or crenulate, sometimes excluded; paraphyses conglutinate, slender, septate, sometimes widened upwards and brown at the tips, the epithecium of reddish-brown granules; spores small, ellipsoid, 8–12 μ long, 4–7 μ thick; hymenial gelatine blue with iodine.—Cromb. in Grevillea vi. p. 21 (1877) & Monogr. i. p. 441. *L. varia* var. *sarcopis* Ach. tom. cit. p. 378; Mudd Man. p. 150; var. *apochræa* Ach. tom. cit. p. 379; subsp. *sarcopis* Cromb. Lich. Brit. p. 52 (1870). *L. sarcopis* Ach. Syn. Lich. p. 177 (1814); Leight. Lich. Fl. p. 187; ed. 3, p. 174; Cromb. Monogr. i. p. 440. *Lichen effusus* Pers. ex Hoffm. Deutschl. Fl. ii. p. 174 (1795). *Parmelia sarcopis* Wahl. ex Ach. Meth. Lich. Suppl. p. 40 (1803). *Rinodina effusa* S. F. Gray Nat. Arr. i. p. 451 (1821). *R. apochræa* S. F. Gray tom. cit. p. 452? (? Ach.).

Esicc. Cromb. n. 161.

The apothecia are generally numerous and crowded, the discs are somewhat similar in colour to those of the *L. subfusca* group, but the different thallus and habitat and the smaller apothecia of *L. effusa* at once distinguish it. The two species, *L. effusa* and *L. sarcopis*, differ only in the thallus, it being more developed in the latter, evidently a growth condition, and not distinguishable even as a variety.

Hab. On old palings, rarely on decorticated stumps of trees.—*Distr.* Rather rare throughout the Channel Islands, England and Scotland, not recorded from Ireland.—*B. M.* Beauport Bay, Jersey; near Penzance, Cornwall; Lyndhurst, New Forest, Hants; near Lewes, Sussex; Bradon Forest, Somerset; Norton and Kempsey, Worcestershire; Gopsall Park, Leicestershire; near Ayton and near Carlton, Cleveland, Yorkshire; Teesdale, Durham; Levens, Westmoreland; Killin and Glen Lyon, Perthshire; Glen Dee and Crathie, Braemar, Aberdeenshire; Glen Morriston, Invernesshire.

Apothecial margin persistent.

44. *L. piniperda* Koerb. Parerg. Lich. p. 81 (1859).—Thallus effuse, very thin, arachnoid-leprose, whitish or with a tinge of

yellow (Kf + yellowish). Apothecia minute, scattered or congregate, the disc plane, becoming convex, flesh-coloured or brownish, slightly pruinose, the thalline margin thin, entire or subcrenulate, at first rather prominent; paraphyses conglutinate, septate, scarcely widened upwards, with a thin epithecium of brown granules; spores oblong-ellipsoid, 8–12 μ long, 3–4 μ thick.—Cromb. in Journ. Bot. xi. p. 133 (1873) & Monogr. i. p. 455; Leight. Lich. Fl. ed. 3, p. 174.

Esicc. Cromb. n. 160; Leight. n. 176.

Well characterized by the thin and generally arachnoid or finely-felted thallus and by the minute dainty apothecia, generally about .3 to .5 mm. in diameter. The pruinose character is difficult to see in such minute objects except under a strong lens.

Hab. On trunks of fir trees, more rarely on old palings.—*Distr.* Rare in the British Isles, probably overlooked.—*B. M.* Millhill and Edgeware, Middlesex; near Worcester; Twyford, Shropshire; Appin, Argyll; near Loch Tummel, Perthshire; Maam, Connemara, Galway.

Var. ochrostoma Koerb. l. c.—Thallus similar to that of the species or almost obsolete. Apothecia generally numerous, becoming convex and the margin soon excluded, the disc more or less yellowish or rusty-red, not pruinose.—Leight. Lich. Fl. ed. 3, p. 174; Cromb. Monogr. i. p. 436.

Differs from the species in the colour of the apothecia. In the few British specimens the thallus has practically disappeared.

Hab. On old palings in wooded districts.—*Distr.* Rare in S. and W. England.—*B. M.* New Forest, Hants; Braydon Forest, Wilts.

Var. glaucella Koerb. l. c.—Thallus more evident, greyish-white. Apothecia bluish-grey-pruinose, the white thalline margin prominent, more persistent.—Subsp. *glaucella* Nyl. ex Cromb. in Grevillea xix. p. 60 (1891) & Monogr. i. p. 436.

Esicc. Johns. n. 264.

Distinguished by the somewhat more developed thallus and by the darker pruinose apothecia.

Hab. On bark of pine trees.—*Distr.* Rather rare in N. and N.W. England.—*B. M.* Bantsdale, Yorkshire; Staveley, near Kendal, Westmoreland; Ennerdale Lake, Cumberland.

45. *L. fugiens* Nyl. in Flora lvi. p. 289 (1873).—Thallus effuse, thin, minutely granulate or obsolete, whitish-grey or -yellow (K + yellow, CaCl + orange). Apothecia minute, scattered, sessile, the disc dull-yellowish, the thalline margin whitish, prominent, entire or sometimes crenulate; paraphyses slender, subdiscrete, septate, irregularly swollen and sometimes yellowish-brown above; spores ellipsoid-oblong, 9–13 μ long, 5–6 μ thick.—Cromb. in Grevillea ii. p. 89 (1873) & Monogr. i. p. 436; Leight. Lich. Fl. ed. 3, p. 184.

Evidently a very rare lichen. The thallus is scarcely evident except in the specimen from Connemara. Nylander has regarded

it as allied to *L. piniperda*. The reactions agree with those of *L. symmicta*, but are not always very pronounced. The spermatogones have spermatia arcuate, 12–16 μ long, 5 μ thick.

Hab. On rocks in maritime districts.—*Distr.* Rare in the Channel Islands and in W. Ireland.—*B. M.* Rozel, Jersey; Salrock, Connemara, Galway.

Var. *chlorophæoides* A. L. Sm.—Thallus effuse, minutely granulate (K + yellow, K(CaCl) + orange-red). Apothecia more numerous and slightly larger, otherwise similar to the species.—*L. chlorophæoides* Nyl. in *Flora lvi.* p. 290 (1873); *Cromb.* in *Journ. Bot.* xii. p. 148 (1874) & *Monogr.* i. p. 442; *Leight. Lich. Fl.* ed. 3, p. 184.

Exsicc. Larb. Lich. Hb. n. 98.

Thallus and apothecia are more abundant than in the species, from which it differs in the reaction with CaCl, possibly due to the more developed state.

Hab. On rocks in maritime districts.—*B. M.* Vale Castle, Guernsey.

F. Sulphurea group.—Thallus variously yellow (reactions various or none). Apothecia persistently light-coloured or becoming dark.

46. *L. expallens* Ach. *Lich. Univ.* p. 374 (1810) (excl. var. *conizæa*).—Thallus effuse, thinnish, leprose-pulverulent, pale-sulphur-yellow (K + yellow, CaCl + orange-red or brownish). Apothecia few, small, subinnate, plane or slightly convex, pale-yellow or flesh-coloured, the thalline margin thin, generally excluded; paraphyses coherent, stoutish, septate, the epithecium of brownish-yellow granules; spores ellipsoid-oblong, 8–16 μ long, 4–5 μ thick.—*Leight. Lich. Fl.* p. 199; ed. 3, p. 184; *Cromb. Monogr.* i. p. 432. *L. varia* var. *orosthea* Mudd *Man.* p. 150 (1861). *Lichen orostheus* Sm. *Engl. Bot.* t. 1549 (1806) (non Ach.). *Lepraria expallens* Pers. ex Ach. l. c. *Lecidea expallens* Borr. ex Hook. in Sm. *Engl. Fl.* v. p. 181 (1833) pro parte; *Tayl. in Mackay Fl. Hib.* ii. p. 127.

Exsicc. Johns. n. 320; *Larb. Lich. Hb.* n. 216.

Distinguished from the equally leprose *L. farinaria* by the thinner paler thallus, which recalls that of *Lecidea lucida*. The reaction with CaCl is not always very clear; often it is yellow changing to brownish. The apothecia are scanty in the species, and the spores generally rather small; in the variety they are better developed and up to 16 μ in length.

Hab. On trunks of trees (fir and oak) and on old palings in lowland and upland districts.—*Distr.* Here and there throughout England, N. Wales, S.W. and N.W. Ireland, not seen from Scotland.—*B. M.* Near Bovey Tracey and near Newton Abbot, Devon; Glynde, Sussex; Coleshorne and Oakley Park, Cirencester, Gloucestershire; Tetsworth, Oxfordshire; Ickworth, Suffolk; Thetford, Norfolk; Upton, Worcestershire; Dolgelly, Merioneth; Garn Dingle, Denbighshire; Anglesea;

Airyholme Wood and Ripon, Yorkshire; St. Bees, Cumberland; Ballynahinch, Connemara, Galway.

Var. *lutescens* Nyl. in Flora lv. p. 248 (1872).—Thallus more granulate, scarcely pulverulent, and somewhat darker greenish-yellow. Apothecia more numerous than in the species, sometimes pruinose, the margins at first prominent then excluded.—Cromb. in Grevillea xviii. p. 69 (1890) & Monogr. i. p. 432. *L. lutescens* Dub. Bot. Gall. ii. p. 668 (1830); Cromb. in Journ. Bot. xi. p. 133 (1873); Leight. Lich. Fl. ed. 3, p. 184 pro parte. *Lichen lutescens* Hoffm. Enum. Lich. p. 3 (1784)? *Patellaria lutescens* DC. Fl. Franc. ii. p. 354 (1805). *Rinodina lutescens* S. F. Gray Nat. Arr. i. p. 453 (1821) pro parte.

Exsicc. Cromb. n. 65; Johns. n. 116.

Bears the same relation to the species as var. *conizæoides* does to *L. farinaria*. Both may be only growth forms. The apothecia are generally numerous and crowded, in some places obscuring the thallus. Thallus and apothecial margins are firmer than in the species.

Hab. On trunks of trees and old palings (chiefly fir) in maritime and inland districts.—*Distr.* General in Great Britain; rare in the Channel Islands and S. Ireland.—*B. M.* Beaufort Bay, Jersey; Roche, Cornwall; near Torquay and Totnes, Devon; New Forest, Hants; Eartham, Sussex; Lydd, Kent; Ulting, Essex; near Ludlow, Herefordshire; Malvern, Worcestershire; Bettws-y-Coed and Trefriw, Carnarvonshire; near Kendal, Westmoreland; Ennerdale, Cumberland; New Galloway, Kirkcudbrightshire; Appin, Argyll; Craig Calliach and near Loch Tummel, Perthshire; near Forfar; Durris, Kincardineshire; Countesswells near Aberdeen and Mar Forest, Braemar, Aberdeenshire; Rothiemurchus, Invernessshire; Applecross, Rossshire; Glenbower Wood and Castlebernard Park, Cork.

Var. *smaragdocarpa* Nyl. in Flora lv. p. 248 (1872) note.—Thallus as in the species. "Apothecia bright emerald-green."—Cromb. in Grevillea xviii. p. 69 (1890) & Monogr. i. p. 433.

Exsicc. Larb. Lich. Hb. (without a number).

The apothecia on our solitary specimen are now very dark, and the epithecium in section is a layer of brown granules; the paraphyses are stout, uneven and branched, the spores measure about 12 μ long and 4 μ thick. It is reported from W. France on oak wood, and is recorded from Lamlash, Arran, by Wheldon and Travis in Journ. Bot. li. p. 251 (1913).

Hab. On a decorticated stump of oak.—*B. M.* Chiltern Hills, Oxfordshire.

Subsp. *inversa* Nyl. in Flora lxii. p. 361 (1879).—Thallus nearly as in the species. Apothecia with a more prominent, subentire margin; spores not seen.—Cromb. ll. c.

There is only one specimen in our herbarium, originally labelled *Lecanora albo-flavida* Tayl. It is too scanty for examination. Nylander thinks that if the spores were known it might be a new species. The reactions agree with those of *L. expallens*.

Hab. On branches of furze.—*B. M.* Finnechy River, Kerry.

47. *L. orosthea* Ach. Lich. Univ. p. 400 (1810).—Thallus spreading or determinate, thin, faintly or coarsely cracked-areolate, sometimes pulverulent, pale yellowish-coloured (K + yellowish-brown, CaCl -). Apothecia small, rather rare, soon immarginate and convex or difform, coloured like the thallus or dull-blackish, subpruinose; paraphyses crowded, slender, septate, scarcely thickened upwards, the epithecium colourless or sometimes blackish-brown; spores ellipsoid-oblong, 9–16 μ long, 6–7 μ thick, but mostly rather small; hymenial gelatine blue with iodine.—Leight. Lich. Fl. p. 199; ed. 3, p. 183; Cromb. Monogr. i. p. 429. *L. varia* subsp. *orosthea* Cromb. Lich. Brit. p. 52 (1870). *Lichen orostheus* Ach. Lich. Suec. Prodr. p. 38 (1798). *Lecidea orosthea* Ach. Meth. Lich. p. 72 (1803); S. F. Gray Nat. Arr. i. p. 470.

Scarcely distinguishable from the preceding species, except in the smooth thinner rather lighter-coloured thallus. Crombie states that it grows chiefly on the smooth sides of perpendicular rocks, is very widely effuse, and generally sterile.

Hab. On siliceous rocks.—*Distr.* Rare in the British Isles, possibly often overlooked owing to the sterility of the thallus.—*B. M.* Ennerdale, Cumberland; West Water, Fife; Craig Calliach, Perthshire; Portlethen, Kincardineshire; Cloghane, Kerry; Wicklow; Kylesmore, Connemara, Galway.

48. *L. sulphurea* Ach. Lich. Univ. p. 399 (1810).—Thallus a thickish smooth or sometimes granular crust, deeply cracked-areolate, the areolæ even or tumid, determinate, but the hypothallus indistinct, greenish-sulphur-coloured (K + yellowish-brown, CaCl -). Apothecia numerous, up to 1.5 mm. across, at first innate, becoming prominent, plane or convex, the disc olive- or dull-black, more or less pruinose, the thalline margin scarcely visible; paraphyses coherent, septate, slightly wider at the tips, the epithecium minutely granular, greenish-black; spores ellipsoid, 10–15 μ long, 5–6 μ thick; hymenial gelatine blue with iodine.—Mudd Man. p. 152; Cromb. Lich. Brit. p. 52 & Monogr. i. p. 428; Leight. Lich. Fl. p. 198; ed. 3, p. 182. *Lichen sulphureus* Hoffm. Enum. p. 32, t. 4, fig. 1 (1784); Dicks. Pl. Crypt. fasc. ii. p. 17; With. Arr. ed. 3, iv. p. 12; Engl. Bot. t. 1186 (upper fig.). *Lecidea sulphurea* Wahlenb. Fl. Lapp. p. 477 (1812); S. F. Gray Nat. Arr. i. p. 470; Hook. Fl. Scot. ii. p. 38 & in Sm. Engl. Fl. v. p. 181; Tayl. in Mackay Fl. Hib. ii. p. 127.

Excicc. Bohl. n. 117; Johns. n. 238; Larb. Lich. Hb. nos. 69, 92; Leight. n. 114; Mudd n. 121.

Distinctive in the colour of the thallus and the practically unmarginate dark apothecia; they are often crowded and become confluent. The spermatogones are punctiform, immersed, with spermatia 15–20 μ long, 1 μ thick.

Hab. On rocks and walls in maritime, more rarely in mountainous regions.—*Distr.* General and common in Great Britain and Ireland,

rare in the Channel Islands.—*B. M.* Sark; St. Minver and Penzance, Cornwall; Bolt Head, Devon; Pulborough and Hastings, Sussex; Walthamstow and near Maldon, Essex; Malvern Hill, Worcestershire; Wrekin Hill, Shropshire; Cheveley Park, Cambridgeshire; Bardon Hill, Leicestershire; Barmouth and Dolgelly, Merioneth; Anglesea; Roseberry, Cleveland, Yorkshire; Staveley near Kendal, Westmoreland; Egglestone, Durham; Wansbeck, Northumberland; Rerrick, Kirkcudbrightshire; Appin, Argyll; Ben Lawers, Perthshire; Portlethen, Kincardineshire; Craig Guie, Braemar, Aberdeenshire; Glen Nevis, Invernessshire; Killarney, Kerry; Letter Hill, Connemara, Galway; Lambay Island, Dublin.

49. *L. epanora* Ach. Lich. Univ. p. 377 (1810).—Thallus effuse, thickish, of crowded or scattered verrucose or subsquamulose granules, greenish-yellow, with citrine-yellow soredia, the hypothallus blackish or obsolete (K—). Apothecia sessile, plane, brownish-yellow, the thalline margin prominent, flexuose or subcrenulate; paraphyses coherent, slender, septate, scarcely widened at the tips, the epithecium brownish-yellow; spores ellipsoid, small, 8–11 μ long, 5.7 μ thick; hymenial gelatine blue with iodine.—Cromb. Lich. Brit. p. 53 & Monogr. i. p. 429; Leight. Lich. Fl. p. 205; ed. 3, p. 189. *L. alboflavida* Tayl. in Mackay Fl. Hib. ii. p. 260 (1836); Mudd Man. p. 155. *Lichen epanorus* Ach. Lich. Suec. Prodr. p. 39 (1798).

Exsicc. Leight. n. 397.

Well distinguished by the yellow soredia which sometimes make large patches seem as if pulverulent. The hypothallus is scarcely visible in our specimens, which are also largely sterile.

Hab. On siliceous rocks and walls.—*Distr.* Local in N. Wales, the Highlands, Scotland, and in S.W. Ireland.—*B. M.* Barmouth and Dolgelly, Merioneth; Ballachulish, Argyll; Glen Fender, Blair Athole, Perthshire; Dunkerron, Kerry.

50. *L. polytropa* Schær. Enum. p. 81 (1850) pro parte (incl. f. *acrustacea*).—Thallus effuse, rather thin, granulate- or cracked-areolate or subsquamulose, or almost evanescent, pale sulphur-coloured or greyish-green, a black hypothallus sometimes visible (K + yellowish). Apothecia small or moderate in size, generally less than 1 mm. across, closely adnate, at first plane, becoming convex, yellowish or reddish-flesh-coloured, the thin entire margin soon excluded; paraphyses rather slender, densely crowded and subconglutinate, sometimes widened and septate upwards, colourless, the epithecium a thin layer of brownish granules; spores broadly ellipsoid, 9–14 μ long, 5–6 μ thick.—Mudd Man. p. 151 (incl. var. *acrustacea*); Leight. Lich. Fl. p. 197 (incl. f. *illusoria*); ed. 3, p. 181; Cromb. Monogr. i. p. 437. *L. varia* var. *illusoria* Ach. Lich. Univ. p. 380 (1810); var. *polytropa* Nyl. in Mém. Soc. Sci. Nat. Cherb. v. p. 114 (1857); Cromb. Lich. Brit. p. 52 (incl. f. *illusoria*). *Lichen polytropus* Ehrh. Exs. n. 294 (1793) nomen nudum; Ach. Lich. Suec. Prodr.

p. 72 (1798); Dicks. Pl. Crypt. iv. p. 22; Engl. Bot. t. 1264 (two lower figs.) (1804). *Lecidea polytropa* Ach. Meth. Lich. p. 72 (1803); S. F. Gray Nat. Arr. i. p. 475; Hook. in Sm. Engl. Fl. v. p. 185. *L. Ehrhartiana* var. *polytropa* Ach. Syn. Lich. p. 47 (1814); Hook. Fl. Scot. ii. p. 40.

Exsicc. Johns. nos. 117, 265, 266; Leight. n. 179.

A species that varies considerably in the form of the thallus, which may be thickish, warted or reduced to small scattered granules or scales or almost absent (vars. *acrustacea* and *illusoria*). The apothecia are generally numerous, and may be small, regularly round and scattered, or much swollen and sometimes aggregate; the forms that follow represent extreme stages of condition that occur in the species.

Hab. On siliceous rocks, boulders and walls in maritime and mountainous districts.—*Distr.* More or less general throughout the British Isles.—*B. M.* Rozel and La Moye, Jersey; near Penzance, Cornwall; Bolt Head, Devon; Dolgelly and Aberdovey, Merioneth; Lounsdale and Cliffrigg, Cleveland, Yorkshire; Egglestone, Durham; Ennerdale, Cumberland; Appin, Argyll; Ben Lawers and Craig Tulloch, Perthshire; Portlethen, Kincardineshire; Bennaboord and Morrone, Braemar, Aberdeenshire; Ben Nevis, Invernesshire; Kinsale, Cork; Derryquin and near Lough Caragh, Dunkerron, Kerry; Doughruagh Mts., Connemara, Galway; Mallaranny, Achill, Mayo.

Form *subglobosa* Cromb. Monogr. i. p. 438 (1894).—Thallus effuse, generally rather thin, or obsolete. Apothecia numerous, rather small, convex and almost subglobose, yellowish or brownish, the margin excluded.—*L. polytropa* var. *conglobata* Mudd Man. p. 152 (1861) (non Flot.); f. *conglobata* Leight. Lich. Fl. p. 197 (1871) (non Sommerf.); ed. 3, p. 180. *L. varia* var. *polytropa* f. *conglobata* Cromb. Lich. Brit. p. 52 (1870).

Exsicc. Johns. n. 118; Leight. n. 152; Mudd n. 120.

The same type of apothecium occurs in the species but not so uniformly.

Hab. Similar to the species.—*Distr.* Local in N. Wales, N. and W. England and in the Scottish Highlands.—*B. M.* Dolgelly, Merioneth; Oswestry, Shropshire; Guisboro' Moor and Ayton Moor, Cleveland, Yorkshire; West Allen Carrs, Northumberland; Braithwaite and Alston, Cumberland; Craig Tulloch, Perthshire; Morrone, Braemar, Aberdeenshire.

Form *alpigena* Leight. Lich. Fl. p. 197 (1871).—Thallus cracked-areolate, pale-yellow, or scarcely visible. Apothecia large, plane or turgid and convex, appressed and very irregular the thalline margin thin, more or less prominent or excluded.—Leight. op. cit. ed. 3, p. 181; Cromb. Monogr. i. 438. *L. varia* var. *alpigena* Ach. Lich. Univ. p. 379 (1810).

Differing from the species in the large irregular apothecia, in our specimens they measure up to 4 mm. across, with the thallus scarcely visible.

Hab. On schistose rocks in alpine regions.—*B. M.* Ben Lawers, Perthshire.

Form *efflorescens* Cromb. Monogr. i. p. 438 (1894).—Thallus of minute scales on a dark hypothallus and sprinkled with pale-yellowish round soralia. Apothecia small, somewhat convex and usually immarginate.

Crombie suggests that this unusual form may be due to the habitat. The hypothallus is formed of short-celled, very dark hyphæ.

Hab. On shaded stones of a schistose wall.—*B. M.* Craig Tulloch, Blair Athole, Perthshire (the only record).

Var. *stenotropa* A. L. Sm.—Thallus effuse, thin, of yellowish-green granules. Apothecia rather small, convex, immarginate, yellowish; spores thinner than in the species, about 7–12 μ long, 3–4 μ thick.—*L. stenotropa* Nyl. in Flora lv. p. 251 (1872); Cromb. in Grevillea xviii. p. 69 (1890) & Monogr. i. p. 440.

A Scandinavian lichen which differs from the species in the slightly smaller thinner spores, otherwise not distinguishable.

Hab. On schistose stones of a wall, associated with *Leccidea leucophaea*.—*B. M.* Craig Tulloch, Blair Athole, Perthshire (the only British record).

51. *L. intricata* Ach. Lich. Univ. p. 380 (1810).—Thallus limited or effuse, thickish and cracked-areolate, or composed of thin scales on a black hypothallus, whitish- or greenish-yellow or -brown (K + yellowish). Apothecia numerous, mostly small, adnate or semi-immersed, becoming convex, dull-flesh-coloured or brownish becoming olive or blackish, the thalline margin disappearing; paraphyses confluent, slender, rather wider and septate at the tips, the epithecium bluish-black; spores oblong-ellipsoid, 9–15 μ long, 5–7 μ thick.—Tayl. in Mackay Fl. Hib. ii. p. 137 (incl. var. *comminuta*?); Leight. Lich. Fl. p. 198; ed. 3, p. 181. *L. comminuta* Tayl. in Lond. Journ. Bot. vi. p. 160 (1847)? *L. polytropa* var. *intricata* Schær. Enum. p. 82 (1880); Mudd Man. p. 152; var. *alpigena* Mudd Man. p. 152 (1861) (non Ach.); subsp. *intricata* Nyl. in Flora lv. p. 251 (1872); Cromb. in Grevillea xviii. p. 69 & Monogr. i. p. 439. *Lichen intricatus* Schrad. Journ. Bot. v. p. 72 (1801) [Göttingen, 1802]. *L. polytropus* Sm. Engl. Bot. t. 1264 (two upper figs.) (1804) (non Ach.).

Exsicc. Johns. n. 40; Leight. n. 153; Mudd n. 119.

Closely allied to the preceding species, of which it is sometimes considered to be a variety or subspecies; it is distinguished by the darker more evident hypothallus, the darker apothecia, and the epithecium bluish-black in section. It is almost certain from the descriptions that Taylor's *L. comminuta* belongs to this species.

The hypothallus of both species and variety is formed of rather stout hyphæ with a bluish-black tinge of colour recalling the somewhat similar hypothallus of *Placynthium nigrum*.

Hab. On rocks, boulders and walls, rarely on old palings, in maritime and mountainous districts.—*Distr.* Less frequent than the

preceding in Wales, N. England, the Highlands of Scotland and W. Ireland.—*B. M.* Barmouth and Dolgelly, Merioneth; Llyn Geirionydd, Carnarvonshire; Bodbury Ring, near Church Stretton, Shropshire; Ayton, Guisboro', Kildale, Baysdale and Ingleby, Cleveland, Yorkshire; Swinhope, Northumberland; Egglestone, Durham; Staveley, Westmoreland; Alston, Cumberland; Crianlarich, Ben Lawers, Killin (corticolous) and Craig Tulloch, Perthshire; Portlethen, Kincardineshire; Morrone, Braemar, Aberdeenshire; Ben Nevis, Invernesshire; Dunkerron, Kerry; Twelve Pins, Doughruagh Mts. and Kylemore, Connemara, Galway.

Var. leptacina Stizenb. Lich. Helv. p. 117 (1882).—Thallus of crowded or scattered thin squamulose minutely crenulate granules, smooth, greenish-straw-coloured on a black hypothallus (K + yellowish). Apothecia numerous, moderate in size, the disc plane, olive or blackish, sometimes yellowish-pruinose, the thalline margin persistent, generally crenulate; paraphyses and spores similar to the species.—*L. leptacina* Sommerf. Suppl. Fl. Lapp. p. 96 (1826). *L. varia* var. *terrestris* Nyl. ex Cromb. Lich. Brit. p. 52 (1870); Leight. Lich. Fl. p. 193; subsp. *leptacina* Cromb. in Journ. Bot. xi. p. 134 (1873); Leight. Lich. Fl. ed. 3, p. 177. *L. polytropha* subsp. *intricata* var. *leptacina* Cromb. in Grevillea xviii. p. 69 (1890) & Monogr. i. p. 439.

Differing from the species in habitat and in the more brightly coloured thallus, very distinct against the dark substratum.

Hab. On mosses (*Grimmia* and *Andraea*), upon boulders in alpine regions.—*Distr.* Rare on the summits of some of the Scottish Grampians.—*B. M.* Ben Lawers, Perthshire; Ben-na-boord, Braemar, Aberdeenshire.

52. *L. frustulosa* Ach. Lich. Univ. p. 405 (1810).—Thallus of scattered or contiguous large or small rounded warts which are seamed or cracked, especially at the edges, yellowish or whitish on a black hypothallus (K + yellowish). Apothecia small or large, the disc plane or rather convex, dark-brown or generally black, the thalline margin entire or crenulate, generally rather prominent, sometimes disappearing; paraphyses coherent, wider and brown upwards, the epithecium dark brown; spores ellipsoid, 10–14 μ long, 5–6 μ thick; hymenial gelatine blue with iodine.—Hook. Fl. Scot. ii. p. 48 & in Sm. Engl. Fl. v. p. 189; Mudd Man. p. 145; Cromb. Lich. Brit. p. 52 & Monogr. i. p. 442; Leight. Lich. Fl. p. 196; ed. 3, p. 179. *Lichen frustulosus* Dicks. Pl. Crypt. fasc. iii. p. 13, t. 8, fig. 10 (1793); With. Arr. ed. 3, iv. p. 19; Engl. Bot. t. 2273. *Rinodina frustulosa* S. F. Gray Nat. Arr. i. p. 451 (1821).

Exsicc. Cromb. n. 165? Johns. n. 80; Leight. n. 293.

An alpine or subalpine lichen, distinguished by the light-coloured smooth polished verrucæ, which are finely seamed and cracked, especially at the circumference, giving to the edge a crenulate appearance. The reaction with potash is much less marked than in the

preceding species, and the spores are smaller; these are present in very few of our specimens, though the apothecia are fairly abundant.

Hab. On siliceous rocks in hilly regions.—*Distr.* Rare in N. England and among the Grampians, Scotland.—*B. M.* Friar's Crag, Keswick; summits of Craig Calliach and Ben Lawers, Perthshire.

53. *L. argopholis* Ach. Lich. Univ. p. 346 (1810).—Thallus subdeterminate, thickish, granulate or warted-areolate, the granules contiguous, flattened or rounded, almost imbricate and crenate at the circumference, yellowish or whitish (K + yellow). Apothecia moderate in size, the disc plane or convex, brownish-black, the thalline margin entire or crenate; paraphyses coherent, scarcely thickened and brown or greenish-black upwards; spores oblong-ellipsoid, 10–18 μ long, 5–9 μ thick; hymenial gelatine blue with iodine.—Hook. in Sm. Engl. Fl. v. p. 186; Cromb. Lich. Brit. p. 52 & Monogr. i. p. 441; Leight. Lich. Fl. p. 196; ed. 3, p. 180. *Parmelia atra* var. *argopholis* Ach. Meth. Lich. Suppl. p. 32 (1803).

Exsicc. Johns. n. 267.

Frequently classified as a variety of *L. frustulosa*, but differs in the more contiguous rimose thallus, in the more pronounced reaction with potash, the crowded apothecia and the larger spores. It differs from *L. gangaleoides* in the colour and the somewhat scaly nature of the thallus and in the less prominent verrucæ.

Hab. On rocks in hilly maritime or mountainous regions.—*Distr.* Rather rare but widely distributed in Great Britain and Ireland.—*B. M.* Cleve Hill, Somerset; near Crosfaen, Monmouth; Trefriw, Llanberis, Glyder Vahr and Carnedd Dafydd, Carnarvonshire; Gunner-ton Craggs, Northumberland; Pugh Crag, Westmoreland; Bassenthwaite, Cumberland; Achosragan Hill, Appin, Argyll; Ben Lawers, Perthshire; Letter Hill and Dawros River, Connemara, Galway.

G. Badia group.—Thallus dark-coloured (K –). Apothecia dull-brown or black, generally small; spores generally rather small.

54. *L. badia* Ach. Lich. Univ. p. 407 (1810).—Thallus wide-spreading, thickish, granulate or warted-areolate, sometimes almost subsquamulose, especially at the circumference, deep chestnut- or olive-brown, hypothallus black (K –, CaCl –). Apothecia generally numerous and crowded, small or moderate in size, the disc plane or rarely convex, dull-brown or brownish-black, the thalline margin persistent, entire or slightly crenulate, often becoming flexuose, not very prominent; paraphyses thickish, coherent, septate, uneven, often branched, slightly wider at the tips and deep-brown; spores fusiform, 10–16 μ long, 4–6 μ thick.—Mudd Man. p. 144, t. 2, fig. 50; Cromb. Lich. Brit. p. 53 & Monogr. i. p. 451; Leight. Lich. Fl. p. 212; ed. 3, p. 198. *L. squamulosa* Tayl. in Mackay Fl. Hib. ii. p. 139 (1836) pro

parte (non Sm. Engl. Bot.). *Lichen badius* Pers. in Ust. Ann. Bot. vii. p. 27 (1794). *Rinodina badia* S. F. Gray Nat. Arr. i. p. 450 (1821).

Excicc. Johns. 120; *Larb. Lich. Hb.* n. 334; *Leight.* n. 206; *Mudd* n. 110.

Easily recognized by the dark colour of the whole plant and by the fusiform spores. The asci are generally thickened at the apices. The spermatogones are frequent, with pleurogenous spermatia, 7-10 μ long, 1 μ thick. Crombie (*Monogr.* i. p. 452) remarks on the overlooking of this plant by early lichenologists, but there is one specimen from Teesdale in Sowerby's herbarium as *Parmelia squamulosa*.

Hab. On rocks and boulders from maritime to alpine districts.—*Distr.* General and common throughout the British Isles.—*B. M.* Guernsey; La Moye, Gorey and Noirmont, Jersey; near Penzance, Cornwall; Bolt Head, Devon; Charnwood Forest, Bardon Hill and Thringstone, Leicestershire; Long Mynd, Shropshire; Barmouth and Dolgelly, Merioneth; Llyn Geirionydd, Carnarvonshire; Malvern, Worcestershire; near Buxton, Derbyshire; Cantley Spout and Roseberry, Cleveland, Yorkshire; Teesdale, Durham; Blacklot and Staveley Head, Westmoreland; Ennerdale, Cumberland; New Galloway, Kirkcudbrightshire; Appin, Argyll; Ben Lawers, Perthshire; Nigg and Portlethen, Kincardineshire; Cairn Ture and Morrone, Braemar, Aberdeenshire; Ben Nevis, Invernessshire; Mount Leinster, Carlow; near Carnlough, Antrim.

Var. cinerascens Nyl. *Lich. Scand.* p. 170 (1871).—Thallus paler, brownish-grey, otherwise as in the species.—*Cromb. Lich. Brit.* p. 54 & *Monogr.* i. p. 452; *Leight. Lich. Fl.* p. 213; ed. 3, p. 198.

The difference in colour is very striking, and entitles the plant to varietal rank, though it may be the result of shaded growth.

Hab. On shady schistose rocks and walls.—*Distr.* Local in Wales, the Central Grampians and N.E. Scotland.—*B. M.* Craig Tulloch, Blair Athole, Perthshire; Portlethen, Kincardineshire.

Subsp. picea Nyl. in *Flora* li. p. 478 (1868).—Thallus and apothecia black or blackish-brown; spores generally smaller.—*Cromb.* in *Journ. Bot.* vii. p. 108 (1869); *Lich. Brit.* p. 54 & *Monogr.* i. p. 452; f. *picea* *Leight. Lich. Fl.* p. 214; ed. 3, p. 199. *Lichen piceus* Dicks. *Pl. Crypt. fasc.* iv. p. 22 (1801).

Characterized by the darker colour. Crombie states that the spores are smaller and oblong, but they vary even in the same apothecium from being minute and ellipsoid to the fusiform condition and size of the species.

Hab. On quartzose rocks in hilly districts.—*Distr.* Rare in N. England and among the Grampians, Scotland.—*B. M.* W. Yorkshshire; Ben Lawers, Perthshire; Morrone, Braemar, Aberdeenshire.

55. *L. austera* Nyl. in *Flora* lvii. p. 309 (1874).—Thallus subdeterminate, unequally thickish, almost scaly, dark tawny-brown, the hypothallus thin, black, scarcely evident (K—).

Apothecia rather large, flexuous and deeply crenate-indented, sometimes proliferous with smaller apothecia growing on the margins, the disc dark-brown, the margin thickish, crenulate; paraphyses discrete, septate and uneven, scarcely thickened upwards; spores globose-ellipsoid, up to $9\ \mu$ long, $7\ \mu$ thick; tips of the asci blue, hymenium otherwise wine-red, with iodine.—Cromb. in Journ. Bot. xiii. p. 140 (1875) & Monogr. i. p. 453; Leight. Lich. Fl. ed. 3, p. 199.

Considered by Crombie to be closely allied to *L. badia*, but differing widely in apothecial and hymenial characters; as in that species, there is a thick wall over the apex of the asci. Spermogones are recorded as frequent, with spermatia $4\text{--}5\ \mu$ long and scarcely $1\ \mu$ thick.

Hab. On weathered quartzose stones.—*B. M.* Summit of Ben Cruachan, Argyll (the only locality).

56. *L. nitens* Ach. Syn. Lich. p. 335 (1814); Nyl. in Flora lii. p. 298 (1869).—Thallus spreading, thickish, cracked-areolate, the areolæ of rounded granules or somewhat scaly, dull- or dark-brown, the hypothallus black, little visible (K—). Apothecia moderate in size, numerous and crowded, appressed, the disc plane, brownish-black, the thalline margin thin, entire, paler; paraphyses coherent, stoutish, uneven, septate, brown upwards; spores oblong, $9\text{--}18\ \mu$ long, $2\cdot5\text{--}4\cdot5\ \mu$ long; the thickened tips of the asci persistently blue with iodine.—Cromb. in Journ. Bot. xx. p. 274 (1882) & Monogr. i. p. 454. *Patellaria nitens* Pers. in Ann. Wetter. Ges. ii. p. 12 (1810).

Resembles *L. badia*, but the thallus of our specimens is lighter in colour and the spores are different, generally they are about $12\ \mu$ long and about $3\ \mu$ thick; I have not seen any so long as $18\ \mu$. *Sphinctrina kylemoriensis* grows on this lichen.

Hab. On schistose rocks.—*Distr.* Local, but plentiful in one of the Channel Islands.—*B. M.* Chateau Point, Sark.

57. *L. atriseda* Nyl. in Act. Soc. Linn. Bord. sér. 3, i. p. 337 (1856) & Lich. Scand. p. 170.—Thallus of rounded contiguous or scattered granules or warts, reddish- or dull-brown (K—). Apothecia numerous, rather small, at first immersed in the granules, gradually widening and becoming plane and appressed, concolorous with the thallus, the margin thin, entire; paraphyses coherent, rather slender, septate, scarcely wider upwards, or slightly capitate, the epithecium brown; spores ellipsoid, $8\text{--}12\ \mu$ long, $5\text{--}7\ \mu$ thick.—Cromb. in Journ. Bot. ix. p. 178 (1871) & Monogr. i. p. 453. *L. badia* var. *atriseda* Leight. Lich. Fl. p. 213 (1871); ed. 3, p. 198. *Parmelia badia* var. *atriseda* Fr. Nov. Sched. Crit. 1827, p. 6 & Lich. Eur. p. 149.

This lichen is always associated with *Rhizocarpon geographicum*. Malme (Bot. Centralbl. lxiv. p. 46 (1895)) describes the association as a case of "antagonistic symbiosis," the *Lecanora* gradually invading and destroying the *Rhizocarpon* tissues.

The apothecia may be so crowded as almost to obscure the thallus; the spermatogones, which are sparingly present, are embedded in the verrucæ and blackish at the ostioles, with spermatia 18–20 μ long, 1 μ thick.

An abnormal specimen was described by Sommerfelt (Suppl. Fl. Lapp. p. 103 (1826)) as *Lecanora nephæa*, but as it refers to a "monstrosity" the name cannot be accepted.

Hab. On rocks in mountainous districts.—*Distr.* Rare in Wales, N. England and the Grampians, Scotland.—*B. M.* Dolgelly, Merioneth; Ennerdale, Cumberland; Morrone, Braemar, Aberdeenshire.

58. *L. torquata* Nyl. in Act. Soc. Linn. Bord. sér. 3, i. p. 338 (1856).—Thallus thickish, generally smooth, cracked-areolate, brownish-mouse-grey (K-); hypothallus black, limiting the thallus. Apothecia small, moderate in size or rather large, brownish-black, the thalline margin paler; paraphyses thickish, discrete, sometimes branched, moniliform-septate, especially upwards, clavate and brown at the tips; spores varying from globose to ellipsoid when more mature, 5–10 μ long, 3–5 μ thick.—Cromb. in Journ. Bot. xii. p. 147 (1874) & Monogr. i. p. 454; Leight. Lich. Fl. ed. 3, p. 200. *Parmelia torquata* Fr. Syst. Orb. Veg. p. 284 (1825).

A somewhat rare lichen with a wide distribution in the Alps, Pyrenees, etc. The thallus is not unlike that of *Lecidea rimosa*. The apothecia in the Alderney specimens are more appressed, with thinner sometimes flexuose and indented margins. The most characteristic features are the well-developed paraphyses with the upper cell or cells a clear rich brown colour. The spores are larger than the recorded sizes (7 μ long), and in our specimens are tinged brown, possibly an effect of age.

Hab. On moist rocks.—*B. M.* Alderney (the only British locality).

59. *L. poliophæa* Ach. Lich. Univ. p. 398 (1810).—Thallus subdeterminate, deeply cracked-areolate, the areolæ composed of closely packed elongate roundish papillæ, greyish- or greenish-brown (K-). Apothecia numerous, small, adnate to the tips of the papillæ, the disc plane, dull-brown or blackish, the thalline margin thin, crenulate or papillate; paraphyses slender, septate, the tips abruptly clavate, sometimes divided, dark-brown especially over the apex; spores ellipsoid, simple, small, 7–13 μ long, 4–6 μ thick.—Cromb. Lich. Brit. p. 50 & Monogr. i. p. 408; Leight. Lich. Fl. p. 214; ed. 3, p. 200. *L. spodophæa* Ach. tom. cit. p. 385; Borr. Engl. Bot. Suppl. t. 2662, fig. 3; Hook. in Sm. Engl. Fl. v. p. 188. *Parmelia poliophæa* Wahlenb. ex Ach. Meth. Lich. Suppl. p. 38 (1803). *P. spodophæa* Wahlenb. tom. cit. p. 37.

Ersicc. Cromb. n. 62.

The papillate granules resemble those of *Lecania aipospila*, but are more slender. In moist situations the thallus is greenish (*L. spodophæa*); in dryer conditions it is dark-coloured (*L. poliophæa*), and that is the more permanent state.

Hab. On granitic and schistose rocks in maritime districts.—*Distr.* Local, though plentiful in the Channel Islands, S.W. England and N.E. Scotland.—*B. M.* Le Fret, Jersey; Tolpedin Penwith, and near Penzance, Cornwall; Portlethen, Kincardineshire.

60. *L. mammillifera* Stirton in Trans. Glasgow Soc. Nat. 1875, p. 85.—Thallus minutely cracked-areolate, dark- or brownish-grey, the areolæ plane (K—, CaCl—). Apothecia small, prominent, convex, black or brownish-black, internally pale-greyish, the margin (thalline?) obtuse, at length depressed; paraphyses few, discrete, thickish, brownish at the clavate apices; hypothecium colourless; spores ellipsoid, 8–10 μ long, 7–8.5 μ thick; hymenial gelatine blue then tawny with iodine.—Leight. Lich. Fl. ed. 3, p. 201; Cromb. Monogr. i. p. 428. Specimen not seen.

Hab. On rocks in a mountainous district; collected by Stirton at Ben-y-gloe, Blair Athole, Perthshire.

§ iii. OCHROLECHIA Massal. Ric. Lich. Crost. p. 30 (1852) (as genus).

Thallus crustaceous. Apothecia small or becoming very large, generally with a thick prominent margin; paraphyses long, slender, branched and intricate; spores 2–8 in the ascus, usually very large. Spermogones with acrogenous straight spermatia.

This section is very frequently regarded as of generic importance on account of the peculiar paraphyses and the very large spores.

61. *L. tartarea* Ach. Lich. Univ. p. 371, t. 7, fig. 3 (1810) (incl. var. *grandinosa*).—Thallus wide-spreading, thick, tartareous, unequal and corrugate on the surface, of crowded granules or warts, whitish or greyish (K + faintly yellow, CaCl + red). Apothecia at first innate and closed, opening widely up to 1 cm. across, the disc generally plane, often wrinkled, pale yellowish-red (CaCl + reddish), the thalline margin thickish, entire or corrugate; paraphyses slender, colourless, loosely coherent, very long, flexuous and branched; spores ellipsoid-oblong, very large, 40–72 μ long, 20–40 μ thick; hymenial gelatine blue with iodine.—Hook. Fl. Scot. ii. p. 49 & in Sm. Engl. Fl. v. p. 191; Tayl. in Mackay Fl. Hib. ii. p. 138; Mudd Man. p. 156, t. 2, fig. 51; Cromb. Lich. Brit. p. 54 (incl. var. *grandinosa*) & Monogr. i. p. 458; Leight. Lich. Fl. p. 187; ed. 3, p. 175 (incl. f. *grandinosa*). *Lichenoides crustaceum et leprosum, acetabulis majoribus luteis, limbis argenteis* Dill. in Ray Syn. ed. 3, p. 71, n. 46 (1724) & Hist. Musc. p. 132, t. 18, fig. 13 (1741). *Lichen tartareus* L. Sp. Pl. p. 1141 (1753); Huds. Fl. Angl. p. 444; Lightf. Fl. Scot. ii. p. 811; Engl. Bot. t. 156; With. Arr. ed. 3, iv. p. 23. *Rinodina tartarica* & *R. grandinosa* S. F. Gray Nat. Arr. i. p. 455 (1821).

Essicc. Bohl. n. 10; Croall n. 589; Cromb. n. 69; Johns. n. 240; Leight. n. 128; Mudd n. 128.

A common lichen in upland districts which yields a purple dye (cudbear). The thallus which spreads widely and is frequently sterile is mostly rather thick and friable. The variety *grandinosa* Ach., with stoutish thalline warts, was founded on a specimen on gorse stems from Teesdale; it does not differ from other corticolous specimens. The apothecia when present are numerous and the disc is sometimes proliferous; the entangled paraphyses make a deep epithelial covering which is interspersed with granules. Specimens with a smooth thallus and with contorted apothecia, sometimes in crowded tubercles, were collected by the late W. West in N. and W. Scotland. They resemble strongly *Pertusaria gyrocheila* in thallus and in apothecia. Spermogones are abundant, with minute oblong spermatia.

Hab. On rocks and old trunks of trees, rarely on the ground, chiefly in hilly districts.—*Distr.* General and abundant in Great Britain and Ireland, rare in the Channel Islands.—*B. M.* Alderney; Lamorna near Penzance, Cornwall; Bolt Head and Dartmoor, Devon; New Forest, Hants; near Sheffield, Sussex; Hemel Hempstead, Herts; Clee Hill, Shropshire; Cader Idris and Aberdovey, Merioneth; Capel Curig, Carnarvonshire; Conway Falls, Denbighshire; Highcliff, Cleveland, Yorkshire; Egglestone and Teesdale, Durham; The Cheviots, Northumberland; Kentmere, Westmoreland; Alston, Cumberland; New Galloway, Kirkcudbrightshire; Ayrshire; Pentland Hills and Dalmahoy Hill, near Edinburgh; Kilmun, Ben Cruachan and Barcaldine, Argyll; Glen Falloch, Finlarig, Craig Calliach, Ben Lawers, Amulree, Craig Vinean and Craig Tulloch, Blair Athole, Perthshire; Clova, Forfarshire; Portlethen and Nigg, Kincardineshire; Crag Coinnoch, Glen Callater, Morrone and Ben-naboord, Braemar, Aberdeenshire; Rothiemurchus Woods, Glen Nevis, Ben Nevis and I. of Harris, Invernessshire; Forres, Nairnshire; Applecross, Rossshire; Lairg, Sutherland; Ronas Hill, near Lerwick, Shetland; Balta Sound, Unst; Doughruagh Mts., Connemara, Galway; Corraun Mts. and Slievemore, Achill, Mayo.

Var. *gonatodes* Ach. Lich. Univ. p. 372 (1810).—Thallus in coralloid branches or elevations, or lobate-verrucose. Apothecia rare; spores 36–40 μ long, 25–27 μ thick (fide Nylander Lich. Nov. Zeal. p. 145 (1888)).—Cromb. in *Grevillea* xviii. p. 70; f. *gonatodes* Leight. Lich. Fl. ed. 3, p. 176 (1879) (excl. ll. cit.). *Lichen gonatodes* Ach. Lich. Succ. Prodr. p. 89 (1798).

An alpine or subarctic lichen, distinguished chiefly by the peculiar thallus; it is rather a growth form or an exaggerated state of the following variety.

Hab. On decayed mosses on the ground in alpine situations.—*B. M.* Summits of Ben Avon, Braemar, Aberdeenshire (the only British record).

Var. *frigida* Ach. Lich. Univ. p. 372 (1810).—Thallus effuse, rather thin, granulate, papillate or coralloid. Apothecia smaller than in the species (up to 4 mm. across), the thalline margin sometimes proliferous.—Mudd Man. p. 156; Cromb. Lich. Brit.

p. 54; var. *upsaliensis* Hook. in Sm. Engl. Fl. v. p. 191 (1833); f. *frigida* Leight. Lich. Fl. p. 188 (1871); ed. 3, p. 175; f. *microcarpa* Th. Fr. Lich. Scand. p. 234 (1871); Cromb. in Grevillea xviii. p. 70 (1890); Hook. Fl. Scot. ii. p. 49 (as var. γ). *Lichen frigidus* Swartz Meth. Musc. p. 36, t. 2, fig. 4 (1781); With. Arr. ed. 3, iv. p. 22; Engl. Bot. t. 1879. *L. upsaliensis* Dicks. Pl. Crypt. fasc. i. p. 12, t. 2, fig. 7 (1785) (non Linn.); Engl. Bot. t. 1634. *Rinodina frigida* S. F. Gray Nat. Arr. i. p. 555 (1821).

Exsicc. Cromb. n. 70; Dicks. Dried Pl. n. 49.

An alpine variety with thinner granular or papillate thallus. A state with minute apothecia occasionally occurs (f. *microcarpa* Th. Fr. Lich. Scand. p. 234 (1871); Cromb. Monogr. i. p. 458).

Hab. On mosses on the ground of moorlands or mountains.—*Distr.* Local in E. England and N. Wales and Central Scotland; plentiful among the Grampians, not recorded from Ireland.—*B. M.* Bury St. Edmund's, Suffolk; Cwm Bychan, Merioneth; Ayton Moor, Cleveland, Yorkshire; Teesdale, Durham; Pentland Hills, near Edinburgh; Ben Cruachan, Argyll; Ben Lawers, Ben Vrackie and Blair Athole, Perthshire; Katelaw and Clova Mts., Forfarshire; Morrone, Ben Macdhuil, Glen Dee and Invercauld Mts., Braemar, Aberdeenshire; Ben Nevis, Invernessshire.

Subsp. *subtartarea* Nyl. in Bull. Soc. Linn. Norm. sér. 2, vi. p. 276 (1872).—Thallus similar to the species but with sorediate pustules or becoming wholly leprose. Apothecia rare, the margin sometimes leprose.—Cromb. in Journ. Bot. xx. p. 274 (1882) & Monogr. i. p. 460. *L. tartarea* var. *arborea* Schær. Enum. p. 80 (1850)? Mudd Man. p. 156; subsp. *palescens* f. *leprosa* Nyl. in Not. Sällsk. Faun. & Fl. Fenn. Förh. v. p. 135 (1866); f. *leprosa* Leight. Lich. Fl. ed. 3, p. 175. *Lichenoides tartareum farinaceum, scutellarum umbone fusco* Dill. Hist. Musc. p. 132, t. 18, fig. 12 (1741). *Patellaria tartarea* var. *arborea* DC. Fl. Franc. ii. p. 364 (1805)?

Distinguished chiefly by the leprose thallus, a character not alluded to either by De Candolle or by Schærer.

Hab. On the trunks of old trees and occasionally on rocks in upland and subalpine regions.—*Distr.* Probably common, though not often recorded.—*B. M.* Roughton, Cornwall; Becky Falls, Devon; Eridge Rocks, Sussex; Lynn Gwernon, Merioneth; Rosedale, Yorkshire; New Galloway, Kirkeudbrightshire; Roslin, near Edinburgh; Barcaldine, Argyll; Ben Vrackie and Craig Calliach, Perthshire; Morrone, Braemar, Aberdeenshire; Ronayne's Island, Killarney, Kerry; Clonmel, Tipperary; Leenane, Connemara, Galway.

62. *L. gemimpara* Th. Fr. Lich. Scand. p. 236 (1871).—Thallus effuse, formed of scattered warts or papillæ, which are roundish or somewhat angular, becoming sorediate, greyish-white (K + yellowish-red; soredia CaCl + reddish). Apothecia on the apices of the papillæ up to 3 mm. across, the disc concave then

plane, purplish-black, the thalline margin thick, inflexed, crenate, persistent; paraphyses conglutinate, intricately branched, brown at the apices; spores 2 in the ascus, ellipsoid, angular from pressure, colourless, becoming dark-coloured, 22–44 μ long, 15–20 μ thick.—Cromb. in Grevillea xviii. p. 70 & Monogr. i. p. 463. *L. leprothelia* Nyl. in Flora lvii. p. 16 (1874) (a sterile form); Cromb. in Journ. Bot. xx. p. 274 (1882).

In the absence of fertile specimens it has not been possible to do more than transcribe Th. Fries's account of this plant. It is evidently rare, both here and on the continent.

Hab. On decayed mosses on the ground in alpine places.—*B. M.* Ben Lawers, Perthshire (the only British record).

63. *L. parella* Ach. Lich. Univ. p. 370 (1810) (excl. vars.).—Thallus wide-spreading, generally determinate, thickish or thin, smooth and submembranaceous or deeply cracked-areolate, whitish or greenish-grey, the hypothallus white (K—, CaCl—). Apothecia small or moderate in size, the disc concave then plane or becoming slightly convex, sometimes granular or wrinkled, pale flesh-red or whitish, generally covered with a white pruina (K(CaCl)+reddish), the thalline margin thick, prominent, entire or wrinkled-crenulate; paraphyses subdiscrete, slender, unequal, flexuose, simple or branched, the tips budding off small cells (the pruina); spores 4–8 (rarely 2) in the ascus, ellipsoid or somewhat globose, 45–88 μ long, 25–50 μ thick; hymenial gelatine blue with iodine.—Hook. Fl. Scot. ii. p. 48 & in Sm. Engl. Fl. v. p. 191; Tayl. in Mackay Fl. Hib. ii. p. 137; Cromb. Lich. Brit. p. 54 (incl. var. *tumidula*, excl. vars. *Turneri* and *upsaliensis*) & Monogr. i. p. 461 (incl. ff. *crenularia* and *porinoides*); Leight. Lich. Fl. p. 188 pro parte; ed. 3, p. 201 pro parte. *L. pallescens* vars. *parella* and *tumidula* Mudd Man. p. 155 (1861). *Lichenoides leprosum tinctorium, scutellis lapidum cancri figura* Dill. Hist. Mus. p. 130, t. 18, fig. 10 (1741). *Lichen parellus* L. Mant. p. 132 (1767); Lightf. Fl. Scot. ii. p. 814; Huds. Fl. Angl. ed. 2, p. 530; With. Arr. ed. 3, iv. p. 17; Engl. Bot. t. 727 (as *L. perellus*). *L. tumidulus* Pers. in Ust. Ann. Bot. xi. p. 18 (1794). *Rinodina parella* S. F. Gray Nat. Arr. i. p. 453 (1821). *Pertusaria incarnata* Leight. in Trans. Linn. Soc. ser. 2, i. p. 241, t. 33, figs. 1–3 (1877) & Lich. Fl. ed. 3, p. 235 (cf. Nyl. in Flora lxvi. p. 534).

Exsicc. Bohl. p. 60; Cromb. n. 166; Dicks. Hort. Sicc. fasc. x. n. 23; Johns. nos. 140, 141, 142, 144; Larb. Cæsar. n. 75 & Lich. Hb. n. 300; Leight. n. 8; Mudd n. 125.

One of the dye-lichens known in early days as the *Pérelle* or *Orseille d'Auvergne*. The variant spelling *perellus* instead of *parellus* reappears in several of the authors cited. It is a very common lichen on stone walls, etc., and grows well in a northern aspect. The apothecia are generally abundant and are very variable in size; the thalline margin is often very thick (var. *tumidula*) and prominent, though sometimes almost level with the thallus; occasionally the disc is

almost entirely enclosed (f. *porinoides* Cromb. Monogr. i. p. 461 (1894)). A dense white pruina is generally present, but the rose-coloured disc is occasionally visible.

Hab. On rocks, walls, and trunks of trees, rarely on palings, from maritime to mountainous regions.—*Distr.* General and common throughout the British Isles.—*B. M.* Boulay Bay, Jersey; Chateau Point, Sark; Penzance and St. Issy, Cornwall; Ilfracombe and Torquay, Devon; Lyndhurst, New Forest, Hants; Ryde, I. of Wight; Wolstonbury, Walmer, Ardingly Rocks, Peasemarsch and near Hastings, Sussex; Greenwich Park and near Tunbridge Wells, Kent; Chelmer, Ulting and Langford, Essex; near Tenby, Pembrokeshire; Barmouth, Merioneth; Llandyssil, Cardiganshire; Nant Francon and Capel Curig, Carnarvonshire; near Shrewsbury, Shropshire; Hale's End, Malvern, Worcestershire; Bardon Hill, Leicestershire; Silverdale, Lancashire; Ayton, Cleveland, Yorkshire; Egglestone, Durham; Wastdale and St. Bees, Cumberland; Chollerford and Wansbeck Valley, Northumberland; Arthur's Seat, Edinburgh; West Water, Fife; Airds, Barcaldine, Lismore and Ballachulish, Argyll; Ben Lawers, Aberfeldy and Craig Tulloch, Blair Athole, Perthshire; Sidlaw Hills and Baldovan, Forfarshire; Portlethen and Cove, Kincardineshire; Morrone, Glen Callater and Glen Dee, Braemar, Aberdeenshire; Glen Nevis, Invernesshire; Applecross, Rossshire; Brandon Mt., Kerry; Clare Island and Achill, Mayo.

Form *nivea* Cromb. Monogr. i. p. 462 (1894).—Thallus and thalline margin of the apothecia soft, snowy-white; otherwise as in the species.

A transition form evidently between the species and var. *Turneri*. It has only been collected once, but has probably been overlooked.

Hab. On the trunk of an old tree in an upland situation.—*B. M.* Killaloe, Clare.

Var. Turneri Nyl. in Mém. Soc. Sci. Nat. Cherb. v. p. 113 (1857).—Thallus more or less leprose-powdery, whitish or greenish-white. Apothecia similar to the species but the thalline margin leprose.—Cromb. Lich. Brit. p. 54 & Monogr. i. p. 462; f. *Turneri* Leight. Lich. Fl. p. 190 (1871); ed. 3, p. 203. *L. Turneri* Ach. Syn. Lich. p. 70 (1814); Hook. in Sm. Engl. Fl. v. p. 191. *L. pallescens* var. *Turneri* Mudd Man. p. 155 (1861). *Lichen Turneri* Sm. Engl. Bot. t. 857 (1801). *Rinodina Turneri* S. F. Gray Nat. Arr. i. p. 454 (1821).

Exsicc. Leight. n. 237; Mudd n. 127.

A corticolous variety distinguished by the powdery sorediate surface of the thallus. The margins of the apothecia, usually entire, are occasionally furrowed, as also in the species (f. *suberenata* Cromb. in *Grevillea* xviii. p. 70 (1890) & Monogr. i. p. 462).

Hab. On trunks of old trees in wooded regions.—*Distr.* Rather rare throughout the British Isles.—*B. M.* Ugbrooke Park, Chudleigh, Devon; Carisbrook and Bembridge, I. of Wight; New Forest, Hants; Hurstpierpoint, Chichester and Balcombe, Sussex; Holmwood, Surrey; Epping Forest and St. Osyth Park, Essex; Savernake Forest, Wilts;

near Barmouth, Merioneth; near Ayton, Cleveland, Yorkshire; Egglestone, Durham; Loch Creran, Barcaldine and Inverary, Argyll; Morrone, Braemar, Aberdeenshire; Old Deer Park, Castlemartyr, Cork; Muckross, Killarney, Kerry.

64. *L. pallescens* Mudd Man. p. 155 (1861) (? Linn.); Nyl. in Bull. Soc. Linn. Norm. sér. 2, ii. p. 68 (1868).—Thallus rather thin and membranaceous or zonate at the circumference, becoming sometimes thickish and wrinkled-granular, whitish or greyish, bounded by a white hypothallus (K —, CaCl —). Apothecia small or moderate in size, the disc concave then plane or wrinkled, faintly yellowish-pink, generally white pruinose (K(CaCl) + reddish); the thalline margin prominent, entire (K(CaCl) + reddish); paraphyses slender; spores 8 in the ascus, ellipsoid, up to $64\ \mu$ long, $18\text{--}34\ \mu$ thick.—Cromb. in Grevillea xviii. p. 70 (1890) & Monogr. i. p. 462; var. *tumidula* Mudd Man. l. c. *L. tartarea* subsp. *pallescens* Cromb. Lich. Brit. p. 54 (1870) pro parte. *L. parella* f. *pallescens* Leight. Lich. Fl. p. 189 (1871) pro parte; ed. 3, p. 202 pro parte. *Lichen pallescens* L. Sp. Pl. p. 1142 (1753).

Essicc. Johns. n. 143; *Larb. Cæsar.* n. 76; Mudd n. 126.

Generally with a thinner thallus and smaller apothecia than *L. parella*, from which it differs in the corticolous habitat, but chiefly in the reaction of the apothecial margin.

Hab. On trunks of trees.—*Distr.* Rare throughout the British Isles.—*B. M.* Jersey; Launceston, Cornwall; near Lustleigh, Devon; New Forest, Hants; Shanklin, I. of Wight; near Hastings, Sussex; Barmouth, Merioneth; Trefriw, Carnarvonshire; near Easby, Cleveland, Yorkshire; Barcaldine, Argyll; Ben More, Perthshire.

65. *L. upsaliensis* Nyl. ex Norrl. in Not. Sällsk. Faun. & Fl. Fenn. Förh. xiii. p. 332 (1873).—Thallus effuse, continuous or of scattered rounded smooth granules, greyish- or yellowish-white (K —, CaCl —). Apothecia rather small, the disc concave, becoming plane, generally densely granular-pruinose, the thalline margin thickish, entire; paraphyses slender; spores 4 to 8 in the ascus, $55\text{--}58\ \mu$ long, $26\text{--}38\ \mu$ thick.—Cromb. in Grevillea xviii. p. 70 & Monogr. i. p. 463; Leight. Lich. Fl. p. 192; ed. 3, p. 176 (excl. Syn. Engl. Bot.). *L. parella* var. *upsaliensis* Hook. Fl. Scot. ii. p. 48 (1821)? Cromb. Lich. Brit. p. 54. *Lichen upsaliensis* L. Sp. Pl. p. 1142 (1753); S. F. Gray Nat. Arr. i. p. 454 (as the Upsal Rinodine)?

Differs from *L. parella* in the habitat and in the character of the thallus. It is possible that Hooker's and Gray's citations may refer to *L. tartarea* var. *frigida*.

Hab. Incrusting mosses on the ground in alpine situations.—*Distr.* Very rare on the Grampians, Scotland.—*B. M.* Craig Calliach, Perthshire; Morrone, Braemar, Aberdeenshire.

§ iv. *ASPICILIA* Massal. Ric. Lich. Crost. p. 36 (1852) (as genus); Mudd Man. p. 161.—Thallus variously crustaceous. Apothecia innate in the thallus then more or less emergent, the thalline margin persistent or disappearing, the proper margin often prominent; hypothecium nearly always colourless; paraphyses generally simple and densely septate; spores ellipsoid, large or small.

Aspicilia is frequently classified as a genus, as the early stages of apothecial development differ from those of *Lecanora*, being more akin to those of *Lecidea*, the thalline margin, which may be prominent and persistent, growing up with and around the apothecium as a later development. *Lecanora Dicksonii* and *L. pelobotrya* are retained for convenience of reference, but they are more truly *Lecideæ*.

There are two groups differing in the gonidia:—

- A. EUASPICILIA..... Algal cells *Protococcaceæ*.
 B. JONASPIS Algal cells *Trentepohlia*.

A. Euaspicilia—Algal cells *Protooccus*.

a. *Thallus whitish or cinereous-grey, K + yellow then red.*

66. *L. cinerea* Sommerf. Suppl. Fl. Lapp. p. 99 (1826).—Thallus effuse or determinate, cracked-areolate, brownish- or whitish-grey (K + yellow, then rusty red, CaCl—). Apothecia rather small, at first immersed and concave, becoming sessile and plane, the disc black, the thalline margin entire; paraphyses coherent, septate, generally divided in moniliform fashion near the tips, the epithecium dark-brown; spores ellipsoid, 8 or sometimes 6 in the ascus, 15–23 μ long, 8–14 μ thick; hymenial gelatine blue then wine-red with iodine.—Cromb. Lich. Brit. p. 54 & Monogr. i. p. 466; Leight. Lich. Fl. p. 195; ed. 3, p. 172 (incl. ff. *rimoso-areolata*, *diffRACTO-areolata* and *verrucoso-areolata*). *Lichen cinereus* L. Mant. i. p. 132 (176)? Huds. Fl. Angl. ed. 2, p. 525? Ach. Lich. Suec. Prodr. p. 32 (1798); Engl. Bot. t. 1751. *Urceolaria cinerea* Ach. Meth. Lich. p. 143 (1803); S. F. Gray Nat. Arr. i. p. 458; Hook. in Sm. Engl. Fl. v. p. 172; Tayl. in Mackay Fl. Hib. ii. p. 132. *Aspicilia cinerea* Kær. Syst. Lich. Germ. p. 164 (1855); Mudd Man. p. 162 pro parte.

Exsicc. Johns. n. 270.

A very variable plant as regards growth stages both of the thallus and the apothecia, so that the reaction with potash is of great value in determining the different forms. The thallus spreads extensively though generally limited. The apothecia are abundant. Crombie has included as a growth stage *Lecanora calcarca* f. *ochracea* Leight. Lich. Fl. ed. 3, p. 193 (1879); as it is based on *Urceolaria cinerea* var. *ochracea* Schær. Spicil. Fl. Helv. p. 72 (1826) it evidently belongs here, but the British Museum specimen of f. *ochracea* (Leight. exs. n. 292) is *L. flavida*. Another specimen labelled *Parmelia cinerea* var. *atrocinerea* (Leight exs. n. 205) is imperfect but evidently a *Lecidea*. Another very small specimen from Jersey collected by

Larbalestier and labelled *L. cerinea* gives the same chemical reaction, but the spores are much smaller. The citations from Linnæus and Hudson are extremely doubtful. *Aspicilia cinerea* var. *ocellata* Mudd l. c. is probably identical with *Buellia verruculosa* (Monogr. ii. p. 172). Spermogones are frequent with spermatia, 16–21 μ long, and 1 μ thick.

According to Hue (Nouv. Arch. Mus. Paris sér. 5, ii. p. 35 (1910)) the black hypothallus so frequently present belongs to some neighbouring species.

Hab. On rocks and walls in maritime and mountainous districts.—*Distr.* Rather local but widely distributed throughout the British Isles.—*B. M.* Moulin Huet Bay and Vale Castle, Guernsey; La Coupe, Jersey; Bray Hill, St. Minver and Lizard, Cornwall; Lazonby, Cumberland; Cader Idris and Barmouth, Merioneth; Snowdon, Carnarvonshire, Teesdale, Durham; near Edinburgh; Barcaldine, Argyll; Ben Lawers and Glen Lochay, Killin, Perthshire; Portlethen, Kincardineshire; Wicklow; Lambay Island, Dublin.

Form *lepidota* Leight. Lich. Fl. ed. 3, p. 173 (1879).—Thallus brownish-grey, areolate, the areolæ convex and wrinkled. Apothecia small, the thalline margins prominent, persistent.—*Lecanora cinerea* var. *lepidota* Leight. in Grevillea iii. p. 116 (1875); Cromb. Monogr. i. p. 467.

Differs in the form of the thallus which is more squamulose and darker.

Hab. On maritime rocks and by lakes in mountainous districts.—*Distr.* Reported only from the Channel Islands and N. Wales.—*B. M.* Beaufort, Jersey; Llyn Dinas near Beddgelert, Carnarvonshire.

Subsp. *epiglypta* Nyl. in Flora lxiv. p. 4 (1881).—Thallus similar to that of the species. Apothecia becoming rather large and prominent, the disc corrugate with prominent lines.—Cromb. in Grevillea xix. p. 57 (1891) & Monogr. i. p. 467.

Characterized by the peculiar apothecia which have a somewhat gyrose appearance. Hue has given it specific distinction (Nouv. Arch. Mus. Paris sér. 5, ii. p. 7 (1910)). He found cephalodia within the thallus and under the hymenium associated with *Gleocapsa* algæ.

Hab. On schistose rocks in mountainous districts.—*Distr.* Rare in N. Wales and W. Scotland.—*B. M.* Cader Idris, Merioneth; Barcaldine, Argyll.

Var. *olivascens* A. L. Sm. Thallus thinner than in the species, smooth and somewhat shining, cracked-areolate. Apothecia small, immersed or rather prominent, the paraphyses dark blue-green at the tips, otherwise as in the species.

Differing from the species in the thinner more shining thallus and in the blue-green tips of the paraphyses. The contents of the spores in some cases are broken up and look like two large globules. The differences may be due to habitat.

Hab. On siliceous rocks in a maritime locality.—*B. M.* Moidart, Invernesshire (the only record), collected by Symers M. Macvicar, Jan. 1914.

67. *L. intermutans* Nyl. in Flora Iv. p. 354 (1872).—Thallus determinate, deeply cracked-areolate, whitish- or brownish-grey (K + yellow then rusty-red, CaCl—). Apothecia immersed, the disc concave, blackish, the thalline margin prominent, entire, becoming inflexed; paraphyses slender, moniliform-septate upwards; spores usually 8 in the ascus, 23–34 μ long, 9–15 μ thick; hymenial gelatine bluish then wine-red with iodine.—Cromb. in Grevillea xix. p. 57 (1891) & Monogr. i. p. 164.

Differs from the preceding species in the larger spores and, according to Nylander, in the smaller spermatia (7–9 μ long, 1 μ thick). In the single specimen in the British Museum the spores measure about 20 μ in length, and contain two large guttulæ. The species is recorded from the Pyrenees and from N.W. France.

Hab. On schistose rocks in a maritime district.—*B. M.* Near Kylemore, Connemara, Galway.

68. *L. alpina* Sommerf. Suppl. Fl. Lapp. p. 91 (1826).—Thallus indeterminate, deeply cracked into rounded or angular somewhat warted areolæ, grey or leaden-greyish on a black hypothallus (K + yellow then red, CaCl—, medulla I + blue). Apothecia numerous, immersed then superficial, the disc plane, reddish or black, the thalline margin prominent; paraphyses septate, clavate and brown at the tips, with a deep brown line over the apex; spores ellipsoid, 9–13 μ long, 6–8 μ thick; hymenial gelatine blue with iodine.—Cromb. in Grevillea xix. p. 57 (1891) & Monogr. i. p. 468 (non Leight. in Grevillea i. p. 125 (1873)). *L. cinereo-rufescens* Cromb. Lich. Brit. p. 55 (1870) (non Nyl.); Leight. Lich. Fl. p. 211; ed. 3, p. 197 (non Nyl. fide Cromb. Monogr. i. p. 468, note).

Differs from *L. cinerea* in the much smaller spores and the blue reaction of the medulla with iodine, a peculiarity shared by *L. cinereo-rufescens*. Spermogones have spermatia 4–6 μ long, and about 1 μ thick. *L. Myrini* Nyl. (Leight. Lich. Fl. ed. 3, p. 173) is not British.

Hab. On a mica-schist rock in an alpine situation.—*B. M.* Ben Lawers, Perthshire (the only British record).

b. *Thallus white or whitish-grey, K—.*

69. *L. calcarea* Sommerf. Suppl. Fl. Lapp. p. 102 (1826).—Thallus effuse or distinctly determinate, often wide-spreading, smooth or farinose, continuous or cracked-areolate, chalky- or greyish-white, sometimes greenish at the circumference (K—, CaCl—). Apothecia generally crowded, immersed, small, irregular in form, becoming plane, the disc black, whitish-pruinose, the thalline margin entire or wrinkled; paraphyses loosely coherent, slender, septate, more or less moniliform at the tips, the epithecium dark-brown; spores ellipsoid or subglobose, with a thick epispore, 18–30 μ long, 14–27 μ thick; hymenial gelatine blue with iodine.—Cromb. Lich. Brit. p. 54 & Monogr. i. p. 473; Leight. Lich. Fl. p. 209; ed. 3, p. 192 (incl. f. *concreta*).

Lichen calcareus L. Sp. Pl. p. 1140 (1753); Huds. Fl. Angl. p. 442; With. Arr. ed. 3, iv. p. 6 pro parte. *L. tessellatus* Sm. Engl. Bot. t. 533 (1798). *L. multipunctus* Sm. op. cit. t. 820 (1800). *Urceolaria calcarea* Ach. Meth. Lich. p. 142 (1803); S. F. Gray Nat. Arr. i. p. 459; Hook. in Sm. Engl. Fl. v. p. 172; Tayl. in Mackay Fl. Hib. ii. p. 132; var. *concreta* Schær. Spicil. Lich. Helv. p. 73 (1826). *U. tessellata* Ach. l. c.; S. F. Gray tom. cit. p. 460. *Aspicilia calcarea* Kær. Parerg. Lich. p. 94 (1859); Mudd Man. p. 161, t. 3, fig. 55.

Exsicc. Johns. nos. 145, 146; Larb. Lich. Hb. n. 166; Leight. n. 13; Mudd n. 133.

Easily distinguished by the whitish thallus (except in var. *Hoffmanni* which is bluish-grey) and by the black apothecia at first immersed, then often with prominent margins. The typical condition of the plant with the areolæ contiguous and angular has been described as var. *concreta*. Two figures in Engl. Bot. *Lichen tessellatus* and *Lichen multipunctus* evidently belong here. The former has been doubtfully cited under *Verrucaria viridula* (Monogr. ii. p. 284).

The spermogones, according to Crombie, are frequent and dark coloured, with spermatia 7-9 μ long, about 1 μ thick.

Hab. On calcareous (rarely granitic) rocks and walls in maritime and upland regions.—*Distr.* General and common in limestone districts.—*B. M.* Near Penzance, Cornwall; Plymouth and Torquay, Devon; Bathampton Downs, Somerset; Mid-Sussex Weald; Folkestone, Kent; Cuddeson, Oxfordshire; Burgh Castle, Suffolk; Malvern Hills, Worcestershire; Llanymynech, Shropshire; Barmouth, Merioneth; Llangollen, Denbighshire; Great Orme's Head, Carnarvon; Anglesea; Cuning Dale, near Buxton, Derbyshire; Bilsdale, Yorkshire; Egglestone, Durham; Levens, Westmoreland; Lismore and Appin, Argyll; Craig Tulloch, Blair Athole, Perthshire; Morrone, Braemar, Aberdeenshire; Dunkerron and Killarney, Kerry; Maam, Connemara, Galway; Clare Island and Castlebar, Mayo.

Var. *contorta* Hepp Flecht. Eur. n. 629 (1860).—Thallus of scattered or contiguous squamule-like areolæ which are rounded or angular and crenulate, often raised in the centre, white or greyish-white. Apothecia immersed in the areolæ, small, spores ellipsoid or subglobose, somewhat smaller than in the species, up to about 25 μ long, 17 μ thick.—Cromb. Monogr. i. p. 474; f. *contorta* Leight. Lich. Fl. ed. 3, p. 193 (1879). *Verrucaria contorta* Hoffm. Pl. Lich. i. p. 97, t. 22, figs. 3-4 (1790). *Urceolaria contorta* DC. Fl. Franc. ii. p. 370 (1805); Tayl. in Mackay Fl. Hib. ii. p. 132. *Aspicilia calcarea* var. *contorta* Mudd Man. p. 162 (1861).

Exsicc. Johns. n. 147; Leight. n. 322.

Distinguished by the scattered and generally rounded thalline areolæ.

Hab. On calcareous rocks chiefly in upland districts.—*Distr.* Rather rare in Great Britain and Ireland.—*B. M.* Near Kingskerswell, Devon; Symond's Yat, Herefordshire; near Malvern, Worcestershire; near Oswestry, Shropshire; Great Orme's Head, Carnarvon-

shire; Newton, Cleveland, Yorkshire; Teesdale, Durham; Alston, Cumberland; The Ochills, near Stirling; Craig Tulloch, Blair Athole, Perthshire; Craig Guie, Braemar, Aberdeenshire; The O'Donoghue's Prison, Killarney, Kerry.

Form *monstrosa* Cromb. in *Grevillea* xix. p. 57 (1891) & *Monogr.* i. p. 474.—Thallus of small scattered round areolæ, somewhat convex and entire at the margins, white. Apothecia minute, undeveloped.—*L. calcarea* var. *monstrosa* Lamy in *Bull. Soc. Bot. Fr.* xxx. p. 392 (1883).

A very neat form, of small button-like white areolæ on a dark background of gelatinous algæ, etc. A central dark dot marks the position of the apothecia. Crombie has suggested that it may be only a young condition.

Hab. On calcareous stones of a wall.—*B. M.* Glen Fender, Blair Athole, Perthshire (the only British locality).

Var. *Hoffmanni* Sommerf. *Suppl. Fl. Lapp.* p. 102 (1826).—Thallus rather thick of squamule-like contiguous warts, or thinnish and cracked-areolate, whitish- or cinerous-grey. Apothecia generally prominent, the margin often crenulate; spores 21–34 μ long, 16–20 μ thick.—Cromb. *Lich. Brit.* p. 54 (excl. syn.) & *Monogr.* i. p. 475; f. *Hoffmanni* Leight. *Lich. Fl.* p. 209; ed. 3, p. 193. *Lichen Hoffmanni* Ach. *Lich. Suec. Prodr.* p. 31 (1798); *Engl. Bot.* t. 1940. *Urceolaria Hoffmanni* Ach. *Meth. Lich.* p. 145 (1803); *S. F. Gray Nat. Arr.* i. p. 459.

Exsicc. Johns. n. 148.

Near to the previous variety, but with more crowded, sometimes continuous thallus. Not unlike *L. gibbosa* in colour, but differing in the form of the thalline warts.

Hab. On rocks and walls, mainly calcareous, in maritime and upland districts.—*Distr.* Rare in Great Britain and W. Ireland.—*B. M.* Beachy Head, Sussex; Duffield, near Cirencester, Gloucestershire; Chance's Pitch, Malvern, Worcestershire; Buxton, Derbyshire; near Roseberry, Cleveland, Yorkshire; Levens, Westmoreland; Ben Cruachan, Argyll; Glen Fender, Blair Athole, Perthshire; Portlethen, Kincardineshire; Doughruagh Mts., Connemara, Galway.

70. *L. pelobotrya* Sommerf. *Fl. Lapp. Suppl.* p. 99 (1826).—Thallus thickish, composed of large irregular crowded warts rounded or plane, smooth, whitish (K —, CaCl —). Apothecia small or moderate in size, immersed or becoming superficial, the disc brownish-black, the thalline margin inflexed; hypothecium brownish-black; paraphyses long, slender, flexuose, septate and dark-brown near the tips; spores 4–8 in the ascus, ellipsoid or oblong-ellipsoid, 23–35 μ long, 12–16 μ thick; hymenial gelatine blue with iodine—Leight. *Lich. Fl.* ed. 3, p. 469; Cromb. *Monogr.* i. p. 469. *Urceolaria pelobotryon* Wahlenb. ex Ach. *Meth. Lich. Suppl.* p. 31 (1803). *Aspicilia pelobotrya* Mudd *Man.* p. 164 (1861). *Lecidea pelobotrya* Cromb. *Lich. Brit.* p. 80 (1870); Leight. *Lich. Fl.* p. 298.

Resembling *Lecanora* in the thalline margin, though frequently placed in *Lecidea* on account of the dark hypothecium. Warty scabrid pale-reddish cephalodia, containing *Glæocapsa* gonidia, are abundant on some of the specimens, but are absent from those growing in streams (f. *rivularis* Cromb. Monogr. i. p. 470).

Hab. On mica-schistose rocks in alpine places.—*Distr.* Rare on the Grampians, Scotland.—*B. M.* Loch-na-Gat, Ben Lawers, Perthshire.

c. Thallus grey, of prominent or isidia-like warts, K -.

71. *L. verrucosa* Laurer ex Sturm Deutschl. Fl. Krypt. ii. 28, p. 63, t. 21 (1835).—Thallus effuse, irregularly squamulose-warty, sometimes slightly pulverulent, greyish-blue-white (K - CaCl -). Apothecia immersed, then prominent on the warts, small, the disc black with a narrow black rim surrounded with a thickish thalline margin; paraphyses coherent, slender, flexuose, submoniliform-septate and dark-brown above; asci large, with a thickish wall when mature, 8-spored; spores large and thick-walled, broadly ellipsoid, variable in size, up to about 62μ long, and 30μ wide (often about $50 \mu \times 30 \mu$); hymenial gelatine blue then quickly wine-red with iodine.—Cromb. Lich. Brit. p. 58; in Grevillea i. p. 172 & Monogr. i. p. 475; Leight. Lich. Fl. p. 214; ed. 3, p. 200. *Urceolaria verrucosa* Ach. Lich. Univ. p. 339 (1810). *Aspicilia verrucosa* Koerb. Syst. Lich. Germ. p. 167 (1855); Mudd Man. p. 164.

Exsicc. Cromb. n. 73.

Well characterized by the large spores and by the habitat.

Hab. Incrusting mosses on rocks (chiefly calcareous), rarely on the ground in upland and subalpine situations.—*Distr.* Rare in N. England and the Grampians, Scotland.—*B. M.* Cunswick Scar, Westmoreland; Loch-na-Gat, Ben Lawers and Craig Tulloch, Blair Athole, Perthshire.

72. *L. poriniformis* Nyl. in Flora xlviii. p. 353 (1865).—Thallus effuse, thinnish, membranaceous and continuous or thicker and cracked, whitish-grey (K -). Apothecia small, embedded in the thallus, then emerging in rounded prominent verrucæ either singly or 3 to 4 in one verruca; the disc rose-coloured or whitish, the thalline margin thick, not prominent; paraphyses crowded, slender, septate and branched; spores 6 to 8 in the ascus, ellipsoid or ovoid, large, with a thinnish wall, $50-80 \mu$ long, $27-50 \mu$ thick; hymenial gelatine blue then tawny-yellow with iodine. Carroll in Journ. Bot. iv. p. 23 (1866); Cromb. Lich. Brit. p. 56; in Grevillea i. p. 172 & Monogr. i. p. 476; Leight. Lich. Fl. p. 190; ed. 3, p. 203.

Exsicc. Cromb. n. 74; Johns. n. 274.

An endemic species resembling a *Pertusaria* when mature, but differing in the early stages, the warts developing along with and as part of the apothecia. These are scattered or crowded.

Hab. On siliceous rocks or walls, rarely incrusting mosses on trunks of old firs in maritime and subalpine districts.—*Distr.* Rare in N. England (Cumberland and Westmoreland), and among the Grampians and N.E. Scotland.—*B. M.* N. England; Ben Lawers and Craig Tulloch, Perthshire; Fortlethen, Kincardineshire.

73. *L. leucophyma* Leight. Lich. Fl. p. 205 (1871).—Thallus of contiguous or scattered smooth rounded or contorted warts or papillæ, pale- or pinkish-grey, pale-yellow within (K—, CaCl—). Apothecia moderate in size, the disc brownish-red or -black, the thalline margin prominent, entire, becoming flexuose; paraphyses slender; spores broadly ellipsoid, thick-walled, very large, 23–35 μ long, up to 20 μ thick.—Leight. op. cit. ed. 3, p. 188; Cromb. Monogr. i. p. 465.

Easily recognized by the papillæ of the thallus. The apothecia are rare, the spores vary greatly in size; as *L. acceptanda* Nyl. (near to *L. complanata* Koerb.), it was described in Flora lxii. p. 204 (1879) with spores 23–27 $\mu \times 11 \mu$. The above measurements are from Leighton's specimen. Spermogones are present with minute spermatia 1.5 μ long, .5 μ thick.

Hab. On micaceous rocks in alpine situations.—*Distr.* Rare among the Grampians, Scotland.—*B. M.* Ben Lawers and Craig Calliach, Perthshire.

d. Thallus grey or brownish-grey, warted or areolate, K—.

74. *L. gibbosa* Nyl. in Not. Sällsk. Faun. & Fl. Fenn. Förh. n.s. v. p. 137 (1866).—Thallus determinate, thick, deeply cracked, the areolæ warted or "gibbous," light- or dark-grey or dark greenish-brown on a black hypothallus (K—, CaCl—). Apothecia rather small, immersed and concave, becoming plane, the disc brown then blackish, the thalline margin entire or slightly crenulate, persistent; paraphyses coherent, long, subflexuose, rarely branched, thickly septate, moniliform towards the tips, which are generally brownish, or the epithecium dark-brown; spores 4–8 in the ascus, ellipsoid or subglobose, large, with a distinct epispore, 21–38 μ long, 12–24 μ thick; hymenial gelatine blue, then quickly wine-red with iodine.—Cromb. Lich. Brit. p. 55 pro parte & Monogr. i. p. 460 (excl. var. *lusca*). Leight. Lich. Fl. p. 210 (excl. ff. *lacustris* and *punctata*); ed. 3, p. 194 (incl. ff. *vulgaris*, *porinoidea*, *squamata*). *L. aspersa* Borr. in Engl. Bot. Suppl. t. 2728 (1832); Hook. in Sm. Engl. Fl. v. p. 188. *L. tuberosa* Hook. l. c. (1833). *Lichen gibbosus* Ach. Lich. Succ. Prodr. p. 30 (1798); Dicks. Pl. Crypt. fasc. ii. p. 20, t. 6, fig. 5 (1790)? With. Arr. ed. 3, iv. p. 20? *L. fibrosus* Sm. Engl. Bot. t. 1732 (1807). *L. tuberosus* Sm. tom. cit. t. 1733. *Urceolaria gibbosa* Ach. Meth. Lich. p. 144 (1803); S. F. Gray Nat. Arr. i. p. 458 (incl. var. *fimbriata*); Hook. in Sm. Engl. Fl. v. p. 172. *U. fimbriata* Ach. tom. cit. p. 145. *Rinodina tuberosa* S. F. Gray Nat. Arr. i. p. 452 (1821). *Zeora gibbosa* ff.

porinoidea & *squamata* Flot. in Uebers. Schles. Ges. Vat. Cult. 1850, p. 128. *Aspicilia gibbosa* Koerb. Syst. Lich. Germ. p. 163 (1855); Mudd Man. p. 162.

Exsicc. Cromb. n. 167; Johns. n. 271; Larb. Lich. Hb. n. 220; Leight. n. 175 pro parte.

A very variable plant, hence the many different growth forms; it is "fibrose" or fimbriate when growing on bare flints, with the thalline areolæ scattered over the dark radiating hypothallus. Occasionally these areolæ swell into rounded warts (*L. tuberculosus*), or they may, in moist conditions, become soreciate (*L. aspersa*). Specimens with crenulate apothecia have been classified as f. *porinoidea*. All or some of these different forms may occur on the same specimen. Spermogones are frequent on young plants, with spermatia 7–10 μ long, 1 μ thick.

Hab. On rocks and stones (chiefly flints) in maritime and hilly districts.—*Distr.* Local, though plentiful in S.W. and N. England, rare in Wales and Scotland.—*B. M.* Chesil Beach, Portland Island, Dorset; Lyndhurst Moor, Hants; Ryde, I. of Wight; Lewes, S. Downs, St. Leonards, Beachy Head and West Dean, Sussex; Lydd Beach, Kent; Hereford Beacon, Malvern, Worcestershire; Crossfaen, Monmouthshire; Cader Idris, Merioneth; Caer Caradoc and Longmynd, Shropshire; Bury St. Edmund's, Suffolk; Cleveland, Yorkshire; Teesdale, Durham; Cumberland; Appin, Argyll.

Var. *zonata* Wain. in Medd. Soc. Faun. & Fl. Fenn. vi. p. 168 (1881).—Thallus thin, cracked-areolate, determinate and zonate at the circumference with concentric lines and limited by a black hypothalline margin. Apothecia as in the species.—Cromb. in *Grevillea* xix. p. 57 (1891) & *Monogr.* i. p. 471. *Sagedia zonata* Ach. in *Vet. Akad. Handl.* 1809, p. 165 & *Lich. Univ.* p. 329 (1810).

A well-marked variety, evidently very rare. Crombie l. c. has suggested that *L. gibbosa* var. *squamata* Th. Fr. *Lich. Scand.* p. 276 (non Flot.) may probably be an early stage of this variety.

Hab. On siliceous stones in maritime and upland situations.—*Distr.* Very rare in S.E. England.—*B. M.* Downs, Sussex; Lydd Beach, Kent.

Subsp. *depressa* Nyl. in *Not. Sällsk. Faun. & Fl. Fenn.* n.s. v. p. 137 (1866) (incl. f. *obscurata*).—Thallus thickish, cracked-areolate, dark-grey or blackish. Apothecia somewhat small, immersed and thinly margined, then emergent, plane and immarginate; paraphyses slender, moniliform-septate and dark-brown at the tips; spores ellipsoid, with a distinct episore, 16–24 μ long, 8–14 μ thick; hymenial gelatine blue, the asci wine-red, with iodine.—Cromb. *Lich. Brit.* p. 55 & *Monogr.* i. p. 471; f. *depressa* Leight. *Lich. Fl.* p. 210 (1871) (excl. syn. Ach.); ed. 3, p. 194 (excl. syn. Ach.).

Distinguished by the immersed immarginate apothecia. It has been given specific rank by Hue (*Nouv. Arch. Mus. Paris* 1910, p. 82)

under the name *Aspicilia obscurata*, and with slightly smaller spore-measurements than obtain in the British Museum specimen.

Hab. On a mica-schistose boulder in alpine situations.—*B. M.* Loch-na-Gat, Ben Lawers, Perthshire.

75. *L. cæsiocinerea* Nyl. in Flora lv. p. 69 (1873).—Thallus thickish, unequally cracked-areolate, bluish-grey, whitish or rather dark (K —, CaCl —). Apothecia rather small, immersed then somewhat prominent, often confluent, the disc becoming plane, blackish, the thalline margin entire or somewhat crenulate; paraphyses moniliform-septate and dark-brown above; spores 18–25 μ long, 10–14 μ thick; hymenial gelatine blue then quickly wine-red with iodine.—Leight. Lich. Fl. ed. 3, p. 194; Cromb. Monogr. i. p. 472.

Æsicc. Johns. n. 272; Larb. Lich. Hb. n. 60; Leight. n. 204.

Distinguished chiefly by the somewhat suffused-like velvety thallus, but otherwise scarcely differing from *L. gibbosa*, of which it might possibly be a growth form. Crombie gives the ascus as 8-spored, but occasionally there are fewer. Hue (Nouv. Arch. Mus. Paris, sér. 5, ii. p. 29 (1910)) finds larger gonidia and larger cortical cells than in *L. gibbosa*.

Hab. On rocks mostly in mountainous districts.—*Distr.* Rather rare throughout the British Isles.—*B. M.* Roughton and near Penzance, Cornwall; Llandyssil, Cardiganshire; Longmynd, Shropshire; Malvern Hills, Worcestershire; Lamplugh and Wastdale Lake-side, Cumberland; Barcaldine, Argyll; King's Park, Stirling; near Portlethen, Kincardineshire; Morrone, Braemar, Aberdeenshire; Kileully near Cork; Kilkee, Clare; Doughruagh Mts., Connemara, Galway; Black Mt., Antrim.

Form *obscurata* Nyl. l. c.—Thallus dark- or olive-greyish. Apothecia as in the species.—Leight. Lich. Fl. ed. 3, p. 195; Cromb. l. c.

Æsicc. Leight. n. 175 pro parte; Mudd n. 135.

Scarcely to be distinguished from the two preceding species, there being transition forms in the colour of the thallus.

Hab. On rocks and boulders in upland and subalpine regions.—*Distr.* Rare in the British Isles.—*B. M.* Malvern Hills, Worcestershire; Caer Caradoc, Shropshire; Cliffrigg, Cleveland, Yorkshire; Reston Scar, Staveley, Westmoreland; King's Park, Stirling; Ben Lawers, Perthshire; Morrone, Braemar, Aberdeenshire.

76. *L. cinereorufescens* Nyl. in Not. Sällsk. Faun. & Fl. Fenn. Forh. n. ser. v. p. 137 (1866).—Thallus subdeterminate, cracked-areolate, pale ash-grey on a black hypothallus (K —, CaCl —, medulla I + blue). Apothecia small or submoderate in size, immersed then somewhat prominent, the disc concave then plane, brownish or dark-red, the thalline margin entire; paraphyses septate, clavate and brown at the tips; spores ellipsoid, 12–24 μ long, 7–16 μ thick.—Cromb. in Grevillea xix. p. 57 (1891) & Monogr. i. p. 468. *Urceolaria cinereorufescens* Ach. Lich. Univ.

p. 677 (1810). *Aspicilia cinerea* var. *cinereorufescens* Mudd Man. p. 163 (1861)?

Differs from *L. cinerea* in the colour of the apothecial disc, more brightly red when moist, and in the absence of reaction with potash. The species has not been recorded in our country, only the following form.

Form *diamarta* Nyl. l. c.—Thallus yellowish-red. Apothecia similar to that of the species, but the thalline margin or the contiguous thallus often somewhat crenate.—Cromb. Lich. Brit. p. 55 & Monogr. i. p. 468; Leight. Lich. Fl. p. 211; ed. 3, p. 197. *Urceolaria diamarta* Ach. Meth. Lich. p. 151 (1803); S. F. Gray Nat. Arr. i. p. 458? *Lichen diamartus* Wahlenb. Fl. Lapp. p. 414 (1812). *L. sinopicus* Sm. Engl. Bot. t. 1776 (lower magnified fig.) (1807) (non Wahlenb.).

The rusty colour of the thallus is due to the large quantity of iron in the rocky substratum. The apothecia are abundant, but spermatogones are few, with spermatia 4–5 μ long, 1 μ thick (fide Crombie).

Hab. On a mica-schist rock in an alpine situation.—*B. M.* Above Loch-na-Gat, Ben Lawers, Perthshire (the only British record).

77. *L. recedens* Nyl. in Flora lxii. p. 361 (1879).—Thallus determinate or effuse, mostly rather thick, deeply cracked-areolate, ashy-grey (K—, CaCl—). Apothecia rather small, often crowded, innate, the disc brownish-black, the thalline margin generally prominent; paraphyses long, thickly septate, almost moniliform especially towards the tips, the epithecium dark-brown; spores broadly ellipsoid or subglobose, 10–12 μ in diam. or 14 μ long, 9 μ thick; hymenial gelatine blue with iodine.—Cromb. in Grevillea xix. p. 57 (1891) & Monogr. i. p. 469. *L. subcinerea* Nyl. in Flora lii. p. 82 (1869); Cromb. in Journ. Bot. xiii. p. 140 (1875); Leight. Lich. Fl. ed. 3, p. 197. *Lecidea recedens* Tayl. in Mackay Fl. Hib. ii. p. 117 (1836).

Exsicc. Larb. Lich. Hb. n. 299.

Differs from *L. cinerea* in the form of the small spores and the absence of reaction with iodine in the medulla. Larbalestier's specimen has a thinner thallus than the others, but the microscopic details are identical.

Hab. On rocks in maritime and upland districts.—*Distr.* Very rare in N. Wales, N. England, and S. and W. Ireland.—*B. M.* Bar-mouth, Merioneth; Holwick Scar, Yorkshire; Dunkerron, Kerry; Derryclare, Connemara, Galway.

78. *L. decincta* Nyl. in Flora lxv. p. 452 (1882).—Thallus determinate, rather thick, smooth, cracked-areolate, the areolae often rounded, umber-grey on a black hypothallus (K—, CaCl—). Apothecia rather small, semi-immersed then plane or convex, black, the thalline margin thinnish, disappearing; paraphyses

discrete, stoutish (about 2μ thick), sparsely branched and septate, variously clavate or capitate at the tips and dark-brown, the pigment descending often $15-20 \mu$; spores ellipsoid, small, $10-14 \mu$ long, $6-8 \mu$ thick; hymenial gelatine blue with iodine.—Cromb. in Grevillea xii. p. 89 (1884) & Monogr. i. p. 480.

This species was placed by Nylander in a distinct section on account of the form of sterigmata and spermatia. The spermogones are very minute, the sterigmata are short tufted branches bearing at the tips minute rod-like spermatia about 3μ long, 1μ thick. It is allied, according to Nylander, with *L. intercineta*, a Portuguese lichen.

Hab. On schistose rocks in a hilly locality.—*B. M.* Red Screes, Westmoreland (the only record).

e. Thallus dark in colour, K—.

79. *L. lusca* Nyl. in Bull. Soc. Linn. Norm. sér. 2, vi. p. 288 (1872) note.—Thallus determinate, rather thin, and membranaceous at the circumference, wrinkled, cracked-areolate and thicker especially towards the centre, sometimes shining, olivaceous-grey, hypothallus scarcely visible (K —, CaCl —). Apothecia rather small, immersed, often irregular in form, the disc black; paraphyses slender, long, subflexuose, moniliform towards the tips, which are brown, or the epithecium dark-brown; spores ellipsoid, $16-22 \mu$ long (rarely 24μ), $10-12 \mu$ (rarely 16μ) thick; hymenial gelatine blue then quickly wine-red with iodine.—Cromb. in Journ. Bot. xx. p. 274 (1882) (excl. spec. from Lazonby). *L. gibbosa* subsp. *lusca* Cromb. in Grevillea xix. p. 57 (1891); var. *lusca* Wain. in Medd. Soc. Faun. & Fl. Fenn. vi. p. 168 (1881); Cromb. Monogr. i. p. 471.

Described sometimes as a variety of *Aspicilia silvatica*. It differs from *L. gibbosa* in the thinner olivaceous thallus and smaller spores and in the longer spermatia, given as $16-21 \mu$ long, but this has not been verifiable. The specimen from Lazonby belongs to *L. cinerca*.

Hab. On rocks in maritime and hilly regions.—*Distr.* Rare though widely distributed in the Channel Islands and Great Britain.—*B. M.* Chateau Point, Sark; Breiddon Hill, Montgomeryshire; Barmouth, Merioneth; Battersby and Newton, Cleveland, Yorkshire; Ben Lawers and Craig Calliach, Perthshire; Bay of Nigg, Kincardineshire.

80. *L. subdepressa* Nyl. in Bull. Soc. Linn. Norm. sér. 2, vi. p. 287 (1872).—Thallus rather thin, plane, irregularly cracked, smooth or somewhat wrinkled, cinereous or dark-grey (K —, CaCl —). Apothecia rather small, scattered, immersed then emergent, the disc and margin black, the thalline margin excluded; paraphyses coherent, slender, often flexuose, septate, dark-brown above; spores ellipsoid, variable in size, $18-32 \mu$ long, $11-15 \mu$ thick; hymenial gelatine faintly blue then quickly wine-red with iodine.—*L. gibbosa* subsp. *subdepressa* Lamy in Bull. Soc. Bot. Fr. xxv. p. 420 (1878); Cromb. in Grevillea xix. p. 57

(1891) & Monogr. i. p. 472. *Urceolaria rufescens* Tayl. in Mackay Fl. Hib. ii. p. 132 (1836) (non Turn.).

Differing from *L. gibbosa* in the appearance of thallus and apothecia, which look as if washed smooth, and in the internal structure. The paraphyses are more sparsely septate and have not so constantly the bead-like appearance upwards. Hue (Nouv. Arch. Mus. Paris, 1910, p. 34) has, however, described them as moniliform and greenish-black above.

Spermogones have spermatia 9–15 μ long (or longer), $\cdot 5 \mu$ thick.

Hab. On schistose rocks in mountainous regions.—*Distr.* Local but plentiful where it occurs in Great Britain and Ireland.—*B. M.* Cader Idris and Camlan Valley, near Dolgelly, Merioneth; Snowdon, Carnarvonshire; Windermere, Westmoreland; Barcalaine, Argyll; Craig Calliach and Ben Lawers, Perthshire; Morrone, Braemar, Aberdeenshire; Cappamore, near Dunkerron, Kerry; Maam Turk Mt., Connemara, Galway.

81. *L. Bockii* Th. Fr. in Bot. Not. p. 105 (1867).—Thallus effuse, plane, cracked-areolate or of minute scattered warts, sometimes with sorediate spots, olive-brown or brownish-grey, on a thin black hypothallus (K(CaCl) + reddish). Apothecia small, immersed or sessile, the disc black, irregular in outline, the thalline margin entire; paraphyses slender, septate, the epithecium brown; spores broadly ellipsoid, 16–21 μ long, 8–11 μ thick; hymenial gelatine blue, the asci wine-red, with iodine.—Cromb. in Journ. Bot. xx. p. 274 (1882) & Monogr. i. p. 464. *Parmelia Bockii* Rodig ex Fr. Syst. Orb. Veg. i. p. 285 (1825).

Evidently a very rare lichen. The apothecia are minute, semi-immersed and often with a dot or fold on the disc. The British specimens are poorly developed; the asci have a very thick tip and the spores are smaller than the sizes given above (Th. Fr. Lich. Scand. p. 170); they measure frequently about 12 μ in length.

Crombie (l. c.) quotes as a synonym *Lecanora sopheropsis* Nyl. (Flora lix. p. 233 (1876) & op. cit. p. 204 (1879)), in the diagnosis of which the spore sizes are given as 17–25 μ long, 11–15 μ thick.

Hab. On a schistose wall in an upland district.—*B. M.* Near Staveley, Kendal, Westmoreland (the only British record).

82. *L. complanatoides* A. L. Sm.—Thallus rather thin, effuse, cracked-areolate, the areolæ small (about $\cdot 3$ mm. in diameter), smooth, sometimes subsquamulose, with a black hypothallus brownish-yellow or -cinereous (K —, CaCl —). Apothecia small, immersed then plane, the margin scarcely visible, the disc dark-brown; hypothecium colourless; paraphyses slender, coherent, flexuose, septate, the cells about 8 μ long, rarely branched below, clavate and often shortly branched above, the tips dark-brown, becoming green with potash: asci clavate up to 68 μ long, 10–12 μ wide, not thickened at the tips; spores 8 in the ascus, ellipsoid, 10–14 μ long, 4–6 μ thick; hymenial gelatine blue then tawny with iodine.

Exsicc. Leight. n. 205 (as *Parmelia cinerea* var. *atrocinerea*).

Nearly related to *L. complanata* Koerb., but differing in the more compact crustaceous-areolate thallus and in the almost non-marginate apothecia.

Hab. On siliceous rocks.—*B. M.* Lyth Hill, Shropshire.

83. *L. superiuscula* Nyl. in Flora lxii. p. 355 (1879).—Thallus of small plane or slightly convex squamulose areolæ, contiguous or scattered, rounded or crenulate, brown or light brownish-grey (K—, CaCl—). Apothecia minute, more or less immersed, blackish, the thalline margin thick and tumid; spores ellipsoid, 10–14 μ long, 5–8 μ thick; paraphyses subdiscrete, brownish at the apices.—Cromb. in Grevillea xiii. p. 112 (1880) & Monogr. i. p. 464.

Considered by Crombie as similar to, if not identical with, *L. complanata* Koerb., a lichen from the Tyrol, but the thalline margin of that species is thinner and crenulate. The spores are usually about 10 $\mu \times 6 \mu$, the larger size has not been verified.

Spermatogones are plentiful with arcuate spermatia 18–25 μ long, $\cdot 6 \mu$ thick.

Hab. On a mica-schist rock in an alpine situation.—*B. M.* Above Loch-na-Gat, Ben Lawers, Perthshire (the only record).

84. *L. morioides* A. L. Sm.—Thallus determinate, thin, composed of minute blackish- or reddish-grey areolæ on a black hypothallus (K—CaCl—). Apothecia minute, immersed, solitary in the areolæ, the disc black, the margin thin, scarcely prominent; paraphyses coherent, slender, septate, clavate at the dark coloured bluish-black tips; asci thickened at the tips; spores 7–9 μ long, 5 μ thick; hymenial gelatine blue then wine-red with iodine.—*Aspicilia morioides* Blomb. ex Arn. Lich. exsicc. n. 904 (1881); Arn. in Verh. Zool. Bot. Ges. Wien, xxxvi. p. 78 (1886); Hue in Nouv. Arch. Mus. Paris, sér. 5, ii. p. 78 (1910).

Our single specimen in the Hugh Davies herbarium differs slightly from the above as described by Hue, though too nearly alike to be separated. The tips of the paraphyses are dark-brown, and the spores—very rarely developed as Hue also points out—are larger and somewhat oblong, they measure 7 \times 3 μ or up to 12 \times 4 μ . The hymenial gelatine also remains persistently blue with iodine. It was labelled *Verrucaria maura* by Davies. The plant has been collected in Scandinavia, and in the Tyrol.

Hab. On siliceous rock.—*B. M.* N. Wales.

f. Thallus variously coloured, thin and mostly continuous.

85. *L. lævata* Nyl. in Flora lv. p. 364 (1872); op. cit. lxiv. p. 183 (1881).—Thallus determinate or effuse, thin, largely continuous, cracked in places, especially towards the centre, smooth, shining, grey- or brown-olivaceous; hypothallus black, often limiting the thallus (K—, CaCl—). Apothecia minute, immersed,

then becoming superficial, the disc concave, black, the thalline margin rather prominent, entire or subcrenulate; paraphyses slender, coherent, flexuose, septate, moniliform upwards, the epithecium dark-brown; spores ellipsoid, 15–24 μ long, 9–16 μ thick; hymenial gelatine bluish, then quickly wine-red with iodine.—Cromb. Monogr. i. p. 473. *Sagedia lævata* Ach. Lich. Univ. p. 327, t. 6, fig. 5 (1810).

Esicc. Johns. n. 273.

Evidently a rare lichen, though of wide distribution on the continent and N. America. According to Nylander (Lich. Fret. Behr. p. 30, 1888) the spermatia measure 20–32 μ long, 5 μ thick. I have been unable to find spermogones on our specimens.

Hab. On damp siliceous rocks in subalpine districts.—*Distr.* Rare in W. England and the Grampians, Scotland.—*B. M.* Wastdale Lake-side, Cumberland, Glen Callater, Braemar, Aberdeenshire.

86. *L. lacustris* Th. Fr. in K. Sv. Vet.-Akad. Handl. vii. 2, p. 24 (1867).—Thallus determinate or somewhat effuse, thin, firm, smooth, irregularly and finely cracked-areolate or continuous, pale-reddish or yellowish (K—CaCl—). Apothecia small, persistently immersed, the disc pale rose-coloured or brownish, the thalline margin tumid, often indistinct; paraphyses coherent, slender, flexuose, septate, slightly thicker and more closely septate at the tips, the epithecium brownish- or yellowish-granulose; spores ellipsoid, usually 13–18 μ long, 6–9 μ thick but sometimes larger; hymenial gelatine blue then quickly wine-red with iodine.—Leight. Lich. Fl. ed. 3, p. 195 (excl. f. *punctata*); Cromb. in Grevillea xix. p. 58 (1891) (excl. var. *cyrtaspis*?) & Monogr. i. p. 477. *L. gibbosa* subsp. *lacustris* Cromb. Lich. Brit. p. 55 (1870) (excl. var. *punctata*); f. *lacustris* Leight. Lich. Fl. p. 210 (1871) pro parte. *Lichen lacustris* With. Arr. ed. 3, iv. p. 21, t. 31, fig. 4 (1796). *L. Acharii* Westr. ex Ach. Lich. Suec. Prodr. p. 33 (1798); Engl. Bot. t. 1087. *Urceolaria Acharii* Ach. Meth. Lich. p. 150 (1803) (excl. var. *cyrtaspis*); S. F. Gray, Nat. Arr. i. p. 457; Hook. Fl. Scot. ii. p. 47 (incl. var. *cyrtaspis* pro parte) & in Engl. Bot. v. p. 172 (incl. var. *cyrtaspis* pro parte); Tayl. in Mackay Fl. Hib. ii. p. 132.

Esicc. Cromb. n. 71; Johns. n. 275.

The thallus is normally pale ochraceous or whitish, but may be rusty from infiltration of iron, as it grows on rocks subject to inundation. In some of our specimens the spores are larger than the sizes given above, measuring up to 24 μ \times 12 μ . There is considerable doubt as to the position of the variety *cyrtaspis*, the description of which in some cases agrees well with *L. lacustris*, and *Lichen punctatus*, cited as a synonym, is probably a form of *L. Prevostii*.

Hab. On rocks in streams in upland and subalpine districts.—*Distr.* Local though plentiful where it occurs throughout the British Isles.—*B. M.* Withiel, Cornwall; Tavy Cleave and Dartmoor, Devon; Lyndhurst Moor, New Forest, Hants; Nannau, Dolgelly and Bar-

mouth, Merioneth; Beddgelert, Trefriw Falls and Carnedd Dafydd, Carnarvonshire; Teesdale, Durham; Appin and Glencoe, Argyll; near the Trossachs, Glen Falloch and Ben Lawers, Perthshire; Glen Callater, Braemar, Aberdeenshire; Invermoriston, Invernesshire; Ballaghbeama Gap, Dunkerron, and Connor Cliffs, Dingle, Kerry; Ballynakill and Lough Inagh, Connemara, Galway; Clare Island, Mayo.

87. *L. Dicksonii* Nyl. ex Carroll in Journ. Bot. iv. p. 255 (1867).—Thallus thin, plane and smooth, finely cracked-areolate, rusty or yellowish-red, with a thin black hypothallus (K—, CaCl—). Apothecia small, innate, becoming superficial, the disc concave, black, with a prominent black rim, the thalline margin very indistinct as an outer reddish covering; hypothecium dark-brown; paraphyses coherent, slender, straight or flexuose, septate, the epithecium bluish or brownish-black; spores ellipsoid, 11–14 μ long, 6–8 μ thick; hymenial gelatine blue with iodine.—Cromb. Lich. Brit. p. 55 & Monogr. i. p. 476; Leight. Lich. Fl. p. 211; ed. 3, p. 196. *Lichen cæsius* Dicks. Pl. Crypt. fasc. ii. p. 19, t. 6, fig. 6 (1790)? (non Hoffm.). *L. Dicksonii* Ach. Lich. Suec. Prodr. p. 76 (1798); With. Arr. ed. 3, iv. p. 20. *L. Oederi* With. op. cit. p. 11 (1796) pro parte (non Web.); Sm. Engl. Bot. t. 1117. *Lecidea Oederi* Wahlenb. Fl. Lapp. p. 474 (1812); S. F. Gray Nat. Arr. i. p. 465; Hook. Fl. Scot. ii. p. 38 & in Sm. Engl. Fl. v. p. 178; Tayl. in Mackay Fl. Hib. ii. p. 122. *L. melanophæa* Fr. in Vet. Akad. Handl. 1822, p. 259; Mudd Man. p. 206.

Exsicc. Cromb. n. 72; Dicks. Hort. Sicc. fasc. ii. n. 24; Johns. n. 149; Leight. n. 127.

Of doubtful systematic position, with perhaps more affinity with *Lecidea* than with *Lecanora*. The apothecia take rise within the thallus and gradually emerge; they are numerous and sometimes confluent, so that the disc may appear to be lined or dotted. The rusty colour is fairly constant, but, as in some other lichens, is generally considered to be due to the infiltration of ferric hydrate, though, as has been pointed out by Wheldon and Wilson (Lich. Perth. p. 42), the species sometimes grows on white quartz where it exhibits the same bright colour. Specimens from Kerguelen Land with a grey thallus have been recorded by Crombie as *Lecidea sincerula* Nyl. (Linn. Soc. Journ. Bot. xv. p. 190 (1877)). The species has been confused with *Rhizocarpon Oederi*, but it differs in the prominent proper margin of the apothecium as well as in spore characters.

Hab. On rocks and walls chiefly schistose, in upland or mountainous regions.—*Distr.* Not uncommon in hilly districts of the British Isles.—*B.* M. Fingle Bridge, near Chagford, Devon; Bar-mouth, Dolgelly and Rhiwgreidden, Merioneth; Bettws-y-Coed, Denbighshire; Cwm Trefayn, Snowdon, Carnarvonshire; Anglesea; Wrekin Hill, Shropshire; Staveley, Kendal, Westmoreland; Lamplugh and Ennerdale, Cumberland; Ben Lawers and Craig Tulloch, Blair Athole, Perthshire; Glen Callater and Morrone, Braemar, Aberdeenshire; Applecross, Rossshire; Croghan (? Cloghane) and Mangerton, Killarney, Kerry.

Form *atrata* Cromb. Monogr. i. p. 477 (1894).—Thallus reduced to minute red portions here and there on the black hypothallus. Apothecia minute.—*Gyalecta atrata* Ach. in Vet. Akad. Handl. 1808, p. 229.

There are connecting links between the very reduced thallus of this form and that of the species.

Hab. On quartzose rocks in an alpine locality.—*B. M.* Morrone, Braemar, Aberdeenshire (the only British record).

88. *L. flavida* Hepp Flecht. Eur. n. 630 (1860).—Thallus effuse, very thin, almost furfuraceous or thinly felted, scarcely cracked, with a radiating dirty-whitish hypothallus, pale-ochraceous or light-greyish (K—, CaCl—). Apothecia very minute, immersed, the disc concave then plane, black, the thalline margin thin, entire; paraphyses coherent, slender, septate, submoniliform upwards, the epithecium of brown granules; spores ellipsoid, 12–18 μ long (or slightly longer), 7–11 μ thick; hymenial gelatine blue with iodine.—Leight. Lich. Fl. ed. 3, p. 195; Cromb. Monogr. i. p. 478. *L. gibbosa* f. *lacustris* Leight. Lich. Fl. p. 210 (1871) pro parte. *Aspicilia ochracea* Mudd Man. p. 163 (1861) (non Schær.).

Exsicc. Leight. n. 292; Mudd n. 136.

Hue (Nouv. Arch. Mus. Nat. Hist. Paris, sér. 5, ii. p. 105) describes the gonidia of this species as “chroolepid.” Some of them are yellow, but they have not the large size of the *Jonaspis* group.

Hab. On rocks and stones in moist situations in hilly districts.—*Distr.* Rare in N. England.—*B. M.* Cockshaw Bank and Ayton, Cleveland, Yorkshire.

89. *L. fulvo-mellea* A. L. Sm.—Thallus effuse, very thin, smooth, in smaller or larger patches, contiguous or scattered, yellowish or tawny-honey-coloured (K—, CaCl—). Apothecia numerous, impressed in the thallus, minute, the disc about .2 mm. wide, yellowish flesh-coloured, becoming slightly brown, the thalline margin thickish, entire and rather prominent, often circumscribed from the thallus; paraphyses conglutinate, slender, sometimes flexuose, septate, submoniliform, the epithecium colourless or of yellowish-brown granules; asci elongate-clavate, about 40–50 μ long, 12 μ thick, 8-spored; spores ellipsoid, colourless, small, 8–12 μ long, 4–5 μ thick; hymenial gelatine scarcely greenish-blue then wine-red with iodine.

The affinity of this lichen is with *L. Prevostii*, or possibly with *L. epulotica*, but the gonidia, though with a thickish somewhat corrugate outer wall, are small on the whole, varying in form and size up to 20 μ long and 12–14 μ thick. It was impossible to trace any filamentous structure.

Hab. On siliceous rocks.—*B. M.* Ashburton, Devon (Herb. H. B. Holl).

90. *L. Prevostii* Th. Fr. Lich. Scand. p. 288 (1871).—Thallus effuse, thin, continuous, generally tartareous, greyish or whitish or pale flesh-coloured (K —, CaCl —). Apothecia minute, deeply immersed, often irregular in outline, concave, the disc pale flesh-coloured, the proper margin connivent, surrounded by and distinct from the thalline margin; paraphyses coherent, slender, septate; spores ellipsoid, 14–22 μ long, 9–11 μ thick; hymenial gelatine blue then quickly wine-red with iodine.—Leight. Lich. Fl. ed. 3, p. 198; Cromb. Monogr. i. p. 478. *L. epulotica* var. *Prevostii* Nyl. Lich. Scand. p. 189 (1861); Cromb. Lich. Brit. p. 55; Leight. Lich. Fl. p. 212. *Gyalecta Prevostii* Fr. Lich. Eur. p. 197 (1831). *G. geolica* Leight. Angioc. Lich. p. 87, t. 15, fig. 1 (1851) (non Wahlenb.).

Easily overlooked owing to the rather neutral colour of the thallus and the inconspicuous apothecia, which are either immersed in pits or more rarely level with the surface.

Hab. On calcareous rocks in hilly or mountainous districts.—*Distr.* Rare in W. and N. England and the Grampians, Scotland.—*B. M.* Bathampton Downs, Somerset; Ease Gill, near Leek, Lancashire; Levens, Westmoreland; Craig Tulloch, Blair Athole, Perthshire; Craig Guie, Braemar, Aberdeenshire.

Form *melanocarpa* Stizenb. Lich. Helv. p. 129 (1882).—Apothecia becoming more prominent and darker, with the thalline margin obliterated.—Cromb. Monogr. i. p. 479. *L. gibbosa* subsp. *lacustris* var. *punctata* Cromb. Lich. Brit. p. 55 (1870)? *L. gibbosa* f. *punctata* Leight. Lich. Fl. p. 210 (1871)? ed. 3, p. 196? *Lichen punctatus* Sm. Engl. Bot. t. 450 (1798)? (Dicks.?) *Urceolaria Acharii* var. *cyrtaspis* Ach. Meth. Lich. p. 151 (1803); Hook. in Sm. Engl. Fl. v. p. 172 pro parte. *U. cyrtaspis* S. F. Gray Nat. Arr. i. p. 458 (1821)? *Aspicilia epulotica* var. *punctata* Mudd Man. p. 161 (1861). *Hymenelia Prevostii* var. *melanocarpa* Krempelh. Fl. Bayer. p. 167 (1861) nomen.

Scarcely distinguishable from the species. *Lichen punctatus*, figured and described in English Botany from a specimen collected at Ludlow, scarcely accords with this variety, and Sowerby's specimen in Hb. Brit. Mus. is from Teesdale, and hardly differs from the species (cf. *L. campestris*. p. 274). Specimens from Somerset (Bathampton Downs) seem to be wholly *Verrucaria integra* Carroll.

Hab. On calcareous rocks in hilly or mountainous districts.—*Distr.* Rare in N. England and the Grampians, Scotland.—*B. M.* Teesdale, Durham; Craig Tulloch, Blair Athole, Perthshire.

Var. *affinis* Nyl. ex. Stizenb. l. c.—Thallus thin, somewhat similar to that of the species or reddish-flesh-coloured. Apothecia minute, becoming more prominent, the thalline margin persistent; spores similar to those of the species or more broadly ellipsoid, 14–18 μ long, 9–13 μ thick.—Cromb. Monogr. i. p. 479.

Hymenelia affinis Massal. Geneac. Lich. p. 13 (1854) & Symm. Lich. p. 23 (1855).

Distinguished by the very minute emergent apothecia.

Hab. On calcareous and associated rocks in subalpine regions.—*Distr.* Rare in N. England and the Grampians, Scotland.—*B. M.* Teesdale, Durham; Craig Tulloch, Blair Athole, Perthshire; The Khoil, near Ballater, Braemar, Aberdeenshire.

B. Jonaspis. Algal cells *Trentepohlia*.

a. Thallus thin, light coloured, K—.

91. *L. epulotica* Nyl. ex Cromb. Lich. Brit. p. 55 (1870).—Thallus subeffuse, tartareous, thin, continuous or faintly cracked, whitish or pale-reddish (K—, CaCl—). Apothecia small, innate, becoming somewhat superficial and circumscribed from the thallus, pale flesh-coloured, the thalline margin thickish; paraphyses coherent, slender, multi-septate, almost moniliform; spores broadly ellipsoid, 18–20 μ long, 10–11 μ thick, hymenial gelatine bluish then wine-red with iodine.—Leight. Lich. Fl. p. 212 pro parte; ed. 3, p. 197; Cromb. Monogr. i. p. 479. *Gyalecta epulotica* Ach. Lich. Univ. p. 151, t. 1, fig. 7 (1810). *Aspicilia epulotica* Mudd Man. p. 161, t. 3, fig. 54 (1861).

Closely related to *L. Prevostii*, but differing in the gonidia, a species of *Trentepohlia*, the filaments of which are mostly broken up into separate cells of a greenish colour, but are easily recognized by their large size, about 30 μ long and 20 μ thick. The British Museum specimen of Johnson's exs. n. 150 does not belong here.

Hab. On calcareous and schistose rocks in upland and subalpine districts.—*Distr.* Rare in N. Wales, N. England and the Grampians, Scotland.—*B. M.* Near Beddgelert, Carnarvonshire; Mardale, Westmoreland; Teesdale, Durham; Craig Calliach and Craig Tulloch, Blair Athole, Perthshire; Morrone, Braemar, Aberdeenshire.

92. *L. chrysophana* Nyl. ex Stizenb. Lich. Helv. p. 129 (1882–3).—Thallus effuse, thin, smoothish or faintly cracked-areolate, dull or chestnut-reddish, becoming blackish-grey or -green when dry (K—, CaCl—). Apothecia minute, concave, blackish, the thalline margin thin, disappearing; paraphyses conglutinate, slender, septate, dark blue-green, moniliform and clavate upwards; spores ellipsoid, about 9–12 μ long, 5–7 μ thick; hymenial gelatine bluish then quickly wine-red with iodine.—Cromb. in Journ. Bot. xx. p. 274 (1882) and Monogr. i. p. 480. *Aspicilia chrysophana* Koerb. Syst. Lich. Germ. p. 159 (1855).

Like the previous species, distinguished by the very large gonidia of the *Trentepohlia* alga, measuring usually about 35 μ by 23 μ , but recorded as larger. The blue-green colour of the epithecium is not always present.

Hab. On siliceous rocks and stones in alpine situations.—*Distr.* Rare on the higher Grampians, Scotland.—*B. M.* Ben Lawers, Perthshire; Ben-naboord, Braemar, Aberdeenshire.

52. **ACAROSPORA** Massal. Ric. Lich. Crost. p. 27 (1852); Mudd Man. p. 158. (Pl. 52.)

Thallus mostly squamulose and thickish, areolate, corticate above or non-corticate, attached to the substratum by hyphæ. Algal cells *Protococcus*. Apothecia generally immersed then plane, discoid, the thalline margin prominent or indistinct; hypothecium colourless; paraphyses slender; spores many in the ascus, mostly very small, colourless, oblong or ellipsoid. Spermogones with acrogenous elongate or almost globose spermatia.

Distinguished by the plurispored asci. The species (*L. pruinosa*, *L. simplex*, etc.) classified under Sect. *Sarcogyne* Cromb. Monogr. i. p. 487, are without gonidia in the apothecia, and are described as species of the lecideine genus *Biatorella* (see Appendix).

1. **A. squamulosa** Th. Fr. Lich. Scand. p. 213 (1871).—Thallus squamulose, closely appressed, cracked-areolate, sometimes more continuous and the squamules rounded at the edge, tawny or dark reddish-brown, white beneath (K —, CaCl —). Apothecia small or moderate in size, sunk in the thallus then emergent, the disc plane, dark reddish-brown, the thalline margin entire; paraphyses discrete, septate, slightly clavate and reddish-brown at the tips; spores oblong-ellipsoid, 8–12 μ long, 4–5 μ thick; hymenial gelatine blue with iodine.—*A. cervina* var. *squamulosa* Mudd Man. p. 158 (1861)? *Lichen squamulosus* Schrad. Samml. Crypt. Gew. n. 153 & in Ust. Ann. Bot. xxii. p. 84 (1797). *L. cervinus* Pers. ex Ach. Meth. Lich. p. 181 (1803). *Lecanora squamulosa* Nyl. in Bull. Soc. Linn. Norm. sér. 2, vi. p. 280 (1872); Leight. Lich. Fl. p. 183 pro parte; ed. 3, p. 169 pro parte; Cromb. Monogr. i. p. 482. *L. cervina* Cromb. Lich. Brit. p. 56 (1870) pro parte.

Distinguished by the comparatively large spores and by the appressed cracked thallus.

Hab. On calcareous rocks in mountainous districts.—*Distr.* Rather rare in N. Wales, N.W. England and on the Grampians, Scotland.—*B. M.* Dolgelly, Merioneth; near Staveley, Kendal, Westmoreland; Craig Tulloch, Blair Athole, Perthshire; Craig Guie and Morrone, Braemar, Aberdeenshire.

Form *albomarginata* A. L. Sm.—Thalline squamules densely white-pulverulent at the margins, giving a mosaic effect. *Lecanora squamulosa* f. *albomarginata* Cromb. Monogr. i. p. 482 (1894).

Hab. On calcareous rocks in a subalpine district.—*B. M.* Craig Tulloch, Blair Athole, Perthshire (the only record).

2. **A. Benedarensis** Knowles in Sci. Proc. Roy. Dubl. Soc. p. 131 (1913).—Thallus globulose-squamulose, thick, the squamules discrete or sometimes confluent, 1–7 mm. wide, about .5 to 1 mm. thick, dark-brown, pale beneath (K —, CaCl —). Apothecia solitary or several in each squamule, at first completely immersed and remaining innate, concave, concolorous with the thallus,

reddish-brown when moist, the margin thick, entire, persistent; paraphyses slender, conglutinate, sparingly branched, yellow-brown at the apices; hypothecium sordid-grumous; ascus clavate, 80–100 μ long, 15–20 μ thick, myriospored; spores minute, 3–4.5 μ long, 1–2.5 μ thick; hymenial gelatine blue then wine-red with iodine. Spermatogones numerous, with spermatia 2.5 μ long, 1–1.5 μ thick.

Hab. On dry clayey soil on disintegrating fine shales in sheltered sunny situations.—*B. M.* Earlscliff, Howth coast, Dublin.

3. *A. glaucocarpa* Kærh. *Parerg. Lich.* p. 57 (1859).—Thallus of small thickish squamules, scattered or rarely subimbricate, sometimes raised and crenate, yellowish- or dull-brown, white beneath (K —, CaCl —). Apothecia moderate in size, the disc becoming plane, reddish-brown, sometimes bluish-grey-pruinose, the thalline margin thick, entire; paraphyses stoutish, coherent, septate, narrowly clavate and yellowish-brown at the tips; spores ellipsoid, 3–5 μ long, 1.5–2.5 μ thick; hymenial gelatine persistently blue with iodine.—*Lichen glaucocarpus* Wahlenb. in *K. Vet. Acad. Handl.* 1806, p. 143, t. 4, fig. 4. *Lecanora glaucocarpa* Ach. *op. cit.* 1810, p. 151; *Cromb. Lich. Brit.* p. 56 & *Monogr. i.* p. 481; *Leight. Lich. Fl.* p. 182; *ed. 3,* p. 168.

Characterized by the form of the squamules. In our specimens, asci and spores are sparingly present; the latter do not measure more than 3–4 μ in length.

Hab. On calcareous and schistose rocks in mountainous regions.—*Distr.* Rare in N. England and the Grampians, Scotland.—*B. M.* Craig-y-Rhiw, Oswestry, Shropshire; Teesdale, Durham; Ben Lawers and Craig Tulloch, Perthshire; Craig Guie, Braemar, Aberdeenshire.

Var. *depauperata* Jatta *Syll. Lich. Ital.* p. 232 (1900).—Thallus almost obsolete. Apothecia varying in size, scattered or crowded, naked or pruinose, the margin more or less prominent.—*A. cervina* var. *glaucocarpa* f. *depauperata* Kærh. *Syst. Lich. Germ.* p. 155 (1855). *Lecanora glaucocarpa* var. *depauperata* *Cromb. in Journ. Bot. xi.* p. 134 (1873) (incl. f. *conferta*) & *Monogr. i.* p. 481 (incl. ff. *pruinifera*, *denudata* *Cromb. in Grevillea xix.* p. 58 (1891)).

Minute portions of the thallus are occasionally visible round the apothecia, which, as in the species, may be pruinose or naked (ff. *pruinifera* and *denudata*). It is closely related, if not identical, with var. *conspersa* Th. Fr. *Lich. Arct.* p. 88 (1860), but the descriptions do not entirely agree.

Hab. On calcareous and schistose rocks in mountainous regions.—*Distr.* Sparingly in N. England and the Grampians, Scotland.—*B. M.* Near Dent, Yorkshire; Craig Tulloch, Blair Athole, Perthshire; Craig Guie and Morrone, Braemar, Aberdeenshire.

4. *A. Lesdainii* Harm. in litt.—Thallus thickish, with an amorphous cortex, areolate-squamulose, or the squamules distinct,

aggregate, irregularly roundish or angular, flat or tumid, pale fawn-coloured above and below (K + yellow then red). Apothecia one or more immersed in the squamules, small or moderate in size, the disc reddish, becoming darker, the thalline margin not prominent; paraphyses rather slender, flexuose, dotted with minute guttulæ, not widening upward, agglutinate and colourless or brownish at the tips; asci large, broadly oblong or ellipsoid, 90–150 μ long, 24–38 μ wide; spores innumerable, cylindrical, minutely guttulate at each end, 2–4 μ long, 1 μ thick; hymenial gelatine blue then wine-red, the hypothecium more persistently blue, with iodine.

Evidently near to *A. glaucocarpa*, but differing in certain characters of thallus and apothecia. There is considerable variation in thalline form; the specimen from Cumberland is flat and cracked, in the others the squamules are alike tumid and generally roundish. The reaction with potash in one of the Yorkshire specimens is not very distinct and the paraphyses are slightly clavate or irregular and sometimes branched, septate, or capitate. This may be only a growth form, as the other characters are similar. The specimen was collected by Mr. Hebden and named by Harmand in honour of his friend Dr. Bouly de Lesdain, of Dunkirk. Owing to the war, Hebden has been unable to secure Harmand's own description.

Hab. On rocks in upland districts.—*Distr.* Somewhat rare in N. and N.W. England.—*B. M.* Near Keighley, Yorkshire; Buttermere, Cumberland.

5. *A. percænoides* Jatta Syll. Lich. Ital. p. 231 (1900).—Thallus thickish, warted-squamulose, the squamules rather small, convex, scattered or imbricate, chestnut-brown, whitish-pruinose, white beneath (K —, CaCl —). Apothecia minute, innate in the areolæ, reddish- or dark-brown; paraphyses stoutish, very slightly clavate, brown and septate at the tips; spores ellipsoid, 3–6 μ long, 1.5–2 μ thick.—*A. cervina* var. *percæna* Mudd Man. p. 159 (1861)? *Lecidea percæna* Ach. Syn. Lich. p. 29 (1814)? *Lecanora castanea* f. *percænoides* Nyl. in Bull. Soc. Bot. x. p. 263 (1863). *L. percænoides* Nyl. ex Wedd. op. cit. xvi. p. 202 (1869); Cromb. in Grevillea xix. p. 58 (1891) & Monogr. i. p. 482.

The squamules in the British specimens are white bordered; the apothecia are badly developed. Mudd's specimen of *A. cervina* var. *percæna* has been determined by Crombie as identical with this species. It is impossible to be sure as the squamules are sterile.

Hab. On calcareous rocks in upland situations.—*Distr.* Rare in S.W. and N.E. England.—*B. M.* Near Yatton, Somerset; Teesdale, Durham.

6. *A. fuscata* Th. Fr. Lich. Scand. p. 215 (1871) pro parte.—Thallus areolate-squamulose, the squamules crowded, angular and irregularly crenate-lobate, dull- or tawny-brown, blackish beneath (K(CaCl) + reddish). Apothecia minute, immersed, becoming partly superficial, the disc reddish- or dark-brown, the thalline

margin thin, flexuose; paraphyses stoutish, subdiscrete, irregularly septate and slightly larger at the tips; spores cylindrical, minute, 3-4 μ long, 1-1.5 μ thick; hymenial gelatine blue then wine-red (more especially the asci) with iodine.—*A. cervina* Massal. Ric. Lich. Crost. p. 28 (1852); Mudd Man. p. 158 pro parte. *Lichen fuscatus* Schrad. Spicil. Fl. Germ. p. 83 (1794). *L. squamulosus* Sm. Engl. Bot. t. 2011 (male) (1809) (non Schrad.). *Psoroma cervina* S. F. Gray Nat. Arr. i. p. 444 (1821) pro parte. *Lecanora squamulosa* Hook. Fl. Scot. ii. p. 50 (1821) & in Sm. Engl. Fl. v. p. 187 pro parte (non Schrad.). *L. cervina* Cromb. Lich. Brit. p. 56 (1870) pro parte. *L. fuscata* Cromb. l. c. pro parte & Monogr. i. p. 483; Leight. Lich. Fl. p. 186 pro parte; ed. 3, p. 171 pro parte.

Esicc. Johns. n. 276; Leight. n. 24; Mudd n. 131.

Differs from *A. squamulosa* in the smaller spores, and also in the form of the squamules, which are often rather thin. The plant is often sterile.

Hab. On rocks, boulders and walls from maritime to upland situations.—*Distr.* Fairly common throughout Great Britain, rarer in Ireland.—*B. M.* La Moye, Jersey; Alderney; Guernsey; near Penzance, Cornwall; Morwell Rocks, Devon; Pulborough and near Hastings, Sussex; Gorleston, Suffolk; Ankerdine Hill, Worcestershire; Charnwood Forest, Leicestershire; Buckstone, near Monmouth, and Crossfaen, Monmouthshire; Barmouth, Dolgelly and Aberdovey, Merioneth; Llyn Geironydd, Carnarvonshire; Oswestry and Haughmond Hill, Shropshire; Ayton and Guisboro' Moors, Cleveland, Yorkshire; Egglestone, Durham; near Hexham, Northumberland; Staveley, Kendal, Westmoreland; King's Park, Stirling; Ballachulish, Argyll; Craig Calliach, Perthshire; Portlethen, Kincardineshire; The Stocket near Aberdeen; Applecross, Rossshire; Dunkerron, Kerry.

7. *A. peliscyphoides* Oliv. Lich. Eur. fasc. ii. p. 76 (1909).—Thallus of crowded somewhat crenate squamules, cracked into areolæ, pale tawny- or reddish-brown (K(CaCl) + reddish). Apothecia becoming plane and rather large, the disc dark reddish-brown and granular-papillate, the thalline margin disappearing; paraphyses coherent, flexuose, irregular, many-septate at the tips; spores numerous, oblong-cylindrical, 3-6 μ long, 1-1.5 μ thick; hymenial gelatine blue then wine-red with iodine.—*Lecanora fuscata* var. *peliscyphoides* Nyl. in Flora lv. p. 364 (1872); Cromb. Monogr. i. p. 484. *L. peliscypha* Cromb. in Journ. Bot. xi. p. 134 (1873) (non Nyl.); Leight. Lich. Fl. ed. 3, p. 172 (according to the locality).

Differs from *A. peliscypha* in the chemical reaction similar to that of *A. fuscata*, and in the larger apothecia.

Hab. On walls in a maritime district.—*B. M.* Near Portlethen, Kincardineshire (the only British record).

8. *A. smaragdula* Massal. Ric. Lich. Crost. p. 29 (1852) (errore *smeragdula*).—Thallus cartilaginous, cracked-areolate, or

of squamules somewhat scattered and rounded, varying in colour from yellowish- to reddish- or dark greenish-brown, dark beneath (K—CaCl—). Apothecia small, immersed and concave, then somewhat plane, solitary or several in each squamule; the disc dark-brown; paraphyses rather stout, variously septate, scarcely wider at the tips, the epithecium brown; spores minutely ellipsoid, about 3–4 μ long, 1 μ thick; hymenial gelatine blue then reddish-brown with iodine.—*A. cervina* vars. *rufescens smaragdula*, *privigna* (non Ach.) Mudd Man. pp. 159, 160 (1861). *Endocarpon smaragdulum* Wahlenb. ex Ach. Meth. Lich. Suppl. p. 29 (1803); Hook. Fl. Scot. ii. p. 44 & in Sm. Engl. Fl. v. p. 158; S. F. Gray Nat. Arr. i. p. 499; Leight. Angioc. Lich. p. 16, t. 4, fig. 3 (incl. var. *rufovirescens* t. 4, fig. 4 & var. *rufescens*). *E. rufovirescens* Tayl. in Mackay Fl. Hib. ii. p. 100 (1836). *Lichen smaragdulus* Sm. Engl. Bot. t. 1512 (1805). *Urceolaria rufescens* Turn. ex Ach. Lich. Univ. p. 329 (1810); Hook. in Sm. Engl. Fl. v. p. 173; Borr. in Engl. Bot. Suppl. n. 2657 (*Lecidea rufescens* in text). *Lecanora rufescens* Nyl. in Flora iv. p. 364 (1872): Cromb. Monogr. i. p. 484. *L. smaragdula* Nyl. l. c.; Cromb. tom. cit. p. 486. *L. fuscata* var. *smaragdula* Cromb. Lich. Brit. p. 56. *L. squamulosa* f. *smaragdula* Leight. Lich. Fl. p. 184; ed. 3, p. 169.

Exsicc. Leight. n. 271; Mudd n. 132.

Resembles *A. fuscata* in the dark undersurface, but differs in the more even thallus and in the absence of thalline reaction. Sometimes the apothecia become papillate. *L. rufescens* and *L. smaragdula* differ only in the scattered squamules of the latter.

Hab. On rocks and walls in maritime and upland districts.—*Distr.* Not common in maritime and hilly regions of the British Isles.—*B. M.* Island of Guernsey; Redruth, Cornwall; Wickwar, Gloucestershire; Beeleigh and Langford, Essex; Cader Idris, Dolly, and near Barnmouth, Merioneth; Gorleston, Suffolk; Howden Gill, Kildale Moor and near Ayton, Cleveland, Yorkshire; Teesdale, Durham; near Hexham, Northumberland; near Kendal, Westmoreland; Barcaldine and Appin, Argyll; King's Park, Stirling; Ben Lawers, Perthshire; Bay of Nigg, Kincardineshire; Derriquin, Sybil Head and Dunkerron, Kerry; Kylemore, Connemara, Galway; Clare Island, Slieve More Mt., Achill Island and Achill Sound, Mayo.

Var. *sinopica* Massal. l. c.—Thallus squamulose-areolate or the small rounded squamules somewhat scattered, rusty-red. Apothecia minute, the disc dark-brown.—*A. cervina* var. *sinopica* Mudd Man. p. 160 (1861). *Endocarpon sinopicum* Wahlenb. ex Ach. Meth. Lich. Suppl. p. 30 (1803); S. F. Gray Nat. Arr. i. p. 499; Hook. in Sm. Engl. Fl. v. p. 159. *E. smaragdulum* var. *sinopicum* Leight. Angioc. Lich. p. 16, t. 5, fig. 1 (1851). *Lichen sinopicus* Sm. Engl. Bot. t. 1776 (upper fig.) (1807). *Lecanora fuscata* var. *sinopica* Cromb. Lich. Brit. p. 56 (1870). *L. squamulosa* f. *sinopica* Leight. Lich. Fl. p. 184 (1871); ed. 3,

p. 170. *L. smaragdula* f. *sinopica* Nyl. ex Nörrlin in Not. Sällsk. Faun. & Fl. Fenn. xiii. p. 332 (1874); Cromb. Monogr. i. p. 486. *Exsicc.* Leight. n. 285.

Differs in the colour, which is due to the infiltration of ferric oxide. The thalline squamules are generally contiguous.

Hab. On rocks and boulders, chiefly schistose, in mountainous regions.—*Distr.* N. Wales and the Grampians, Scotland.—*B. M.* Dolgelly, Merioneth; Aber and Beddgelert, Carnarvonshire; Anglesea; Achosragan Hill, Appin, Argyll; Killin, Ben Lawers and Ben Vrackie, Perthshire; Glen Cluny, Braemar, Aberdeenshire; Glen Nevis, Invernessshire.

9. *A. peliocypha* Th. Fr. Lich. Arct. p. 89 (1860).—Thallus thickish, cracked-areolate, of crowded somewhat crenate squamules, tawny-brown, somewhat shining, blackish beneath (K(CaCl)—). Apothecia rather small, immersed then plane, reddish-brown, the disc granular-papillate, the thalline margin persistent, crenulate and flexuose; paraphyses stoutish, irregular, variously septate and clavate or ovoid at the tips; spores numerous, oblong-cylindrical, 3–5 μ long, 1–1.5 μ thick; hymenial gelatine bluish then quickly wine-red with iodine.—*Parmelia peliocypha* Wahlenb. ex Ach. Meth. Lich. Suppl. p. 40 (1803). *Lecanora peliocypha* Nyl. in Not. Sällsk. Faun. & Fl. Fenn. Förh. n. ser. v. p. 182 (1866); Cromb. in Grevillea xix. p. 58 (1891) & Monogr. i. p. 483.

Distinguished by the contrast in colour between thallus and apothecia and by the granular-papillate discs of the latter.

Hab. On granitic rocks in alpine situations; recorded by Crombie from Braeriach, Braemar, Aberdeenshire.

10. *A. rhagadiza* Oliv. Lich. Eur. fasc. ii. p. 80 (1909).—Thallus spreading, unequal, variously and deeply cracked, dark olive-greyish, dark beneath (K—CaCl—). Apothecia small, innate, concave or plane, reddish-flesh-coloured; paraphyses slender; spores oblong, narrow, about 3.5 μ long, 1 μ thick; hymenial gelatine tawny-wine-coloured with iodine.—*Lecanora rhagadiza* Nyl. in Flora lxiv. p. 178 (1881); Cromb. in Grevillea x. p. 23 (1881) & Monogr. i. p. 485.

Considered by Nylander as nearly related to "*Lecanora rufescens*." It differs in the colour of the thallus and of the apothecial disc, which may possibly be the effect of the damp habitat.

Hab. On moist sandstone rocks in a maritime locality.—*B. M.* Whitehaven, Cumberland (the only record).

11. *A. discreta* Th. Fries Lich. Scand. p. 217 (1871).—Thallus effuse, warted- or angular-areolate, the areolæ contiguous or discrete, dark-brown, dark beneath (K—CaCl—). Apothecia minute, impressed, somewhat angular, dark-brown, the thalline margin obtuse or indistinct; paraphyses stoutish or slender, somewhat clavate and generally reddish-brown at the extreme

tips; spores oblong, 3-4 μ long, 1 μ thick; hymenial gelatine blue then wine-red with iodine.—*Parmelia squamulosa* var. *discreta* Ach. Meth. Lich. Suppl. p. 41 (1803). *Parmelia discreta* Fr. Summ. Veg. Scand. p. 106 (1866). *Lecanora admissa* Nyl. in Flora l. p. 370 (1867); Cromb. Lich. Brit. p. 57 & Monogr. i. p. 485; Leight. Lich. Fl. p. 185. *L. discreta* Nyl. in Flora lv. p. 364 (1872); Leight. Lich. Fl. ed. 3, p. 171; Cromb. Monogr. i. p. 485.

Exsicc. Johns. n. 151.

Distinguished by the dark, angularly areolate thallus. A species collected by Harriman at Teesdale, with scattered areolæ, belongs to *A. smaragdula*.

Hab. On exposed siliceous rocks in upland or mountainous regions.—*Dist.* Rare in N. Wales, N. England and the Grampians, Scotland.—*B. M.* Y Fegle Fawr, near Barmouth, Merioneth; Bywell, Northumberland; summit of Ben Lawers, Perthshire; summit of the Khoil, near Ballater, Aberdeenshire.

12. *A. Heppii* Koerb. Parerg. p. 61 (1859).—Thallus effuse, very thin, continuous or partly obsolete, dirty-yellowish (K—CaCl—). Apothecia small, the disc dark reddish-brown, the margin prominent, entire; paraphyses coherent, slender, sometimes branched, septate, scarcely widened upwards, the epithecium dark-brown; spores oblong-ellipsoid, 4-4.5 μ long, 1-2 μ thick; hymenial gelatine blue with iodine.—*A. cervina* var. *Heppii* Mudd Man. p. 160 (1861). *Myriospora Heppii* Naeg. ex Hepp Flecht. Eur. n. 57 (1853). *Lecanora Heppii* Nyl. in Not. Sällsk. Faun. & Fl. Fenn. Förh. n.s. v. p. 182 (1866); Cromb. Lich. Brit. p. 57 & Monogr. i. p. 487; Knowles in Soc. Proc. Roy. Dubl. Soc. xiv. p. 131 (1913). *L. squamulosa* f. *privigna* Leight. Lich. Fl. p. 185 (1871) pro parte; f. *Heppii* op. cit. ed. 3, p. 170 (1879).

Exsicc. Leight. n. 196.

An inconspicuous plant, with the thallus often scarcely visible. The apothecia are numerous. The spores in the specimens examined (Hepp exs. n. 57 and others) are smaller than the sizes quoted from Th. Fries; they measure about 2.5-3 μ long, 1 μ thick.

Hab. On siliceous and calcareous rocks in maritime and inland districts.—*Distr.* Rare in S. and N. England, Wales and E. Ireland.—*B. M.* Lyndhurst, New Forest, Hants; South Downs and Hastings, Sussex; Bexley Hill, Kent; Great Ayton and Easby, Cleveland, Yorkshire; Llandrindod, Radnorshire.

53. **LECANIA** Massal. Alc. Gen. p. 12 (1853); Mem. Lich. p. 120 (1853); Mudd Man. p. 140 (1861) pro parte. (Pl. 53.)

Thallus squamulose, imbricate or lobed at the circumference and corticate above, or variously crustaceous. Algal cells *Protococcus*. Apothecia reddish-brown or blackish, marginate when young, the margin often disappearing; spores generally 8

in the ascus (4-16 in *L. syringea*), colourless, more or less elongate and rather narrow, 1-3-septate. Spermogones with pleurogenous or acrogenous arcuate or straight spermatia.

Lecania, as here understood, includes not only *Lecania* but *Placolecania* A. Zahlbr., which has a more distinctly squamulose-effigurate thallus and pleurogenous spermatia. The apothecia in several of the species lose the thalline margin at an early stage, and look like *Biatorina*.

Thallus more or less squamulose..... § i. PLACOLECANIA.

Thallus variously crustaceous..... § ii. EULECANIA.

§ i. PLACOLECANIA Stein. in S. B. Akad. Wiss. Wien. Math.-Nat. Cl. cvii. Abth. i. p. 106 (1898).—Thallus squamulose, the squamules effigurate at the circumference, imbricate, or becoming granular.

1. *L. candidans* A. Zahlbr. in Oesterr. Bot. Zeitschr. lv. p. 61 (1905).—Thallus orbicular, adnate, squamulose, continuous or lobed or cracked-areolate in the centre, plicate-lobate at the circumference, glaucous- or greyish-white, often pruinose (K—). Apothecia rather small, about 1 mm. across, the disc brownish-black, more or less pruinose, the thalline margin entire, persistent; paraphyses slender, wider and brown at the tips; spores fusiform-ellipsoid, 1-septate, 7-14 μ long, 4-7 μ thick.—*Lichen candidans* Dicks. Pl. Crypt. fasc. iii. p. 15, t. 9, fig. 5 (1793); With. Arr. ed. 3, iv. p. 17; Engl. Bot. t. 1778. *L. epigea* Ach. Lich. Suec. Prodr. p. 105 (1798) (non Pers.). *Lecanora epigea* Ach. Lich. Univ. p. 422 (1810); Hook. Fl. Scot. ii. p. 50. *L. candidans* Schær. Enum. p. 59 (1850); Cromb. in Grevillea xviii. p. 46 & Monogr. i. p. 390. *Placodium epigeum* S. F. Gray Nat. Arr. i. p. 446 (1821) (non Pers.). *Pl. candidans* Dub. Bot. Gall. p. 661 (1830); Mudd Man. p. 133; Cromb. Lich. Brit. p. 46; Leight. Lich. Fl. p. 178; ed. 3, p. 164. *Squamaria candidans* Hook. in Sm. Engl. Fl. v. p. 195 (1833) pro parte.

Exsicc. Johns. n. 411; Leight. n. 218.

Placed recently in the genus *Placolecania* by Zahlbruckner because of the squamulose thallus; it is a very well-marked lichen which could only be confused with *Buellia canescens*, from which, however, it can be distinguished by the marginate apothecia and by the absence of reaction with potash. The apothecia are generally abundant, but the spores are rarely formed or are very imperfect.

Hab. On calcareous or cretaceous rocks in maritime and inland districts. — *Distr.* Here and there in England; rare in N. Wales and W. Scotland, not seen from Ireland.—*B. M.* Portland Island and Swanage, Dorset; near Beachy Head, Sussex; Weston-super-Mare, Cleve Hill and Bathampton Downs, Somerset; Malvern, Worcestershire; Buxton and near Cromford, Derbyshire; Llanymynech Hill, Shropshire; Great Orme's Head, Carnarvonshire; Anglesea; Teesdale and Egglestone, Durham; Arnbarrow and Helsington, Westmoreland; near Shean Ferry, Argyll.

Var. *Cesatii* A. L. Sm.—Thallus densely white-pruinose, of more crowded growth, with the outer lobes narrower. Apothecia pruinose, with a thick margin.—*Ricasolia Cesatii* Massal. Mem. Lich. p. 47, t. 8, fig. 46 (1853). *Placodium Cesatii* Leight. Lich. Fl. ed. 3, p. 164 (1879). *Lecanora candicans* var. *Cesatii* Nyl. ex Cromb. in Grevillea xviii. p. 46 (1889) & Monogr. i. p. 390.

Hab. Similar to the species.—*B. M.* Sherbourne, Gloucestershire (the only British locality).

2. *L. holophæa* A. L. Sm.—Thallus squamulose, subcontiguous or imbricate, dull- or chestnut-brown, the squamules thickish, rounded and crenate (K—, CaCl—). Apothecia small, adnate, plane, with an entire margin, becoming convex and immarginate, the disc dark-brown; paraphyses very slender, septate, with a brown subglobose or truncate head; spores oblong-fusiform, 12–18 μ long, 4–5 μ thick.—*Parmelia holophæa* Mont. in Webb & Berth. Hist. Nat. Canar. iii. 3, p. 113 (1840). *Lecidea sublurida* Nyl. in Mém. Soc. Sci. Nat. Cherb. v. p. 337 (1857) (nomen nudum). *Thalloidima sublurida* Mudd Man. p. 172 (1861). *Lecanora holophæa* Nyl. in Bull. Soc. Bot. Fr. viii. p. 755 (1861); Carroll in Journ. Bot. iv. p. 23 (1866); Cromb. Lich. Brit. p. 48 & Monogr. i. p. 392; Leight. Lich. Fl. p. 227; ed. 3, p. 217.

Exsicc. Leight. n. 380.

The thallus recalls that of *Lecidea lurida*, but it is easily distinguished by the apothecia. It is an Atlantic species that grows from the Canaries as far north as the British Islands. Carroll says it is not rare in crevices of rocks all round the Irish coasts. The spores in the British specimens, as far as observed, are about 14 μ long and 4 μ thick. The spermatogones have short septate sterigmata and straight short spermatia.

Hab. On the ground in crevices of rocks and walls in maritime, very rarely in inland, districts.—*Distr.* The Channel Islands, S. and W. England and S. and N.E. Ireland.—*B. M.* Moulin Huet Bay, Guernsey; Saltash and near Penzance, Cornwall; Bradstone and near Prawle Point, Devon; Pulborough, Sussex; near Bridgenorth, Shropshire; Sybil Head, Kerry; Coast of Clare; Kylemore, Conne-mara, Galway; Ardglass, Down.

Var. *glauco-sporea* A. L. Sm.—Thallus paler, of smaller squamules, becoming whitish-leprose. Apothecia with subentire persistent margin, otherwise as in the species.—*Lecanora holophæa* var. *glauco-sporea* Nyl. in Flora li. p. 164 (1868); Cromb. Lich. Brit. p. 48 & Monogr. i. p. 392; Leight. Lich. Fl. p. 227; ed. 3, p. 218.

Exsicc. Lerb. Lich. Cæsar. n. 79.

Differs very considerably in the aspect of the thallus which often becomes granular or leprose, obscuring the squamules.

Hab. On rocks in maritime districts.—*Distr.* Sparingly in the Channel Islands and S.W. England.—*B. M.* Grosnez Common, Jersey; Saint's Bay, Guernsey; Alderney; near Endellion, Cornwall.

3. *L. leucospirea* A. L. Sm.—Thallus of minute subcrenate scattered or massed squamules, adnate, often somewhat granular, white (K—, CaCl—). Apothecia minute, plane, the disc brown, the thalline margin entire; paraphyses slender, yellowish-brown at the apices; spores oblong or ovoid-oblong, 1-septate, 11–13 μ long, about 3.5 μ thick.—*Lecanora leucospirea* Nyl. in Flora li. p. 473 (1868); Cromb. Lich. Brit. p. 48 & Monogr. i. p. 393; Leight. Lich. Fl. p. 227; ed. 3, p. 218.

Hab. On gravelly soil in maritime districts.—*Distr.* Rare in the Channel Islands and E. Ireland.—*B. M.* Boulay Bay, Jersey; Howth, Dublin.

§ ii. *EULECANIA* Stizenb. in St. Gall. Ber. Nat. Ges. iii. p. 170 (1862).—Thallus crustaceous. Apothecia frequently becoming immarginate.

Spores mostly 1-septate.

Thallus determinate or subdeterminate.

4. *L. Ralfsii* A. L. Sm.—Thallus subdeterminate, cartilaginous-areolate or gibbous, smooth, leaden-grey or dark olive-green (K—, CaCl—). Apothecia small, rather prominent, the disc plane, brownish or dark reddish-brown, the margin thin, disappearing; paraphyses subdiscrete, slender, septate, broader and brown at the apices; spores large, oblong-ellipsoid, sometimes slightly constricted at the septum, 18–23 μ long, 6–9 μ thick; hymenial gelatine blue then violet coloured with iodine.—*Lecidea Ralfsii* Salw. in Ann. Penz. Nat. Hist. Soc. ii. p. 145 (1853). *L. Muddii* Salw. ex Mudd Man. p. 179 (1861); Cromb. Lich. Brit. p. 74 (1870); Leight. Lich. Fl. p. 315. *Biatorina Muddii* Mudd Man. p. 78 (1861). *Lecanora Ralfsii* Cromb. in Grevillea ii. p. 13 (1873) & Monogr. i. p. 393; Leight. Lich. Fl. ed. 3, p. 220 (excl. syn. *L. actæa*).

Exsicc. Johns. n. 132; Larb. Lich. Hb. n. 134.

Characterized by the dark-green thallus and large spores; it is frequently associated with *L. prosechoides*. *Biatorina jejuna* A. L. Sm. Monogr. ii. p. 114, with the synonyms *Lecanora jejuna* and *Lecidea subdiluta* are perhaps identical with this lichen as stated by Crombie (l. c.), but differ in the thinner thallus and light-coloured biatorine apothecia.

Hab. On siliceous maritime rocks.—*Distr.* Rather rare round the British coasts.—*B. M.* Jersey; St. Mary's, Scilly; the Lizard and near Penzance, Cornwall; Barrowmouth, Cumberland; Barcaldine, Argyll; Bay of Nigg, Kincairdineshire; Killery Bay, Connemara, Galway.

5. *L. actæa* B. de Lesd. Lich. Dunk. p. 178 (1910).—Thallus determinate, rather thick or thin, unequal, deeply cracked, greyish-leadene coloured, bluish and thinly white fimbriate at the circumference (K—, CaCl—). Apothecia small, somewhat

prominent, blackish, becoming convex; paraphyses thickish, septate, more or less coherent; epithecium dark-bluish; spores ellipsoid or subfusiform, 12–14 μ long, 4–5 μ thick; hymenial gelatine blue, the asci at length violet, with iodine.—*Lecanora actæa* Nyl. in Flora lvi. p. 290 (1873); Cromb. in Grevillea ii. p. 89 (1873) & Monogr. i. p. 447; Knowles in Sci. Proc. Roy. Dubl. Soc. xiv. p. 130 (1913).

The specimens in the herbarium are too scanty to allow reexamination. Bouly de Lesdain describes a var. *violacea* (l. c.) with violet fimbriate hypothallus, smoky-brown epithecium, capitate paraphyses, spores 9–15 μ long, 5–6 μ thick, and shorter spermatia, 12–16 μ long, those of the species being 16–20 μ long. De Lesdain considers that spermatia may vary considerably within the species, and he also suggests that *L. actæa*, though seeming so different, may be a growth form of *L. crysibe*.

Hab. On rocks in maritime districts.—*Distr.* Rare in the Channel Islands and E. Ireland.—*B. M.* Boulay Bay, Jersey.

6. *L. spodophæiza* A. L. Sm.—Thallus in small determinate patches, areolate-warted, brownish, thinly white fimbriate at the circumference (K—, CaCl—). Apothecia minute, the disc dark-red, the margin stout, subentire; paraphyses rather stout, subcoherent, septate, irregular and generally brown at the tips; spores oblong- or fusiform-ellipsoid, sometimes slightly curved, becoming distinctly septate, 10–18 μ long, 4–6 μ thick.—*Lecanora spodophæiza* Nyl. in Flora lvi. p. 290 (1873); Cromb. in Grevillea ii. p. 89 (1873) & Monogr. i. p. 447; Leight. Lich. Fl. ed. 3, p. 220; Knowles l. c.

Differs from *L. crysibe* in the determinate thallus and in the apothecia, but very closely related to some forms of that species. The spermatia are 18–25 μ long, 5 μ thick.

Hab. On rocks in maritime districts.—*Distr.* Rare in the Channel Islands and E. Ireland.—*B. M.* Mont Orgueil, Jersey.

7. *L. aipospila* Th. Fr. Lich. Scand. p. 293 (1871).—Thallus suborbicular or spreading irregularly, composed in the centre of crowded angular or tuberculose papillæ, which are scattered and are smaller or flattened out towards the edge, greyish- or very dark-brown (K—), a dark hypothallus sometimes limiting the thallus. Apothecia small, innate in the papillæ, dark-brown or blackish, plane, becoming convex and immarginate; paraphyses widening upwards, thickly-septate, brown at the tips; spores ellipsoid, 9–14 μ long, 4–6 μ thick (or rather larger up to 16 μ \times 6 μ); hymenial gelatine bluish then dark-violet with iodine.—*L. crysibe* var. *aipospila* Mudd Man. p. 141 (1864). *Parmelia aipospila* Wahlenb. ex Ach. Meth. Suppl. p. 36 (1802?). *Lecanora aipospila* Ach. Lich. Univ. p. 385 (1810); Engl. Bot. Suppl. t. 2662, fig. 2; Hook. in Sm. Engl. Fl. v. p. 187; Cromb. Lich. Brit.

p. 49 & Monogr. i. p. 407; Leight. Lich. Fl. p. 228; ed. 3, p. 219.

Essicc. Cromb. n. 159.

A well-marked plant, closely allied to, if not identical with, *L. Rabenhorstii* (Hepp) A. Zahlbr. It differs from *L. erysibe* in the rugged thallus and in the position of the apothecia at the tips of the papillæ. Some of the specimens are almost black, due, according to Crombie, to a drier habitat. Spermogones occur near the edge of the thallus, with arcuate spermatia 16–23 μ long, 1 μ thick.

Hab. On granitic and schistose rocks in maritime districts.—*Distr.* Plentiful in the Channel Islands, S.W. and N.E. England, N.E. Scotland and S.W. Ireland.—*B. M.* Le Fret, Jersey; Jerbourg, Guernsey; Tolpedn, Penwith, near Penzance, Land's End, and near the Lizard, Cornwall; Holy Island and Staples Island, Northumberland; Portlethen and Cove, Kincardineshire; near Peterhead, Aberdeenshire; Glandore, Cork; Shirky Island, Kerry.

Var. maritima A. L. Sm.—Thallus granular, the granules more flattened than in the species, subrenate at the circumference, greyish, sometimes dark-coloured. Apothecia on the granules, becoming immarginate.—*Lecanora maritima* Sommerf. in Vet. Acad. Handl. 1823, p. 116. *L. aipospila* var. *maritima* Nyl. Lich. Scand. p. 158 (1861); Cromb. Lich. Brit. & Monogr. i. p. 408; f. *maritima* Leight. Lich. Fl. p. 229 (1871); ed. 3, p. 219.

Hab. On granitic and schistose rocks in maritime districts.—*Distr.* Local and scarce in S.W. and W. England and N.W. Scotland.—*B. M.* Near Penzance, Cornwall; Douglas, Isle of Man; Portlethen, Kincardineshire.

Thallus effuse, variously areolate or granulose.

8. *L. albariella* A. L. Sm.—Thallus effuse, thin, white-farinose, or irregularly granular-areolate (K —, CaCl —). Apothecia rather small, dark-coloured, becoming convex, with a thin white farinose disappearing margin; paraphyses discrete, septate, slightly thicker and brown at the tips; spores ellipsoid, 8–12 μ long, 3–5 μ thick; hymenial gelatine quickly becoming violet-red with iodine.—*Lecanora albariella* Nyl. in Bot. Zeit. xix. p. 338 (1861) note & in Act. Soc. Linn. Bord. xxv. p. 63 (1864); Jones in Nat. Hist. Soc. Dublin, 1864, p. 119; Cromb. Lich. Brit. p. 50; Leight. Lich. Fl. p. 229; ed. 3, p. 219. *L. erysibe* subsp. *albariella* Nyl. in Flora lxiv. p. 454 (1881); Cromb. in Grevillea xviii. p. 69 (incl. var. *lactea*) & Monogr. i. p. 444.

Distinguished by the whitish cream-coloured thallus, more especially evident in the apothecial margins, and by the discrete paraphyses.

Hab. On calcareous (rarely arenaceous) rocks and mortar of walls.—*Distr.* Rare in S. England and in W. and N.E. Ireland.—*B. M.* I. of Wight; near Eastbourne, Sussex; Clare Island, Mayo; Glenarm, Antrim.

9. *L. prosechoides* Oliv. Exp. Syst. Lich. Fr. i. p. 311 (1897).—Thallus thin or thickish in places, unequally or warted-areolate, whitish or dull-yellowish (K —, CaCl —). Apothecia rather small, plane, somewhat prominent, the disc brown, becoming black, the thalline margin subentire, partly disappearing; paraphyses somewhat concrete, thickish, septate, enlarged and brown at the tips; spores ellipsoid, simple, becoming 1-septate, 9–17 μ long, 4–6 μ thick.—*Lecanora helicopsis* f. *dilutior* Nyl. Lich. Scand. p. 159 (1861); Carroll in Journ. Bot. iv. p. 25 (1866); Cromb. Lich. Brit. p. 50. *L. umbrina* subsp. *prosechoides* Nyl. ex Cromb. Lich. Brit. p. 51 (1870); f. *prosechoides* Leight. Lich. Fl. p. 208 (1871); ed. 3, p. 191. *L. prosechoides* Nyl. in Flora lv. p. 250 (1872) (incl. f. *sublutior* op. cit. lxxv. p. 456 (1882)); Cromb. in Grevillea iii. p. 82 & Monogr. i. p. 426 (incl. f. *sublutior*). *L. prosecha* Leight. Lich. Fl. ed. 3, p. 224 (1879) (non Ach.).

Ecsicc. Cromb. n. 67; Larb. Lich. Hb. n. 94.

A maritime plant, differing from *L. crysibe* in the stouter thallus and in the generally thicker spores. In the British specimens they measure usually about 8–12 μ in length, the size given by Crombie. The thallus may be determinate and the apothecia are frequently the host of *Arthonia varians*. In some specimens the hymenium in the upper part is bluish-green. Sometimes the apothecia are lighter in colour (f. *sublutior*).

Hab. On schistose, rarely on cretaceous rocks or cement in maritime districts.—*Distr.* Fairly general round the coasts of the British Isles.—*B. M.* Noirmont, Jersey; Vale Bay, Guernsey; Penzance, Cornwall; between Porlock and Lynton, Devon; Manorbier, Tenby, Pembrokeshire; Southerndown, Glamorganshire; The Mowddach and Dolgelly, Merioneth; Pwlheli, Carnarvonshire; Port Soderick, I. of Man; Barcaldine and Loch Creran, Argyll; Portlethen, Kincardineshire; Unst, Shetland; Kilkee, Clare; Letterfrack, Conemara, Galway; Ardglass, Down.

Var. *melacarpoides* Oliv. tom. cit. p. 312.—Thallus bluish-white. Apothecia black or bluish-black.—*Lecanora prosechoides* subsp. *melacarpoides* Nyl. in Flora lxxiv. p. 7 (1881); var. *melacarpoides* Knowles in Sci. Proc. Roy. Dubl. Soc. xiv. p. 129 (1913). Specimen not seen.

Hab. On rocks by the shore. Collected on top of the sea-wall at Sutton, Howth, Dublin, by M. C. Knowles.

Var. *æruginasces* (errore *æruginosa*) Oliv. l. c.—Thallus leaden-white, limited by an æruginous dendritic hypothallus, also visible between the areolæ—*Lecanora prosechoides* var. *æruginasces* Wedd. in Mém. Soc. Sci. Nat. Cherb. xix. p. 273 (1875); Knowles l. c. (errore *æruginosa*). Specimen not seen.

Hab. On quartz rocks by the shore. Collected near Needles at Howth, Dublin, by M. C. Knowles.

10. *L. spodomela* A. L. Sm.—Thallus effuse, thin, subleprose, areolate, greyish, or greyish-brown (K —, CaCl —). Apothecia small, the disc blackish, the thalline margin light-grey, subcrenulate; paraphyses slender, brown and septate at the clavate tips, surmounted by a blackish epithecium, spores ellipsoid, 11–16 μ long, 6–7 μ thick; hymenial gelatine blue with iodine.—*Lecanora spodomela* Nyl. in Flora lix. p. 572 (1876) and lxix. p. 101 (1886); Cromb. in Grevillea v. p. 106 (1877) & Monogr. i. p. 394; Leight. Lich. Fl. ed. 3, 221.

The thallus is obscured by a dark growth of blue-green algæ; but apothecia are abundant and well developed. The paraphyses frequently show a dark line over the tip like those of *L. prosechoidiza*.

Hab. On maritime sandstone rocks.—*Distr.* Rare in W. Ireland.—*B. M.* Killery Bay and Kylemore Lake, Connemara, Galway.

11. *L. atrynioides* Knowles in Sci. Proc. Roy. Dublin Soc. xiv. p. 130 (1913).—Thallus greyish, coarsely areolate, thin, effuse; hypothallus dark. Apothecia crowded and often angulose, .5 to 1 mm. in diameter, the disc dark reddish-brown, becoming convex, margined when young, the margin thin, whitish, entire or subcrenulate, subpersistent; paraphyses subdiscrete, septate, clavate and blackish-brown at the tips; spores ellipsoid, occasionally constricted at the septum, sometimes slightly curved, 10–14 μ long, 4–6 μ thick; hymenial gelatine deep blue then violet with iodine. Spermogones with slender arcuate spermatia borne on the tips of simple sterigmata.

With a general resemblance to *Lecanora atryneae* (*L. cœnsia* var. *atrynea*) and growing in similar situations.

Hab. On schistose maritime rocks about high spring tide-level, at Red Rocks, Howth, Dublin.

12. *L. cœnsia* A. L. Sm.—Thallus subdeterminate, thinnish, tartareous, granulate and areolate-diffract, darkish cæsious (K + CaCl —); hypothallus white. Apothecia moderate in size, depressed, plane or convex; epithecium dark cæsio-pruinose, the margin prominent, white-sorediate and flexuose-crenate; paraphyses slender, conglutinate, branched; spores 8 in the ascus, colourless, oblong-ellipsoid, 1-septate; hymenial gelatine deep blue with iodine. *Lecanora cœnsia* Johns. exs. n. 326 (1900).

Exsicc. Johns. n. 326.

A maritime species. Johnson was unable to find the spermogones. There is only a small specimen, but it seems to show that the dark colour of the thallus is due to blue-green algæ. The gonidia are small, about 7–8 μ in diameter. The paraphyses are slender, very crowded and undulate, entirely colourless, but the epithecium of dark granules. The spores are usually about 15 μ long and 5–6 μ thick, but vary in length, 10 μ to 17 μ or rarely longer. The apothecia are rather small but sometimes conglomerate, with farinose white margins.

Hab. On arenaceous rocks.—*B. M.* Hudshead near Berwick-on-Tweed.

13. *L. prosechoidiza* A. L. Sm.—Thallus thin, areolate, blackish-grey (K —, CaCl —). Apothecia small, the disc blackish or brownish-black, the thalline margin thin, disappearing: paraphyses stoutish, unequal, rather cohering, septate, swollen at the tips and brown, with a dark-brown line over the top; spores ellipsoid, 9–14 μ long, 4–6 μ thick, simple then faintly septate; hymenial gelatine blue then tawny with iodine.—*Lecanora prosechoidiza* Nyl. in Flora lxiv. p. 3 (1881); Cromb. in Journ. Bot. xxiii. p. 195 (1885) & Monogr. i. p. 427.

Closely allied to *L. prosechoides* or to *L. erysibe* but with a much darker thallus and apothecia. The spores are so frequently simple that it might more truly be classified with *Lecanora*, but its affinity is with *Lecania*. Spermiogones are rare with spermatia 16–22 μ long, $\cdot 5 \mu$ thick.

Hab. On schistose and calcareous rocks in maritime districts.—*Distr.* Somewhat rare in W., N.E. and N. Scotland and E. Ireland.—*B. M.* Barcaldine, Argyll; Bay of Nigg, near the Cove and Portlethen, Kincardineshire; Forse, Caithness.

14. *L. erysibe* Mudd Man. p. 141, t. 2, fig. 47 (1861) pro parte (incl. var. *Rabenhorstii* (non Hepp), excl. var. *aipospila*).—Thallus crustaceous, effuse, cracked-areolate or granulose, dull grey or greenish-olive or brown, sometimes very thin (K —). Apothecia rather small, innate, with a slight margin, becoming convex and immarginate, brown- or dull-red; paraphyses coherent, stoutish, septate, slightly enlarged upwards and brown at the tips; spores oblong-ellipsoid, becoming 1-septate, 10–15 μ long (rarely 19 μ), 3–5 μ thick; hymenial gelatine blue with iodine. *Lichen erysibe* Ach. Lich. Suec. Prodr. p. 50 (1798). *Lecanora erysibe* Nyl. in Mém. Soc. Sci. Nat. Cherb. v. p. 114 (1857); Cromb. Lich. Brit. p. 53 & Monogr. i. p. 443; Leight. Lich. Fl. p. 228; ed. 3, 218. *L. phæoleucodes* Nyl. in Flora lxii. p. 356 (1879); Cromb. in Grevillea viii. p. 112 (1880) & Monogr. i. p. 445 (incl. subsp. *proteiformis* Nyl. in Flora lxiv. p. 538 (1881)?).

Exsicc. Johns. n. 371 (as *Lecanora albariella*); Mudd nos. 104, 105.

A very variable plant in the form of the thallus, which is mostly granulate-areolate, and in the apothecia, which become prominent and convex. *Lecanora phæoleucodes* has been included as not being specifically distinct. Crombie has inadvertently given its spermatia measurements (16–20 μ long) for those of the spores; they measure only up to 15 μ in length. A specimen in Johnson's Exs. named *L. albariella* has also been included; the spores are very long, up to 19 μ , and occasionally an additional septum is formed in one of the cells. B. de Lesdain records several instances of equally long spores (Lich. Dunk. pp. 174 and 175), and I have agreed with him in including these long-spored specimens under *L. erysibe*, though possibly the differences are specific. A form with a thin finely areolate thallus growing on limestone has been described by Crombie as subsp. *proteiformis*. It is evidently a poorly developed condition of the species. *Lecania proteiformis* is synonymous with *L. Rabenhorstii*, and is

more nearly related to *L. aipospila*. *L. Rabenhorstii* (Hepp) B. de Lesd. has not been found in Britain.

Hab. On rocks, very rarely on decorticated trees, in maritime and inland districts.—*Distr.* Widely distributed throughout the British Isles.—*B. M.* St. Aubin's Fort, St. John's, Rozel, Fliquet Bay, Noirmont and St. Brelade's (*lignicolous*), Jersey; Sark; Guernsey; near Penzance, Cornwall; near Torquay, Devon; Luccombe, I. of Wight; Rottingdean Cliffs, Sussex; Ulting, Essex; Bathampton Downs, Somerset; near Painswick and near Cirencester, Gloucestershire; Goodwick Bay, Pembrokeshire; Abdon, Shropshire; Norton, Worcestershire; Redcar, near Ayton and Coatham, Cleveland, Yorkshire; St. Bees, Cumberland; Lismore and Barcaldine, Argyll; Portlethen, Kincardineshire; Craig Guie, Braemar, Aberdeenshire; Lower Glanmire Road, Cork; near Kilkee, Clare; Down.

Var. *cinereofusca* Mudd l. c. t. 2, fig. 48.—Thallus effuse, very thin, leprose, greyish-green when moist, greyish-brown when dry. Apothecia minute, scattered, numerous, the disc plane, dark-brown, slightly pruinose, at length convex; spores more ellipsoid, indistinctly septate.—*Lecanora erysibe* f. *cinereofusca* Cromb. in Grevillea xviii. p. 69 (1890) & Monogr. i. p. 444.

Exsicc. Mudd n. 106.

Considered by Crombie to be only a form of the species, but the very minute apothecia and indistinctly septate spores justify its varietal position.

Hab. On rocks and walls in maritime and inland districts.—*Distr.* Sparingly in S.W. and N. England.—*B. M.* Hastings, Sussex; Crowle near Worcester; near Ayton, Cleveland, Yorkshire.

Var. *sincerior* B. de Lesd. Lich. Dunk. p. 176 (1910).—Thallus whitish, granulate-areolate or of scattered granules. Apothecia with a persistent thalline margin, the disc reddish-brown.—*Lecanora erysibe* var. *sincerior* Nyl. in Flora lix. p. 577 (1876); Cromb. in Grevillea v. p. 108 (1876) & Monogr. i. p. 444: f. *sincerior* Leight. Lich. Fl. ed. 3, p. 219.

Exsicc. Johns. n. 138; Larb. Lich. Hb. without a number.

Differs from the species in the whiter colour of the thallus and the persistently marginate apothecia. B. de Lesdain gives spore sizes as 15-18 μ long, 5-6 μ thick. They are constantly 15 μ long, 5 μ thick in the British specimens, and they are very distinctly septate.

Hab. On rocks and walls in maritime localities.—*Distr.* Rare in the Channel Islands, S. and N. England, and N.W. Ireland.—*B. M.* Vale Castle, Guernsey; Hastings, Sussex; near Torpoint, Devon; North Tyne, Northumberland; St. Bees, Cumberland; Lettermore, Connemara, Galway.

15. *L. Hutchinsia* A. L. Sm.—Thallus effuse, thin, areolate, somewhat furfuraceous, or almost disappearing, pale dull-brownish (K —, CaCl —). Apothecia rather small, reddish- or yellowish-brown, convex, the slight thalline margin disappearing at an early stage; paraphyses subdiscrete, rather slender, septate, slightly clavate upwards, colourless at the tips; spores oblong-

ellipsoid or fusiform, 10–12 μ long, 3–4 μ thick; hymenial gelatine blue or partly wine-red with iodine.—*Lecanora Hutchinsia* Nyl. in Flora l. p. 326 (1867); Carroll in Journ. Bot. v. p. 255 (1867); Cromb. Lich. Brit. p. 50 & Monogr. i. p. 445 (incl. var. *accessitans*); Leight. Lich. Fl. p. 226; ed. 3, p. 217. *Lecidea albocarnea* Nyl. in Flora lix. p. 234 (1876) & op. cit. lxii. p. 361 (1879); Cromb. in Grevillea v. p. 26 (1876); Leight. Lich. Fl. ed. 3, p. 340 (incl. f. *umbrosa*). *L. accessitans* Nyl. op. cit. lix. p. 306 (1876); Cromb. l. c.; Leight. tom. cit. p. 260.

Exsicc. Cromb. n. 164; Larb. Lich. Hb. nos. 71, 72, 224, 269.

Allied to *L. crysibe*, which it resembles in the appearance of the thallus, but differing in the early disappearance of the apothecial margin and in the more slender colourless paraphyses. It has not been recorded on the Continent as a distinct species, but may have been overlooked or included as a form of *L. crysibe*. *L. accessitans* differs only in the more scanty thallus, probably owing to the shady habitat.

Hab. On schistose rocks and walls in maritime and inland districts.—*Distr.* Rare in the Channel Islands, S.W. England and W. Ireland.—*B. M.* Near Rozel, Jersey; Moulin Huet Bay, Guernsey; St. John's, Devonport, Devon; near Penzance, Cornwall; Dawros, Renvyle, Glendalough, Kylemore and Doughruagh Mts., Connemara, Galway.

Form *bellissima* A. L. Sm.—Thallus thin, subgranulate. Apothecia usually in small groups, slightly pruinose.—*Lecanora crysibe* f. *bellissima* Leight. Lich. Fl. ed. 3, p. 217 (1879); Cromb. Monogr. i. p. 446; var. *congregabilis* Nyl. in Flora lxii. p. 361 (1879); Cromb. in Grevillea viii. p. 114 (1880).

Hab. On shady walls in a maritime district.—*B. M.* Cleghan, Connemara, Galway.

16. *L. umbraticula* A. L. Sm.—Thallus effuse, thin, subleprose, greenish (K —, CaCl —). Apothecia small, rather plane, the margin disappearing, yellow; paraphyses conglutinate, rather slender, the epithecium colourless; spores fusiform, at first simple, becoming 1-septate, 8–16 μ long, 2–3 μ thick; hymenial gelatine blue then wine-red with iodine.—*Lecanora umbraticula* Nyl. in Flora lxii. p. 205 (1879); Cromb. in Grevillea viii. p. 28 (1879) & Monogr. i. p. 446.

Exsicc. Larb. Lich. Hb. (without a number) as *Lecidea umbraticula*.

Not unlike a "*Biatora*," but with gonidia below the hypothecium. It is distinguished by the leprose thallus, the brightly coloured apothecia and the narrowly fusiform spores.

Hab. On shady calcareous rocks in a maritime district.—*B. M.* Achnanure Castle, Galway.

Spores 3-septate.

17. *L. Nylanderiana* Massal. Sched. Crit. Lich. Ital. p. 152 (1855).—Thallus effuse, granular, unequal, cracked-areolate, dull-

cinereous or whitish (K —, CaCl —). Apothecia rather small, at first plane, with a thin whitish-grey margin, becoming convex and immarginate, the disc brown or blackish, generally bluish-white-pruinose; paraphyses rather slender, coherent, septate, wider upwards and colourless, but the epithecium suffused with brown; spores oblong or subfusiform, rarely curved, becoming 3-septate, 14–20 μ long, 4–5 μ thick; hymenial gelatine blue then wine-red with iodine.—*L. cœrulescens* Mudd Man. p. 140, t. 2, fig. 46 (1861) (incl. var. *cœruleorubella*). *Lecanora athrocarpa* f. *cœrulescens* Cromb. Lich. Brit. p. 53 (1870); Leight. Lich. Fl. p. 231; ed. 3, p. 223. *L. Nylanderiana* Nyl. ex Norrl. in Sällsk. Faun. & Fl. Fenn. i. p. 24 (1876); Cromb. Monogr. i. p. 448 (incl. var. *cœruleorubella*).

Exsicc. Leight. n. 294; Mudd n. 103.

Distinguished by the broken granular thallus and the pruinose apothecia.

Hab. On old walls in upland districts.—*Distr.* Local and scarce in W. and N. England.—*B. M.* Preston, near Cirencester, Gloucestershire; near Stokesley, near Marsk and near Ayton, Cleveland, Yorkshire.

18. *L. syringea* Th. Fr. Lich. Scand. p. 290 (1871).—Thallus effuse, thinly furfuraceous or scarcely visible, greyish-white (K —, CaCl —). Apothecia small, numerous, the disc plane, brownish or brownish-black, naked or pruinose, becoming convex, the thin entire thalline margin disappearing; paraphyses coherent, slender, sparsely septate, clavate and generally brown at the tips; spores 4–16 in the ascus, ellipsoid, oblong or subfusiform usually somewhat curved, 1–3-septate, 12–16 μ long, 4–6 μ thick; hymenial gelatine blue then wine-red or violet with iodine.—*L. fuscella* Mudd Man. p. 140, t. 2, fig. 45 (1861) pro parte (non Massal.). *Parmelia Hageni* var. *syringea* Ach. Meth. Lich. p. 163 (1803). *P. pallida* var. *fuscella* Schar. Lich. Helv. Spicil. p. 397 (1839). *Lecanora athrocarpa* Cromb. Lich. Brit. p. 53 (1870) (? Duby) (incl. var. *fuscella*); Leight. Lich. Fl. p. 231 pro parte; ed. 3, p. 223 pro parte. *L. syringea* Lamy in Bull. Soc. Bot. Fr. xxv. p. 415 (1878); Cromb. in Grevillea xviii. p. 70 (1890) & Monogr. i. p. 448.

Exsicc. Johns. n. 269.

Apt to be mistaken for a species of *Bilimbia*, unless the thalline margin is specially looked for, as at an early stage the apothecia become convex. Jatta (Fl. Ital. Crypt. Lich. p. 402) retains *L. athrocarpa* Massal. as a separate species with persistent apothecial margin and smaller spores, and with it he associates *L. fuscella* Massal. as a synonym, so that the name *L. syringea* is correct for the above lichen.

Hab. On trees, chiefly poplar and maple, in maritime and upland districts.—*Distr.* Rather rare in S.W. and N. England.—*B. M.* Ilsham, near Torquay, Devon; near Brading, I. of Wight; Brockenhurst and near Stoney Cross, New Forest, Hants; near The Beck, Malvern, Worcestershire; Stokesley, Cleveland, Yorkshire; Teesdale, Durham.

Form *metabolica* A. L. Sm.—Thallus very thin. Apothecia minute, convex, dark-brown or nearly black, the margin excluded.—*Lecanora metabolica* Ach. Lich. Univ. p. 351 (1810). *L. athroocarpa* var. *metabolica* Cromb. Lich. Brit. p. 53 (1870); Leight. Lich. Fl. p. 232; ed. 3, p. 224. *L. syringea* f. *metabolica* Cromb. Monogr. i. p. 448 (1894).

Distinguished by the smaller more scattered and darker apothecia.

Hab. On trees, chiefly maple, in maritime districts.—*Distr.* Very rare in the Channel Islands and S. England.—*B. M.* Trinity, Jersey; Brading, I. of Wight.

19. *L. dubitans* A. L. Sm.—Thallus a thin grey effuse rather irregular crust, sometimes almost obsolete (Kf + yellowish, CaCl—). Apothecia minute, the disc pale- or dark-brown, the margin thin, soon evanescent; paraphyses somewhat coherent, irregularly widening, septate and brownish upwards; spores oblong-fusiform or ellipsoid, usually curved, 1-septate, 12–18 μ long, 4–6 μ thick.—*Lecidea dubitans* Nyl. Lich. Scand. p. 207 (1861) fide Th. Fr. Lich. Scand. p. 294. *Lecanora athroocarpa* subsp. *dimeria* Nyl. tom. cit. p. 169. *L. dimeria* Nyl. ex Norrl. in Medd. Sällsk. Faun. & Fl. Fenn. i. p. 24 (1876) incl. var. *dubitans*; Cromb. in Grevillea xviii. p. 70 (1890) & Monogr. i. p. 449. *L. Sambuci* subsp. *dimeria* Wheld. & Wils. Lich. Perth. p. 40 (1915).

Distinct from the preceding in the form of the spores. Crombie states that the epithecium gives a pale rose-coloured reaction with potash. I have failed to obtain this.

Hab. On the smooth bark of trees in mountainous districts.—*Distr.* Rare in the Scottish Highlands.—*B. M.* Morrone, Braemar, Aberdeenshire.

20. *L. curvescens* A. L. Sm.—Thallus of minute scattered or congregate grey roundish granules or minutely squamulose and dark-brown. Apothecia moderate in size, rather prominent, becoming expanded and thin and slightly convex, the disc dark reddish-brown, the margin lighter coloured, disappearing; paraphyses coherent, very slender, more or less distinctly septate and variously widened upwards, pale yellowish-brown in the mass; asci broadly clavate, 6–8-spored; spores obtusely fusiform, slightly curved, 3-septate, 30–34 μ long, 4–6 μ thick.—*Pannaria curvescens* Mudd Man. p. 125, t. 2, fig. 38 (1861). *Lecanora curvescens* Nyl. ex Carroll in Journ. Bot. iii. p. 288 (1865) emend. *L. rhypariza* f. *curvescens* Nyl. in Not. Sällsk. Faun. & Fl. Fenn. Förh. n. ser. v. p. 135 (1866); Cromb. Lich. Brit. p. 53 & Monogr. i. p. 450; Leight. Lich. Fl. p. 214; ed. 3, p. 199.

There is only one scanty specimen of this very rare lichen in the herbarium of the British Museum, but an examination of it has proved that the spores are distinctly 3-septate. The reaction with

potash is given for *Lecanora rhypariza* as K + yellow, then blood-red. There was only a yellow reaction in our specimen of *L. curvirescens* as tested now, but there is a deep red stain on one of the apothecia, which was probably obtained when the specimen was newly gathered.

Hab. Encrusting mosses (*Andraea* & *Grimmia*) in an alpine situation.—*B. M.* Summit of Ben Lawers, Perthshire; the only record.

54. **ICMADOPHILUS** Massal. Ric. Lich. Crost. p. 26 (1852); Mudd Man. p. 64. *Bæomyces* Pers. pro parte. (Pl. 54.)

Thallus crustaceous, not corticated. Algal cells *Protococcus*. Apothecia sessile or almost stalked, with a thalline margin at length disappearing; hypothecium colourless with gonidia partly below; paraphyses slender, simple, free; spores fusiform, 2-4-celled colourless. Spermogones globose, immersed, with septate sparingly branched sterigmata, and cylindrical pleurogenous spermatia, which are slightly thicker at each end.

The genus is frequently included in *Bæomyces*, but the structure and development of the apothecia are lecanorine.

I. ericetorum A. Zahlbr. in Wiss. Mittheil. Bosn.-Herzeg. iii. p. 605 (1895).—Thallus effuse, closely granular, greenish or whitish (K + yellow). Apothecia moderate in size or somewhat large, with a disappearing thalline margin, the disc soft, flesh-coloured, smooth or slightly wrinkled (K + orange); asci cylindrical, 6- or 8-spored; the spores fusiform, 1-3-septate, 13-27 μ long, 4-6 μ thick; hymenial gelatine blue, the asci deep wine-red with iodine.—*I. æruginosa* Mudd Man. p. 64, t. 1, fig. 13 (1861). *Lichen ericetorum* L. Sp. Pl. p. 1141 (1753); Huds. Fl. Angl. p. 443 pro parte; Engl. Bot. t. 372; var. β Lightf. Fl. Scot. ii. p. 809? *L. æruginosus* Scop. Fl. Carniol. ii. p. 361 (1772). *L. icmadophila* Ehrh. Phytophyl. n. 40 (1780) nomen nudum; Hoffm. Enum. i. p. 34, t. 8, fig. 1 (1784); With. Arr. ed. 3, iv. p. 15. *Lecidea icmadophila* Ach. Meth. p. 58 (1803); S. F. Gray Nat. Arr. i. p. 473; Hook. Fl. Scot. ii. p. 39 & in Sm. Engl. Fl. v. p. 184; Tayl. in Mackay Fl. Hib. ii. p. 129. *Bæomyces æruginosus* DC. Fl. Fr. ii. p. 343 (1805); Cromb. Monogr. i. p. 113. *B. icmadophilus* Nyl. in Act. Soc. Linn. Bord. sér. 3, i. p. 281 (1856); Cromb. Lich. Brit. p. 16; Leight. Lich. Fl. p. 54; ed. 3, p. 52.

Ersicc. Croall n. 587; Cromb. n. 118; Johns. n. 47; Larb. Lich. Hb. n. 44; Leight. n. 209; Mudd n. 32.

Though the apothecium is sometimes not altogether sessile, there is no true podetium as in the *Cladoniaceæ*. In shady localities it is a beautiful green colour, but becomes yellowish in herbaria. The spermogones are enclosed in thalline granules.

Hab. On moist turfy soil, on decayed *Sphagna* in bogs, and on rotten trunks of trees in upland and subalpine districts.—*Distr.*

Local though plentiful where it occurs in Great Britain and Ireland.—*B. M.* Ardingly, Sussex; Tunbridge Wells, Kent; Bagshot Heath, Surrey; Island of Anglesea; Dent and Guisboro' Moor, Cleveland, Yorkshire; Teesdale, Durham; Alston Moor, Cumberland; New Galloway, Kirkcudbrightshire; Pentland Hills and Swanston Hill, near Edinburgh; Appin, Argyll; Blairdrummond near Stirling; Glen Falloch, Craig Calliach, Ben Lawers and Killin, Perthshire; Sidlaw Hills and Clova, Forfarshire; Glen Callater and Morrone, Braemar, Aberdeenshire; Moidart, Rothiemurehus and Glen Nevis, Invernessshire; near Lairg, Sutherland; Pass of Keimaneigh and Gouganebarra, Cork; Dunkerron and Killarney, Kerry; Connemara, Galway; Slieve More, Achill, Mayo.

55. *HÆMATOMMA* Massal. Ric. Lich. Crost. p. 32 (1852): Mudd Man. p. 157. (Pl. 55.)

Thallus crustaceous, corticate on the upper surface or non-corticate. Algal cells *Protococcus*. Apothecia sessile or sometimes immersed; paraphyses discrete, slender; spores 8 in the ascus, narrowly elongate, straight, bent or sometimes partly coiled, 3-many-septate, colourless. Spermogones with simple or branched sterigmata and arcuate acrogenous spermatia.

1. *H. ventosum* Massal. Ric. Lich. Crost. p. 33 (1852).—Thallus determinate, thick, firm, crowdedly and irregularly warted, cracked-areolate, greenish-yellow or dark greenish-grey (K + yellow). Apothecia sessile, small, moderate in size, or rather large and often irregular (up to 3 mm. across), the disc plane or convex, dark-crimson or blood-red (K + blue-purple), the thalline margin thin, often excluded; paraphyses discrete, stoutish, septate, scarcely widened upwards; spores irregularly elongate-fusiform, somewhat curved or contorted, 3-7-septate, 40-55 μ long, up to 5 μ thick; hymenial gelatine blue with iodine.—Mudd Man. p. 157, t. 2, fig. 52. *Lichenoides tartareum lividum, scutellis rufis, margine exili* Dill. Hist. Musc. p. 133, t. 18, fig. 14 (1741). *Lichen ventosus* L. Sp. Pl. p. 1141 (1753): Lightf. Fl. Scot. ii. p. 806; Huds. Fl. Angl. ed. 2, p. 527; Engl. Bot. t. 906; With. Arr. ed. 3, iv. p. 16. *L. gelidus* Huds. tom. cit. p. 528 (1778) (non Linn.). *Lecanora ventosa* Ach. Lich. Univ. p. 399 (1810); Hook. Fl. Scot. ii. p. 48 & in Sm. Engl. Fl. v. p. 189; Grev. Fl. Edin. p. 332; Tayl. in Mackay Fl. Hib. ii. p. 136; Cromb. Lich. Brit. p. 57 (incl. var. *subfestiva*) & Monogr. i. p. 456 (incl. var. *subfestiva*); Leight. Lich. Fl. p. 233; ed. 3, p. 225. *Rinodina ventosa* S. F. Gray Nat. Arr. i. p. 451 (1821).

Exsicc. Bohl. n. 36; Croall n. 588; Dicks. Hort. Sicc. fasc. v. n. 23; Leight. n. 9; Mudd n. 29.

Distinguished from other species by the thicker non-leprose thallus and by the generally darker apothecia, the deep colour of which tinges the covering paper in herbaria. When very dark they have been referred to var. *lepadolemma* (*Parmelia ventosa* var. *lepa-*

dolemma Ach. Meth. p. 167 (1803)), and recorded by Wilkinson from Merioneth in Journ. Bot. xxxviii. p. 184 (1900). The apothecia of var. *subfestiva* are small and badly developed, but otherwise it is similar to the species. Crombie records the spermogones as dark-coloured, with septate sterigmata and short rod-like spermatia.

Hab. On exposed siliceous rocks and boulders in upland or alpine situations.—*Distr.* Fairly common in upland districts of England and Scotland, rare in Ireland.—*B. M.* Wistman's Wood and Pew Tor, Dartmoor, Devon; Epsom Downs, Surrey; Clee Hills, Shropshire; Moel-y-golfa, Montgomeryshire; Cader Idris, Merioneth; Nant Francon, Penmaenmawr, Trefriw and Moel Siabod, Carnarvonshire; Dent and Kildale Moor, Cleveland, Yorkshire; Leck, Lancashire; Teesdale, Durham; Gunnerton Crags, Northumberland; New Galloway, Kirkcudbrightshire; North Berwick Law, Berwickshire; Achosragan Hill and Ben Cruachan, Argyll; Ben Lawers, Ben Vrackie and Birnam Hill, Perthshire; Katelaw and Clova, Forfarshire; Lochnagar, Morrone and Glen Callater, Braemar, Aberdeenshire; Ben Nevis, Invernessshire; Hills of Applecross, Rossshire; Wicklow.

Form *lævigatum* A. L. Sm.—Thallus smooth, areolate-cracked, yellowish straw-coloured. Apothecia small, depressed.—*Lecanora ventosa* f. *lævigata* Johns. ex Cromb. in Grevillea xix. p. 60 (1891) & Monogr. i. p. 457.

Hab. On rocks in an upland district.—*B. M.* Bowness Knolt, Ennerdale Lake, Cumberland (the only record).

2. *H. coccineum* Koerb. Syst. Lich. Germ. p. 153 (1855).—Thallus effuse, tartareous-farinose, generally thinnish, whitish or pale-sulphur-coloured, with a white hypothallus (K + yellow). Apothecia scattered, at first innate, gradually emerging and becoming sessile, small or rarely up to about 2 or 3 mm. across, the disc plane or convex, crimson or reddish-brown (K + violet-purple), the thalline margin thickish or insignificant, more or less crenulate, granular or pulverulent; paraphyses coherent, slender, sometimes branched, sparsely septate, slightly and variously widened at the tips; spores elongate-fusiform, 3–7-septate, 30–60 μ long, 5–7 μ thick; hymenial gelatine blue with iodine.—Mudd Man. p. 157. *Lichen coccineus* Dicks. Pl. Crypt. fasc. i. p. 8, t. 2, fig. 1 (1785); Engl. Bot. t. 223; With. Arr. ed. 3, iv. p. 16. *L. hæmatomma* Ehrh. Hannover Mag. 1786, p. 285? Pers. in Ust. Ann. Bot. xi. p. 16 (1794) (incl. var. *porphyrius*); Engl. Bot. t. 486. *Lecidea saxetana* Ach. in Vet. Akad. Handl. 1808, p. 269. *Lecanora hæmatomma* Ach. Lich. Univ. p. 388 (1810) (incl. vars. *coccinea* and *porphyria*); Hook. Fl. Scot. ii. p. 40 & in Sm. Engl. Fl. v. p. 190; Grev. Fl. Edin. p. 333; Tayl. in Mackay Fl. Hib. ii. p. 136; Cromb. Lich. Brit. p. 57 & Monogr. i. p. 454 (incl. var. *saxetana*); Leight. Lich. Fl. p. 232; ed. 3, p. 224. *Rinodina hæmatomma* & *R. porphyria* S. F. Gray Nat. Arr. i. p. 457 (1821).

Esicc. Bohl. n. 120; Dicks. Hort. Sicc. fasc. v. n. 24;

Johns. n. 239; Larb. Lich. Hb. n. 339; Leight. n. 214; Mudd n. 130.

The spores according to Harmand (Lich. Fr. p. 1097) attain a length of $70\ \mu$, in our specimen they are generally about $40\ \mu$ long. The brightly-coloured apothecia contrast strongly with the white or yellowish thallus, which spreads widely on rocks and boulders. On tree-trunks, where it occurs occasionally (in the New Forest, Dorset and Suffolk), it is always sterile in our country. The recorded forms or varieties seem to be simply growth stages. The spermatogones, according to Crombie (Monogr. i. p. 455), are minute and look like young apothecia with which they are concolorous. I have been unable to verify this.

The purple reaction of the hymenium with potash is due to the presence of hymenorhodin (Zopf, Flechten Stoffe, p. 320); it belongs to the same group of acid products as parietin.

Hab. On shaded perpendicular rocks and boulders, rarely on trees, in maritime and upland districts.—*Distr.* Not uncommon throughout the British Isles.—*B. M.* La Coupe and Rozel, Jersey; Guernsey; Brechou; Alderney; near Penzance, Cornwall; Ardingly and Withyam, Sussex; Beeleigh Abbey, Essex; Stonehenge, Wilts; Malvern, Worcestershire; Acton Burnell and Nesscliff Hill, Shropshire; Breiddon Hill, Montgomeryshire; Barmouth, Merioneth; Nant Francon and Carnedd Dafydd, Carnarvonshire; Battersby, Cleveland, Yorkshire; Egglestone, Durham; Harlaw Hill, Northumberland; Cumberland; West Kilbride, Ayrshire; Roslin, near Edinburgh; Airds, Appin, Argyll; Bowling Bay, Dumbartonshire; West Water, Fife; Blaeberry Hill near Perth, The Trossachs and Craig Calliach, Perthshire; Portlethen, Kincardineshire; Will's Braes, Forfarshire; Morrone, Braemar, Aberdeenshire; Glen Nevis, Invernesshire; near Belfast, Antrim; Western Blasquet Island, Kerry.

3. *H. elatinum* Koerb. Syst. Lich. Germ. p. 153 (1855).—Thallus effuse, thin, granular-furfuraceous, whitish or pale-yellowish-white (K + yellow). Apothecia rather small, scattered, the disc plane, then convex, light brownish-red, the thalline margin thin, soon disappearing; paraphyses subdiscrete, slender, indistinctly septate, sometimes branched, slightly clavate, the epithecium of brownish-yellow granules; spores elongate-fusiform, 3-5-septate, usually curved, about $40-50\ \mu$ long, $4-5\ \mu$ thick; hymenial gelatine blue with iodine.—*Lecanora elatina* Ach. Lich. Univ. p. 387 (1810); Cromb. in Journ. Bot. viii. p. 98 (1870) & Monogr. i. p. 455; Leight. Lich. Fl. p. 231; ed. 3, p. 223.

Differing from either of the preceding species in the much thinner thallus, and in the absence of reaction with potash in the fruit. The asci are thick-walled, the spores lie in a half spiral. Though extremely rare in the British Islands it has a wide distribution, more especially in Scandinavia.

Hab. On the bark of old hollies.—*B. M.* Derrycuntry, Killarney, Kerry (the only British record).

ORDER XIV. **PERTUSARIACEÆ.**

Thallus crustaceous, effuse or determinate, attached by hyphæ to the substratum, corticate or non-corticate above. Algal cells *Protococcus*. Apothecia, one or several, immersed in thalline protuberances (verrucae or warts), the discs often compound, semi-enclosed, surrounded by a stout thalline margin; paraphyses mostly branched and intricate; asci 1-8-spored; spores colourless or brownish, usually very large, oblong-ellipsoid, simple or 1-septate. Spermogones with simple or sparingly branched sterigmata and acrogenous long spermatia.

The affinity of the order is with Lecanoraceæ, more especially with the section *Ochrolechia*, which has been included in Pertusariaceæ by some lichenologists. There are two British genera:—

Spores simple	56. <i>Pertusaria</i> .
Spores 1-septate.....	57. <i>Varicellaria</i> .

56. **PERTUSARIA** DC. Fl. Fr. ii. p. 319 (1805). *Variolaria* Pers. in Ust. Ann. Bot. vii. p. 23 (1794); Hook. Fl. Scot. ii. p. 46 & in Sm. Engl. Fl. v. p. 168; S. F. Gray Nat. Arr. i. p. 490; Grev. Fl. Edin. p. 330; Tayl. in Mackay Fl. Hib. ii. p. 112; Turn. & Borr. Lich. Brit. p. 51. *Porina* Ach. Lich. Univ. p. 60 (1810); S. F. Gray Nat. Arr. i. p. 495; Hook. Fl. Scot. ii. p. 45; Tayl. in Mackay Fl. Hib. ii. p. 101. (Pl. 56.)

Thallus continuous or cracked-areolate, thick and unequally warted and wrinkled, or thinner and smoothish, generally superficial, rarely subcorticolous (hypophleodal). Apothecia one or several immersed in the fertile protuberances (verrucae or warts), more rarely impressed in the thalline areolæ, the discs appearing as minute ostioles or broadening out into lecanorine form; hypothecium colourless; paraphyses long, very slender; spores 1-8 in the ascus, colourless or rarely blackish, simple, mostly very large, with a thick epispore, generally the asci alone are coloured deep blue with iodine.

The name *Variolaria* precedes that of *Pertusaria*, but it was founded solely on a non-essential character—a sorediate thallus—and is therefore set aside. By some of the older writers *Variolaria* was classified along with somewhat indefinite genera, such as *Spiloma*. Certain species of *Variolaria* recorded in the older British Floras are now indeterminable in the absence of specimens. Such are *Variolaria cinerea* Sm. Engl. Bot. t. 2411 (1812); Hook. in Sm. Engl. Fl. v. p. 170. *V. torta* Tayl. in Mackay Fl. Hib. ii. p. 114 (1836). *V. terricola* Tayl. tom. cit. p. 115 is less indefinite, as a specimen in the Salwey herbarium labelled "from Dr. Taylor" is a sterile thallus of *Baromyces roseus*. There are several species of *Variolaria* recorded by Turner and Borrer in "Lichenographia Britannica," such as *V. vitiligo*, *V. griseo-virens*, etc., that are of doubtful determination. It is noteworthy that though the above work was published in 1839

it had been widely circulated for many years previously, and is quoted as early as 1812 in Smith's "English Botany" (see *Variolaria griseo-virens* t. 2400).

The species of *Pertusaria* have been arranged according to the prevailing number of spores in the ascus, it is not a constant character.

A. Spores one in the ascus.

Thallus non-sorediate.

1. *P. dactylina* Nyl. in Act. Soc. Sci. Fenn. vii. p. 447 (1863) note 1.—Thallus thin, with crowded upright rounded stoutish papillæ about 1 mm. in height, simple or rarely divided or coalescent, whitish (K+ orange-yellow then red). Apothecia rather rare, immersed in the apices of the papillæ, the disc blackish, usually almost covered over; spores one in the ascus, 125–230 μ long, 65–85 μ thick.—Cromb. Lich. Brit. p. 60 & Monogr. i. p. 493; Leight. Lich. Fl. p. 239; ed. 3, p. 230. *Lichen dactylinus* Ach. Lich. Suec. Prodr. p. 89 (1798). *L. oculatus* Sm. Engl. Bot. t. 1833 (1808) (non Dicks.). *Rinodina oculata* S. F. Gray Nat. Arr. i. p. 449 (1821) (non Dicks.).

Distinguished by the stoutish dactyloid papillæ, and by the reactions with potash.

Hab. On the ground or on decayed mosses in alpine regions.—

Dist. Confined to the summits of the Grampians, Scotland.—*B. M.* Ben Lawers, Perthshire; Morrone and Ben-naboord, Braemar, Aberdeenshire.

2. *P. Hutchinsix* Leight. Angioc. Lich. p. 30, t. 11, fig. 1 (1851).—Thallus effuse, thickish, unequally wrinkled or warted, whitish or cream-coloured (K–). Apothecia immersed in the verrucæ, small or moderate in size, the disc well-exposed, depressed, brownish-black and greyish-pruinose, the margin thicker, somewhat torn; spores one in the ascus, 80–165 μ long (or more), 40–55 μ thick.—Mudd Man. p. 277; Cromb. Lich. Brit. p. 59 & Monogr. i. p. 493; Leight. Lich. Fl. p. 243; ed. 3, p. 233. *Thelotrema Hutchinsix* Borr. Engl. Bot. Suppl. t. 2652 (1830); Hook. in Sm. Engl. Fl. v. p. 162; Tayl. in Mackay Fl. Hib. ii. p. 103; Turn. & Borr. Lich. Brit. p. 178.

An endemic Irish species somewhat resembling *Leccanora verrucosa* though with larger thalline warts. Its nearest ally is *Pertusaria panyrga* Th. Fr. Lich. Scand. p. 308 (1871), in which the thallus tends to become papillate. Crombie's spore length, 80–120 μ , is too small, greater lengths have been observed more nearly approaching the dimensions of *P. panyrga* (110–220 μ).

Hab. On the ground incrusting mosses and heaths.—*B. M.* Hills near Bantry, Cork.

3. *P. monogona* Nyl. in Bull. Soc. Linn. Norm. sér. 2, vi. p. 289 (1872).—Thallus subdeterminate, thickish, wrinkled,

cracked-areolate and warted, greyish-white (K+yellow then orange-red). Apothecia innate in the somewhat flattened warts, the disc rather wide, uneven, brownish, white-pulverulent, the thalline margin thick, entire or furrowed; spores one in the ascus, 150–235 μ long, 78–80 μ thick.—Cromb. in Grevillea xix. p. 59 (1891) & Monogr. i. p. 494.

Easily distinguished by the reaction with potash and by the single-spored asci. *P. dealbata*, with which it has been compared, has almost the same reaction (less intensely red), is more generally isidiose and has a 2-spored ascus.

Hab. On schistose rocks.—*B. M.* Cader Idris, Merioneth (the only British record).

Thallus more or less sorediate.

4. *P. bryontha* Nyl. Lich. Scand. p. 178 (1861).—Thallus effuse, rather thin and spreading, or often consisting of subglobose fertile granules, which are sometimes sorediate, white or greyish-white (K+yellowish, soredia CaCl+reddish). Apothecia at first closed, then with a plane open disc up to 2 mm. across (in Brit. specimen), fawn-coloured, then cinereous-black, the thalline margin prominent, then almost excluded; spores one in the ascus, 120–230 μ long, 40–70 μ thick, or sometimes smaller.—Cromb. Lich. Brit. p. 58 & Monogr. i. p. 492; Leight. Lich. Fl. p. 240; ed. 3, p. 230. *P. macrospora* Hepp Flecht. Eur. n. 424 (1857); Mudd Man. p. 277. *Parmelia subfusca* var. *bryontha* Ach. Meth. Lich. p. 167 (1803).

One of our rarest lichens. Reactions are sometimes given as CaCl+orange-red, but I have been unable to verify that on our specimen.

Hab. On the ground encrusting mosses and decayed plants, in alpine places.—*Distr.* Local and scarce among the N. Grampians, Scotland.—*B. M.* Cairngorm and Ben-naboord, Braemar, Aberdeenshire.

5. *P. ophthalmiza* Nyl. in Flora xlviii. p. 354 (1865).—Thallus effuse, thin, smooth or granulate, unequally wrinkled, light-cinereous-grey (K–, CaCl–). Fertile verrucæ small, scattered or generally crowded, containing 1, rarely 2–3, apothecia, the disc fairly open, blackish, the outer margin rugose or rarely subleprose; spores one in the ascus, 160–205 μ long, 80–100 μ thick.—Carroll in Journ. Bot. iv. p. 23 (1866); Leight. Lich. Fl. p. 242; ed. 3, p. 233; Cromb. Monogr. i. p. 496. *P. velata* subsp. *multipuncta* var. *ophthalmiza* Nyl. Lich. Scand. p. 180 (1861). *P. globifera* subsp. *ophthalmiza* Cromb. Lich. Brit. p. 59 (1870).

Distinguished by the thinish thallus and the small *Lecanora*-like fertile verrucæ. The spores in the Glen Falloch specimens, evidently mature, measure only up to 175 μ long, 55 μ thick. Otherwise they correspond with Nylander's description.

Hab. On the trunks of old pines in mountainous districts.—*Dist.* Rare in the Highlands, Scotland.—*B. M.* Glen Falloch and Black Wood, Rannoch, Perthshire.

6. *P. velata* Nyl. Lich. Scand. p. 179 (1861).—Thallus thinnish, determinate, smooth or unequally wrinkled, or sometimes cracked, with slight radiate folds towards the circumference, greyish or white (K —, CaCl + rose-red). Fertile verrucæ crowded, small, flat, sometimes sorediate at apices, the apothecia with open disc somewhat flesh-coloured, but "veiled" by a white layer of hyphæ, mixed with oxalate of lime crystals, and surrounded by a stoutish margin; spores one in the ascus, very large, 190–310 μ long, 67–90 μ thick (or smaller).—Mudd Man. p. 274, t. 5, fig. 114; Cromb. Lich. Brit. p. 59 & Monogr. i. p. 497; Leight. Lich. Fl. p. 241; ed. 3, p. 232 pro parte. *Parmelia velata* Turn. in Trans. Linn. Soc. ix. p. 143, t. 12, fig. 1 (1808). *Lichen velatus* Sm. Engl. Bot. t. 2062 (1809). *Variolaria velata* Ach. Lich. Univ. p. 319, t. 5, fig. 7 (1810); S. F. Gray Nat. Arr. i. p. 490; Hook. in Sm. Engl. Fl. v. p. 170.

The small lecanorine apothecia, the reaction with calcium hypochlorite, and the absence of definite soralia distinguish *P. velata* from other monosporous species. It is a subtropical plant, and occurs in Europe in the western regions. *Lichen conspurcatus* Sm. Engl. Bot. t. 964 (1801), and other citations have been quoted by Leighton as synonymous with *P. velata*. The small sterile fragments accompanying Smith's plate do not bear out the determination; but it is impossible to identify them (see also note to n. 11, *P. lactea*).

Hab. On trees in wooded districts.—*Dist.* Rare in S. England, N. Wales and S. Ireland.—*B. M.* Ivy Bridge, Devon; Lulworth, Dorset; Quarn Wood, I. of Wight; New Forest, Hants; St. Leonard's Forest, Sussex; near Rusthall Common, Kent; Castlemartyr, Cork.

Form *aspergilla* Cromb. in Grevillea xix. p. 59 (1891).—Fertile verrucæ scattered, rather large, prominent and white-sorediate (K —, CaCl + rose-red).—Cromb. Monogr. i. p. 498. *Lichen aspergillus* Ach. Lich. Suec. Prodr. p. 28 (1798)? *Variolaria aspergilla* Ach. Meth. Lich. p. 13 (1803)?; Sm. Engl. Bot. t. 2401 (1812); Hook. in Sm. Engl. Fl. v. p. 170; Tayl. in Mackay Fl. Hib. ii. p. 112; Turn. & Borr. Lich. Brit. p. 67. *V. communis* var. *aspergilla* S. F. Gray Nat. Arr. i. p. 491 (1821).

Differs from the species in the prominent, generally sparsely scattered and densely sorediose verrucæ. It has been quoted by Hue (Bull. Soc. Bot. xxxvii. p. 95) as synonymous with *P. multipuncta*, and the continental plant which is saxicolous may possibly belong to that species, but the British specimens give the same chemical reaction as *P. velata*.

Hab. On trees and palings in inland situations.—*Distr.* Rare in S. and Central England.—*B. M.* New Forest, Hants; St. Leonard's Forest, Sussex; Sevenoaks, Kent; Shiere, Surrey; Quantock Combes, Somerset; Hay Park, Herefordshire; Ickworth, Suffolk.

7. *P. globulifera* Nyl. in Mém. Soc. Sci. Nat. Cherb. v. p. 116 (1857).—Thallus suborbicular, thickish, somewhat membranaceous and cartilaginous and with a zonate margin, generally wrinkled and plicate, sometimes granular-isidioid, crowded with large discoid soralia, greenish-grey (K—, CaCl—). Apothecia enclosed in large corticate verrucæ, depressed, globular and closed, then lacerate-dehiscent and white soreciate; spores one in the ascus (rarely two), 207–276 μ long, 50–80 μ thick.—Mudd Man. p. 273 (excl. vars.); Cromb. Lich. Brit. p. 59 (errore *globifera*) (excl. vars.) and Monogr. i. p. 495; Leight. Lich. Fl. p. 243; ed. 3, p. 233. *Lichenoides candidum et farinaceum, scutellis fere planis* Dill. Hist. Musc. p. 131, t. 18, fig. 11 B, C (1741). *Lichen discoideus* Sm. Engl. Bot. t. 1714 (1807) (non Pers.) & *L. globuliferus* t. 2008 (1809). *Variolaria globulifera* Turn. in Trans. Linn. Soc. ix. p. 139, t. 10, fig. 2 (1808); S. F. Gray Nat. Arr. i. p. 490; Grev. Fl. Edin. p. 330; Hook. in Sm. Engl. Fl. v. p. 169; Turn. & Borr. Lich. Brit. p. 59. *V. discoidea* Hook. in Sm. Engl. Fl. v. p. 269 (1833) (? Ach.); Tayl. in Mackay Fl. Hib. ii. p. 112? Turn. & Borr. Lich. Brit. p. 61. *V. faginea* Tayl. l. c. ? (non Linn.).

Esicc. Bohl. n. 96; Johns. n. 327; Mudd n. 263 pro parte.

Though normally determinate, the thallus may spread indefinitely. Fertile verrucæ are rare, generally they take the form of densely powdery-white soralia (f. *discoidea* Cromb. in Grevillea xix. p. 59 (1891) & Monogr. i. p. 496). The spores examined are generally up to 220 μ long, and frequently shorter than 207 μ . The citations from Taylor are doubtful. His *V. faginea* is not bitter to the taste, while *V. discoidea*, according to him, is so.

Hab. On trunks of old trees in wooded districts.—*Distr.* General and common throughout the British Isles.—*B. M.* Boconnoc and near Withiel, Cornwall; Chudleigh, Beckey Falls and Bovey Tracey, Devon; New Forest, Hants; St. Leonard's Forest, Danny, Ardingly, Crawley and Beeding Priory, Sussex; Penshurst, Kent; Shiere, Surrey; Ulting and Epping Forest, Essex; Cirencester, Gloucestershire; Broadwas and Malvern, Worcestershire; Yarmouth, Suffolk; Madingley, Cambridgeshire; Lambeth, S. Wales; Barmouth, Merioneth; Anglesea; Craig-y-Rhiw and Haughmond Hill, Shropshire; Charnwood Forest and Gopsall, Leicestershire; near Ayton, Cleveland, Yorkshire; Egglesstone, Durham; Helensburgh, Dumbar-tonshire; Inverary and by Loch Crean, Argyll; Craigforth, Stirling; Glen Lochay, Killin and Blaeberry Hill near Perth, Perthshire; Den of Mains, Forfarshire; Murtle, near Aberdeen; Loch Linnhe, Invernessshire; Castlemartyr and Macroom Demesne, Cork; Ashley Park, near Galway; Louisburgh, Mayo.

8. *P. faginea* Leight. Lich. Fl. p. 242 (1871); Wain. in Medd. Soc. Faun. & Fl. Fenn. xiv. 14, p. 24 (1888).—Thallus determinate, thickish or rather thin, wrinkled, granulate and cracked, subzonate at the circumference, grey, thickly covered with white soralia, bitter to the taste (K—, CaCl—). Fertile verrucæ rather rare (K + yellowish, K(CaCl) + rose-

red or violet), apothecia small, solitary, with a wide white pulverulent disc and thin margin, becoming immarginate; spores one in the ascus, up to $150\ \mu$ long, $40\text{--}50\ \mu$ thick.—Leight. Lich. Fl. ed. 3, p. 232. *P. globulifera* var. *sorediata* Mudd Man. p. 274 (1861) pro parte (non Fr.); Cromb. Lich. Brit. p. 59 (1870)? (non Fr.). *P. amara* Nyl. in Flora lvi. p. 22 (1873); Cromb. in Grevillea xix. p. 59 & Monogr. i. p. 496. *Lichenoides candidum et farinaceum, scutellis fere planis* Dill. Hist. Musc. p. 131, t. 18, fig. 11 c (1741). *Lichen fagineus* L. Sp. Pl. p. 1141 (1753); Huds. Fl. Angl. p. 443? Lightf. Fl. Scot. ii. p. 807? With. Arr. ed. 3, iv. p. 4 pro parte; Engl. Bot. t. 1713. *Variolaria faginea* Pers. in Ust. Ann. Bot. vii. p. 24 (1794); Turn. & Borr. Lich. Brit. p. 64; Hook. in Sm. Engl. Fl. v. p. 169. *V. amara* Ach. Lich. Univ. p. 324 (1810); Hook. Fl. Scot. ii. p. 46; Grev. Fl. Edin. p. 330.

Exsicc. Bohl. n. 26; Johns. n. 153.

Distinguished from allied monosporous species by the bitter taste (hence the trivial name *amara*) and by the chemical reaction. Crombie has given the spore sizes as $190\text{--}236\ \mu$ long, $50\text{--}70\ \mu$ thick. The above much smaller measurements are from specimens in the herbarium. The spore walls are rather thin when mature.

Mudd has quoted, as synonyms of his var. *sorediata*, the species *Variolaria griscovirens* Turn. & Borr. ex Sm. Engl. Bot. t. 2400 (1812), a specimen of which is preserved with the drawing; Turn. & Borr. Lich. Brit. p. 54. It is a thin sterile thallus with small yellowish-green soralia, and might be a form of *Lecanora farinaria* Borr. *Spiloma vitiligo* (Ach. Meth. Lich. p. 10 (1803) & Sm. Engl. Bot. t. 2075 (1809)), quoted as synonymous with *Variolaria vitiligo* Turn. & Borr. tom. cit. p. 53 (1839), the powdery bodies of which are much darker, is equally indefinite.

Hab. On trunks of old trees, especially beech and elm in wooded tracts.—*Distr.* General and fairly common, though not seen from the Channel Islands.—*B. M.* Withiel and near Penzance, Cornwall; Lydford, Devon; Minety, Wilts; New Forest, Hants; St. Leonard's Forest, Sussex; Lydd, Kent; Hainault Forest and near Gosfield, Essex; Buildwas, Shropshire; Cwm Bychan, Merioneth; Anglesea; Gopsall and Rothery Temple, Leicestershire; Chatsworth, Derbyshire; Teesdale, Durham; Meldon Park, Northumberland; Windermere, Westmoreland; Asby, Cumberland; near Glasgow, Lanarkshire; Craigforth, Stirling; Airds, Appin, Argyll; Finlarig, Killin, Perthshire; Applecross, Rosshire; Dunkerron, Kerry.

9. *P. multipuncta* Nyl. in Flora lxiii. p. 393 (1880).—Thallus generally determinate, thinnish, indistinctly cracked- or wrinkled-granulate, dotted with round flat white sorediate verrucae, whitish or greyish-white (Kf + yellow, then sometimes red, CaCl—, I \mp dark-blue). Apothecia one or several in each verrucae, pale or brownish, with thinnish margin, the whole surface white-powdery; spores one in the ascus, thick-walled, oblong, $106\text{--}140\ \mu$ long, $28\text{--}68\ \mu$ thick.—Leight. Lich. Fl. p. 236 (errore *P. multipunctata*); ed. 3, p. 226; Cromb. Monogr. i.

p. 494. *P. globulifera* var. *multipunctata* Mudd Man. p. 274 (1861); Cromb. Lich. Brit. p. 59 (errore *P. globifera*). *P. sublactea* Leight. in Ann. Mag. Nat. Hist. ser. 4, vi. p. 474 (1870) & Lich. Fl. p. 245; ed. 3, p. 236 (saxicolous) fide Nyl. in Flora lxvi. p. 534 (1883). *Variolaria multipuncta* Turn. in Trans. Linn. Soc. ix. p. 137, t. 10, fig. 1 (1808); S. F. Gray Nat. Arr. i. p. 490; Hook. in Sm. Engl. Fl. v. p. 170 (errore *V. multipunctata*); Turn. & Borr. Lich. Brit. p. 73. *Lichen multipunctus* Sm. Engl. Bot. t. 2061 (1809).

Exsicc. Johns. n. 152; Mudd n. 262.

Readily identified by the neat white pustules and by the habitat on trees, very rarely on rocks, and then to be distinguished from *P. lactea* by the absence of reaction with calcium hypochlorite. There is a faint yellow reaction with potash which passes at once to reddish-brown or sometimes red, especially the medulla.

Hab. On trunks and branches of trees, rarely on schistose rocks, in maritime and inland districts.—*Distr.* Fairly common in England and Wales, less so in Scotland and Ireland.—*B. M.* Boconnoc, Cornwall; East Lynn, Devon; I. of Wight; New Forest, Hants; St. Leonard's Forest, Sussex; Shiere, Surrey; Cirencester, Gloucestershire; Barmouth and Cwm Bychan, Merioneth; Conway Falls, Carnarvonshire; Brantsdale, Yorkshire; Teesdale, Durham; Asby, Cumberland; Barcaldine, Argyll; Castlebernard, Cork; Cromaglow and Tore Mt., Killarney, Kerry; Kylemore Lake, Connemara, Galway; Powerscourt, Wicklow.

Form *lævigata* Cromb. Monogr. i. p. 495 (1894).—Thallus thin, almost continuous and scarcely wrinkled.—*Variolaria multipuncta* var. *lævigata* Turn. & Borr. ex Hook. in Sm. Engl. Fl. v. p. 170 (1833) & Lich. Brit. p. 73 (1839). *V. constellata* Tayl. in Mackay Fl. Hib. ii. p. 113 (1836).

A thinner less developed thallus and apothecia than in the species, possibly due to the habitat on smooth bark.

Hab. On smooth bark of young trees.—*Distr.* Found only in a few localities in S. England and S.W. Ireland.—*B. M.* Falmouth, Cornwall; New Forest, Hants; St. Leonard's Forest, Hants; Askew Wood, Kerry.

Form *fastigiata* Cromb. l. c. Thallus of crowded coralloid fertile verrucae, fastigiata and sorediate at the apices.—*P. fastigiata* Leight. in Ann. & Mag. Nat. Hist. ser. 4, vi. p. 474 (1870) & Lich. Fl. p. 245; ed. 3, p. 236. *Isidium oculatum* var. *fastigiatum* Turn. & Borr. Lich. Brit. p. 103 (1839), fide Leight. l. c.; var. β Hook. in Sm. Engl. Fl. v. p. 232. *Variolaria polythecia* Tayl. in Mackay Fl. Hib. ii. p. 113 (1836).

A well marked form. Dr. Taylor (l. c.) describes it as conspicuous by the crowded and stalked apothecia placed in contact, like certain basaltic columns.

Hab. On naked rocks and incrusting mosses in mountainous regions.—*Dist.* Recorded only from S. and W. Ireland (Bantry, Cork; Connemara, Galway).—*B. M.* Dunkerron, Kerry.

10. *P. reducta* Stirton in Scott. Naturalist, iv. p. 28 (1877).—Thallus thin, cracked-areolate, greyish or greyish-brown (K + yellow, then deep red). Apothecia sessile, with open disc, 1 in each thalline verruca, brown or reddish-brown, bluish-grey-pruinose; spores 1 in the ascus, 90–140 μ long, 30–40 μ thick.—Leight. Lich. Fl. ed. 3, p. 229; Cromb. Monogr. i. p. 498. Specimen not seen.

“Closely allied to *P. multipuncta* Turn., younger spores with broadish epispore, mature ones with coarsely granular contents.” The only plant of this section, except *P. dactylina*, with the marked reaction with potash. Wainio has recorded it from the Philippines (Phil. Journ. Sci. viii. p. 104 (1913)), in a sterile condition.

Hab. On trees in the S.W. Highlands of Scotland (Ben Brecht, Argyll).

11. *P. lactea* Nyl. in Flora lxiv. p. 539 (1881).—Thallus determinate, somewhat radiate and *Placodium*-like at the circumference, generally smooth, continuous or cracked-areolate, more or less dotted with soralia, light- or cinereous-grey or whitish (K —, CaCl + red, K(CaCl) + deeper red). Apothecia rare, small, solitary in the verrucæ, the disc white, subleprose, the thalline margin irregular; spores 1 in the ascus, 180–205 μ long, 65–70 μ thick.—Cromb. in Journ. Bot. xx. p. 274 (1882) & Monogr. i. p. 498. *P. lactescens* var. *lactea* Mudd Man. p. 272 (1861). *Lichen lacteus* L. Mant. p. 132 (1767); Huds. Fl. Angl. ed. 2, p. 526; With. Arr. ed. 3, iv. p. 5; Engl. Bot. t. 2410. *Variolaria lactea* Pers. in Ust. Ann. Bot. vii. p. 24 (1794); S. F. Gray Nat. Arr. i. p. 492; Hook. Fl. Scot. ii. p. 46 & in Sm. Engl. Fl. v. p. 170; Grev. Fl. Edin. p. 330; Tayl. in Mackay Fl. Hib. ii. p. 113; Turn. & Borr. Lich. Brit. p. 62; Leight. Lich. Fl. p. 242; ed. 3, p. 232 (as synonym of *P. velata*). *V. conspurcata* Turn. & Borr. ex Hook. in Sm. Engl. Fl. v. p. 168 (1833)? & Lich. Brit. p. 57 (1839)?

The thallus may spread very widely and varies in thickness; it is generally very light in colour, and may be easily distinguished from other sorediate species by the saxicolous habitat and by the chemical reaction. It is rarely fertile. The spore sizes are those given by Nylander. It is probable that *Variolaria conspurcata* Turn. & Borr. is a synonym of *P. lactea*, but it is impossible to be quite sure. Several specimens, labelled *Variolaria conspurcata*, on limestone or mortar from Shropshire and Derbyshire, give the same chemical reactions as *P. lactea*. They are sterile and indeterminate, but are probably abnormal forms owing to the unusual habitat.

Hab. On granitic and schistose rocks in mountainous regions.—*Distr.* Somewhat rare throughout the British Isles.—*B. M.* Chateau Point, Sark; Eridge, Sussex; Aberdovey and Cwm Bychan, Merioneth; Anglesea; Craig-y-Rhiw, Shropshire?; Matlock, Derbyshire?; near Mofiatt, Dumfriesshire; West Water, Forfarshire; Ben Lawers and Craig Calliach, Perthshire; Portlethen, Kincardineshire; Glen Ey, Braemar, Aberdeenshire; Blackwater, Kerry.

12. *P. melanochlora* Nyl. in Bull. Soc. Linn. Norm. sér. 2, vi. p. 289 (1872).—Thallus effuse (or determinate), tartareous, thick, wrinkled and warted, subareolate, densely papillate, the papillæ short, stout, rounded and sometimes sorediate at the apex, greyish-white or greyish-smoke-coloured (K(CaCl) \mp violet-rose-coloured). Apothecia small, several (2-5) in the sorediate papillæ; spores 1 in the ascus, 180-250 μ long, 75-100 μ thick.—Cromb. in Grevillea xix. p. 59 (1891) & Monogr. i. p. 493. *Isidium melanochlorum* DC. Fl. Fr. ii. p. 326 (1805).

The chemical reaction is distinct in Nylander's specimen from the Pyrenees; it is very slight in the one from Wales. The spores are very thick-walled and taper downwards, perhaps a development stage, and, so far as observed, measure from 45 μ in width. The spermatia (fide Nyl.) measure about 4-5 μ long, 1 μ thick.

Hab. On quartzose and schistose rocks.—*B. M.* Barmouth, Merioneth (the only British record).

B. Spores usually two in the ascus.

Thallus non-sorediate; spores colourless.

13. *P. pustulata* Nyl. in Act. Soc. Linn. Bord. sér. 3, i. p. 441 (1856) (? Leight. Angioc. Lich. p. 30, t. 10, fig. 4 (1851)).—Thallus developed beneath or above the bark, determinate, thinnish, smooth or finely granulate in parts, cream-coloured or greyish-white (K + yellowish, K(CaCl) + slightly reddish). Apothecia solitary or several in small convex scattered or congregate verrucæ, the ostioles punctiform and dark, then becoming lacerate and exposing a small flesh-coloured open disc; spores 2 in the ascus, 60-126 μ long, 25-45 μ thick.—Mudd Man. p. 275 pro parte; Cromb. Lich. Brit. p. 60 pro parte & Monogr. i. p. 504; Leight. Lich. Fl. p. 244; ed. 3, p. 234 pro parte. *P. melaleuca* Dub. Bot. Gall. ii. p. 673 (1830); Leight. Angioc. Lich. p. 29, t. 10, fig. 4 & Lich. Fl. p. 240; ed. 3, p. 230; Mudd Man. p. 275; Cromb. Monogr. i. p. 504. *Porina pustulata* Ach. Lich. Univ. p. 309 (1810). *Lichen melaleucus* Sm. Engl. Bot. t. 2461 (1813). *Thelotrema melaleucum* Turn. & Borr. ex Sm. l. c. & Lich. Brit. p. 183; Hook. in Sm. Engl. Fl. v. p. 161.

Characterized by the thin smoothish thallus and by the 2-spored ascus. The reaction with potash is most easily seen in sections under the microscope, with calcium hypochlorite added the thallus is generally tinged reddish. There is no specific distinction between *P. pustulata* and *P. melaleuca*; several British specimens classified by Crombie and others as *P. pustulata* belong to *P. communis* or to *P. leioplaca*. In a specimen from Dolgelly the verrucæ are whitish on a grey thallus; it has been determined by Crombie as f. *superpallens* Nyl. (Flora lxix. p. 466 (1886)).

Hab. On trees in wooded districts.—*Distr.* Rather rare in the southern and midland counties of England and in N. Wales.—*B. M.* New Forest, Hants; \dagger Ardingly and St. Leonard's Forest, Sussex;

Shiere, Surrey; Epping Forest, Hadleigh and Hockley Woods, Essex; Burnham Beeches, Bucks; Dolgelly and Barmouth, Merioneth.

14. *P. pertusa* Dalla Torre & Sarnth. Die Flecht. Tirol, p. 309 (1902).—Thallus determinate, warted-areolate or wrinkled, thick, or sometimes flat and thinnish, especially towards the concentrically marked margin, the fertile warts or verrucae large and prominent, irregularly sub-globose, generally crowded, though sometimes thinly scattered, greyish or greenish-grey (K \pm ^{yellowish}/_{orange}, CaCl -). Apothecia one or several in each verruca, punctiform, the disc minute, slightly depressed, blackish; epithecium K + violet; paraphyses slender; spores 2 in the ascus (sometimes 1 or 3 or 4), 130-205 μ long, 45-80 μ thick; hymenial gelatine round the asci persistently blue with iodine.—*P. communis* DC. Fl. Fr. ii. p. 320 (1805) (incl. f. *rupestris*); Hook. in Sm. Engl. Fl. v. p. 160; Turn. & Borr. Lich. Brit. p. 196 (incl. var. *rupestris*); Leight. Angioc. Lich. p. 27 & Lich. Fl. v. p. 238; ed. 3, p. 229 (incl. f. *rupestris*); Mudd Man. p. 275; Cromb. Lich. Brit. p. 58 & Monogr. i. p. 499 (incl. f. *rupestris*). *P. rupestris* Schaer. Enum. p. 227 (1850); Mudd Man. p. 272 (incl. var. *areolata?* (non Clem.)). *Lichenoides verrucosum et rugosum, cinereum, glabrum* Dill. Hist. Musc. p. 128, t. 18, fig. 9 (1741). *Lichen pertusus* L. Mant. p. 131 (1767); Lightf. Fl. Scot. ii. p. 802; Huds. Fl. Angl. ed. 2, p. 525; With. Arr. ed. 3, iv. p. 15; Engl. Bot. t. 677. *Porina pertusa* Ach. Lich. Univ. p. 308 (1810); S. F. Gray Nat. Arr. i. p. 495; Hook. Fl. Scot. ii. p. 45; Grev. Fl. Edin. p. 354; Tayl. in Mackay Fl. Hib. ii. p. 102.

Exsicc. Bohl. n. 54; Johns. nos. 278, 279, 422 (Brit. Mus. set as *P. pustulata*); Leight. n. 71 (Brit. Mus. set as *P. fallax*); Mudd nos. 259 (f. *rupestris*), 264.

One of the commonest British lichens, easily known by the prominent verrucae. The apothecia vary from one to many in each verruca, the narrowed discs are generally dark coloured, but may be whitish in shade conditions (f. *leucostoma* Schaer. Enum. p. 229 (1850)) when there is also no reaction of the epithecium with K. The reactions of both thallus and apothecia, the latter characteristic of several other species, are sometimes rather faint. The thallus is frequently the host of *Sphinctrina turbinata*. Form *rupestris* differs only in habitat, it is rather uncommon.

Hab. On the trunks of old trees, rarely on palings or on rocks in lowland and upland regions.—*Distr.* General in the British Isles.—*B. M.* Sark; Guernsey; Withiel, Cornwall; near Bovey Tracey and Lustleigh, Devon; Appuldurcombe, I. of Wight; New Forest, Hants; near Hastings, near Battle, St. Leonard's Forest, Ardingly, Henfield and Offham, Sussex; Penshurst, Kent; Shiere, Surrey; Hockley Wood, Hatfield Peverel and Epping Forest, Essex; near Buckingham; Cirencester, Gloucestershire; Broadwas and near Malvern, Worcestershire; Twycross and Gopsall Park, Leicester; Hafod, Cardiganshire; Barmouth and Dolgelly, Merioneth; Buildwas, Shropshire; Bettws-y-Coed, Denbighshire; near Conway, Carnarvonshire; Anglesea;

Church Stretton and Llanford, Shropshire; Enville, Staffordshire; Great Glenham, Suffolk; Millersdale, Derbyshire; Kildale and near Ayton, Cleveland, Yorkshire; Teesdale, Durham; Windermere, Westmoreland; Calder Abbey, Northumberland; Gilgarron and near Whitehaven, Cumberland; New Galloway, Kirkeudbrightshire; Roslin and Colinton Woods, Midlothian; near Glasgow; Barcaldine and I. of Lismore, Argyll; Glen Lochay, Killin, Aberfoyle and Balthayock Woods, Perthshire; Countesswells Woods, near Aberdeen and Craig Cluny, Braemar, Aberdeenshire; near Fort William, Invernesshire; Applecross, Rossshire; Lairg, Sutherlandshire; Dunkerron, Kerry.

15. *P. areolata* Nyl. in Flora lxiv. p. 456 (1881).—Thallus determinate, thickish, more or less densely papillate, cracked-areolate, light- or darkish-grey (K + yellow). Apothecia with a minute blackish disc; epithecium K + violet; spores 2 in the ascus (or sometimes more), 130–205 μ long, 45–80 μ thick.—Cromb. in Grevillea xix. p. 59 (1891). *P. communis* subsp. *areolata* Nyl. ex Hue Add. Nov. Lich. Eur. p. 118 (1886); Cromb. Monogr. i. p. 500. *Thelotrema pertusum* var. *areolatum* Clem. Ensayo, p. 300 (1807).

Though classified as a subspecies of *P. pertusa* by Nylander and others, there is a great difference in thalline characters, and in the much brighter reaction with potash. The British specimens are without apothecia; it has therefore been impossible to verify the spore characters.

Hab. On siliceous rocks and walls in maritime districts.—*Distr.* Among the Grampians, Scotland, and W. Ireland.—*B. M.* Craig Calliach and Craig Tulloch, Blair Athole, Perthshire; Morrone, Braemar, Aberdeenshire; Hills of Applecross, Rossshire.

16. *P. ceuthocarpa* Turn. ex Sm. Engl. Bot. t. 2372 (1821) note.—Thallus determinate, thickish, cracked-areolate and warted, the areolæ convex, unequal, cream-coloured (K + yellow, then deep-red). Apothecia in subglobose or irregularly conglomerate smooth verrucæ, deeply immersed, the discs punctiform, blackish; spores 2 in the ascus, thick-walled, 150–175 μ long, 40–60 μ thick.—Hook. in Sm. Engl. Fl. v. p. 160; Turn. & Borr. Lich. Brit. p. 200; Leight. Angioc. Lich. p. 28, t. 9, fig. 4 & Lich. Fl. p. 237; ed. 3, p. 228; Mudd Man. p. 271; Cromb. Lich. Brit. p. 58 & Monogr. i. p. 501. *Lichen ceuthocarpus* Sm. Engl. Bot. t. 2372 (1812). *Porina ceuthocarpa* Tayl. in Mackay Fl. Hib. ii. p. 102 (1836).

Exsicc. Leight. n. 284.

There are only a few British *Pertusariæ* with the above strongly-marked potash reaction, and among them *P. ceuthocarpa* is distinguished by the thickish unequal thallus, by the large tumid fertile verrucæ, and by the saxicolous habitat. On the continent it is classified along with *P. coccodes*, which is corticolous, while Smith's plant is saxicolous. Fries, however, records *P. ceuthocarpa* as saxicolous in Scandinavia and in Germany (Lich. Eur. p. 423).

Hab. On rocks in maritime and mountainous districts.—*Distr.* Rare throughout the British Isles, though fairly plentiful where it occurs.—*B. M.* Jersey; Pentire, Kynance and Lamorna, Cornwall; Harlech, Barmouth, Aberdovey and near Dolgelly, Merioneth; Holyhead, Anglesea; Airds, Appin, Argyll; Craig Calliach, Perthshire; Lambay Island, Dublin.

Form *microstictica* Cromb. Monogr. i. p. 502.—Thallus sprinkled with minute brownish papillæ.—*Lichen microsticticus* Sm. Engl. Bot. t. 2243 (1811). *Isidium microsticticum* Turn. & Borr. ex Hook. Fl. Scot. ii. p. 66 (1821) & Lich. Brit. p. 94; S. F. Gray Nat. Arr. i. p. 774; Hook. in Sm. Engl. Fl. v. p. 231.

Exsicc. Leight. nos. 280, 342.

Scarcely to be considered as a true form, as the same type of small brown papillæ are occasionally present in *P. concreta*. When they are abraded they leave a minute white dot on the thallus.

Hab. On rocks in maritime and mountainous regions.—*Distr.* Rare in the Channel Islands, N. Wales and S.W. Ireland (*vide* Crombie).—*B. M.* Barmouth, Merioneth.

Form *variolosa* Mudd Man. p. 271 (1861).—The thalline verrucæ sterile, sorediate.—Cromb. in Grevillea xix. p. 59 & Monogr. i. p. 502.

Exsicc. Leight. n. 341.

The pulverulent verrucæ are crowded and are more regular, as well as generally smaller, than in the species, but the affinity is easily recognized by the reaction with potash.

Hab. On rocks in maritime districts.—*Distr.* Rare in N. Wales and W. Ireland.—*B. M.* Dolgelly, Merioneth; Achill Island, Mayo.

17. *P. concreta* Nyl. in Mém. Soc. Sci. Nat. Cherb. v. p. 117 (1857) & in Flora lix. p. 233 (1876).—Thallus determinate, thickish, unequal or generally plane, cracked-areolate, whitish (K + yellow, then red). Apothecia immersed in the areolæ, the disc punctiform then somewhat exposed, flesh-coloured to blackish; spores 2 in the ascus, 115–250 μ long, 60–80 μ thick.—Cromb. in Grevillea v. p. 25 (1876) & Monogr. i. p. 505; Leight. Lich. Fl. ed. 3, p. 227.

Exsicc. Larb. Lich. Hb. n. 27.

Originally described from the Eastern Pyrenees, and considered by Nylander to be the specific form of *Isidium Westringii*. It differs from *P. cuthocarpa* in the absence of pronounced verrucæ, minute papillæ are often present. Fertile specimens are very rare; in one from Clare Island the spores were barely mature, but the largest measured only 175 μ \times 55 μ .

Hab. On rocks in maritime districts.—*Distr.* Local but somewhat abundant in W. Ireland.—*B. M.* Letterfrack, Connemara, Galway; Clare Island, Achill Island and Mallaranny, Achill, Mayo.

Form *Westringii* Nyl. in Flora lix. p. 234 (1876).—Thallus thin or thickish, determinate, cracked-areolate, more or less densely papillate, the papillæ minute, then large, simple or branched.—Cromb. in Grevillea xix. p. 59 (1891) & Monogr. i. p. 503. *P. Westringii* Leight. Lich. Fl. p. 236 (1871); ed. 3, p. 227 pro minima parte (excl. syn. *P. lactescens*). *Lichen Westringii* Ach. in Vet. Acad. Handl. xv. p. 179, t. 6, fig. 1 (1794); Dicks. Pl. Crypt. fasc. iv. p. 20; Engl. Bot. t. 2204. *Isidium Westringii* Ach. Meth. Lich. p. 138 (1803); S. F. Gray Nat. Arr. i. p. 412 (1821) (excl. syn. *Lichen punctatus*); Hook. Fl. Scot. ii. p. 66 & in Sm. Engl. Fl. v. p. 231; Turn. & Borr. Lich. Brit. p. 92.

Generally a thin plane thallus covered with papillæ, but these may coalesce into a somewhat warted condition when it approaches *P. ecuthocarpus* in appearance. Leighton's description seems to refer largely to that species. It is a sterile form.

Hab. On rocks and walls in maritime and mountainous districts.—*Distr.* Rather rare throughout the British Isles.—*B. M.* Guernsey; Jersey; near St. Austell and Penzance, Cornwall; Barmouth and Aberdovey, Merioneth; Arkendale, Durham; Thornthwaite, near Keswick, Cumberland; Achosragan Hill, Appin, Argyll; Craig Tulloch, Blair Athole, Perthshire; Glen Callater, Braemar, Aberdeenshire; Kylemore, Connemara, Galway; Clare Island and Achill, Mayo.

Thallus non-sorediate; spores olivaceous or blackish.

18. *P. lactescens* Mudd Man. p. 272 (1861) (excl. var. *luctea*).—Thallus thickish, smooth, unequal, becoming granulate or cracked-areolate (K + yellow, then red). Fertile verrucæ scattered, flat, contorted and difform, the apothecia innate in the areolæ, with a somewhat open blackish disc; spores usually 2 (rarely 3-4), in the ascus, ellipsoid, becoming olivaceous or blackish (K + violet), 90-130 μ long, 45-85 μ thick.—Cromb. Monogr. i. p. 504. *P. spilomanthodes* Nyl. in Flora lxiv. p. 179 (1881); Cromb. in Grevillea x. p. 23 (1881).

Exsicc. Mudd n. 260.

A purely British species so far as is yet known. In some of the specimens there are scattered sorediate or abraded small spots. *P. spilomanthodes* was collected at Ennerdale, Cumberland, by the Rev. W. Johnson.

Hab. On rocks and walls in upland districts.—*Distr.* Rare in N. England.—*B. M.* Ayton Moor, Cleveland, Yorkshire; Ennerdale, Cumberland.

19. *P. urceolaria* Nyl. in Bull. Soc. Linn. Norm. p. 324 (1873) note.—Thallus rather thin, cracked-areolate, the surface scabrid with short papillæ, whitish (K + yellow, then red). Apothecia small, sunk in the areolæ, the disc blackish, depressed-urceolate, then becoming rather open, with a stoutish minutely

papillate margin; spores 1-4 in the ascus, olivaceous or blackish (K + violet), 100-140 μ long, 50-75 μ thick.—Leight. Lich. Fl. ed. 3, p. 228 pro parte; Cromb. Monogr. i. p. 505.

Exsicc. Larb. Lich. Hb. n. 28.

Occasionally confused with *P. spilomantha*, which, however, has a single large spore in the ascus. It approaches very closely the preceding species, the only real difference being in the papillose thallus which may be simply a varietal distinction, but that can only be determined by the discovery of further specimens.

Hab. On granitic stones of a wall in a maritime district.—*B. M.* La Moye, Jersey (the only locality).

Thallus sorediate; spores colourless.

20. *P. coccodes* Nyl. in Mém. Soc. Sci. Nat. Cherb. v. p. 116 (1857).—Thallus determinate or effuse, thin, following the inequalities of the bark, subfarinose or isidiose, areolate, occasionally warted, whitish (K + yellow, then rusty-red). Apothecia one or several in scattered or congregate small subglobose verrucæ; the discs minute, dark-coloured; spores 2 in the ascus, 115-140 μ long, 40-60 μ thick.—Cromb. Lich. Brit. p. 59 & Monogr. i. p. 502 (incl. f. *bacillosa*); form *bacillosa* Nyl. ex Lamy in Bull. Soc. Bot. Fr. xxv. p. 425 (1878). *P. globulifera* var. *coccodes* Mudd Man. p. 274 (1861). *Lichen coccodes* Ach. Lich. Suec. Prodr. p. 10 (1798); Engl. Bot. t. 1511. *Isidium coccodes* Ach. Meth. Lich. p. 139 (1803); S. F. Gray Nat. Arr. i. p. 412; Hook. in Sm. Engl. Fl. v. p. 230; Turn. & Borr. Lich. Brit. p. 89 (incl. var. *phymatodes*). *I. phymatodes* Ach. l. c.?

Somewhat resembling the thallus of *Lecanora parella* var. *Turneri*, but easily distinguished by the reaction with potash; occasionally the papillæ are very luxuriant (f. *bacillosa*), and a sorediate form (f. *variolaria*) is recorded by Harmand (Lich. Fr. v. p. 1127 (1913)). In some specimens there is a pale reddish colour in parts (f. *phymatodes*). British plants are sterile.

Hab. On trunks of old trees in inland districts.—*Distr.* Rare from S. to N. England.—*B. M.* New Forest, Hants; Albourne, Sussex; Salperton, Gloucestershire; Hay Park, Herefordshire; near Quendon and Hainault Forest, Essex; near Norwich, Norfolk; Baysdale, Cleveland, Yorkshire.

21. *P. dealbata* Cromb. Lich. Brit. p. 59 (1870) (excl. syn. *P. lactescens*).—Thallus effuse, occasionally with a definite margin, of crowded unequal small granules or papillæ, generally rather thick, finely or coarsely cracked-areolate, whitish or ash-grey (K + yellow (then frequently red), CaCl - , medulla I + pale blue). Fertile verrucæ prominent, subglobose, containing several apothecia, white-pulverulent above; spores 2 in the ascus, very

variable in size, 80–150 μ long, 50–82 μ thick (or smaller).—Cromb. in Grevillea xii. p. 59 & Monogr. i. p. 500; Leight. Lich. Fl. p. 238; ed. 3, p. 228 pro parte. *P. syncarpa* Mudd Man. p. 273 (1861) (incl. var. *dealbata*). *Lichen dealbatus* Ach. Lich. Suec. Prodr. p. 29 (1798). *Variolaria dealbata* DC. Fl. Fr. ii. p. 325 (1805); Engl. Bot. t. 2519. *V. corallina* Ach. Lich. Univ. p. 319 (1810); S. F. Gray Nat. Arr. i. p. 492; Tayl. in Mackay Fl. Hib. ii. p. 113. *V. chlorothecia* Tayl. tom. cit. p. 114 (1836). *Isidium paradoxum* Turn. & Borr. ex Hook. in Sm. Engl. Fl. v. p. 231 (1833) & Lich. Brit. p. 97.

Exsicc. Johns. n. 328; Leight. n. 320; Mudd n. 261.

Distinguished by the generally papillate thallus and the scattered pustular verrucæ, which are frequently several-aggregate. The chemical reaction is very pronounced, and frequently the yellow colour changes to orange or red. The thallus is occasionally the host of *Sclerococcum sphaerale* Fr.

Hab. On rocks, boulders and walls in maritime and mountainous regions.—*Distr.* Fairly common throughout the British Isles.—*B. M.* Sark; St. Austell, Cornwall; Dartmoor Tors, Devon; Barmouth, Aberdovey and Cwm Bychan, Merioneth; Nant Gwynant, Carnarvonshire; Anglesea; Oswestry and Caer Caradoc, Shropshire; Kildale Moor, Cleveland, Yorkshire; Teesdale, Durham; Cumberland; Ochill Hills, near Stirling; Lismore and Ben Cruachan, Argyll; The Trossachs, Crianlarich, Ben Lawers, Craig Calliach and Ben Vrackie, Perthshire; Sidlaw Hills and Clova, Forfarshire; Glen Callater and Morrone, Braemar, Aberdeenshire; Dunkerron and Finnehy River, Kerry; Dawros River, Connemara, Galway.

Form *corallina* Cromb. Monogr. i. p. 501 (1894).—Thallus more densely papillate than in the species, with the papillæ more elongate, simple or branched.—Var. *corallina* Cromb. in Grevillea xii. p. 59 (1883). *P. syncarpa* var. *corallina* Mudd Man. p. 273 (1861). *Lichen corallinus* L. Mant. p. 131 (1767); Lightf. Fl. Scot. ii. p. 808; Huds. Fl. Angl. ed. 2, p. 526; With. Arr. ed. 3, iv. p. 16; Engl. Bot. t. 1541. *Isidium corallinum* Ach. Meth. Lich. p. 138 (1803); S. F. Gray Nat. Arr. i. p. 412; Hook. Fl. Scot. ii. p. 669 & in Sm. Engl. Fl. v. p. 231; Grev. Fl. Edin. p. 346; Turn. & Borr. Lich. Brit. p. 100.

Differing from the species in the more definitely branched coralloid papillæ, though connected with it by intermediate states. In our county, and in France, it is recorded as always sterile, but Zahlbruckner has issued a specimen from Saxony (Krypt. exs. n. 256) which bears apothecia.

Hab. On rocks in maritime and upland situations.—*Distr.* Local and rare in Great Britain and Ireland.—*B. M.* Maresfield Common, Sussex; Pontneddfychan, Brecknockshire; Barmouth, Merioneth; Anglesea; Malvern, Worcestershire; Ayton Moor, Cleveland, Yorkshire; Egglestone, Durham; Alston, Cumberland; Ben-y-gloe, Perthshire; Sidlaw Hills and Baldovan Woods, Forfarshire; Oban, Argyll; The Dargle River, Wicklow.

C. Spores usually four in the ascus.

Thallus non-sorediate.

22. *P. glomerata* Schær. Lich. Helv. Spicil. p. 66 (1823).—Thallus effuse, thin, somewhat wrinkled, but consisting mostly of small subglobose crowded and sometimes confluent fertile verrucæ, white or faintly yellowish cream-coloured (K + yellow, then blood-red, CaCl—). Apothecia usually solitary, with punctiform or slightly open blackish discs; epithecium K + violet; spores generally 4 in the ascus (sometimes 2 or up to 7), 72–125 μ long, 28–44 μ thick.—Mudd Man. p. 277; Carroll in Journ. Bot. iii. p. 289 (1865); Cromb. Lich. Brit. p. 60 & Monogr. i. p. 510; Leight. Angioc. Lich. p. 73 note & Lich. Fl. p. 237; ed. 3, p. 227. *P. glomulifera* Borr. ex Leight. Lich. Fl. p. 243 (1871); ed. 3, p. 234. *Lichen glomeratus* Schleich. Pl. Crypt. Cent. iii. n. 77, in Schrad. Neu. Journ. Bot. i. 2, p. 199 (1806) nomen nudum. *Porina glomerata* Ach. Lich. Univ. p. 310 (1810).

An alpine lichen, sufficiently distinguished from other "moss" species by the number of spores and by the reaction with potash. The violet reaction of the epithecium is well marked, suggesting affinity with *P. Wulfenii*. It is described and figured without a name in Leight. Angioc. Lich. p. 30, t. xi. fig. 2 (1851).

Hab. Encrusting dead mosses in mountainous places.—*Distr.* Rare in the Scottish Grampians.—B. M. Craig Calliach and Ben Lawers, Perthshire.

23. *P. leioplaca* Schær. Lich. Helv. Spicil. p. 66 (1823).—Thallus thin, developed above or within the outer periderm layers, subdeterminate, smooth or with scattered unequal slight wrinkles and cracks, white or yellowish-white (K – or f + yellowish). Fertile verrucæ numerous, scattered, prominent, smooth, the apothecia 1–5 in each verruca, with pale or dark punctiform ostioles; spores normally 4, uniseriate in the ascus, sometimes varying in the same hymenium from 2 to 6 or even 8, ellipsoid, variable in size, 42–110 μ long, 20–40 μ thick.—Mudd Man. p. 276; Cromb. Lich. Brit. p. 60 & Monogr. i. p. 509 (incl. var. *hexaspora* Nyl. Lich. Scand. p. 182 (1861)); Leight. Lich. Fl. p. 244; ed. 3, p. 234. *P. communis* var. *leioplaca* Turn. & Borr. ex Schær. l. c. & Lich. Brit. p. 197. *Porina leioplaca* Ach. in K. Vet. Acad. Handl. xxx. p. 159 (1809) & Lich. Univ. p. 309, t. 7, fig. 2 (1810) (excl. vars.).

Exsicc. Johns. n. 157; Leight. n. 230; Mudd nos. 265, 267.

Distinguished by the thin, partly hyphophæodal, thallus and by the normally 4-spored ascus. Very rarely, there are 8 spores present, which are then smaller (var. *octospora* Nyl. Lich. Scand. p. 182 (1861); Wheld. & Trav. in Journ. Bot. li. p. 251) (1913)). The reaction with potash, according to Th. Fries (Lich. Scand. p. 316), is less pro-

nounced in the lighter-coloured thalli. There is a doubtful specimen recorded from La Moye, Jersey, which is only spermogoniferous.

Hab. On the trunks of trees from maritime to upland situations.—*Distr.* Fairly common in most parts of the British Islands.—*B. M.* La Moye, Jersey? Withiel, Cornwall; Widdecombe, Lydford, Lustleigh and Torquay, Devon; Hinton Abbey, Somerset; New Forest, Hants; Shanklin, I. of Wight; St. Leonard's Forest, Lindfield, Danny and Handcross, Sussex; Ightham, Kent; near Highbeach, Epping Forest, Hockley and Hadleigh Woods and near Bocking, Essex; near Cirencester, Gloucestershire; Woodbury Hill and Malvern, Worcestershire; Gopsall Park and Twycross, Leicestershire; near Oswestry and Nesscliff, Shropshire; Gloddaeth, Carnarvonshire; Bettws-y-coed, Denbighshire; Anglesea; Newton Wood and Sowerdale, Cleveland, Yorkshire; Lamplugh, Cumberland; Barcaldine, Argyll; Calliach and Falls of Moness, Aberfeldy, Perthshire; Moor of Morrone, Braemar, Aberdeenshire; Glen Nevis, Invernesshire; Enniskean, Cork; Kenmore, M'Carthy's Island, Upper Lake and Dinish, Killarney, Kerry; Renvyle Wood, Connemara, Galway; Westport, Mayo.

24. *P. xanthostoma* Fr. Lich. Eur. p. 426 (1831).—Thallus effuse, thin, smooth, white, the fertile verrucæ scattered, subglobose (K—, CaCl—). Apothecia 1 to 5 in each verruca, the ostiole punctiform then opening to discoid form, pale yellowish flesh-coloured; spores up to 6 in the ascus, 55–75 μ long, 30–40 μ thick.—Cromb. in Journ. Bot. xiii. p. 141 (1875); Leicht. Lich. Fl. ed. 3, p. 235. *Porina xanthostoma* Sommerf. in Vet. Acad. Handl. 1823 [1824], p. 115.

The fertile verrucæ strongly resemble the apothecia of *Lecanora pormiformis* or early stages of *L. parella*, but the plant can be distinguished by differences in thallus, etc.

Hab. On old stems of heather, etc., in alpine and subalpine localities.—*Distr.* Rare in the Grampians and Highlands of Scotland.—*B. M.* Morrone, Braemar, Aberdeenshire; near Lairg, Sutherlandshire.

Thallus sorediate.

25. *P. lutescens* Lamy in Bull. Soc. Bot. Fr. xxv. p. 427 (1878).—Thallus subeffuse, thickish, unequal, warted or areolate, the thallus generally covered with sorediate verrucæ, greenish-yellow (K(CaCl) + orange-yellow). Apothecia rare, the disc open, black, the margin tumid; spores rarely 8 in the ascus (usually 4–7), about 66 μ long, 36 μ thick.—Cromb. in Grevillea xix. p. 59 (1891) & Monogr. i. p. 507. *P. fallax* var. *variolosa* Fries Lich. Eur. p. 425 (1831); Mudd Man. p. 276. *Lichen lutescens* Hoffm. Enum. Lich. p. 3 (1784). *Lepra lutescens* Hoffm. Pl. Lich. p. 100, t. 23, ff. 1, 2 (1790). *Lepraria lutescens* Sm. Engl. Bot. t. 1529 (1806). *Isidium lutescens* Turn. & Borr. ex Hook. in Sm. Engl. Fl. v. p. 320 (1833) & Lich. Brit. p. 87.

Somewhat similar to *P. sulphurea* in colour, but differing in the habitat and in the constantly furfuraceous thallus. All the specimens available for examination are sterile, though fruiting forms have been collected on the continent. The spore sizes are quoted from Harmand (Lich. Fr. v. p. 1138). He gives the hymenial reaction as CaCl + rose.

Hab. On the trunks of old trees, chiefly oaks.—*Distr.* Rare in S.W. and N. England.—*B. M.* New Forest, Hants; Hurstpierpoint, Sussex; Ockham, Surrey, Epping Forest, Essex; Ickworth Park, Suffolk; Oswestry, Shropshire; near Battersby, Cleveland, Yorkshire.

D. Spores usually eight in the ascus.

Thallus non-sorediate.

26. *P. oculata* Th. Fr. Lich. Scand. p. 307 (1871).—Thallus effuse, mostly coralloid-papillate, the papillæ rather slender, smooth, rounded at the tips, which are frequently occupied by dark-coloured spermogones, white or greyish (K + yellow, then reddish). Apothecia immersed in the apices of the papillæ, the disc blackish, the thalline margin tumid, entire; spores 8 in the ascus, ellipsoid, 18–30 μ long, 11–14 μ thick.—*Lichen oculatus* Dicks. Pl. Crypt. ii. p. 17, t. 6, fig. 5 (1790); With. Arr. ed. 3, iv. p. 7. *Isidium oculatum* Ach. Meth. Lich. p. 140 (1803); Turn. & Borr. ex Hook. in Sm. Engl. Fl. v. p. 232 pro parte & Lich. Brit. p. 105 (excl. vars.). *Lecanora oculata* Ach. Syn. Lich. p. 148 (1814); Hook. Fl. Scot. ii. p. 47 pro parte; Mudd Man. p. 156; Cromb. Lich. Brit. p. 56 & Monogr. i. p. 465 (incl. f. *depressa*); Leight. Lich. Fl. p. 200; ed. 3, 173.

Frequently classified under *Lecanora*. It looks like a miniature form of *P. dactylina*. It has been impossible, in the absence of apothecia in all available specimens, to verify the details as to spores, etc. Spermogones are more generally present.

Hab. On mosses on the ground, rarely on schistose rocks in alpine localities.—*Distr.* Rare on the summits of the Grampians, Scotland.—*B. M.* Craig Calliach and Ben Lawers, Perthshire; Cairngorm, Cairntoul and Ben-naboord, Braemar, Aberdeenshire.

27. *P. carneopallida* Anzi ex Nyl. in Flora li. p. 478 (1868).—Thallus developed under the bark (hypophlæodal) in spots, pale yellowish (in dried specimens) (K–, CaCl–). Apothecia erumpent, small, not prominent, the disc flesh-coloured, covered at first, plane, then somewhat convex and naked with an irregular minutely sublobate margin; spores 8 in the ascus, rather small, ellipsoid, 18–32 μ long, 11–20 μ thick.—Cromb. in Grevillea xii. p. 60 (1883) & Monogr. i. p. 507. *Lichen cupularis* With. Arr. ed. 3, iv. p. 22 (1796) (non Ehrh.) pro parte (hab. on trees) fide Crombie ll. c. *Lecidea carneopallida* Nyl. Bot. Not. 1853, p. 183 & Lich. Scand. p. 196, t. 1, fig. 9.

A Scandinavian plant not unlike *Gyalecta carneolutea*; it has only once been collected in Great Britain. It was first recorded by

Sommerfelt in Fl. Lapp. Suppl. p. 85 (1826) as *Lecidea carneolutes* (non Turn.) with the name *Lecidea protuberans* Sommerf. in litt. in the synonymy. The first of these names was based on error, the second is a synonym which has been republished by Th. Fries in Lich. Arct. p. 102 (1860) as *Lecanora protuberans* and in Lich. Scand. p. 305 as *Pertusaria protuberans*. Nylander's is the first authentic name.

Hab. On the bark of alders in mountainous regions; recorded by Crombie from Appin, Argyll.

28. *P. Wulfenii* DC. Fl. Fr. ii. p. 320 (1805).—Thallus effuse or determinate, thin and membranaceous or becoming thickish, wrinkled or areolate-cracked, whitish- or yellowish-grey (K + yellowish, K(CaCl) + orange-yellow). Fertile verrucæ numerous, sometimes confluent, of irregular form, with one or several apothecia, at first with punctiform ostioles, then enlarging to a dark-coloured (more rarely flesh-coloured) disc, with an irregular tumid crenate margin; epithecium K + violet; spores usually 8 in the ascus (sometimes fewer), 58–115 μ long, 28–50 μ thick.—Cromb. Lich. Brit. p. 60 & Monogr. i. p. 505 (incl. var. *glabrescens*). *P. fallax* Hook. in Sm. Engl. Fl. v. p. 160 (1833); Light. Angioc. Lich. p. 29, t. 10, fig. 2 (1851) & Lich. Fl. p. 240 pro parte; ed. 3, p. 231; Mudd Man. p. 276. *Lichenoides verrucosum et rugosum, cinereum, glabrum* Dill. Hist. Musc. p. 128, t. 18, fig. 9 pro parte (1741). *Lichen hymenius* Ach. Lich. Suec. Prodr. p. 80 (1798)? Engl. Bot. t. 1731. *Thelotrema hymenium* Ach. Meth. Lich. p. 133 (1803)? Turn. & Borr. Lich. Brit. p. 185 pro parte. *Verrucaria fallax* Pers. ex Ach. Meth. Lich. p. 133 (1803)? nomen nudum. *Porina fallax* Ach. Syn. Lich. p. 110 (1814); Tayl. in Mackay Fl. Hib. ii. p. 102. *P. hymenea* S. F. Gray Nat. Arr. i. p. 495 (1821).

Æsicc. Bohl. n. 100; Johns. nos. 154, 156 (as var. *diffracta*); Light. n. 71; Mudd n. 266.

Similar to *P. pertusa* in habitat and in the peculiar reaction of the epithecium with potash, but differing in the wide open disc, and in the number of the spores; these vary considerably in size according to the number in the ascus and to the stage of maturity; the sizes recorded in British Floras are too small. The thallus varies from a thin film with prominent verrucæ (var. *glabrescens* Nyl. in Bull. Soc. Linn. Norm. sér. 2, vi. p. 290 (1872)), to a thick coarsely cracked-areolate crust (var. *diffracta* Johns. exs. n. 156). There are numerous intermediate stages, and they evidently depend on the type of bark on which the plant grows. Though normally a corticolous species, it may stray to other substrata; a specimen from a stone and mortar wall, collected at Belclare, Mayo, is typical *P. Wulfenii*, and quite distinct from var. *rupicola* (*P. sulphurea*), and with a more developed thallus than form *sparsilis*. According to Th. Fries (Lich. Scand. p. 317), *Lichen hymenius* Ach. more probably represents a form of *P. bioplaca*, while the original *Verrucaria fallax* Pers. is synonymous with *P. pustulata* (tom. cit. p. 313).

Hab. On trunks of trees in parks and woods (rarely saxicolous).—*Distr.* General and fairly common in the wooded districts of the

British Isles.—*B. M.* Boconnoc and Withiel, Cornwall; near Totness and Lustleigh, Devon; New Forest, Hants; St. Leonard's Forest, Tilgate and Chanctonbury, Sussex; Penshurst, Kent; Epping and Hainault Forests, Hadleigh Woods, Messing, Weald Hall and Mark's Hall, Essex; Sotterly, Ugley and Yarmouth, Suffolk; Batheaston, Somerset; Charnwood Forest, Leicestershire; Dolgelly and Aberdovey, Merioneth; Capel Curig and near Conway, Carnarvonshire; Trefriw, Denbighshire; Oswestry and Llanyblodwell, Shropshire; Ingleby Park, Cleveland, Yorkshire; Teesdale, Durham; Calder Abbey, Keswick and Greenbank, Whitehaven, Cumberland; Barcaldine, Argyll; Aberfeldy, Craig Calliach and Blair Athole, Perthshire; Durris, Kincardineshire; Craig Cluny, Braemar, Aberdeenshire; Castlebernard Park, Cork; Dinish, Killarney, Kerry; Belclare, Mayo.

Form *carnea* Fr. Lich. Eur. p. 424 (1831).—Thallus as in the species. Apothecial disc protruding, tumid and flesh-coloured.—Cromb. in Grevillea xix. p. 59 (1891) & Monogr. i. p. 506. *Thelotrema hymenium* var. *carneum* Turn. & Borr. Lich. Brit. p. 185 (1839).

Probably only a growth condition, and perhaps due to extremely moist conditions.

Hab. On trees.—*Distr.* Local and rare in S. England.—*B. M.* New Forest, Hants; Eridge Park, Tunbridge Wells, Sussex; Toy's Hill, Canterbury, Kent.

Form *sparsilis* Cromb. Monogr. i. p. 506 (1894).—Thallus very scanty or obsolete, whitish, the fertile verrucæ scattered, otherwise as in the species.—*P. fallax* f. *sparsilis* Nyl. ex Leight. Lich. Fl. ed. 3, p. 232 (1879).

A peculiar growth condition, also probably depending, as has been suggested, on the habitat.

Hab. On moist shady rocks.—*B. M.* Near Lough Inagh, Conne-mara, Galway (the only British locality).

Var. *rugosa* Nyl. in Bull. Soc. Linn. Norm. sér. 2, vi. p. 290 (1872); Johns. exs. n. 155.—Thallus thick, coarsely warted; otherwise as in the species.

Exsicc. Johns. n. 155.

Perhaps more a growth form than a variety. The thallus is very thick and crowdedly warted; the apothecia are numerous. Intermediate states are not wanting.

Hab. On old trees and rails.—*B. M.* Cumberland (the only British record).

29. *P. inquinata* Th. Fr. in Bot. Not. 1867, p. 108.—Thallus rather thin, continuous or cracked-areolate, sometimes warted-granulate, dark, or pale-grey (K—, CaCl—). Apothecia one or several in more or less prominent warts, the discs rather open, irregular, rounded or angular, with thin persistent paler margins surrounding one or several confluent discs; epithecium brownish (K + dull purple or violet); spores 8 in the ascus, with thickish

walls, 25–30 μ long, 14–18 μ thick.—Leight. Lich. Fl. ed. 3, p. 235; Cromb. Monogr. i. p. 508. *Lecanora coarctata* var. *inquinata* Ach. Lich. Univ. p. 353 (1810).

Exsicc. Larb. Lich. Hb. (without a number).

Easily distinguished by the several minute dark ostioles grouped in a common prominent disc. Both species and form are not unlike some forms of *Lecanora* (*Aspicilia*) *cinerea*.

Hab. On rocks in maritime and upland regions.—*Distr.* Scarce in N.E. England, W. Scotland and W. Ireland.—*B. M.* Barcaldine, Argyll; Lettermore, Connemara, Ireland.

Form *nolens* Harm. Lich. Fr. v. p. 1133 (1913).—Thallus smooth, cracked-areolate. Apothecia one or more innate in the areolæ, depressed; spores 30–42 μ long, 15–22 μ thick. *P. nolens* Nyl. in Flora xlvii. p. 489 (1864); Carroll in Journ. Bot. iii. p. 289 (1865); Jones in Proc. Nat. Hist. Soc. Dublin iv. p. 133 (1865); Cromb. Lich. Brit. p. 61 & Monogr. i. p. 508; Leight. Lich. Fl. p. 245; ed. 3, p. 235.

Frequently regarded as synonymous with the species, but distinct in the depressed apothecia and the somewhat large spores. The epithecium gives the same reaction with potash.

Hab. On rocks in maritime districts.—*Distr.* Rare in W. and N.E. Ireland.—*Distr.* Glenarm, Antrim; Lough Feagh, near Lough Muck, Connemara, Galway.

Thallus sometimes sorediate.

30. *P. sulphurea* Schær. Enum. p. 228 (1850); emend Massal. Ric. Lich. Crost. p. 187 (1852).—Thallus effuse, thin or often rather thick, plane- or warted-areolate, sometimes scabrous-sorediate, sulphur- or greenish-yellow coloured (K(CaCl) + orange, or yellowish-red). Fertile verrucæ crowded, irregular, at first with punctiform dark ostioles, the disc widening, with a tumid crenate margin; epithecium K + violet; spores 8 in the ascus, variable in size, 50–80 μ long, 25–30 μ thick.—*P. sulphurea* var. *rupicola* Schær. Enum. p. 229 (1850). *P. fallax* var. *sulphurea* Mudd Man. p. 276 (1861); form *sulphurea* Leight. Lich. Fl. ed. 2, p. 482; ed. 3, p. 231. *P. Wulfenii* var. *rupicola* Nyl. in Bull. Soc. Linn. Norm. sér. 2, vi. p. 290 (1872); Cromb. in Grevillea xix. p. 59 (1891) & Monogr. i. p. 507. *Endocarpon sulphureum* Tayl. in Mackay Fl. Hib. ii. p. 100 (1836); Leight. Angioc. Lich. p. 15, t. 3, fig. 4.

Frequently regarded as a variety of *P. Wulfenii*, but differing in colour, habitat, in the presence of soredia and in the spores. The sizes given of these have been measured from Schærer's specimen (exs. n. 595). British specimens are mostly sterile and several of them are dotted with small round lighter-coloured sorediose verrucæ, well seen in Taylor's specimen of *Endocarpon sulphureum* from Dunkerron. Though the latter represents the earliest trivial name, Schærer's later designation is a coincidence merely and was not based on Taylor's plant.

Hab. On rocks in maritime and mountainous regions.—*Distr.* Rather rare in Wales, N. England, S.W. Highlands of Scotland and S. and W. Ireland.—*B. M.* Dolgelly, Merioneth; Anglesea; Ingleby Park, Cleveland, Yorkshire; Lismore, Argyll; The Trossachs, Perthshire; Dunkerron, Kerry; Belclare and Corraun Mt., Achill, Mayo.

31. *P. gyrocheila* Nyl. in *Flora* xlvi. p. 354 (1865).—Thallus effuse or determinate, unequally granulate, deeply cracked, grey (K + yellow, CaCl -). Apothecia in prominent tubercles, simple or becoming subgyrose, with the disc labyrinthine (glypholeceine); spores 8 in the ascus, 68-70 μ long, 36-50 μ thick; hymenial gelatine and asci bluish with iodine.—Carroll in *Journ. Bot.* iv. p. 23 (1866); *Cromb. Lich. Brit.* p. 61 & *Monogr.* i. p. 509; *Leight. Lich. Fl.* p. 241; ed 3, p. 232.

The above description is taken from Nylander. Of the two specimens in the British herbarium from rocks, Ben Lawers, determined as *P. gyrocheila*, one may be perhaps considered a co-type, as it presumably forms part of the original collection; the other, also from Ben Lawers, was collected by Crombie. The material is too scanty to permit of exhaustive examination, but, as far as can be judged, they are very weathered exposed forms of *Lecanora tartarea* with exactly the same thalline reaction and the same size of spores as in that species. A series of somewhat similar specimens collected by the late W. West in Shetland and the Outer Hebrides were at first determined as *Pertusaria gyrocheila*, but finally were proved to be *Lecanora tartarea*, with transition stages from a normal open disc to a gyrose apothecium.

57. **VARICELLARIA** Nyl. in *Mém. Soc. Sci. Nat. Cherb.* v. p. 117 (1857); *Lich. Scand.* p. 182. (Pl. 57.)

Thallus thin crustaceous, corticate. Apothecia in convex verrucæ, deeply immersed; paraphyses slender, branched, intricate; asci 1-spored; spores very large, ellipsoid, 1-septate, colourless. Spermogones unknown.

According to Darbshire (*Engl. Bot. Jahrb.* xxii. p. 631 (1897)) there is generally a cortex of plectenchyma about two cells thick both above and below. Strong hyphæ traverse the internal tissue, uniting the two cortices, while from the lower cortex rhizinae are produced, which attach the thallus to the substratum.

1. *V. microsticta* Nyl. ll. c.—Thallus subdeterminate, unequal, thin, smooth, sometimes isidiose or leprose, whitish (K -, CaCl -). Apothecia usually solitary in the fertile verrucæ, of which several may be confluent, at first immersed then opening, the disc pale-reddish or flesh-coloured, generally white-suffused from the breaking down of the overlying tissues, the margins also suffused; spores very large, 225-350 μ long, 95-115 μ thick; hymenial gelatine and asci deep-blue with iodine.—*Cromb.* in *Journ. Bot.* xx. p. 272 (1882) & *Monogr.* i. p. 511.

Sufficiently distinguished by the 2-celled enormous spore, the largest known in lichens. When poorly developed it resembles

Pertusaria. Th. Fries (Lich. Scand. p. 322) states that *Pertusaria rhodocarpa* Koerb. Syst. Lich. Germ. p. 384 (1855) is identical from an examination of Koerber's plant; but the diagnosis does not correspond, the spores being described as 1-celled, etc., so that Nylander's name must be retained.

Hab. On mosses on the ground in an alpine situation.—*B. M.* Ben Avon, Braemar, Aberdeenshire.

ORDER XV. THELOTREMACÆ.

Thallus crustaceous, thin or thickish, mostly non-corticate. Algal cells *Trentepohlia* or *Protococcus*. Apothecia at first immersed and closed, then more or less open, with a proper margin generally well developed, and usually surrounded by a converging thalline margin; paraphyses simple or branched; spores 1-8 in the ascus, elongate-septate, or muriform, rather large, colourless or dark-coloured. Spermogones with acrogenous short, or long and curved, spermatia.

The immersed apothecia of the order recall those of *Pertusariaceæ*, though in the latter the proper margin is undeveloped; it is also poorly represented in *Phlyctis*, while in *Conotrema* it is the thalline margin that tends to disappear. The paraphyses are of the lecanorine type. *Conotrema* is described in Monogr. ii. p. 1.

The British genera are as follows:—

Algal cells *Trentepohlia*.

Spores septate or muriform 58. *Thelotrema*.

Algal cells *Protococcus*.

(Spores elongate, multi-septate (see
Monogr. ii. p. 1) *Conotrema*).

Spores muriform, colourless 59. *Phlyctis*.

Spores muriform, dark-coloured..... 60. *Diploschistes*.

58. **THELOTREMA** Ach. Meth. Lich. p. 130 (1803); emend Lich. Univ. p. 312 (1810). (Pl. 58.)

Thallus crustaceous, superficial or partly developed beneath the bark, non-corticate, or with an amorphous cortex, attached by hyphæ. Algal cells *Trentepohlia*. Apothecia at first immersed, then emerging like small verrucae, the disc half-concealed or opening out, the inner proper margin persistent, continued or wanting below the hypothecium, the outer thalline margin prominent, overarching the disc; spores 1-8 in the ascus, oblong or fusiform, usually colourless, septate or irregularly muriform.

The genus is characterized by the crater-like apothecia and by the septate or muriform spores. It is poorly represented in Europe, nearly all the species belong to the warmer regions of the globe.

1. *Th. lepadinum* Ach. Meth. Lich. p. 132 (1803) & Lich. Univ. p. 312, t. 6, fig. 1 (1810). —Thallus rather thin, smooth or

slightly wrinkled, somewhat shining, whitish or straw-coloured (K + reddish, CaCl -). Apothecia moderate in size (1-2 mm. across), numerous, prominent as a wart-like elevation, the disc semi-enclosed, dark-brown or blackish, pruinose or naked, the thalline margin thin, inflexed, even and sharp at the edge; paraphyses massed, coherent, slender, slightly clavate and often brown at the tips; spores 2-8 in the ascus, oblong-fusiform, colourless, 35-70 μ long, 11-16 μ thick (or larger); septate and partly muriform; hymenial gelatine bluish with iodine.—Hook. Fl. Scot. ii. p. 45 & in Sm. Engl. Fl. v. p. 161; S. F. Gray Nat. Arr. i. p. 494; Grev. Fl. Edin. p. 330; Tayl. in Mackay Fl. Hib. ii. p. 102; Turn. & Borr. Lich. Brit. p. 180; Leight. Angioc. Lich. p. 31, t. 12, fig. 1 & Lich. Fl. p. 247; ed. 3, p. 238; Mudd Man. p. 278, t. 5, fig. 116; Cromb. Lich. Brit. p. 61 & Monogr. i. p. 513. *Lichen lepadinus* Ach. Lich. Suec. Prodr. p. 30 (1798). *L. inclusus* Sm. Engl. Bot. t. 678 (1799).

Exsicc. Baxter's Stirp. Crypt. Ox. n. 20; Bohl. n. 29; Johns. n. 158; Leight. n. 121; Mudd n. 268.

The apothecia are numerous and are very markedly crater-like. The spore sizes given above are too small, as they measure not unfrequently up to 95 or 100 μ long, 22 μ thick; as in other instances, the size is relative to the number of spores in the ascus, sometimes they have a thick epispore.

Hab. On smooth bark of trees from maritime to upland districts.—*Distr.* General and common in England, apparently rare in Scotland and Ireland.—*B. M.* St. Breock, Cornwall; New Forest and Southampton Common, Hants; St. Leonard's Forest, near Tunbridge Wells and Ardingly, Sussex; Ightham, Kent; Ugley, Walthamstow, near Ingatestone and Hockley Woods, Essex; Bagley Wood, Berks; Leigh Woods near Bristol, Gloucestershire; Hollybush Hill, Malvern. Worcestershire; Hafod, Cardiganshire; Haughmond Hill, Church Stretton and Acton Burnell Hill, Shropshire; Charnwood Forest and Bardon Hill, Leicestershire; Cwm Bychan and Barmouth, Merioneth; Baysdale, Cleveland, Yorkshire; Teesdale, Durham; Calder Abbey, Cumberland; New Galloway, Kirkcudbrightshire; Foot of Ben Lomond, Dumbartonshire; Appin, Argyll; Glen Falloch and Loch Katrine, Perthshire; Morrone, Braemar, Aberdeenshire; Riverstone, Cork; Killarney, Kerry; Achill Island, Mayo.

Var. scutelliforme Ach. Lich. Univ. p. 313 (1810) & Syn. Lich. p. 115 (1814).—Thallus rather thick, unequal and sometimes sorediose, light-coloured. Apothecia crowded, the disc more open, and the thalline margin tumid and rugose.—Tayl. in Mackay Fl. Hib. ii. p. 103 (1836); Cromb. in Grevillea xix. p. 60 & Monogr. i. p. 514 (incl. f. *rupestre*); *var. rupestre* Turn. & Borr. Lich. Brit. p. 180 (1839); Leight. Angioc. Lich. p. 32, t. 12, fig. 2; Mudd Man. p. 278; form *rupestre* Cromb. Lich. Brit. p. 61 (1870); Leight. Lich. Fl. p. 248; ed. 3, p. 238.

A well-marked variety in the extreme forms; the apothecia are generally very crowded and often in prominent groups, due apparently to inequalities of the substratum.

Hab. On rugged bark of trees or on rocks in maritime and upland districts.—*Distr.* Sparingly throughout the British Isles.—*B. M.* New Forest, Hants; Nannau, Lyn Bodlyn and Cammlan Valley, Merioneth; Garn, Denbighshire; Teesdale, Durham; Wark, Northumberland; Lismore, Argyll; Glenstale, Tipperary; Kenmore Road and Derrycuntry, Killarney, Kerry; Kylemore and Doughruagh Mts., Connemara, Galway.

2. *Th. subtile* Tuckerm. in *Americ. Journ. Sci. Art.* xxv. p. 426 (1858); Nyl. in *Flora* xlvii. p. 491 (1864) note.—Thallus thin, generally determinate, smooth or somewhat felted, sometimes shining, cream-coloured or whitish (Kf + yellow, CaCl -). Apothecia erumpent, small, the disc whitish, the proper margin prominent, often white-pulverulent; paraphyses slender, not widened upwards, budding off small colourless cells at the tips; spores 8 in the ascus, narrowly elongate 9–12-septate, 40–50 μ long, 8–10 μ thick.—Carroll in *Journ. Bot.* iii. p. 289 (1865); Cromb. *Lich. Brit.* p. 61 & *Monogr.* i. p. 515; Leight. *Lich. Fl.* p. 248; ed. 3, p. 239.

Exsicc. Cromb. n. 169; *Larb. Lich. Hb.* n. 62.

An American species, the European representatives of which are confined to our western shores. Nylander (l. c.) states that its affinity is with *Th. bicinctulum*, an Australasian species. The specimen from Moidart was collected by the late Mr. W. West.

Hab. On smooth bark of trees in upland districts.—*Distr.* Rare in Scotland and W. Ireland.—*B. M.* Moidart, Invernesshire; Tore Mt., Cromaglow and Lough Inchiquin, Kerry; Lough Derryclare, Holy Island and Lough Inagh, Connemara, Galway.

59. **PHLYCTIS** Wallr. *Naturg. Flecht.* i. p. 527 (1825) emend Koerb. *Syst. Lich. Germ.* p. 390 (1855). (Pl. 59.)

Thallus crustaceous, continuous or cracked, or pulverulent, developed above or beneath the bark. Algal cells *Protococcus*. Apothecia immersed, then scarcely emerging, the proper margin poorly developed, the outer thalline margin irregularly dehiscent or indistinct; paraphyses slender, mostly unbranched; spores 1–8 in the ascus, elongate or ellipsoid, muriform, with a thin episporic, colourless. Spermogones with simple sterigmata and short slender straight spermatia.

Though placed by some lichenologists in Lecanoraceæ, the immersed apothecia and muriform spores show the affinity with Thelotremaceæ. In appearance the species are not unlike *Pertusaria*.

1. *Phl. agelæa* Koerb. *Syst. Lich. Germ.* p. 391 (1855).—Thallus effuse or subdeterminate, thin, partly developed beneath the bark, smooth or somewhat wrinkled, often pulverulent, white or greyish-white (K + yellow, then red). Apothecia small, one or several enclosed in rather flat pulverulent verrucæ, the disc flesh-coloured then dark, the surrounding margin somewhat tumid and torn; spores 2 (or 3–4) in the ascus, ellipsoid, muriform,

with an apiculus at each end 35–80 μ long, 11–32 μ thick.—Mudd Man. p. 279, t. 5, fig. 118; Cromb. Lich. Brit. p. 61 & Monogr. i. p. 512; Leight. Lich. Fl. p. 246; ed. 3, p. 237. *Lichen agelæus* Ach. Lich. Suec. Prodr. p. 30 (1798); Engl. Bot. t. 1730. *Thelotrema agelæa* S. F. Gray Nat. Arr. i. p. 494 (1821) pro parte. *Variolaria agelæa* Turn. & Borr. ex Hook. in Sm. Engl. Fl. v. p. 171 (1833) & Lich. Brit. p. 78. *V. constellata* Tayl. in Mackay Fl. Hib. ii. p. 113 (1836) pro parte.

Exsicc. Leight. n. 282; Mudd n. 269.

The thallus is thin and often spreads widely over the bark. Apothecia are generally numerous and become dark with age, though for the most part covered over by the leprose thallus. This species and the following have recently been reported from Perthshire by Wheldon and Wilson (Journ. Bot. 1915, Suppl. p. 45).

Hab. On trunks of trees in maritime and inland situations.—*Distr.* Fairly common throughout England, rare in S. Ireland and Scotland.—*B. M.* Arton near Totnes and Ilsham Walk, Torquay, Devon; Carisbrooke, I. of Wight; New Forest, Hants; near Lindfield, Glynde and Henfield, Sussex; Shiere, Surrey; Penshurst, Kent; Epping Forest, Quendon, Rickling, Hadleigh Woods and Stansted Mountfitchet, Essex; Bathampton Downs, Somerset; Cirencester, Gloucestershire; Forden, Montgomeryshire; Huglith, near Church Stretton and Oswestry, Shropshire; Barmouth and Aberdovey, Merioneth; Harboro' Magna, Warwickshire; Airyholm Wood and Hoggart's Wood, Cleveland, Yorkshire; Kitsboro', Riverstone and Castlebernard Park, Cork; Askew Wood and Dunkerron, Killarney, Kerry.

2. *Phl. argena* Koerb. Syst. Lich. Germ. p. 391 (1855).—Thallus effuse, thin, smooth or wrinkled, pulverulent, silvery-grey or cream-coloured (K + yellow then deep red). Apothecia small, the disc blackish and pruinose; spores 1 in the ascus, oblong-ellipsoid, not apiculate, very large, 100–140 μ long, 27–50 μ thick.—Mudd Man. p. 280; Cromb. Lich. Brit. p. 61 & Monogr. i. p. 513; Leight. Lich. Fl. p. 246; ed. 3, p. 237. *Lichen argenus* Ach. Lich. Suec. Prodr. p. 8 (1798); Engl. Bot. t. 1923. *Variolaria argena* Turn. & Borr. ex Hook. in Sm. Engl. Fl. v. p. 171 (1833) & Lich. Brit. p. 75.

Differs from the preceding in the somewhat thinner more pulverulent thallus, and in the non-apiculate spores. Fruiting specimens are not common.

Hab. On the trunks of old trees in upland districts.—*Distr.* Rather rare in S.W. and Central England.—*B. M.* Beckey Falls, Devon; New Forest, Hants; Shiere and Haslemere, Surrey; Ightham, Kent; Epping Forest, Gosfield Hall and Stansted Mountfitchet, Essex; Burnham Beeches, Bucks; Charnwood Forest and Gopsall Wood, Leicestershire; Broadwas and near Worcester; Barmouth, Merioneth; Oswestry, Shropshire.

60. **DIPLOSCHISTES** Norm. in Nyt. Mag. Nat. Vidensk. vii. p. 232 (1853). *Urceolaria* Ach. Meth. Lich. p. 141 (1803) pro parte (non Willd.); S. F. Gray. Nat. Arr. i. p. 457 pro parte;

Grev. Fl. Edin. p. 330 pro parte; Hook. in Sm. Eng. Fl. v. p. 171 pro parte; Tayl. in Mackay Fl. Hib. ii. p. 132 pro parte; emend. Nyl. in Mem. Soc. Sci. Nat. Cherb. iii. p. 180 (1855); Mudd Man. p. 165; Leight. Lich. Fl. p. 234; ed. 3, p. 239; Cromb. Monogr. i. p. 515. (Pl. 60.)

Thallus crustaceous, generally areolate, rarely obsolete, non-corticate or with an imperfect cortex. Algal cells *Protococcus*. Apothecia immersed-urceolate, with a well-developed proper margin, and an outer persistent or disappearing thalline margin; paraphyses slender; spores 4-8 in the ascus, muriform, dark-coloured. Spermogones with short cylindrical straight spermatia.

A small genus not unlike *Thelotrema* in the form of the apothecia, but with different algal cells. The name *Urceolaria* was given by Willdenow (ex Cothen. Disp. Veg. Meth. p. 10 (1790)) to a genus of Rubiaceæ.

1. *D. scruposus* Norm. in Nyt. Mag. Nat. Vidensk. vii. p. 232 (1853).—Thallus determinate or effuse, thickish, uneven, granulate- or warted-areolate, deeply cracked, grey, greyish-white or dark-grey (K + yellowish, CaCl + red, I ± blue). Apothecia moderate in size, crater-like, the disc blackish, more or less pruinose, the proper margin greyish black, connivent, the thalline margin thickish, sometimes wrinkled or crenulate and overarching, or the disc widening, and the thalline margin thin, entire at the edge; hypothecium black; paraphyses slender, somewhat flexuose, brownish at the tips; spores ellipsoid, 5-septate, the middle cells longitudinally divided, colourless then dark-brown, about 22-38 μ long, 10-15 μ thick; hymenial gelatine yellow with iodine.—*Lichenoides crustaceum et leprosum, scutellis nigricantibus majoribus et minoribus* Dill. Hist. Musc. p. 133, t. 18, fig. 15B (1741). *Lichen scruposus* Schreb. Spicil. Fl. Lips. p. 133 (1771); Dicks. Pl. Crypt. fasc. i. p. 11; Engl. Bot. t. 266; With. Arr. ed. 3, iv. p. 19. *Urceolaria scruposa* Ach. Meth. Lich. p. 147 (1803) (incl. var. *plumbea*); S. F. Gray Nat. Arr. i. p. 459; Grev. Fl. Edin. p. 331; Hook. in Sm. Engl. Fl. v. p. 172; Tayl. in Mackay Fl. Hib. ii. p. 132; Mudd Man. p. 165; Leight. Lich. Fl. p. 234; ed. 3, p. 239; Cromb. Monogr. i. p. 516 (incl. f. *plumbea*). *Lecanora scruposa* Sommerf. Fl. Lapp. Suppl. p. 100 (1826); Cromb. Lich. Brit. p. 58.

Exsicc. Cromb. n. 75; Johns. n. 159; Larb. Cantab. n. 35 & Lich. Hb. n. 136; Leight. nos. 54, 379; Mudd n. 137.

Easily distinguished by the characters both of the thallus and of the apothecia. The former varies, but in general it is thick and irregular; in some situations it is darker-coloured (f. *plumbea*). The reaction of the medulla with iodine is frequently indistinct. *Lichen scruposus* has been erroneously credited to Linnæus by Krempelhuber and succeeding lichenologists. The name was first used by Schreber.

Hab. On rocks and walls, rarely on old wood or on calcareous soil, from maritime to upland districts.—*Distr.* General and common throughout the British Isles.—*B. M.* Jersey; Guernsey; near

Penzance and near Padstow, Cornwall; near Shanklin, I. of Wight; Shaston (Shaftesbury), Dorset; Barton Mills, Maresfield, West Hoathly, Danny and Pulborough, Sussex; Walthamstow (?), Essex; Kew Gardens, Surrey (1798); Bathampton Downs, Somerset; Wigmore Church, Herefordshire; near Worcester, Pershore and Malvern, Worcestershire; Leamington, Warwickshire; Ampthill, Bedfordshire; Gogmagog hill and Cheveley Park, Cambridgeshire; Thetford Warren and Livermore, Suffolk; Charnwood Forest and Bardon Hill, Leicestershire; Oswestry, Newport, Grinshill, near Shrewsbury and High Rock, Bridgenorth, Shropshire; Barmouth, Merioneth; Bedd Gelert and Nant Ffrancon, Carnarvonshire; Anglesea; Buxton, Derbyshire; Lounsdale, Cleveland, Yorkshire; Teesdale, Durham; Roman Wall, Chesters, Northumberland; Windermere and Staveley, Westmoreland; Alston and Bassenthwaite, Cumberland; New Galloway, Kirkeudbrightshire; King's Park and Craiglockhart, Edinburgh; West Water, Fifeshire; near Dunkeld, Killin and Ben Vrackie, Perthshire; Strathmartine and Den of Mains, Forfarshire; Morrone, Braemar, Aberdeenshire; near Fort William, Invernessshire; Kilcully, Cork; Loughcooter, Galway.

2. *D. bryophilus* Zahlbr. in *Hedwigia* xxxi. p. 34 (1892).—Thallus effuse, rather thin and sometimes pulverulent or sometimes almost obsolete (CaCl+red). Apothecia generally numerous, prominent, the disc opening widely, black, whitish-pruinose, the thalline margin often thin and entire or somewhat turgid, wrinkled or crenulate; spores, etc., as in *D. scruposus*. *Lichen bryophilus* Ehrh. exs. n. 236 (1791) nomen nudum in Beitr. Naturk. vii. p. 102 (1792) (cf. Arn. in Flora lxiii. p. 554). *Urceolaria scruposa* var. *bryophila* Schær. Lich. Helv. Spicil. p. 75 (1826); Mudd Man. p. 165; Cromb. Lich. Brit. p. 58; f. *bryophila* Leight. Lich. Fl. p. 235 (1871); ed. 3, p. 240; subsp. *bryophila* Nyl. ex Nörrl. in Medd. Sällsk. Faun. & Fl. Fenn. i. p. 27 (1876); Cromb. Monogr. i. p. 517.

Exsicc. Johns. n. 280; Larb. Lich. Hb. nos. 63, 221; Leight. nos. 359, 360.

Generally regarded as a species, though possibly only a variety of *D. scruposus*, and differing chiefly in the habitat and in the more scanty thallus. The pulverulent condition has been recorded as *Urceolaria scruposa* var. *dealbata* Ach. Lich. Univ. p. 341 (1810). Not unfrequently it spreads to *Cladonia* squamules, where its own thallus often practically disappears, and the fruits which are freely produced are semi-parasitic on the *Cladonia*. The base of the apothecium is embedded in the host, the tissue of which is discoloured and injured immediately below. This condition has been recorded as *Lecanora scruposa* var. *parasitica* Sommerf. Fl. Lapp. Suppl. p. 100 (1826) pro parte (fide Crombie) and as subsp. *bryophila* f. *ecrustacea* Cromb. in Grevillea xix. p. 60 (1891).

Hab. Spreading over mosses, humus and *Cladonia* squamules in maritime and upland regions.—*Distr.* Not uncommon in the British Islands.—*B. M.* Quenvais, Jersey; St. Minver and Penzance, Cornwall; near Torquay and Lustleigh Cleeve, Devon; Bathford Hill, Somerset; Wotton-under-Edge and Pembury Park, Cirencester, Gloucestershire; Chelmsford and Epping Forest, Essex; Thetford Warren, Norfolk; Dolgelly and Barmouth, Merioneth; High Rocks, Bridge-

north, Shropshire; Matlock, Derbyshire; Langbaugh, Cleveland, Yorkshire; Egglestone, Durham; Lismore and Appin, Argyll; Glen Lochay, Ben Lawers, Craig Tulloch and Blaeberry Hill, Perthshire; Morrone, Braemar, Aberdeenshire; near Kilcully, Cork; Killarney, Kerry; Glen Inagh, Connemara, Galway; Deer Park, Belfast, Antrim.

3. *D. gypsaceus* Zahlbr. in *Hedwigia* xxxi. p. 35 (1892).—Thallus thick, soft, continuous or cracked, unequally wrinkled, more or less pulverulent (K —, CaCl + red). Apothecia immersed in the thallus, the disc blackish, white-pruinose, small and enclosed or widening to about 2 mm. across, the thalline margin scarcely perceptible or turgid; hymenium dark-brown; paraphyses slender, intricate, budding off small cells at the tips; spores oblong-ellipsoid up to 8-septate, irregularly muriform, 23–42 μ long, 9–17 μ thick; hymenial gelatine faintly bluish then yellowish with iodine.—*Urceolaria scruposa* var. *albissima* Ach. *Meth. Lich.* p. 147 (1803); f. *gypsacea* Leight. *Lich. Fl.* p. 234; ed. 3, p. 239. *U. gypsacea* Ach. *Lich. Univ.* p. 338 (1810); Cromb. in *Grevillea* xix. p. 60 (1891) & *Monogr.* i. p. 518.

Differs from *D. scruposa* in the whiter softer pulverulent thallus and in the spore characters. As to the latter, all measurements taken agree with the above sizes given by Harmand, though Crombie has stated them to be up to 57 μ long and 16–24 μ thick. Crombie also points out as a specific character that the medulla of the thallus does not turn blue with iodine.

Hab. On calcareous and cretaceous rocks in maritime and upland districts.—*Distr.* Recorded from few localities in S. and Central England, S. Wales and W. Ireland; probably overlooked.—*B. M.* The Downs, Lewes, Sussex; Bathampton Downs, Somerset; N. Derbyshire; Aberdw Rocks, Brecknockshire; Glencorbot, Connemara, Galway.

4. *D. actinostomus* Zahlbr. in *Hedwigia* xxxi. p. 34 (1892).—Thallus subdeterminate, thickish, rather uniform and smooth, cracked-areolate, the areolæ more or less convex, light-grey (K —, CaCl + red, I \mp blue). Apothecia minute, one or several immersed in an areola, the disc punctiform, enclosed, then opening and somewhat plane, blackish, whitish-grey-pruinose, the proper margin finely striate, the thalline margin thickish, not prominent; hypothecium narrow, brown; paraphyses slender, intricate; spores rather broadly ovoid or ellipsoid, 5–6-septate and muriform, up to 35 μ long, 16–20 μ thick; hymenial gelatine slightly tinged, blue then yellow with iodine.—*Urceolaria actinostoma* Pers. ex Ach. *Lich. Univ.* p. 288 (1810); Cromb. in *Journ. Bot.* xxiii. p. 196 (1885) & *Monogr.* i. p. 518.

The species is not represented in our Islands, but only the following variety. The fruits in their enclosed stage are not unlike a *Verrucaria*, and it was so named by Acharius (l. c.). The striate character of the inner proper margin is mostly obscured by the overlying thalline margin; it is evidently due to tufts of dark-brown hyphæ which are more or less apart, thus appearing as dark streaks.

Var. *cæsioplumbea* A. L. Sm.—Thallus greyish leaden-coloured somewhat shining. Apothecia as in the species.—*Urcularia actinostoma* var. *cæsioplumbea* Nyl. in Bull. Soc. Linn. Norm. sér. 2, vi. p. 298 (1872); Cromb. in Grevillea xix. p. 60 (1891) & Monogr. i. p. 518.

Exsicc. Johns. n. 160.

Hab. On rocks in maritime districts.—*Distr.* Sparingly in the Channel Islands and N.W. England.—*B. M.* Chateau Point, Sark; St. Bees, Cumberland.

ORDER XV. CHRYSOTHRICACEÆ.

Thallus byssoid, spongy, of branched loosely interwoven hyphæ, not corticate. Algal cells Protococcaceæ or *Trentepohlia*, generally in groups lodged among the hyphæ (partly homoio-merous). Apothecia without a thalline margin, but with a double proper margin; spores colourless, simple or septate. Spermogones (seen only in one species), with simple sterigmata and small spermatia.

The Order was inadvertently omitted from the synoptical list of Cyclocarpineæ (p. 26). It has been placed by Hue in a separate family "Intertextæ" on account of the byssoid structure. It is not truly homoio-merous as the algæ are mostly congregated near the surface, a medullary stratum lying between the gonidial zone and the dark rhizoidal hyphæ of the hypothallus. Only one genus is represented in our country.

Thallus with algal cells, *Protococcus* 61. *Crocynia*.

61. **CROCYNIA** Massal. in Atti Ist. Venet. Sci. Lett. ed Art. ser. 3, v. p. 251 (1860). *Leproloma* Nyl. in Flora lxvi. p. 107 (1883); Cromb. Monogr. i. p. 348. (Pl. 61.)

Thallus of felted intricate hyphæ, spreading, noncorticate. Algal cells *Protococcus* or *Trentepohlia*. Apothecia sessile or immersed, without a thalline margin, the disc red or blackish; paraphyses conglomerate, thickish, not branched; spores 6–8 in the ascus, simple or 1–3-septate.

There is only one sterile species recorded in our Islands, though a number of species also sterile have been found in Northern France and may have been overlooked here.

1. **C. lanuginosa** Hue in Mém. Soc. Sci. Nat. Cherb. sér. 4, xxxvii. p. 229 (1909).—Thallus orbicular or effuse, adnate-lobate at the circumference, granular-pulverulent at the centre, white or yellowish-white (K–); hypothallus dark-brown, tomentose. Apothecia not known.—*Lichen membranaceus* Dicks. Pl. Crypt. fasc. 2, p. 21, t. 6, fig. 1 (1790)? With. Arr. ed. 3, iv. p. 61? *L. lanuginosus* Ach. Lich. Suec. Prodr. p. 120 (1798). *Parmelia lanuginosa* Ach. Meth. Lich. p. 207 (1803); Hook. Fl. Scot. ii.

p. 53; S. F. Gray Nat. Arr. i. p. 439; Tayl. in Mackay Fl. Hib. ii. p. 148. *Squamaria lanuginosa* Hook. in Sm. Engl. Fl. v. p. 196 (1833). *Amphiloma lanuginosum* Nyl. in Mém. Soc. Sci. Nat. Cherb. v. p. 110 (1857); Mudd Man. p. 126; Cromb. Lich. Brit. p. 44; Leight. Lich. Fl. p. 170; ed. 3, 156. *Leproloma lanuginosum* Nyl. in Flora lxvi. p. 107 (1883); Cromb. Monogr. i. p. 348.

Ecsicc. Johns. n. 234; Larb. Lich. Hb. n. 332; Leight. n. 55.

The plant is always sterile, though Dickson and Acharius both describe apothecia. It seems doubtful if Dickson were really dealing with this species. In Acharius' herbarium there are authentic specimens, but according to Lönnroth (Th. Fr. Lich. Arct. p. 79) they are all sterile. The early records in our country are all described as bearing apothecia, until Taylor, who says these bodies had not been seen in Ireland.

Hab. On decaying mosses on shaded rocks or soil in maritime and upland districts.—*Distr.* General and fairly common throughout the British Isles.—*B. M.* Rozel, Jersey; Guernsey; Roche Rock, Cornwall; Vixen Tor, Dartmoor and Lustleigh Cleeve, Devon; Eridge Rocks and High Rocks, Tunbridge Wells, Sussex; Longmynd Hill, Haughmond Hill and Craigford, Shropshire; Barmouth, Merioneth; Carnedd Dafydd, Carnarvonshire; Malvern, Worcestershire; Charnwood Forest, Leicestershire; Ayton, Cleveland, Yorkshire; Falcon Clints, Durham; Kentmere, Westmoreland; Wastdale, Cumberland; Black Craig, New Galloway, Kirkcudbrightshire; Ben Lomond, Dumbartonshire; Achosragan Hill, Appin, Argyll; near Killin, Ben Lawers, The Trossachs and Craig Calliach, Perthshire; Canlochan, Forfarshire; Craig Cluny, Braemar, Aberdeenshire; Glen Nevis, Invernesshire; near Lairg, Sutherlandshire; Bonane, near Dunkerron, Kerry.

APPENDIX.

THE Orders, genera and species described below had already been published by Crombie in his Monograph, Part 1, before the preparation of Part 2, in which they should have rightly been placed, was undertaken. The modern views of affinity accepted by lichenological students have necessitated the classification adopted. These Orders were left unnumbered in Part 2; but it is now possible to indicate the numerical arrangement, not only of those described here (marked by an asterisk), but of the remaining Orders of Subseries III. Graphidineæ, and of Series II. Pyrenocarpeæ, included in Part 2, to which references are duly given.

The completed list is as follows :—

Subseries II. *CYCLOCARPINEÆ*—continued from p. 26.

- Order *XVI. GYROPHORACEÆ, Part 2, p. 2; described in whole.
,, *XVII. CLADONIACEÆ, Part 2, p. 2; described in whole.
,, XVIII. COENOGONIACEÆ, Part 2, p. 2.
,, *XIX. LECIDEACEÆ, Part 2, p. 4; described in part.

Subseries III. *GRAPHIDINEÆ*.

(Tribe XIX. GRAPHIDEI, Part 2, p. 200.)

- Order *XX. DIRINACEÆ, Part 2, p. 200; described in whole.
,, *XXI. ROCCELLACEÆ, Part 2, p. 200; described in whole.
,, XXII. LECANACTACEÆ, Part 2, p. 201.
,, XXIII. ARTHONIACEÆ, Part 2, p. 205.
,, XXIV. GRAPHIDACEÆ, Part 2, p. 220.
,, XXV. CHIODECTONACEÆ, Part 2, p. 258.

Series II. *PYRENOCARPINEÆ*.(Tribe XX. *PYRENOCARPEI*, Part 2, p. 263.)

- Order *XXVI. *PYRENIDIACEÆ*, Part 2, p. 264 ; described in part.
 ,, XXVII. *DERMATOCARPACÆ*, Part 2, p. 266.
 ,, *XXVIII. *VERRUCARIACEÆ*, Part 2, p. 275 ; described in part.
 ,, *XXIX. *PYRENULACEÆ*, Part 2, p. 312 ; described in part.
 ,, XXX. *THELOCARPACEÆ*, Part 2, p. 345.
 ,, XXI. *TRYPETHELIACEÆ*, Part 2, p. 347.
 ,, XXXII. *MYCOPORACEÆ*. Part 2, p. 348.

ORDER XVI. *GYROPHORACEÆ*.

Thallus foliose, monophyllous or polyphyllous, corticate on both surfaces, attached by a central hold-fast or by rhizine. Algal cells *Protococcus*. Apothecia sessile or almost stalked, with proper margin only (lecideine) ; the disc plane or furrowed (gyrose) black ; spores 1 to 8 in the ascus, colourless or dark-brown, simple or muriform. Spermogones with septate sterigmata and pleurogenous short spermatia (in British genera).

The Order is now classed with *Cladoniaceæ* and *Lecideaceæ* on account of the lecideine fruit.

There are two British genera :—

- | | |
|--|--------------------|
| Apothecia usually with gyrose disc ; spores mostly simple, colourless..... | <i>Gyrophora</i> . |
| Apothecia with plane disc ; spores large, muriform, brown..... | <i>Umbilicaria</i> |

GYROPHORA Ach. Meth. Lich. p. 100 (1803). *Umbilicaria* Hoffm. ex Schreb. Gen. Pl. ed. 8, ii. p. 768 (1791) pro parte ; Leight. in Ann. Mag. Nat. Hist. ser. 2, xviii. p. 273 (1856) ; Cromb. Lich. Brit. p. 40. (Pl. 62.)

Thallus monophyllous or polyphyllous, with plectenchymatous cortex above and below, attached by a central or subcentral hold-fast and naked below or rhizinose. Apothecial disc plane, or furrowed more or less concentrically with alternate fertile and sterile tissue ; hypothecium dark-coloured ; paraphyses sub-discrete ; asci ellipsoid-cylindrical or broadly ellipsoid, 8-spored ; spores one-celled (rarely septate), rather small, ellipsoid, colourless or becoming brownish.

Acharius substituted for the earlier comprehensive name *Umbilicaria* that of *Gyrophora*, which he considered more descriptive and more suitable. It is now restricted to those species generally with gyrose fruits and colourless, mostly simple spores. The gyrose types of

fructification were termed "tricæ" by Acharius (Meth. Lich. p. xvii.), and after him by some British lichenologists.

The species are classified in two sections:—

- Apothecial discs plane..... i. AGYROPHORA.
 Apothecial discs gyrose ii. EUGYROPHORA.

§ i. AGYROPHORA A. Zahlbr. in Engler & Prantl Pflanzenf. i. 1*, p. 148 (1905). *Umbilicaria* subg. *Agyrophora* Nyl. in Flora lxi. p. 247 (1878); Cromb. Monogr. i. p. 323.

Apothecial discs plane; spores simple, colourless.

1. *G. leiocarpa* Steudel, Nomencl. Bot. p. 194 (1824).—Thallus moderate in size or rather large, monophyllous or deeply lobate-polyphyllous, rigid, the surface finely cracked- or wrinkled-areolate, brownish-black, or reddish-grey and sometimes pruinose towards the centre both above and below, generally smoother or more finely areolate below (K—, CaCl—). Apothecia rather small, prominent, stalked, plane, the margins thin, more or less irregular or crenulate; paraphyses coherent, the hymenium brown; spores oblong or elongate-oblong, 12–17 μ long, 4–6 μ thick.—*G. atro-pruinosa* Schær. in Meisner's Naturwiss. Anz. i. p. 8 (1817). *Umbilicaria leiocarpa* DC. Fl. Fr. ii. p. 410 (1805). *U. atro-pruinosa* Schær. ex Ser. Mus. Helv. Hist. Nat. p. 109, pl. 12 (1821) pro parte; Cromb. in Journ. Bot. p. 273 (1882) & Monogr. i. p. 323.

Often confused with *Lichen anthracinus* Wulf., a plant referred by Acharius (Syn. Lich. p. 63) to *Gyrophora glabra*. The spore descriptions are taken from Th. Fries (Lich. Scand. p. 166), as spores are wanting in all the specimens examined, though apothecia are abundant; these differ from those of other *Gyrophoræ* in the plane disc.

Hab. On granitic boulders in exposed alpine situations.—*Distr.* Rare in the Grampians, Scotland.—*B. M.* Summit of Cairntoul, Braemar, Aberdeenshire.

§ ii. EUGYROPHORA A. Zahlbr. l. c. Apothecial discs gyrose-plicate.

The peculiar lines denoting alternate sterile and fertile tissue in the apothecium are due, according to Lindau (Schwendener, Bot. Untersuch. 1899, pp. 19–36), to the interrupted centrifugal development of the ascigerous tissue: a central area of paraphyses alone is first formed, then surrounded by a fertile ascus zone, and the alternation of sterile and fertile areas is repeated as growth proceeds in irregularly concentric lines.

Thallus with few or no rhizinx or fibrils.

2. *G. grisea* Turn. & Borr. Lich. Brit. p. 236 (1839).—Thallus monophyllous, rather small (about 5 cm. across), thin,

minutely papillate or areolate, light grey or brownish-mouse-grey; beneath darker, naked or scarcely rhizinose in the centre (K—CaCl₂ \mp red). Apothecia rare, sessile, becoming convex and immarginate, the disc gyrose-plicate; spores 11–18 μ long, 8–10 μ thick.—Mudd Man. p. 120; Cromb. in Journ. Linn. Soc. Bot. xvii. p. 575 (1880) & Monogr. i. p. 324 pro parte. *G. murina* Ach. Meth. Lich. p. 110 (1803); Engl. Bot. t. 2486; S. F. Gray Nat. Arr. i. p. 478; Hook. in Sm. Eng. Fl. v. p. 218. *Lichenoides saxatile foliis minus divisis, cinereo-fuscis* Dill. in Ray Syn. ed. 3, p. 73, n. 66 (1724). *Lichenoides coriaceum cinereum, peltis atris compressis* Dill. Hist. Musc. p. 219, t. 30, fig. 117 (1741) (excl. syn. Hb. Buddle). *Lichen griseus* Swartz ex Westr. in K. Vet. Acad. Handl. xiv. p. 52 (1793). *L. Dillenii* With. Arr. ed. 3, iv. p. 63 (1796) (excl. habitat St. Vincent's Rocks). *L. murinus* Ach. Lich. Suec. Prodr. p. 143 (1798). *Umbilicaria grisea* Hoffm. Deutschl. Fl. ii. p. 111 (1795); Leight. Lich. Fl. p. 159; ed. 3, p. 147. *U. varia* var. *grisea* Leight. in Ann. & Mag. Nat. Hist. ser. 2, xviii. p. 288 (1856).

A very rare plant in the British Islands; many of the citations are based on the mistaken identity by Dillenius of a plant from St. Vincent's Rocks, Bristol. According to Crombie (ll. c.), however, Dillenius certainly was dealing with this species, as the two specimens in his herbarium are typical, though both of them, of continental origin, were received from Celsius. The British specimen from St. Vincent's Rocks (*Lichen petraeus cinereus Anglicus* Buddle Hort. Sicc. ii. fol. 36 in Hb. Sloane) has proved on examination to be *Dermatocarpon miniatum*. Crombie and others had evidently accepted Dillenius' determination of the specimen without verification. *Lichen deustus* Huds. Fl. Angl. p. 455 (1762) (non Linn.), though quoted by Crombie as a synonym of the above, is also a misidentification.

Hab. On rocks in maritime districts.—*Distr.* Rare in the Channel Islands and ? N. Wales.—*B. M.* Beaufort, Jersey; also a specimen marked Glyder Vawr (?) N. Wales, and a second small scrap, evidently collected by Hugh Davies (N. Wales).

3. *G. proboscidea* Ach. Meth. Lich. p. 105 (1803).—Thallus small or moderate in size (generally about 5 cm. in width), monophyllous, rather thin, lobed and crenate at the margins, the upper surface tuberculate or irregularly wrinkled-reticulate, blackish-brown, generally greyish-pruinose in the centre; beneath smooth, pale- or dark-greyish-brown (K—CaCl₂ \pm reddish). Apothecia becoming immarginate and gyrose-plicate; spores oblong-ellipsoid, 12–18 μ long, 6–8 μ thick.—Engl. Bot. t. 2484; S. F. Gray Nat. Arr. i. p. 476; Hook. Fl. Scot. ii. p. 41 & in Sm. Engl. Fl. v. p. 217; Mudd Man. p. 118; Cromb. Monogr. i. p. 325. *Lichen proboscideus* L. Sp. Pl. p. 1150 (1753); Ach. Lich. Suec. Prodr. p. 147 (1798). *L. deustus* Lightf. Fl. Scot. ii. p. 861 (1777) (excl. syn.) (non Linn.); With. Arr. ed. 3, iv. p. 63. *Umbilicaria proboscidea* DC. Fl. Fr. ii. p. 410 (1805) pro parte;

Cromb. Lich. Brit. p. 40; Leight. Lich. Fl. p. 160; ed. 3, p. 147. *U. varia* var. *deusta* Leight. in Ann. Mag. Nat. Hist. ser. 2, xviii. p. 289 (1856).

Exsicc. Croall n. 100.

Differs from other species of the genus in the wrinkled corrugate upper surface, more marked towards the centre of the thallus, other parts of the thallus being frequently almost smooth; the lower surface is smooth and generally lighter in colour. The apothecia are usually abundant.

Two of the specimens in the Linnean herbarium labelled *Lichen proboscideus* belong to *G. cylindrica*, a third is typical *G. proboscidea* (fide Wainio in Medd. Faun. & Fl. Fenn. xiv. p. 7 (1888)). Linnaeus' description refers to the latter.

Hab. On rocks and stone walls in upland and subalpine regions.—*Distr.* The mountainous regions of N. Wales, N. England, S.W. and the Grampians, Scotland, reported also from E. and S.W. Ireland.—*B. M.* Cader Idris, Merioneth; Snowdon, Carnarvonshire; Cardigan-shire; Teesdale, Durham; New Galloway, Kirkcudbrightshire; Ben Lawers and Ben More, Perthshire; Clova, Forfarshire; Craig Coinnoch, Lochnagar, near Invercauld, Ben-naboord, Glen Callater, Ben Macdhui and Glen Cluny, Braemar, Aberdeenshire; Ben Nevis, Invernesshire.

Form *corrugata* Mudd Man. p. 118 (1861) (incl. f. *mesenteriformis* (non Wulf.)).—Upper surface of thallus with deeply marked reticulate ridges or corrugations, otherwise as in the species.—Var. *exasperata* Ach. Meth. Lich. p. 105 (1803); f. *exasperata* Cromb. Monogr. i. p. 326. *G. deusta* var. *corrugata* and var. *mesenteriformis* (non Wulf.) Turn. & Borr. Lich. Brit. p. 222 (1839). *Lichen exasperatus* Gunn. Fl. Norw. ii. p. 131 (1766) fide Th. Fr. (excl. Syn. Dill.). *Umbilicaria corrugata* Hoffm. Pl. Lich. p. 65, t. 43, figs. 4-7 (1794). *U. varia* var. *deusta* ff. *corrugata*, *mesenteriformis* Leight. in Ann. Mag. Nat. Hist. ser. 2, xviii. pp. 290, 291 (1856). *U. proboscidea* var. *exasperata* Cromb. Lich. Brit. p. 40 (1870); ff. *corrugata* and *mesenteriformis* Leight. Lich. Fl. pp. 160, 161 (1871); ed. 3, p. 148.

Connected with the species by intermediate stages; it represents an extreme northern or alpine form.

Hab. On rocks and boulders in alpine places.—*B. M.* Ben-naboord, Braemar, Aberdeenshire.

Form *fimbriata* Mudd Man. p. 118 (1861).—Thallus sparingly fibrillose or rhizinose at the margin and occasionally on either surface; otherwise as in the species.—Cromb. Monogr. i. p. 326; var. *deplicans* Cromb. in Journ. Bot. xx. p. 273 (1882) & Monogr. i. p. 326. *G. deusta* var. *fimbriata* Turn. & Borr. Lich. Brit. p. 222 (1839). *Umbilicaria proboscidea* var. *deplicans* Nyl. Lich. Scand. p. 116 (1861); f. *fimbriata* Leight. Lich. Fl. p. 160; ed. 3, p. 147.

As in the species, the rugosities vary from well-marked reticulations to an areolate-pustular surface (var. *deplicans*). The marginal and superficial fibres occur irregularly, and may be very scanty or fairly abundant.

Hab. On rocks and stone walls in upland or alpine regions.—*Distr.* Similar to species.—*B. M.* Swinhope Fell, Durham; Ben Lawers and Ben More, Perthshire; Clova, Forfarshire; Cairngorm, Glen Callater, Ben-naboord and Morrone, Braemar, Aberdeenshire; Ben Nevis, Invernesshire.

4. *G. arctica* Ach. Meth. Lich. p. 106, t. 2, fig. 6 (1803).—Thallus monophyllous, reaching fairly large dimensions in arctic regions, rather thick and coriaceous, slightly lobed, crenate and reflexed at the margin, the upper surface with crowded granulate wrinkles, sometimes rising to ridges, pale-grey to brownish or blackish-brown, the centre lighter coloured and somewhat pruinose when dry; beneath almost smooth or finely granulate papillose, paler in colour, blackish towards the centre (K —, CaCl ± reddish). Apothecia numerous, becoming convex; spores 12–16 μ long, 6–8 μ thick (or frequently smaller).—Turn. & Borr. Lich. Brit. p. 225 (locality doubtful); Engl. Bot. t. 2485; S. F. Gray Nat. Arr. i. p. 477; Cromb. Monogr. i. p. 331. *G. proboscidea* var. *arctica* Wahlenb. Fl. Lapp. p. 483 (1812); Hook. Fl. Scot. ii. p. 42 & in Sm. Engl. Fl. v. p. 217. *G. hyperborea* var. *arctica* Mudd Man. p. 117. *Lichenoides atrum, corii Persici instar exasperatum* Dill. Hist. Musc. p. 220, t. 30, fig. 119 (1741). *Urbicularia varia* var. *arctica* Leight. in Ann. Mag. Nat. Hist. ser. 2, xviii. p. 283 (1856). *U. arctica* Cromb. Lich. Brit. p. 40 (1870); Leight. Lich. Fl. p. 157; ed. 3, p. 145 pro parte.

A northern or alpine lichen near to *G. hyperborea*, rare in our country. A specimen quoted by Turner and Borrer as collected in Durham seems of doubtful determination. The slightly pruinose character of the thallus may have suggested to Dillenius its likeness to the skin of a peach.

Hab. On rocks in alpine situations.—*B. M.* Ben-naboord, Braemar, Aberdeenshire.

5. *G. hyperborea* Ach. Meth. Lich. p. 104 (1803).—Thallus monophyllous, moderate in size (generally about 5 cm. across), thin and tough, the surface pustulate-wrinkled and very unequal, more or less lacerate at the margins, deep chestnut- to blackish-brown; beneath smooth or finely granulate-papillose, sublacunose, brownish-black (K —, CaCl + reddish). Apothecia sessile, appressed, irregular in form, elongate or triangular, becoming rounded and convex; spores elongate-ellipsoid, 12–16 μ long, 7–8 μ thick.—Turn. & Borr. Lich. Brit. p. 227; Mudd Man. p. 117 (excl. var. *arctica*); Cromb. Monogr. i. p. 330. *Lichen ustulatus* Ehrh. Exs. n. 296 (1793) nomen nudum, fide Wainio in Medd. Soc. Faun. & Fl. Fenn. xiv. p. 23 (1888). *L. hyperboreus* Ach. in Vet. Acad. Handl. xv. p. 89, t. 2, fig. 2 (1794).

L. pullus Wulf. ex Jacq. Misc. ii. p. 83, t. 9, fig. 3 (1781) (non Schreb.); Dicks. Pl. Crypt. fasc. ii. p. 23. *L. Jacquini* With. Arr. ed. 3, iv. p. 62 (1796)? (? Gmel.). *Umbilicaria hyperborea* Hoffm. Fl. Deutschl. ii. p. 110 (1795); Cromb. Lich. Brit. p. 41; Leight. Lich. Fl. p. 157; ed 3, p. 145. *U. varia* var. *hyperborea* Leight. in Ann. Mag. Nat. Hist. ser. 2, xviii. p. 282 (1856).

Distinguished from *G. proboscidea* by the small crowded contorted pustules of the upper surface, which do not form into reticulate ridges as in that species. Gmelin (Linn. Syst. Veg. ii. p. 1374 (1796)) describes his species *Lichen Jacquini* as smooth on both surfaces.

Hab. On rocks and boulders in alpine situations.—*Distr.* Apparently confined to the higher Scottish Grampians.—*B. M.* Clova, Forfarshire; Ben More, Perthshire; Lochnagar, Morrone and Ben-naboord, Braemar, Aberdeenshire; Ben Nevis, Invernessshire.

6. *G. flocculosa* Turn. & Borr. Lich. Brit. p. 217 (1839).—Thallus small or moderate in size, thin, the upper surface smooth or partly flocculose, in other parts beset with minute isidia-like elevations or with squamules, the margins often lacerate and reflexed, dull olive- or blackish-brown; beneath smooth, subconcolorous, lacunose-pitted (K —, CaCl \mp _{rel}). Apothecia very rare, sessile; spores oblong or oblong-ellipsoid, sometimes slightly curved, 18–27 μ long, 7–9 μ thick.—Cromb. in Grevillea xv. p. 79 (1887) & Monogr. i. p. 333. *G. deusta* Ach. Meth. Lich. p. 102 (1803) (non Linn.); Engl. Bot. t. 2483; S. F. Gray Nat. Arr. i. p. 478; Hook. Fl. Scot. ii. p. 42 & in Sm. Engl. Fl. v. p. 218; Grev. Fl. Edin. p. 328. *G. polyphylla* var. *flocculosa* Mudd Man. p. 116 (1861). *Lichen flocculosus* Wulf. in Jacq. Coll. iii. p. 99, t. 1, fig. 2 (1789). *Umbilicaria flocculosa* Hoffm. Fl. Deutschl. ii. p. 110 (1795); Cromb. Lich. Brit. p. 41; Leight. Lich. Fl. p. 156; ed. 3, p. 144. *U. varia* var. *flocculosa* Leight. in Ann. Mag. Nat. Hist. ser. 2, xviii. p. 280 (1856).

Exsicc. Leight. n. 219.

Distinguished by the dull frequently matted or squamulose surface and by the lacunæ of the smooth under surface, with the absence of fibrils or rhizinae. The description of the spores is taken from Nylander (Lich. Scand. p. 119); it has not been possible to verify the details. *Lichen deustus* L. has been identified by Wainio (Medd. Soc. Faun. & Fl. Fenn. xiv. p. 7 (1888)) as probably synonymous with *G. reticulata* Th. Fr., which is not British.

Hab. On rocks and walls in upland and mountainous districts.—*Distr.* Rather rare in Great Britain, not yet seen from Ireland.—*B. M.* Caer Caradoc, Shropshire; Cader Idris and Cellfawr, near Barmouth, Merioneth; Whitwick Rocks, Leicestershire; Egglestonc, Durham; New Galloway, Kirkeudbrightshire; Achosragan Hill, Appin and Ben Cruachan, Argyll; Ben Lawers, Perthshire; Glen Callater, Braemar, Aberdeenshire; Ben Nevis, Invernessshire.

7. *G. polyphylla* Hook. in Sm. Engl. Fl. v. p. 217 (1833).—Thallus thin, polyphyllous or generally monophyllous, but with

crowded deeply divided lobes, which are rounded or sometimes lacerate, irregular in size, generally smooth, olive-reddish- or blackish-brown; beneath smooth, blackish (K —, CaCl f. + reddish). Apothecia very rare, sessile, small, with few gyrose lines; spores 13–18 μ long, 7–8 μ thick.—Turn. & Borr. Lich. Brit. p. 214 (incl. var. *sulcata*); Mudd Man. p. 116 (incl. f. *lacera*, excl. var. *flocculosa*); Cromb. in Journ. Linn. Soc. xvii. p. 576 (1880) & Monogr. i. p. 331. *G. glabra* var. *polyphylla* S. F. Gray Nat. Arr. i. p. 476 (1821); Hook. Fl. Scot. ii. p. 41. *Lichenoides tenuis pullum, foliis utrinque glabris* Dill. Hist. Musc. p. 225, t. 30, fig. 129 (1741). *Lichen polyphyllus* L. Sp. Pl. p. 1150 (1753); Huds. Fl. Angl. p. 455; Lightf. Fl. Scot. ii. p. 863; With. Arr. ed. 3, iv. p. 65; Engl. Bot. t. 1282. *Umbilicaria polyphylla* Schrad. Spicil. p. 102 (1794); Carroll in Journ. Bot. iv. p. 22 (1866); Cromb. Lich. Brit. p. 41 (incl. var. *lacera*); Leight. Lich. Fl. p. 155; ed. 3, p. 143 (incl. ff. *lacera*, *sulcata*). *U. varia* var. *polyphylla* Leight. in Ann. Mag. Nat. Hist. ser. 2, xviii. p. 278 (1856) (incl. ff. *sulcata*, *lacera*).

Essicc. Croall n. 392; Johns. n. 364; Larb. Lich. Hb. n. 331; Leight. n. 313; Mudd n. 87.

Distinguished by the smooth somewhat shining surface of the thallus, which, from being monophyllous, divides and branches into numerous overlapping irregular lobes with a polyphyllous appearance, or several centres may be present in one plant; all gradations are present, the extreme forms being described below; the outer lobes may be torn (f. *lacerata*) and the outer epidermis is sometimes cracked, exposing the inner darker layer (f. *sulcata*). The colour reaction with calcium chloride is rather uncertain.

Apothecia are so rare, both in home and foreign specimens, that it has not been possible to verify details of spores, etc.

Hab. On rocks, boulders and walls in upland and mountainous districts.—*Distr.* Fairly general in the hilly parts of Great Britain, apparently rare in Ireland.—*B. M.* Near St. Clear, Cornwall; Dartmoor, Devon; Cader Idris and Cellfawr near Barmouth, Merioneth; Carnedd Llewelyn and Cwm Trefayn, Snowdon, Carnarvonshire; Charnwood Forest, Leicestershire; Ingleby and Battersby Moors, Cleveland, Yorkshire; between Hyshope and Wasterly, Durham; Kentmere, Westmoreland; near Wallington, Northumberland; New Galloway, Kirkcudbrightshire; Ben Lomond, Stirlingshire; Ben Lawers, near Tummel Bridge and Craig-y-Barns, Dunkeld, Perthshire; Sidlaw Hills, Clova Mts. and Cortachy, Forfarshire; Glen Callater, Morrone and Lochnagar, Braemar, Aberdeenshire; Ben Nevis, Invernesshire; Luggelaw, Wicklow (almost f. *congregata*).

Form *glabra* Cromb. Monogr. i. p. 332 (1894).—Thallus rather large, monophyllous, lobate or laciniate at the margin.—*G. glabra* Ach. Meth. Lich. p. 101 (1803); S. F. Gray Nat. Arr. i. p. 476; Hook. Fl. Scot. ii. p. 41. *Lichen glaber* Ach. in Vet. Acad. Handl. xv. p. 31 (1794) & Lich. Succ. Prodr. p. 144 (1798). *L. anthracinus* Wulf. ex Jacq. Misc. ii. p. 84, t. 9, fig. 4 (1781) (fide Ach.); Dicks. Pl. Crypt. iii. p. 19 (1793); With. Arr.

ed. 3, iv. p. 63. *Umbilicaria varia* var. *polyphylla* f. *monophylla* Leight. in Ann. Mag. Nat. Hist. ser. 2, xviii. p. 278 (1856)? *U. polyphylla* f. *monophylla* Leight. Lich. Fl. p. 155 (1871)? ed. 3, p. 143; f. *glabra* Stizenb. St. Gall. Nat. Ges. 1876, p. 212.

Differs from the species in the persistently monophyllous thallus, which is also somewhat stouter and firmer. *Lichen anthracinus* was included by Acharius (Syn. Lich. p. 63) under his *Gyrophora glabra*, with which the description agrees, and Dickson's plant seems also to be referable here.

Hab. On rocks and boulders in upland or mountainous districts.—*Distr.* Collected only rarely in N. Scotland and E. Ireland.—*B. M.* Ben Lawers, Perthshire; Lough Bray, near Dublin.

Form *congregata* Turn. & Borr. Lich. Brit. p. 214 (1839).—Thallus of small crowded lobes, clustered and curled, with the margins erect or reflexed, entire or crenate-lacerate.—Cromb. Monogr. i. p. 332. *Umbilicaria varia* var. *polyphylla* f. *congregata* Leight. in Ann. Mag. Nat. Hist. ser. 2, xviii. p. 279 (1856). *U. polyphylla* f. *congregata* Leight. Lich. Fl. p. 156 (1871); ed. 3, p. 144.

Exsicc. Leight. n. 65.

Distinguished by the small ascending closely packed lobes, which may have separate hold-fasts or may be parts of a single thallus. It is connected with the species by intermediate stages.*

Hab. On rocks in upland districts.—*Distr.* Rare in W. and N. England and E. Scotland.—*B. M.* Arcoll Hill, Caer Caradoc and The Wrekin, Shropshire; Howden Gill, Cleveland, Yorkshire; Kincardineshire.

Thallus with fibrils or rhizinæ.

8. *G. cylindrica* Ach. Meth. Lich. p. 107 (1803).—Thallus moderate in size (generally about 5 cm. across), subcoriaceous, mostly polyphyllous, sinuate-lobate, crenate or lacerate, greyish or black-fibrillose at the margins, the surface generally smooth, dull, greyish-brown above and sometimes pruinose; beneath often lighter and sometimes mottled with black, sparingly fibrillose and with one or more hold-fasts (K —, CaCl —). Apothecia sessile becoming pedicellate, up to 2 mm. across, thinly margined; spores rather small, 10–14 μ long, 6–8 μ thick.—S. F. Gray Nat. Arr. i. p. 477; Hook. Fl. Scot. ii. p. 42 & in Sm. Engl. Fl. v. p. 218; Tayl. in Mackay Fl. Hib. ii. p. 155; Mudd Man. p. 119; Cromb. Monogr. i. p. 327. *G. proboscidea* Turn. & Borr. Lich. Brit. p. 219 (1839) (non Linn.). *Lichenoides cornucum marginibus eleganter fimbriatis* Dill. Hist. Musc. p. 218, t. 29, fig. 116A (1741). *Lichen cylindricus* L. Sp. Pl. p. 1144 (1753) (excl. Syn. Dill.); Ach. Lich. Suec. Prodr. p. 148 (1798). *L. crinitus* Lightf. Fl. Scot. ii. p. 860 (1777). *L. proboscideus* Huds. Fl. Angl. ed. 2, p. 551 (1778) (non Linn.); With. Arr. ed. 3, iv. p. 65; Engl. Bot. t. 522 (two upper figs.). *Umbilicaria*

varia var. *proboscidea* Leight. in Ann. Mag. Nat. Hist. ser. 2, xviii. p. 291 (1856). *U. cylindrica* Cromb. Lich. Brit. p. 40 (1870); Leight. Lich. Fl. p. 161; ed. 3, p. 148.

Essicc. Croall n. 196; Johns. n. 231; Leight. n. 95; Mudd n. 88.

Well marked by the densely fimbriate margins of the lobes. The fibrils are irregularly branched and vary in length and colour. The lobes arise by branching outgrowths from the main frond or fronds, and become crowded and overlapping. Apothecia and spermogones are numerous.

Hab. On rocks and boulders from upland to alpine regions.—*Distr.* Rather rare in the hilly or mountainous regions of W. England, Wales and Ireland, more abundant in Scotland.—*B. M.* Dartmoor, Devon; Rhewgreidden, Dolgelly, Cwm Bychan and Aran Mowddwy-Merioneth; Cwm Trefayn and Glyder Vawr, Carnarvonshire; Cronkley Scarr, Yorkshire; Teesdale, Durham; Ennerdale, Cumberland; Ben Lawers and near Aberfeldy, Perthshire; Clova, Forfarshire; Ben-naboord, Morrone and near Invercauld, Braemar, Aberdeenshire; Ben Nevis, Invernesshire; Mangerton and Brandon Mts., Kerry; Convalla, Cork; Doughruagh Connemara, Galway; Slieve More Mts., Achill, Mayo.

Form *denudata* Mudd Man. p. 119 (1861).—Thallus lobes almost destitute of fibrils.—Cromb. Monogr. i. p. 328. *G. proboscidea* var. *denudata* Turn. & Borr. Lich. Brit. p. 219 (1839). *Umbilicaria varia* var. *proboscidea* f. *denudata* Leight. in Ann. Mag. Nat. Hist. ser. 2, xviii. p. 293 (1856). *U. cylindrica* var. *denudata* Cromb. Lich. Brit. p. 40 (1870); f. *denudata* Leight. Lich. Fl. p. 162 (1871); ed. 3, p. 149.

Though generally the lobes are almost naked, a few fibrils somewhat similar to those of the species are always present. The thallus is probably affected by some growth conditions.

Hab. On rocks and boulders in subalpine regions.—*Distr.* Rare in the mountainous districts of the British Isles.—*B. M.* Cader Idris, Merioneth; Ben Lawers, Perthshire; Ben-naboord, Braemar, Aberdeenshire; Brandon Mt., Kerry.

Form *exasperata* Mudd Man. p. 119 (1861).—Thallus polyphyllous, the lobes crowded, complicate, often small, ascending and crisp, somewhat rugose-uneven on the upper surface, smooth below, the fibrils sparingly produced on the margins or lower surface.—Var. *tornata* Th. Fr. Lich. Scand. p. 157 (1871); Cromb. Monogr. i. p. 329. *G. tornata* Ach. Lich. Univ. p. 222. t. 2, fig. 13 (1810). *G. proboscidea* var. *exasperata* Turn. & Borr. Lich. Brit. p. 219 (1839). *Umbilicaria* var. *proboscidea* f. *exasperata* Leight. in Ann. Mag. Nat. Hist. ser. 2, xviii. p. 294 (1856). *U. cylindrica* f. *exasperata* Leight. Lich. Fl. p. 162 (1871); ed. 3, p. 149.

Essicc. Johns. n. 94.

Not unlike the previous form but differing from it in the generally smaller lobes and in the more or less uneven surface.

Hab. On rocks and boulders in subalpine regions.—*Distr.* Rare in N. England and among the Grampians, Scotland.—*B. M.* Teesdale, Durham; Cairn Turc, Braemar, Aberdeenshire.

Var. *fimbriata* Ach. Lich. Univ. p. 224 (1810).—Lobes of the thallus generally small, rounded and finely and densely black-ciliate, occasionally a few fibrils rise on the under surface.—*S. F. Gray* Nat. Arr. i. p. 477: f. *fimbriata* *Cromb. Monogr. i.* p. 328 (1794). *Lichen proboscideus* var. 2, *With.* Arr. ed. 3, iv. p. 65 (1796). *Umbilicaria cylindrica* var. *fimbriata* *Cromb. Lich. Brit.* p. 40 (1870).

The lobes are more densely ciliate than in the species, and the cilia are generally black, shorter and more slender, they sometimes rise in little tufts on the surface of the thallus. Some of the specimens approach very near to the species.

Hab. On rocks and boulders in upland and subalpine regions.—*Distr.* Coextensive with, though less common than, the species.—*B. M.* Dartmoor, Devon; Teesdale, Durham; near Amulree and Ben Lawers, Perthshire; Clova, Forfarshire; above Invercauld, Morrone and Loch Phadrig, Braemar, Aberdeenshire.

Var. *denticulata* Ach. Meth. Lich. p. 107 (1803).—Lobes of the thallus somewhat lacerate, coarsely fimbriate or denticulate, the fibrils long, broad at the base, branched and tapering.—*Form denticulata* *Mudd Man.* p. 119 (1861); *Cromb. Monogr. i.* p. 327. *G. proboscidea* var. *denticulata* *Turn. & Borr. Lich. Brit.* p. 219 (1839). *Lichenoides* &c. *Dill. l. c.* fig. 116 B. *Lichen proboscideus* *Sm. Engl. Bot. t.* 522 (two lower figures) (1799) (non Linn.). *Umbilicaria varia* var. *proboscidea* f. *denticulata* *Leight. in Ann. Mag. Nat. Hist. ser. 2, xviii.* p. 293 (1856). *U. cylindrica* f. *denticulata* *Leight. Lich. Fl.* p. 162 (1871); ed. 3. p. 149.

Crombie calls attention to the resemblance of the marginal fibrils when seen enlarged to the proboscis of the elephant beetle. It is a well-marked variety.

Hab. On rocks and boulders in upland and mountainous regions.—*Distr.* Rather rare in W. and N. England, Wales, the Scottish Grampians and E. Ireland.—*B. M.* Llauberris, Snowdon and Carnedd Llewelyn, Carnarvonshire; Teesdale, Durham; The Cheviots, Northumberland; Ben Lawers, Perthshire; Clova, Forfarshire; Lochnagar, above Invercauld and Ben-naboord, Braemar, Aberdeenshire; Ben Nevis, Invernessshire; Applecross, Rosshire; Slieve Donard, Wicklow.

Var. *Delisei* *Th. Fr. Lich. Scand.* p. 158 (1871).—Thallus stouter and firmer, fibrils similar to those of the species, less abundant on the margins but generally numerous on the under surface. Apothecia pedicellate, rather large, crowded.—*Cromb. in Journ. Bot. xx.* p. 273 (1882) & *Monogr. i.* p. 328. *Umbilicaria cylindrica* var. *Delisei* *Despr. ex Nyl. Lich. Scand.* p. 117 (1861).

Rather a dark coloured lichen; not to be confused with *G. polyrrhiza*, in which the rhizine cover the under surface, but are absent from the margins. The apothecia are beautifully gyrose.

Hab. On rocks and boulders in alpine regions.—*B. M.* Mt. near Strathyre, Perthshire; Ben-naboord, Braemar, Aberdeenshire; Ben Nevis, Invernessshire.

9. *G. erosa* Ach. Meth. Lich. p. 103 (1803).—Thallus monophyllous, thin, rigid when dry, wrinkled areolate, laciniate and erose at the margins, olive-brown or blackish-brown; beneath finely granulate-papillose in parts or smooth, and minutely sub-fibrillose-scaly, pale-brown (K —, CaCl —). Apothecia small, plane, then somewhat convex; spores 8–12 μ long, 4–7 μ thick.—Cromb. in Grevillea xv. p. 79 (1887) & Monogr. i. p. 329. *Lichen erosus* Web. Spicil. Fl. Goett. p. 259 (1778)? Ach. Lich. Suec. Prodr. p. 145 (1798).

Esicc. Croall n. 393.

Constantly confused with or included under the following species. It is distinguished by the thin flat thallus with the lace-like margin, the small scale-like fibrils of the under surface, and by the absence of thalline reactions. The erosions in this and the following species arise from the branching growth and subsequent anastomosis of narrow laciniae. The open spaces thus left are gradually bridged over by converging growth of the medulla from the margins; the centre of the thallus is thus almost continuous in the lower parts of the thallus though breaks persist in the gonidial and upper cortical layers for some time.

Hab. On rocks in alpine regions.—*Distr.* Rare on the higher Grampians.—*B. M.* Lochnagar and Morrone, Braemar, Aberdeenshire.

10. *G. torrefacta* Cromb. in Grevillea xii. p. 74 (1884).—Thallus monophyllous, coriaceous, crumpled, the surface rough with irregular granulations or wrinkles, generally somewhat laciniate and erose at the margins, olive-brown or brownish-black; beneath pale-brownish, finely granulate-papillose in parts, beset with perforations or often with fibrils or with trabeculae between the perforations (K — CaCl \pm reddish). Apothecia as in *G. erosa*.—Cromb. Monogr. i. p. 329. *G. erosa* var. *torrida* Ach. Meth. Lich. p. 104 (1803). *G. erosa* Sm. Engl. Bot. t. 2066 (1809) (non Ach.); S. F. Gray Nat. Arr. i. p. 477; Hook. Fl. Scot. ii. p. 42 & in Sm. Engl. Fl. v. p. 218; Tayl. in Mackay Fl. Hib. ii. p. 155; Turn. & Borr. Lich. Brit. p. 229 pro parte; Mudd Man. p. 117. *Lichenoides rugosum durum pullum, peltis atris verrucosis* Dill. Hist. Musc. p. 118, t. 30, fig. 118 (1741). *Lichen torrefactus* Lightf. Fl. Scot. ii. p. 862 (1777); With. Arr. ed. 3, iv. p. 62. *Umbilicaria erosa* Hoffm. Fl. Deutchl. ii. p. 111 (1795) pro parte; Cromb. Lich. Brit. p. 41 pro parte (incl. var. *torrida*) Leight. Lich. Fl. p. 158; ed. 3, p. 145. *U. varia* var. *erosa* Leight. Ann. Mag. Nat. Hist. ser. 2, xviii. p. 284 (1856).

Esicc. Bohl. n. 19; Johns. n. 232.

The two plants *G. erosa* and *G. torrefacta* are easily distinguished, especially by the lacunose trabeculate under surface of the latter likened to shavings in Engl. Bot. l. c., though it is doubtful if the

differences may not be due to some growth condition. In *G. torrefacta* the gonidial zone up to the darker cells of the cortex becomes a somewhat evanescent rose-red, on the application of calcium chloride to the thallus sections, and is more marked in some specimens than in others; with potash there is no colour reaction. Occasionally the margins are lacerate (*G. torrida* f. *subdividens* Nyl. ex Cromb. in Journ. Bot. xx. p. 273 (1882)).—The lacunæ of the lower surface evidently arise by the breaking down of the tissue and not from anastomosing laciniaæ as at the margin.

Hab. On rocks and boulders in upland to alpine regions.—*Distr.* General and common in most of the upland or mountainous districts of Great Britain and Ireland.—*B. M.* Causand Beacon and Great Mis Tor, Dartmoor and Walkhampton, Devon; Cader Idris and near Barmouth, Merioneth; Carnedd Dafydd, Cwm Trefayn, Dywen and Snowdon, Carnarvonshire; Swinhope Fell, Durham; The Cheviots and West Allen Carrs, Northumberland; New Galloway, Kirkcudbrightshire; Goatfell, Arran; Ben Cruachan, Argyll; Ben More and Ben Lawers, Perthshire; Katelaw and Clova, Forfarshire; Loch Muick, Craig Coinnoch and Ben-naboord, Braemar, Aberdeenshire; Ben Nevis, Invernesshire; Bennabad, Caithness; Killarney Mts. and Mangerton, Kerry; Doughruagh Mts., Connemara, Galway; Curslieve, Croagh Patrick, and Slieve More and Malaranny, Achill, Mayo.

11. *G. polyrrhiza* Koerb. Parerg. Lich. p. 41 (1859).—Thallus monophyllous or very deeply and unequally lobed and sub-polyphyllous, moderate in size or small, crenate and undulate at the margins, more or less deeply reddish-brown, smooth and somewhat shining above; beneath very black, minutely papillate and almost everywhere densely rhizinose, the rhizinae shortly and divaricately branched at the apex (K - CaCl ± ^{rose-red}). Apothecia orbicular or irregular, plane, then convex and finely gyrose; spores small, 8-11 μ long, 4-5 μ thick.—Mudd Man. p. 119; Cromb. Monogr. i. p. 333. *G. pellita* Ach. Meth. Lich. p. 108 (1803); S. F. Gray Nat. Arr. i. p. 478; Hook. Fl. Scot. ii. p. 42 & in Sm. Engl. Fl. v. p. 219; Tayl. in Mackay Fl. Hib. ii. p. 155; Turn. & Borr. Lich. Brit. p. 338. *Lichenoides pullum superne et glabrum, inferne nigrum et cirrhosum* Dill. Hist. Musc. p. 226, t. 30, fig. 130 (1741). *Lichen polyrrhizos* (errore *polyrhizos*) L. Sp. Pl. p. 1151 (1753); Huds. Fl. Angl. p. 455; Lightf. Fl. Scot. ii. p. 864; With. Arr. ed. 3, iv. p. 64. *L. velleus* Huds. Fl. Angl. p. 454 (1762) (non Linn.). *Lichen pellitus* Ach. in Vet. Acad. Handl. xv. p. 99 (1794); Engl. Bot. t. 931. *Umbilicaria polyrrhizos* Fr. Lich. Eur. p. 358 (1831); Cromb. Lich. Brit. p. 41; Leight. Lich. Fl. p. 159; ed. 3, p. 146. *Exsicc.* Croall n. 197; Johns. n. 233; Mudd n. 89.

Distinguished by the crowded pannose matted rhizinae with apical branching; they curl round at the margin and burst through to the upper surface where any break occurs in the thallus, as small black tufts, the "branching black warts" of English Botany. Apothecia are very rare.

Gyrophora vellea found on high mountains has not been recorded for Britain; Hudson's specimen from Settle, Yorkshire, must have been wrongly determined. *Lichen velleus* had been reported as English by Linnæus, who mistook Dillenius' specimen from New Jersey as from a British locality (see Tuckerm. N. Amer. Lich. p. 88).

Hab. Saxicolous in upland and subalpine regions.—*Distr.* Rather rare in the upland districts of England and Ireland, more plentiful among the Grampians, Scotland.—*B. M.* Helmlinton, Cornwall; Dartmoor, Devon; Cader Idris, Cwm Bychan and near Barmouth, Merioneth; Ayton Moor, Cleveland, Yorkshire; Teesdale, Durham; The Cheviots, Northumberland; Ennerdale, Cumberland; New Gallo-way, Kirkeudbrightshire; Dalmahoy Hill near Edinburgh; Aberfeldy, Pass of Leny, Amulree and Glenshee, Perthshire; Cortachy and Clora, Forfarshire; Lochnagar, Loch Phadrig, Glen Callater, Glen Dee and Craig Coinnoch, Braemar, Aberdeenshire; near Rothiemurchus, Ben Nevis and Ben Ferrog, Invernessshire; Applecross, Rossshire.

Form *luxurians* Th. Fr. Lich. Scand. p. 159 (1871).—Thallus much divided, the margins lobulate, lacinate and crisp.—Cromb. Monogr. i. p. 334. *G. pellita* var. *luxurians* Ach. Lich. Univ. p. 228 (1810). *Umbilicaria polyrrhiza* var. *luxurians* Cromb. Lich. Brit. p. 41 (1870); Leight. Lich. Fl. ed. 3, p. 147.

The crowded lobules tend to form cushion-like masses; occasionally there are only few rhizinae. Apothecia have not been seen on this form.

Hab. Saxicolous in upland or mountainous regions.—*Distr.* Rare in S.W. England and among the Grampians, Scotland—*B. M.* Walkhampton and Sharpitor, Devon; near Killin, Ben Lawers and near Tummel Bridge, Perthshire; Glen Callater, Braemar, Aberdeenshire; Glen Nevis, Invernessshire.

12. *G. cirrosa* Wain. in Medd. Soc. Faun. & Fl. Fenn. xiv. p. 23 (1888). Thallus monophyllous, rather thick and coriaceous, smooth on the upper surface, and somewhat pruinose, irregularly but not deeply lobate, cinereous- or brownish-grey; beneath dark in colour, or grey in parts, granulate and rhizinoso, the rhizinae grey or dark-brown, branched or simple, with simple tips (K—, CaCl ±^{red}). Apothecia sessile, up to 1.5 mm. in diam., becoming convex, generally with a papilla in the centre, and gyrose-plicate or with irregular lines or asperities; spores rather large, about 17–27 μ long, 13–17 μ thick.—*G. spodochoa* Ach. Meth. Lich. p. 108; Wilson & Wheldon in Journ. Bot. xlvii. pp. 431, 447 (1909); A. L. Sm. Part 2, p. 332. *Umbilicaria cirrosa* Hoffm. Pl. Lich. p. 9, t. 2, figs. 3–4 (1790). *Lichen spodochrous* Ehrh. exs. n. 316 (1793) nomen nudum; Ach. Lich. Succ. Prodr. p. 149 (1798).

Not unlike *G. vellea*, an alpine or northern lichen, but of rather thinner texture and with larger spores which are often brownish. The species was found by Martindale at Langdale, and was reported in the "Westmoreland Note Book and Natural History Record" in

1889 fide Wilson & Wheldon l. c. It was collected by Wilson & Wheldon at the same locality in 1908.

Hab. Saxicolous in upland or mountainous regions.—*B. M.* Langdale Pikes, Westmoreland.

UMBILICARIA Hoffm. ex Schreb. Gen. Pl. ed. 8, ii. p. 768 (1791). Subg. *Lasallia* Cromb. Monogr. i. p. 322 (1894). *Lasallia* Mérat. Nouv. Fl. Paris i. p. 398 (1836). (Pl. 63.)

Thallus rather large, coriaceous attached by a single central or subcentral holdfast, with plectenchymatous cortex above and below, without rhizinae. Apothecia sessile, discoid, the disc mostly plane; hypothecium dark-coloured; paraphyses discrete; asci ellipsoid, 1-2-spored; spores ellipsoid, dark-coloured, muriform, with a thin epispore.

Hoffmann first used the name *Umbilicaria* in binomial combination in his Pl. Lich. i. p. 7, figs. 1-2 (1790). It was defined as a genus by Schreber the following year. The species included by Hoffman under *Umbilicaria* in Pl. Lich. and in Deutschl. Fl. ii (1795), are nearly all *Gyrophoræ* as now understood; but as Acharius at a later date instituted the name *Gyrophora* for species with mostly furrowed apothecia, the genus *Umbilicaria* is restricted to those with plane fruits and, more definitely, to those with dark muriform spores. The genera are closely allied, but are now well delimited.

1. *U. pustulata* Hoffm. Pl. Lich. ii. p. 13, t. 28, figs. 1-2 & t. 29, fig. 4 (1794).—Thallus normally orbicular, monophyllous, rather thin, attaining a large size (up to 18 cm. across, or more), becoming irregularly torn and lobed, crowded with pustulose swellings with corresponding depressions (foveolæ) on the under surface, pale-greyish or greyish-brown, with here and there compact groups of branching dark-brown isidia, both surfaces often densely pruinose and finely areolate, the lower surface dark-brown (K—, CaCl \mp reddish). Apothecia moderate in size or rather small, blackish, the disc plane or depressed, the proper margin crenulate-rugose; paraphyses discrete, septate, rather wider and dark at the tips; spores one in the ascus, 28-70 μ long, 18-34 μ thick (or sometimes larger); hymenial gelatine bluish then wine-red with iodine.—Hook. in Sm. Engl. Fl. v. p. 219; Leight. in Ann. Mag. Nat. Hist. ser. 2, xviii. p. 294 (1856) & Lich. Fl. p. 154; ed. 3, p. 143; Mudd Man. p. 115, t. 2, fig. 35. *Lichenoides pustulosum cinereum et veluti ambustum* Dill. Musc. p. 226, t. 30, fig. 131 A, B (1741). *Lichen pustulatus* L. Sp. Pl. p. 1150 (1753); Huds. Fl. Angl. p. 454; Lightf. Fl. Scot. ii. p. 858; With. Arr. ed. 3, iv. p. 64; Engl. Bot. t. 1283. *Gyrophora pustulata* Ach. Lich. Univ. p. 226 (1810); S. F. Gray Nat. Arr. i. p. 478; Hook. Fl. Scot. ii. p. 42; Tayl. in Mackay Fl. Hib. ii. p. 155; Turn. & Borr. Lich. Brit. p. 232; Cromb. Lich. Brit. p. 40.

Exsicc. Bohl. n. 125; Cromb. n. 52; Johns. n. 230; Larb. Cæsar. n. 25; Leight. n. 166.

Easily known by the pustules, the development of which is due to unequal intercalary growth. The thallus is greenish when moist. Apothecia are rather rare in British specimens. It is chiefly a mountainous or northern lichen.

Hab. On rocks and boulders, rarely on old walls, in maritime or upland regions.—*Distr.* Not uncommon in rocky districts throughout the British Isles.—*B. M.* La Moye and New Gorey, Jersey; Guernsey; Helminton, Cornwall; Blackstone Rock, near Bovey Tracey, Hay Tor and Hunter Tor, Dartmoor, and near the Teign, Devon; Malvern Hills, Worcestershire; Charnwood Forest, Leicestershire; Nesscliffe Hill and Caer Caradoc, Shropshire; Cwm Bychan, Merioneth; Capel Curig and Nant Gwynant, Carnarvonshire; Nephra, Westmoreland; Wastdale, Cumberland; New Galloway, Kirkcudbrightshire; Loch Corruisk, Skye; Ben Nevis, Invernessshire; Sandy Loch, near Lerwick, Shetland; Mizzen Head and Glengariff, Cork; near Dunkerron, Kerry.

ORDER XVII. CLADONIACEÆ.

Thallus usually of twofold character: primary thallus crustaceous or squamulose, often evanescent, corticate or non-corticate, attached to the substratum by the hypothallus, by rhizinae or occasionally by a branching rhizoid; secondary thallus or podetium upright, varying from a short apothecial stalk to a simple or branched usually tubular structure, corticate or non-corticate, tapering to a point or opening out into a trumpet-shaped scyphus. Algal cells *Protococcus*. Apothecia sessile on the tips of the podetia or on the margin of the scyphus, rarely on the primary thallus, immarginate; paraphyses generally unbranched; spores simple or variously septate, colourless. Spermogones closely associated with or replacing the apothecia, with branching sterigmata and acrogenous spermatia.

The upright thallus, though mostly endogenous in origin, and regarded sometimes as an apothecial stalk, has become by metamorphosis an organ of absorption and assimilation and functions as a vegetative thallus.

The following British genera are included in the family:—

Podetia short, usually simple.

Podetia glabrous.

Thallus granular, spores 2-4-septate..... **Bæomyces.**

Thallus a gelatinized crust, spores up to 100-septate..... **Gomphillus.**

Podetia granular.

Thallus granular, spores simple **Pilophorus.**

Podetia usually well developed.

Podetia with a solid stalk, minutely squamulose, spores 4-pluriseptate **Stereocaulon.**

Podetia with a hollow stalk, spores simple..... **Cladonia.**

BÆOMYCES Pers. in Ust. Ann. Bot. vii. p. 19 (1794); Nyl. Syn. Lich. i. p. 175 (1860) (excl. *B. icmadophilus*). (Pl. 64.)

Horizontal or primary thallus crustaceous, granular, pulverulent or squamulose. Podetia endogenous in origin, rising from the inner tissue of the thalline granules, very short and with or without gonidia. Apothecia terminal, immarginate, light-coloured; hypothecium pale; spores usually 8 in the ascus, ellipsoid or fusiform, simple or septate, colourless. Spermogones immersed in small tubercles, with septate sterigmata and acrogenous spermatia.

The podetia are very short, and originate generally, as do those of *Cladonia*, within the thallus. Usually they are naked, though in some species they have a gonidial layer.

1. *B. rufus* DC. Fl. Fr. ii. p. 342 (1805).—Thallus effuse, thinnish, furfuraceous, whitish or bluish-green (K + yellow). Podetia short, subcompressed, whitish, sometimes with gonidia. Apothecia small or moderate in size, plane or convex, reddish or brownish flesh-coloured (K -); paraphyses often slightly branched; spores 6 to 8 in the ascus, oblong-ellipsoid, simple, small, 6–12 μ long, 3–4 μ thick; hymenial gelatine not tinged with iodine.—S. F. Gray Nat. Arr. i. p. 413; Hook. Fl. Scot. ii. p. 65 & in Sm. Engl. Fl. v. p. 137; Cromb. Lich. Brit. p. 16 & Monogr. i. p. 109; Leight. Lich. Fl. p. 52; ed. 3, p. 50. *B. rupestris* Pers. in Ust. Ann. Bot. vii. p. 19 (1794); Tayl. in Mackay Fl. Hib. ii. 78; var. *lignorum* Ach. Meth. Lich. p. 322 (1803). *B. lignorum* S. F. Gray l. c. pro parte. *B. byssoides* Schær. Enum. Lich. p. 183 (1850); Mudd Man. p. 63. *Lichenoides fungiforme terrestre, capitulis fuscis* Dill. in Ray Syn. ed. 3, p. 70, n. 39 (1724). *Coralloides fungiforme saxatile pallide fuscum* Dill. Hist. Musc. p. 78, t. 14, fig. 4 (1741). *Lichen rufus* Huds. Fl. Angl. p. 443 (1762); With. Arr. ed. 3; iv. p. 14. *L. byssoides* L. Mant. p. 133 (1767); Lightf. Fl. Scot. ii. p. 809; Huds. Fl. Angl. ed. 2, p. 527; Engl. Bot. t. 373. *L. fungiformis* Scop. Fl. Carniol. ed. 2, ii. p. 360 (1772); With. Arr. ed. 3, iv. p. 14.

Exsicc. Cromb. n. 12; Johns. n. 46; Larb. Cæsar. n. 6 & Lich. Hb. n. 43; Leight. n. 178; Mudd n. 30.

Usually spreads extensively, and varies in thickness and colour according to substratum and exposure. The apothecia are generally numerous, scattered or crowded, the stalk occasionally branched, and when dry wrinkled and furrowed.

Hab. On sandy and gravelly soil, occasionally on rocks and stones, rarely on rotten wood in shady situations.—*Distr.* General and common, chiefly in hilly and mountainous regions.—*B. M.* Rozel, Jersey; Sark; Withiel and near Boconnoc, Cornwall; near South Brent and Dartmoor, Devon; I. of Wight; New Forest, Hants; Ardingly Rock and Tilgate, Sussex; Ightham Common, Kent; Leith Hill and Hart Wood, Surrey; Hornsey Wood, Middlesex; Epping

Forest and Thorndon Hall, Essex; Ampthill, Bedfordshire; Malvern, Worcestershire; Charwood Forest, Leicestershire; Meriden, Warwickshire; Welshpool, Montgomeryshire; Barmouth and Dolgelly, Merioneth; Bangor, Carnarvonshire; Ayton, Cleveland, Yorkshire; Grayrigg Forest and Asby, Westmoreland; Keswick, Cumberland; Hexham, Northumberland; Egglestone, Durham; New Galloway, Kirkeudbrightshire; Leadhills, Lanarkshire; Pentland Hills, near Edinburgh; Ashburn, Gourock, Renfrewshire; Sidlaw Hills, Forfarshire; Kilblane, Argyll; Craig Calliach, Ben Lawers and Blair Athole, Perthshire; Invermoriston, Invernessshire; Mangerton, Kerry; Connemara, Galway; Mallaranny, Achill, Mayo.

Var. *subsquamulosus* Nyl. in Flora lx. p. 463 (1877).—Thallus usually orbicular, determinate, minutely squamulose more especially at the circumference. Apothecia almost sessile, small, solitary or conglomerate, dark-brown.—Cromb. in Grevillea xv. p. 15 (1889) & Monogr. i. p. 110. *B. lignorum* S. F. Gray Nat. Arr. i. p. 413 (1821) pro parte. *B. rufus* vars. *sessilis* and *carneus* Nyl. Syn. Lich. p. 177 (1860); Cromb. Lich. Brit. p. 16. Var. *carneus* Leight. Lich. Fl. p. 53; ed. 3, p. 51 (incl. f. *sessilis*).

Exsicc. Larb. Cæsar. n. 7; Cromb. n. 116.

Not to be confused with *B. carneus* Floerke, a continental species, with a more squamulose thallus, and the reaction K + yellow then saffron-red.

Hab. On sandy and peaty soil, rarely on rotten wood in maritime and upland situations.—*Distr.* Rather rare in the Channel Islands, in S., S.W. and E. England, and among the Grampians, Scotland.—*B. M.* Noirmont, Jersey; near Bodmin, Cornwall; Epping Forest, Essex; Menstrie Glen, near Stirling; Glen Lochay, Schiehallion, Blair Athole and Rannoch, Perthshire; Braemar, Aberdeenshire; Killarney, Kerry.

Var. *Prostii* Harm. Lich. Fr. iii. p. 217 (1907).—Thallus granulose-warted, the warts often pulverulent. Apothecia large, convex sessile, difform or 2-4-connate and forming a mass reaching 3 mm. in diameter.—*Bæomyces Prostii* Duf. MS. in Herb. fide Harm. Specimen not seen.

Recorded by Wheldon and Travis in Journ. Linn. Soc. xlvi. p. 119 (1915), from Hey Slacks Clough, Boulsworth Hill, Lancashire, May 1913.

2. *B. roseus* Pers. in Ust. Ann. Bot. vii. p. 19 (1794).—Thallus granular-crustaceous, effuse or determinate, whitish (K + yellow). Podetia rather short, terete, white. Apothecia nearly globose, rose or pale-flesh-coloured (K + orange); spores 6 or 8 in the ascus, fusiform-oblong or fusiform, simple or sometimes obsolete 1-septate, narrow, 11-26 μ long, 2.5-3 μ thick; hymenial gelatine scarcely tinged, but the tips of the asci pale-bluish with iodine.—S. F. Gray Nat. Arr. i. p. 412; Hook. Fl. Scot. ii. p. 65 & in Sm. Engl. Fl. v. p. 137; Mudd Man. p. 63, t. i. fig. 12; Cromb. Lich. Brit. p. 16 & Monogr. i. p. 111;

Leight. Lich. Fl. p. 53; ed. 3, p. 51. *Lichenoides fungiforme, crusta leprosa candida, capitulis et pediculis incarnatis* Dill. in Ray Syn. ed. 3, p. 70, n. 40 (1724). *Coralloides fungiforme carneum, basi leprosa* Dill. Hist. Musc. p. 76, t. 14, fig. 1 (1741). *Lichen ericetorum* Huds. Fl. Angl. p. 443 (1762) pro parte (non Linn.); Lightf. Fl. Scot. ii. 809 (1777) (excl. var.); With. Arr. ed. 3, iv. p. 14. *L. Bæomyces* Sm. Engl. Bot. t. 374 (1797). *Variolaria terricola* Tayl. in Mackay Fl. Hib. ii. p. 115 (1836).
Æsicc. Carroll Lich. Hib. n. 9; Cromb. n. 117; Johns. n. 171; Leight. n. 355; Mudd n. 31.

Distinguished from *B. rufus* by the longer podetia and by the colour of the apothecia. The thallus spreads extensively, and is often sprinkled with globose white or rosy-white granules. The apothecia are somewhat rare, but the rather large spermogones, which are blackish above, are frequent; the spermatia are $5\ \mu$ long and $1\ \mu$ thick. *Lichen ericetorum* L. Sp. Pl. p. 1141 (1753) is *B. æruginosus* (*Icmadophila ericetorum*, p. 352).

Hab. On bare gravelly or turfy soil on moorlands.—*Distr.* General in hilly or mountainous regions.—*B. M.* St. Breock Down and Tregawn, Cornwall; Uckfield, Lavington Common, Henfield Stone and Tilgate, Sussex; Hurt Wood, Surrey; Toys Hill, near Sevenoaks, Kent; Epping Forest, Essex; Wapley Hill, Herefordshire; Cader Idris, Cwm Bychan, Barmouth and Aberdovey, Merioneth; Montgomeryshire; Cleveland, Yorkshire; Cold Fell, Cumberland; The Cheviots, Northumberland; New Galloway, Kirkeudbrightshire; Leadhills, Lanarkshire; Achosragan Hill, Appin, Argyll; Sheriffmoor, Stirlingshire; Glen Lochay, Ben More, Craig Tulloch and Ben Lawers, Perthshire; Baldovan Woods and Sidlaw Hills, Forfarshire; Glen Dee, Braemar, Aberdeenshire; Glen Nevis, Invernesshire; near Clonmell, Tipperary.

3. *B. placophyllus* Ach. Meth. Lich. p. 323, t. 7, fig. 4 (1803).—Thallus membranaceous, orbicular, squamulose, or partly crustaceous, the squamules adnate, wrinkled or plicate and subcrenulate, glaucous-green or whitish (K + yellow). Podetia short, compressed, colourless, often divided at the apex. Apothecia rare, rather small, reddish or brownish-flesh-coloured (K -); spores oblong-ellipsoid, simple, $10-15\ \mu$ long, $2-4\ \mu$ thick; hymenial gelatine not tinged with iodine.—Hook. in Sm. Engl. Fl. v. p. 137; Mudd Man. p. 63; Cromb. Lich. Brit. p. 16; Leight. Lich. Fl. p. 53; ed. 3, p. 51.

In general aspect resembling, when sterile, *Physcia grisea*, though with a much thicker thallus.

Hab. On gravelly soil among heaths in moorland districts.—*Distr.* Local and scarce in the mountainous regions of Great Britain.—*B. M.* Corwen, Cader Idris and Barmouth, Merioneth; Mardale, Westmoreland; near Keswick and Calder Abbey, Cumberland; Teesdale, Durham; New Galloway, Kirkeudbrightshire; Sidlaw Hills, Forfarshire; Ben Lawers and Falls of Bruar, Perthshire; Morrone, Braemar, Aberdeenshire; Glen Nevis, Invernesshire; Ach-na-druim, Rosshire.

GOMPHILLUS Nyl. in Bot. Not. 1853, p. 165 & in Mém. Soc. Sci. Nat. Cherb. iii. p. 186 (1855). (Pl. 65.)

Thallus effuse, of thick-walled agglutinate hyphæ and sparsely scattered gonidia, forming a thin gelatinized continuous crust. Apothecia one or several borne at the tip of a short stalk or podetium rising from the horizontal thallus, dark-coloured, of a horn-like consistency; paraphyses slender, simple; spores 8 in the ascus, filiform, pluriseptate; spermatogones with simple short sterigmata, and minute acrogenous spermatia.

A monotypic genus nearly allied to *Bæomyces*; recorded also from France and Italy.

1. *G. calycioides* Nyl. in Act. Soc. Linn. Bord. sér. 3, i. p. 392 (1857).—Thallus effuse, thin or obsolete, greyish or greyish-green with a varnished appearance. Apothecia with somewhat slender short furrowed stalks, subglobose, dark or blackish; hypothecium colourless; paraphyses slender, conglutinate, the epithecium interspersed with brown colouring substance; asci cylindrical; spores 8 in the ascus, filiform up to 100-septate, 160–200 μ or more long, about 2 μ thick.—Carroll in Journ. Bot. iii. p. 287 (1865); Cromb. Lich. Brit. p. 15 & Monogr. i. p. 108 (incl. f. *microcephalus*); Leight. Lich. Fl. p. 52 (incl. f. *microcephalus* Nyl. Syn. i. p. 175 (1860)); ed. 3, p. 50. *Bæomyces calycioides* Del. ex Dub. Bot. Gall. p. 636 (1830). *B. microcephalus* Tayl. in Mackay Fl. Hib. ii. p. 78 (1836).

Essicc. Cromb. n. 115.

The form or variety *microcephalus* differs only in the specimens bearing slightly smaller apothecia.

Hab. Incrusting decaying mosses on the ground, trees or boulders.—*Distr.* Rare in N. Wales, W. Scotland and in S.W. Ireland.—*B. M.* Barmouth, Merioneth; Barcaldine, Argyll; Dinish, Tore Mt.; Muckross, Cromaglown and Dunkerron, Kerry; Letter Hill, Connemara, Galway.

PILOPHORUS Th. Fr. Ster. Pil. Comm. p. 40 (1857). *Stereocaulon*, sect. *Pilophoron* Tuckerm. Syn. Lich. New Engl. p. 46 (1848). (Pl. 66.)

Primary thallus crustaceous, granular or minutely squamulose, non-corticate. Cephalodia present. Podetia developed from the upward growth of the granules (not endogenous), rigid, cylindrical, simple or sparingly branched, beset with granules, non-corticate, tubular or solid with a central strand of compact parallel hyphæ. Apothecia terminal on the podetia, single or in groups, subglobose, immarginate; hypothecium thick, dark-brown; paraphyses thickish, dark at the apices; asci clavate, thickened at the apices; spores elongate-ellipsoid, simple. Spermatogones terminal, globose, with acrogenous rod-like straight or curved spermatia.

Resembling *Sterocaulon* in the non-endogenous development of the podetium and in the presence of cephalodia, but differing in the more persistent primary thallus and the darker apothecia.

1. *P. cereolus* Stiz. in Verh. St. Gall. Nat. Ges. 1875, p. 198.—Thallus effuse, crustaceous, granular, sometimes cracked into areolæ, greyish-white, sprinkled with rather flat finely granular dark-olive cephalodia containing *Stigonema* algæ (K + yellowish). Podetia short, erect, simple, greyish-white. Apothecia subglobose, black; spores ellipsoid-fusiform, usually 16–20 μ long, 5–8 μ thick.—Cromb. in Grevillea xv. p. 15 (1886) & Monogr. i. p. 114. *P. fibula* Th. Fr. Ster. Pil. Comm. p. 40 (1857); Leight. in Ann. Mag. Nat. Hist. ser. 4, iv. p. 201 (1869) and Lich. Fl. p. 76, ed. 3, p. 69; Cromb. in Journ. Bot. viii. p. 96 (1870). *P. strumaticus* Nyl. ex Cromb. in Journ. Bot. xiii. p. 140 (1875) & Monogr. i. p. 115. *Lichen (Isidium) cereolus* Ach. Lich. Suec. Prodr. p. 89 (1798). *Sterocaulon cereolus* Ach. Meth. p. 316, t. 7, fig. 1 (1803); Borr. in Engl. Bot. Suppl. t. 2667; Hook. in Sm. Engl. Fl. v. p. 233; Tayl. in Mackay Fl. Hib. ii. p. 83. *St. fibulum* Tuckerm. Syn. Lich. p. 46 (1848). *St. condensatum* subsp. *cereolinum* Cromb. Lich. Brit. p. 17 (1870).

Exsicc. Leight. n. 383; Larb. Lich. Hb. n. 5.

Not unlike *Sterocaulon pileatum*, but easily distinguished by the darker apothecia and by the more finely granular thallus. The spores of *P. cereolus* attain a larger size than the measurements given by Crombie (16–22 $\mu \times 4-5 \mu$). Usually they reach about 17–20 μ in length and 7 μ in width; one abnormal spore measured 25 $\mu \times 5 \mu$. In *P. strumaticum* the normal size is the same, though rather thicker spores up to 9 μ thick have been observed. In one specimen of that "species" the podetia are crowded and the apothecia confluent, which may have given the appearance of a strumose, deformed base in section. There is no other trace of it.

Hab. On moist shady rocks in upland and subalpine situations.—*Distr.* Local and scarce in the mountainous parts of Great Britain and Ireland.—*B. M.* Llyn Gwernon, Cader Idris and Dolgelly, Merioneth; Glyder and Carnedd Dafydd, Carnarvon; Egglestone, Durham; New Galloway, Kirkcudbrightshire; Achosragan Hill, Appin and Ben Cruachan, Argyll; Craig Calliach, Glen Lyon, Killin and Ben Lawers, Perthshire; Morrone, Braemar, Aberdeenshire; Sligachan, Skye and Glen Nevis, Invernesshire; Applecross, Ross-shire; Dunkerron, Kerry; Kylemore, Connemara, Galway.

STEREOCAULON Schreb. Gen. Pl. ed. 8, ii. p. 768 (1791); Nyl. Syn. i. p. 230 (1860). *Leprocaulon* Nyl. ex Lamy in Bull. Soc. Bot. Fr. xxv. p. 352 (1878); Cromb. Monogr. i. p. 123. (Pl. 67.)

Primary thallus granular, or minutely squamulose, usually soon evanescent. Podetia erect or decumbent developed from the upward growth of the primary thallus (not endogenous) much branched, solid in the centre, the exterior beset with minute warts or variously formed squamules which are more or less corticate. Cephalodia present usually on the podetia and con-

taining *Nostoc* or *Stigonema*. Apothecia terminal or lateral, usually dark-brown, immarginate (rarely with a thalline margin); hypothecium colourless; paraphyses slender, discrete; asci cylindrical, 6–8-spored; spores elongate 4-pluri-septate, colourless. Spermogones with filiform or cylindrical straight or bent acrogenous spermatia.

Along with *Pilophorus* differing from *Cladonia* in the origin of the podetium, but similar in the twofold character of the thallus and for that reason retained in the *Cladoniaceæ*.

Primary thallus persistent.

1. *St. condensatum* Hoffm. Deutsch. Fl. ii. p. 130 (1795).—Primary thallus persistent, of coarse rounded granules sometimes flattened out into crenate squamules, glaucous or greyish-white. Cephalodia dark-greyish, verrucose, intermixed with the thallus, containing *Stigonema*. Podetia short or almost none, at first slightly tomentose then glabrous, the podetial squamules often confluent, similar to those of the primary thallus. Apothecia moderate in size, terminal, plane, becoming convex, dark-reddish-brown; spores 3–7-septate, fusiform-cylindrical, 20–36 μ long, 1.5–2.5 μ thick.—Mudd Man. p. 66; Cromb. Lich. Brit. p. 17 & Monogr. i. p. 121; Leight. Lich. Fl. p. 79; ed. 3, p. 71.

Exsicc. Leight. n. 295; Mudd n. 33.

The primary thallus usually spreads extensively, forming a granular crust; the podetia are often scarcely developed, and the apothecia may be developed on the basal granules.

Hab. On the ground and on turf-covered walls in maritime and hilly regions.—*Distr.* General and common in the hilly regions of the British Isles, rare in the Channel Islands.—*B. M.* Near Mildenhall, Suffolk; near Buxton, Derbyshire; Battersby and Baysdale Moors, Cleveland, Yorkshire; Teesdale, Durham; Housesteads, Northumberland; Doune, near Stirling; Auchterhouse, Forfarshire; Aberfeldy, Perthshire; Portlethen, Kincardineshire; Craig Guie, Braemar, Aberdeenshire.

Var. *condyloideum* Nyl. Lich. Scand. p. 66 (1861).—Podetia rather more developed and branched, especially near the apex.—Cromb. Lich. Brit. p. 17 & Monogr. i. p. 122 (as form); Leight. Lich. Fl. p. 80; ed. 3, p. 72. *S. condyloideum* Ach. Meth. Lich. p. 51 (1803); Hook. in Sm. Engl. Fl. v. p. 233.

Hab. On turf-covered walls in upland districts.—*Distr.* Local and scarce among the Grampians, Scotland.—*B. M.* Ben Lawers, Aberfeldy, Killin and Glen Fender, Perthshire.

2. *St. pileatum* Ach. Lich. Univ. p. 582 (1810).—Primary thallus persistent, effuse, formed of rather rounded granules which tend to become squamulose or coralloid. Cephalodia dark-coloured, in flattened tubercles, not frequent, containing *Stigonema*. Podetia short, erect, glabrous, simple or rarely branched; the podetial squamules minute. Apothecia terminal,

cap-shaped (pileate), plane then convex, brown or reddish-brown; spores 3-septate, narrowly ellipsoid, obtuse at the ends, 18–30 μ long, 4–5 μ thick.—Cromb. in *Grevillea* xv. p. 15 (1886) & *Monogr.* i. p. 122. *St. cereolus* Borr. in *Engl. Bot. Suppl.* t. 2667 (1830) descr. pro parte; Hook. in *Sm. Engl. Fl.* v. p. 233 pro parte. *St. cereolinum* Koerb. *Syst. Lich. Germ.* p. 14 (1855); *Mudd Man.* p. 67. *St. condensatum* var. *cereolinum* Cromb. *Lich. Brit.* p. 17 pro parte; *Leight. Lich. Fl.* p. 79; ed. 3, p. 72.

Exsicc. *Larb. Lich. Hb.* n. 6

Closely allied to the preceding but differs in the larger podetia and in the coralline structure of the basal squamules. Th. Fries (*Lich. Scand.* p. 52) describes the cephalodia as occurring towards the base of the podetia. In British specimens they occur on the thallus as in the previous species.

Hab. On rocks in subalpine districts.—*Distr.* Rare and local in N. Wales, N. England, S.W. Scotland, the W. Highlands and N.W. Ireland.—*B. M.* Cader Idris and Dolgelly, Merioneth; Wastdale, Cumberland; New Galloway, Kirkeudbrightshire; Ben Cruachan, Argyll; Glen Ogle and Glen Lochay, Perthshire; Connemara, Galway.

3. *St. nanum* Ach. *Meth. Lich.* p. 315 (1803).—Primary thallus effuse, granular, powdery, the granules small whitish or bluish-green. Podetia crowded, slender, rather short, obsoletely arachnoid, simple or sparingly fastigiately branched towards the apices (K—). Apothecia and spermogones unknown.—S. F. Gray *Nat. Arr.* i. p. 411; *Mudd Man.* p. 67; *Cromb. Lich. Brit.* p. 17; *Leight. Lich. Fl.* p. 80; ed. 3, p. 73. *Lichen nanus* Ach. *Lich. Suec. Prodr.* p. 206 (1798). *Leprocaulon nanum* Nyl. ex Lamy in *Bull. Soc. Bot. Fr.* xxv. p. 352 (1878); *Cromb.* in *Grevillea* xv. p. 15 (1836) & *Monogr.* i. p. 123.

Exsicc. *Larb. Lich. Hb.* n. 284.

Frequently placed in a separate genus *Leprocaulon* on account of the leprarioid structure; it agrees with *Stereocaulon* in the two-fold thallus and in the squamulose podetia. Th. Fries (*Monogr. Ster. & Pil.* p. 65 (1858)) describes cephalodia as “conglomerate, plane, smooth, black”; there are none present on the British specimens.

Hab. In crevices of rocks and walls in maritime and mountainous districts.—*Distr.* Local, though plentiful where it occurs, throughout the British Islands.—*B. M.* Boulay Bay, Jersey; Guernsey; Lamorna and Helmen Tor, Cornwall; Loddiswell, Cawsand Bay, near Kingsbridge and Totnes, Devon; near Alfrick, Knightswick and Worcester Beacon, Malvern Hills, Worcestershire; Oswestry and Llanymynech, Shropshire; Bettws-y-Coed, Carnarvonshire; Teesdale, Durham; Balmerino and Westwater, Fife; Glen Lochay, Perthshire; Den of Balthayock and Reeky Linn, Forfarshire; Falls of Lui, Braemar, Aberdeenshire; Learmont, Derry.

Primary thallus evanescent.

4. *St. coralloides* Fr. *Sched. Crit.* iv. p. 24 (1824).—Podetia cæspitose, erect, branched, the axis glabrous, the podetial

squamules coralline, digitately branched or subfibrillose, greyish (K † yellow). Cephalodia on the podetia, somewhat spherical, opaque, verrucose and minutely granular on the surface, greyish, containing *Stigonema*. Apothecia mostly terminal, moderate in size, globose, brown or dark-reddish; spores 3- (rarely 5-7) septate, fusiform-cylindrical, 22-40 μ long, 2.5-5 μ thick.—Cromb. Lich. Brit. p. 16 & Monogr. i. p. 117; Leight. Lich. Fl. p. 77; ed. 3, p. 69. *St. paschale* Ach. Meth. Lich. p. 315 (1803); S. F. Gray Nat. Arr. i. p. 411; Hook. Fl. Scot. ii. p. 66 & in Sm. Engl. Fl. v. p. 233; Tayl. in Mackay Fl. Hib. ii. p. 83; Mudd Man. p. 65 (incl. var. *corallinum*, t. 1, fig. 14); Cromb. Lich. Brit. p. 17 pro parte; Leight. Lich. Fl. p. 77 pro parte. *Lichen paschalis* Huds. Fl. Angl. p. 460 (1762) pro parte (non L.); Lightf. Fl. Scot. ii. p. 886 pro parte; With. Arr. ed. 3, iv. p. 44 pro parte; Engl. Bot. t. 282.

Exsicc. Bohl. n. 14; Croall n. 595; Cromb. n. 119; Johns. n. 210; Leight. n. 148.

Distinguished by the coralloid processes into which the podetial squamules are divided, and by the united bases of the podetia.

Hab. On rocks, boulders and old walls in upland and subalpine districts.—*Distr.* General and common in the hilly districts of Great Britain, rare in Ireland.—*B. M.* Near Penzance, between Arthur's bed and Wring Cheese and near Helminton, Cornwall; Okehampton, Devon; Abdon Burf and near Oswestry, Shropshire; Cader Idris and Dolgelly, Merioneth; Pen-y-Gwryd, Carnarvonshire; Black Edge, Buxton, Derbyshire; near Staveley, Kendal and Ambleside, Westmoreland; Wastdale, Cumberland; Teesdale, Durham; New Galloway, Kirkcudbrightshire; Leadhills, Lanarkshire; Inverary and Appin, Argyll; Ben Lawers and Blair Athole, Perthshire; Sidlaw Hills, Balgay Wood, Glen Isla and Strathmartine, Perthshire; Craig Nich, Glen Callater and Glen Dee, Braemar, Aberdeenshire; near Forres, Elginshire; Ben Nevis and Lochaber, Invernessshire; Hills of Apple Cross, Rossshire; Killarney, Kerry; Connemara, Galway; Slieve More, Achill, Mayo.

5. *St. Delisei* Bory ex Dub. Bot. Gall. ii. p. 619 (1830).—Podetia small, loosely caespitose, branched, the main axis thinly tomentose or naked; podetial squamules minute, crenate or digitately divided, grouped near the apices, whitish and becoming soreciate (K \pm yellow). Apothecia unknown.—Cromb. in Journ. Bot. xxiii. p. 195 (1885) & Monogr. i. p. 117.

Known only from W. France and N. Scotland. The granules at the tips of the podetia are whitish and almost entirely soreciate. Cephalodia are very rare, and similar to those of *St. coralloides*.

Hab. Among mosses or granitic boulders in Central Grampians, Scotland.—*B. M.* Near Loch Eagle, Rannoch Moor, Perthshire.

6. *St. evolutum* Græwe ex Th. Fr. in Bot. Not. (1865) p. 181.—Podetia small or moderate in size, caespitose, frequently and intricately branched, especially towards the apices, glabrous;

podetial squamules crowded, swollen and branched, greyish glaucous or whitish. Cephalodia rather scarce, somewhat spherical, minutely granular on the surface, greyish, containing *Stigonema*. Apothecia terminal, at first thinly margined and plane, becoming convex and difform and often splitting, pale or dark-brown; spores oblong-ellipsoid, obtuse, constantly 3-septate, 18–28 μ long, 5–7 μ thick.—Cromb. in Journ. Bot. xiv. p. 359 (1876) & Monogr. i. p. 118; Leight. Lich. Fl. ed. 3, p. 72.

Exsicc. Cromb. n. 120.

Intermediate between *St. coralloides* and *St. paschale*. The podetia are subdecumbent, the squamules stouter more branched and less distinctly palmate than in *S. paschale*, but not coralloid.

Hab. On rocks and walls in maritime and hilly regions.—*Distr.* General and common in W. and N. England, N. Wales, among the Grampians, Scotland and W. Ireland.—*B. M.* Hay Tor, Widdicombe, Wistmain's Wood and near Buckland on the moor, Devonshire; Plynlimmon, Cardiganshire; Cader Idris, Llyn Bodlyn, Dolgelly, near Barmouth and Garth, Merioneth; Beddgelert, Carnarvonshire; Teesdale, Durham; near Galloway, Kirkcudbrightshire; Appin, Argyll; Crianlarich, Ben Lawers and near Loch Eagle, Rannoch, Perthshire; Ben Avon, Aberdeenshire; Loch Linnhe, Invernessshire; near Forres, Elginshire; Applecross, Rossshire; Cahir and Blackwater Bridge, Kerry; Connemara, Galway.

7. *St. paschale* Fr. Stirp. Femsj. p. 35 (1825).—Podetia moderately high (about 3 to 9 cm.), crowded or dispersed, erect or spreading, much branched, the axis slightly compressed, tomentose, becoming nearly glabrous; podetial squamules palmate or crenate, greyish white or whitish. Cephalodia warted, containing *Stigonema*. Apothecia terminal or subterminal, plane or convex, brown or dark-brown; spores usually 3- sometimes 5–9-septate, fusiform-cylindrical, 18–40 μ long, 3·5–4·5 μ thick.—Cromb. Lich. Brit. p. 17 pro parte; in Grevillea xv. p. 15 (1886) & Monogr. i. p. 118; Leight. Lich. Fl. p. 77; ed. 3, p. 70 pro parte. *Lichen paschalis* L. Sp. Pl. p. 1153 (1753) pro parte.

A plant of northern or cold regions and very rare in this country. It has frequently been confused with *St. coralloides*, but differs in the form of the podetial squamules, which are smaller and are never coralloid.

Hab. Among mosses on rocks and on the ground in alpine regions.—*Distr.* Rare in the northern regions of Scotland.—*B. M.* Upper Glen Dec, Braemar, Aberdeenshire; Morven, Caithness.

8. *St. denudatum* Flörke Deutsch. Lich. iv. p. 13 (1819).—Podetia small or moderate in size, up to 5 cm. in height, attached below, nearly erect and branched above, attenuate and rarely sorediate at the apices, the axis glabrous; podetial squamules whitish, subpeltate, at first somewhat globose then flattened and depressed in the centre, with a crenulate margin, sometimes discoid and crowded, often fewer towards the tips. Cephalodia

warted, olive-brown, somewhat shining, containing *Stigonema*. Apothecia very rare, small, lateral, plane or somewhat convex, brownish; spores elongate-fusiform, 3-7-septate, 26-46 μ long, 3-4 μ thick.—Cromb. Lich. Brit. p. 17 & Monogr. i. 120; Leight. Lich. Fl. p. 78; ed. 3, p. 71. *S. paschale* var. *denudatum* Mudd Man. p. 66 (1861). *Lichenoides non tubulosum, cinereum ramosum totum crustaceum* Dill. in Ray Syn. ed. 3, p. 66, n. 11 (1724) (specimen in Buddle Hort. Sicc. ii. fol. 2, n. 7, in Herb. Sloane). *Coralloides crispum et botryforme alpinum* Dill. Hist. Musc. p. 114, t. 17, fig. 33 (1741).

Exsicc. Croall n. 499; Johns. n. 211; Larb. Lich. Hb. n. 244.

Easily distinguished from other British species by the subpeltate squamules and by the thin squamulose podetia near the tips. When larger and more robust it is f. *validum* Laur. (ex Fr. Lich. Eur. p. 205 (1831); Cromb. Monogr. i. p. 120). Squamules and podetia are rarely somewhat sorediate (f. *capitatum* Flot. ex Koerb. Syst. Lich. Germ. p. 13 (1855); Cromb. l. c.).

Hab. On rocks and boulders in upland and alpine situations.—*Distr.* General and frequent in the more mountainous districts of Great Britain and Ireland.—*B. M.* Cawsand Beacon, Sharpitor Rock and Mis Tor, Dartmoor, Devon; near Dolgelly and Cader Idris, Merioneth; Capel Curig, Pen-y-Gwryd, Moel Siabod, Llyn Idwal and Snowdon, Carnarvonshire; Anglesea; Mynydd-y-Myfyr, Shropshire; Faliin Clints and Cronkley Scar, Teesdale, Durham; Staveley Head, Westmoreland; Ennerdale, Cumberland; near Galloway, Kirkcudbrightshire; Ben Cruachan, Argyll; Ben Ledi, Ben Lawers and Rannoch Moor, Perthshire; Sidlaw Hills and Clova, Forfarshire; Glen Candlic, Craig Coinnoch, Cairn Drochit and Ben-naboord, Braemar, Aberdeenshire; Ben Nevis, Invernessshire; Hills of Applecross, Rossshire; Lairg, Sutherland; Killarney, Kerry; Kylemore, Connemara, Galway.

Var. *pulvinatum* Th. Fr. Ster. & Pil. Comm. p. 27 (1857).—Podetia densely cæspitose, short, fastigiately and intricately branched, forming cushion-like growths, the squamules turgid, crowded.—Cromb. in Journ. Bot. xx. p. 272 (1882) & Monogr. i. p. 121. *St. botryosum* Ach. Lich. Univ. p. 581; Hook. in Sm. Engl. Fl. v. p. 233. *St. paschale* var. *pulvinatum* Schær. Lich. Helv. Spicil. p. 274 (1833); var. *botryosum* Mudd Man. p. 66 (1861). *St. tomentosum* var. *botryosum* Cromb. Lich. Brit. p. 17 (1870); Leight. Lich. Fl. p. 78; ed. 3, p. 71.

Exsicc. Johns. n. 212; Leight. n. 387.

Differs from the species in the short congested podetia and the somewhat confluent podetial squamules.

Hab. On rocks and boulders in mountainous regions.—*Distr.* Rather local in N. England, N. Wales, among the Scottish Grampians and in S.W. Ireland.—*B. M.* Cader Idris, Merioneth; Llyn Howel and Snowdon, Carnarvonshire; Castleton, Derbyshire; Teesdale, Durham; Ben Lawers, Craig Calliach and near Loch Eagle, Rannoch, Perthshire; Ben Macdhuil, Braemar, Aberdeenshire; Ben Nevis, Invernessshire; Connor Cliffs, Kerry.

9. *St. tomentosum* Fr. Sched. Critt. iii. p. 20 (1824) pro parte; Th. Fr. Ster. Pil. Comm. p. 29 (1857).—Podetia solitary or loosely cæspitose, ascending or spreading, 3–9 cm. high, branched above, the axis densely tomentose; podetial squamules palmate-digitate, crowded above, scarcely any below, whitish or greyish-green. Cephalodia minute, greyish or bluish-green, containing *Nostoc*. Apothecia small, terminal and lateral, concave, becoming subglobose, brown or dark-brown; spores elongate-fusiform, 3- rarely 5–7-septate, 22–37 μ long, 2–3 μ thick.—Mudd Man. p. 65; Cromb. Lich. Brit. p. 17 & Monogr. i. p. 119; Leight. Lich. Fl. p. 78; ed. 3, p. 70.

Exsicc. Dicks. Hort. Sicc. n. 24 (as *Lichen paschalis*).

Distinguished from the preceding by the tomentum on the podetia, though that disappears somewhat with age. Apothecia are rather rare in British specimens; spermogones are more frequent, with spermatia 5–6 μ long, 1 μ thick.

Hab. Among gravel in stony places in maritime and subalpine districts.—*Distr.* Local and scarce in S.W. and N. England and in the hilly regions of Scotland.—*B. M.* Near Tavistock, Devon; Helvellyn, Cumberland; Sands of Barrie and Clova Mts., Forfarshire; Ben-naboard, Glen Dee, Glen Lui Beg, Braemar and Ben Macdhuil, Aberdeenshire; Ben Nevis and Glen Feshie, Invernesshire.

10. *St. alpinum* Laur. ex Fr. Lich. Eur. p. 204 (1831).—Podetia rather short, branched and densely congested, adherent to the substratum, the axis thinly tomentose; podetial squamules above of conglomerate turgid granules almost obscuring the branches, more sparse below and subpalmate. Cephalodia bluish-green, containing *Nostoc*. Apothecia few, usually terminal and dilated, plane, becoming convex, dark-red or brownish-black; spores 3- rarely 5–7-septate, 22–37 μ long, 2–3 μ thick.—Cromb. in Grevillea xv. p. 15 (1886) & Monogr. i. p. 119. *St. tomentosum* var. *alpinum* Th. Fr. Ster. Pil. Comm. p. 30 (1857); Cromb. Lich. Brit. p. 17; Leight. Lich. Fl. p. 78; ed. 3, p. 71. *St. paschale* var. *alpinum* Mudd Man. p. 66 (1861).

Exsicc.—Larb. Lich. Hb. n. 7.

Distinguished from the preceding by character of the more erect congested podetia and the crowded turgid squamules.

Hab. On the ground and on boulders in subalpine districts.—*Distr.* Local and scarce among the Scottish Grampians and W. Ireland.—*B. M.* Ben Vrackie, Perthshire; Morrone, Braemar, Aberdeenshire.

CLADONIA Hill Hist. Pl. p. 91 (1751) pro parte; Hoffm. Deutschl. Fl. ii. p. 114 (1795). *Scyphophorum* Necker Elem. Bot. iii. p. 350 (1790). *Cenomyce* Ach. Lich. Univ. p. 105 (1810); Hook. Fl. Scot. ii. p. 61 (1821). *Helopodium*, *Schasmaria* and *Scyphophora* S. F. Gray Nat. Arr. i. pp. 416, 417 (1821). *Scyphophorus* Hook. in Sm. Engl. Fl. v. p. 236 (1833). (Pl. 68.)

Primary thallus crustaceous, squamulose or subfoliaceous.

sometimes evanescent; secondary thallus or podetia upright, simple or branched, tapering to a point or widening to form a shallow cup or scyphus, more or less corticate, pulverulent or beset with squamules, tubular and sometimes perforate at the axils or in the scyphi. Apothecia terminal, at first somewhat plane or even marginate, becoming convex; spores 8 in the ascus, oblong, simple, colourless. Spermogones usually terminal on the podetia, with cylindrical straight or curved acrogenous spermatia.

Characterized by the well-developed tubular podetia. There are three subgenera represented in the British Isles:—

- Primary thallus crustaceous or squamulose soon evanescent; podetia mostly ascyphous..... i. CLADINA.
 Primary thallus crustaceous, persistent; podetia ascyphous..... ii. PYCNOTHELIA.
 Primary thallus squamulose, usually persistent; podetia scyphous or ascyphous..... iii. CENOMYCE.

Subgenus i. CLADINA Leight. Lich. Fl. p. 72 (1871). *Cladina* Nyl. in Not. Sällsk. Faun. & Fl. Fenn. Förh. n. s. v. p. 110 (1866); Cromb. Monogr. i. p. 173.—Basal thallus granular or minutely squamulose, soon disappearing; podetia perishing at the base, with long continued apical growth and without podetial squamules.

The species of *Cladina* were considered to have no primary thallus, and though that has been disproved by careful observations for most of the species, the basal granules or squamules disappear very soon. The limits of Nylander's genus have been followed. Wainio and some others have excluded *Cladonia uncialis* and *C. amaurocrea*, etc. (placing them under the subgenus *Cenomyce*).

Podetia ascyphous, slender, cylindrical.

1. *C. rangiferina* Web. in Wiggers Prim. Fl. Hols. p. 90 (1780) pro parte.—Primary thallus of contiguous or scattered minute greyish granules soon disappearing; podetia rising from the granules or from fragments of older podetia dying at the base but with continued apical growth, usually about 5 to 12 cm. long, but shorter or sometimes very much longer, usually tomentose and somewhat scabrid, cylindrical, rather slender, the main axis usually about 1·5 mm. thick, with many short branches, often dilated and perforate at the axils, the branchlets short, spreading or subdeflexed and subsecund, the apices nodding when sterile, erect and subcorymbose when fertile, greenish-grey or whitish (K + yellow, CaCl -). Apothecia small, rare; spores oblong-fusiform, 10–15 μ long, 3·5 μ thick.—S. F. Gray Nat. Arr. i. p. 415; Hook. in Sm. Engl. Fl. v. p. 235; Mudd Man. p. 58 (excl. vars.) & Brit. Clad. p. 24 (incl. f. *major*, p. 25, excl. other forms). *Lichenoides tubulosum ramosissimum, fruticuli specie caudicans* Dill. in Ray Syn. ed. 3, p. 66, n. 14 (1724). *Coral-*

loides montanum fruticuli specie, ubique candicans Dill. Hist. Musc. p. 107, t. 16, fig. 29 A-D (1741). *Lichen rangiferinus* L. Sp. Pl. p. 1153 (1753); Huds. Fl. Angl. p. 458 (excl. var. β); Lightf. Fl. Scot. ii. p. 877 (excl. vars.); With. Arr. ed. 3, iv. p. 41; Engl. Bot. t. 173. *Cenomyce rangiferina* Ach. Syn. Lich. p. 277 (1814) (incl. f. *gigantea*); Hook. Fl. Scot. ii. p. 65; Tayl. in Mackay Fl. Hib. ii. p. 79. *Cladina rangiferina* Nyl. in Not. Sällsk. Faun. & Fl. Fenn. Förh. n. s. v. p. 110 (1866); Leight. in Ann. Mag. Nat. Hist. ser. 3, xviii. p. 418 (1866) & Lich. Fl. p. 74; ed. 3, p. 67; Cromb. Lich. Brit. p. 22 & Monogr. i. p. 174 (incl. f. *gigantea* Lamy in Bull. Soc. Bot. Fr. xxv. p. 358 (1878)).
Exsicc. Croall n. 400.

This species is the well-known "Rein-deer Moss," and is distinguished from the following chiefly by the larger size and by the yellow reaction with potash. It grows in dense groups and sometimes in northern countries to a great height (1½ ft.). Usually it is tomentose and often covered with scurfy dots, or it is quite smooth and in older specimens tends to become greyish-brown. The apothecia are rare, but the spermogones are more frequent.

Hab. On the ground, usually in boggy places, mostly on high moorlands.—*Distr.* Not general nor common in Great Britain; not seen from Ireland.—*B.* M. Trevello Carne, near Penzance, Cornwall; Charwood Forest, Leicestershire; Delamere Forest, Cheshire; Snowdon, Carnarvonshire; The Cheviots, Northumberland; Glen Lochay and Ben Lawers, Perthshire; Clova Mts., Forfarshire; Craig Coinnoch and Glen Callater, Braemar, Aberdeenshire; Rothiemurehus Forest and Glen Nevis, Invernesshire.

2. *C. sylvatica* Hoffm. Deutschl. Fl. ii. p. 114 (1795).—Primary thallus of contiguous or dispersed yellowish-green granules, soon evanescent; podetia branched, dying at the base but with continued apical growth, mostly about 5 cm. in length and slender, but attaining to 20 cm. and the main axis stoutish, about 1.5 mm. thick, cylindrical, somewhat tomentose and scabrid, greenish-white, or pale-straw-coloured, the branches short, spreading or deflexed, often dilated and perforate at the axils, the ultimate branchlets short, subsecund, nodding when sterile, erect and subcorymbose when fertile, greenish-grey or pale-straw-coloured (K —, K(CaCl) + yellow). Apothecia and spores as in the preceding species.—*C. rangiferina* var. *sylvatica* Schær. Lich. Helv. Spic. p. 38 (1823), Mudd Man. p. 59 & ff. *tenuis*, *lappacea*, *sylvatica* and *grandis* Brit. Clad. p. 25 (1865); var. *tenuis* Floerk. Clad. Comm. p. 164 (1828) & var. *sylvatica* f. *grandis* tom. cit. p. 169. *C. impexa* Harm. Lich. Fr. p. 232 (1907); A. L. Sm. Monogr. ii. p. 351 (1911). *C. ciliata* Stirt. in Scot. Nat. n. s. iii. p. 308 (1888). *Coralloides fruticuli species candicans corniculis rufescentibus* Dill. Hist. Musc. p. 110, t. 16, fig. 30 B (1741). *Cladina sylvatica* Nyl. in Not. Sällsk. Faun. & Fl. Fenn. Forh. n. s. v. p. 110 (1866); Leight. in Ann. Mag. Nat. Hist. ser. 3, xviii. p. 418 (1866) & Lich. Fl. p. 72 (incl. f. *sabrosa*).

ed. 3, p. 66; Cromb. Lich. Brit. p. 22 & Monogr. i. p. 175 (incl. f. *tenuis* and var. *grandis*).

Ersicc. Bohl. n. 6; Johns. nos. 54, 55, 182, 300; Larb. Lich. Hb. nos. 242, 243 & Lich. Cantab. n. 4; Leight. n. 57; Mudd nos. 19, 20 & Clad. nos. 57, 58, 60.

One of our commonest British Lichens; it differs little from the preceding species except in the absence of colour reaction with potash and in the generally smaller lighter-coloured and less tomentose podetia. Forms *tenuis* and *grandis* represent the somewhat more extreme developments. In f. *lappacea* the podetia are more crowded and branched. *Cladonia impeza* is whitish and almost translucent in appearance, but otherwise like the species; the translucent character appears occasionally both in this species and in the preceding. It is more than probable that *Lichen rangiferinus* of the older writers refers to this, the much commoner species.

Hab. On the ground in forests and moorlands.—*Distr.* General and common in Great Britain and Ireland, rare in the Channel Islands.—*B. M.* Tregawn, Cornwall; Dartmoor, Devon; New Forest, Hants; Shanklin Downs, I. of Wight; Aldrington, Tilgate, Lavington and Crowborough, Sussex; Wimbledon, Surrey; Farnham Royal Common, Bucks; Epping Forest, Essex; Charnwood Forest, Leicestershire; Wyre Forest and Malvern, Worcestershire; Haughmond Hill, Shropshire; Barmouth and Rhewgreidden, Merioneth; Thetford Warren, Suffolk; North Wootton Common, Norfolk; Ayton and Kildale Moors, Cleveland, Yorkshire; Windermere, Westmoreland; Alston, Cumberland; The Cheviots and West Allen Carrs, Northumberland; New Galloway, Kirkeudbrightshire; Pentland Hills, near Edinburgh; Ben Cruachan, Argyll; Ben Lawers, Kinnoul Hill and Moncreiffie Hill, near Perth, Glen Lochay and Rannoch Moor, Perthshire; Sidlaw Hills, Rossie Moor and Baldovan, Forfarshire; Mar Forest and Ben-naboord, Braemar and Countess Wells Wood, Aberdeenshire; Rothiemurchus and Ben Nevis, Invernessshire; Lairg, Sutherlandshire; Applecross, Rossshire; Kilminster Moor, Caithness; Arklow, Wicklow; Connemara, Galway; Mallaranny, Slieve More Mt., Achil Island and Clare Island, Mayo; Kirkeubbin, Down.

Form *lacerata* Wain. Mon. Clad. i. p. 29 (1887).—Podetia rather long and stoutish, very shortly branched, perforate or lacerate at the axils.—*Cenomyce sylvatica* var. *lacerata* Del. in Duby Bot. Gall. ii. p. 621 (1830). *Cladina sylvatica* f. *lacerata* Cromb. in Grevillea xi. p. 115 (1883) & Monogr. i. p. 176.

Hab. In moist sandy places and on moorlands in maritime and inland districts.—*Distr.* Scarce in the Channel Islands and in Great Britain.—*B. M.* Quenvais, Jersey; near Bodmin, Cornwall; New Galloway, Kirkeudbrightshire; Rannoch Moor, Perthshire.

Var. *portentosa* Wain. Mon. Clad. i. p. 32 (1887).—Podetia stout and rather inflated, difform, tomentose, scabrid, sometimes translucent, shortly branched, denticulate-crispate at the apices and sometimes also at the axils.—*Corallina montana varietas elegans* Buddle Hort. Sicc. ii. fol. i. n. 3, in Herb. Sloane. *Cenomyce portentosa* Duf. in Ann. Sci. Phys. viii. p. 69 (1821). *Cladina sylvatica* f. *portentosa* Leight. in Ann. Mag. Nat. Hist.

ser. 3, xviii. p. 419 (1866) & Lich. Fl. p. 73; ed. 3, p. 67; Cromb. Lich. Brit. p. 22 & Monogr. i. p. 176.

Fairly constant in appearance, though probably an abnormal growth form due to excessive moisture. It is rarely fertile.

Hab. In moist places on moorlands.—*Distr.* Rare in S.W. and Central England, S. Scotland.—*B. M.* Near Penzance, Cornwall; Hampstead, London (18th century); Charnwood Forest, Leicestershire; New Galloway, Kirkcudbrightshire; Moor of Rannoch, Perthshire; Glen Dee, Braemar, Aberdeenshire.

3. *C. alpestris* Rabenh. Clad. Eur. p. 11, fide Bausch in Verh. Nat. Ver. Carlsruhe, iv. p. 17 (1869).—Podetia somewhat soft, with apical dense radiately spreading cymose branches forming a thyrus, the main axis stoutish, that of the branches and branchlets rather slender, tips upright, usually light-straw-coloured (K —, K(CaCl) + yellow). Apothecia rare in Great Britain, minute, solitary or aggregate, brown or reddish-brown; spores fusiform or oblong, 10–14 μ long, 3–3.5 μ thick.—*C. rangiferina* var. *alpestris* Mudd Man. p. 59 (1861) & f. *alpestris* Brit. Clad. p. 25 (1865). *Coralloides montanum fruticuli specie, ubique candicans* Dill. Hist. Musc. p. 107, t. 16, fig. 29 E, F. *Lichen rangiferinus alpestris* Linn. Sp. Pl. p. 1153 (1753). *L. alpestris* Huds. Fl. Angl. p. 458 (1762); Lightf. Fl. Scot. ii. p. 877. *Cladina sylvatica* var. *alpestris* Nyl. in Not. Sällsk. Faun. & Fl. Fenn. n. s. v. p. 176 (1866); Leight. in Ann. Mag. Nat. Hist. ser. 3, xviii. p. 419 (1866); Cromb. Lich. Brit. p. 22 & Monogr. i. p. 177; f. *alpestris* Leight. Lich. Fl. p. 73; ed. 3, p. 66.

Exsicc. Larb. Lich. Hb. n. 85.

So well-marked and constant in the form of the branching that it is now held to rank as a species. It is rarely fertile in the British Isles. The spermogones contain a rose-red colouring substance.

Hab. In moist places in woods and moorlands in upland and sub-alpine regions.—*Distr.* Rare in England and Ireland; more frequent among the Grampians, Scotland.—*B. M.* Rhewgreidden, Merioneth; Glen Lochay, Perthshire; Hill of Ardo, near Aberdeen and Benaboard, Braemar, Aberdeenshire; Glen Nevis, Invernesshire; Ballytore, Kildare; Kylemore and Roundstone, Galway.

Form *pumila* A. L. Sm.—Podetia shorter, very much branched, forming somewhat dense cushions, rather fragile.—*Cenomyce rangiferina* var. *pumila* Ach. Lich. Univ. p. 566 (1810). *C. rangiferina* f. *lappacea* Floerk. Clad. Comm. p. 162 (1828); Mudd Brit. Clad. p. 25. *Cladina sylvatica* f. *pumila* Leight. Lich. Fl. p. 73 (1871); ed. 3, p. 67; var. *alpestris* f. *pumila* Cromb. Lich. Brit. p. 22 (1870) & Monogr. i. p. 177.

Exsicc. Mudd Clad. n. 59.

Hab. In dry bare places or heaths, and on turf walls in upland districts.—*Distr.* Local and scarce in Great Britain, not seen from Ireland.—*B. M.* Broadwater Forest, Sussex; Leith Hill, Surrey;

Charnwood Forest, Leicestershire; Rhewgreidden, Merioneth; Burton Head, Cleveland, Yorkshire; Appin, Argyll; Rannoch, Perthshire; Glen Dee, Braemar, Aberdeenshire; Rothiemurchus, Invernesshire.

Form *spumosa* Norrl. ex Wain. Mon. Clad. i. p. 46 (1887).—Podetia shorter, more straggling and irregularly branched, the main branches soft and tomentose, whitish or greyish.

Without the dense apical branching of the species, but agreeing in the presence of red colouring substance in the spermogones.

Collected by the late W. West; determined by T. Hebden.—*B. M.* Roundstone, Galway.

Podetia ascyphous, tubular.

4. *C. uncialis* Web. in Wigg. Prim. Fl. Hols. p. 90 (1780).—Primary thallus of minute squamules, straw-coloured above, white beneath, scattered or aggregate, soon disappearing; podetia rising from the margin of the squamules or more frequently from the base of older members, increasing indefinitely at the apex, dying off below, usually about 5 cm. in height, but varying from 2 cm. upwards and about 2 mm. thick less or more, subcylindrical, shortly and dichotomously branched, more or less perforated and often dilated at the axils, corticate and continuous, areolate and verruculose, the apices erect, subulate or denticulate when sterile, radiately divided when fertile, greenish-straw-coloured (K —, K(CaCl) + yellowish). Apothecia small, pale or brown; spores oblong-fusiform, 8–12 μ long, 3·5 μ thick. *S. F.* Gray Nat. Arr. i. p. 415; Hook. in Sm. Engl. Fl. v. p. 234; Mudd Man. p. 59 (incl. f. *humilior*); f. *humilior* Fr. Lich. Eur. p. 244 (1831). *C. stellata* Schær. Lich. Helv. Spic. p. 42 (1823) pro parte; Mudd Brit. Clad. p. 26 (incl. ff. *uncialis* and *depressa*). *C. anaurocraea* f. *diercea* Mudd Brit. Clad. p. 27 (1865)? *Lichenoides tubulosum cauliculis mollioribus et crassioribus, minus* Dill. in Ray Syn. ed. 3, p. 67, n. 21 (1724) (in Buddle Hort. Sicc. ii. fol. 1, n. 4 in Hb. Sloane). *Coralloides perforatum minus, molle et tenue* Dill. Hist. Musc. p. 99, t. 16, fig. 22 A, C, D, and fig. 27 A (1741). *Lichen uncialis* L. Sp. Pl. p. 1153 (1753); Huds. Fl. Angl. p. 459; Lightf. Fl. Scot. ii. p. 880; With. Arr. ed. 3, iv. p. 44; Engl. Bot. t. 174. *Bæomyces uncialis* var. *dierceus* Ach. Meth. Lich. p. 353 (1803). *Cenomyce uncialis* Ach. Lich. Univ. p. 558 (1810) (incl. var. *bolacina*); Hook. Fl. Scot. ii. p. 64; Tayl. in Mackay Fl. Hib. ii. p. 79. *Cladina uncialis* Nyl. in Not. Sällsk. Faun. & Fl. Fenn. n. s. v. p. 111 (1866); Cromb. Lich. Brit. p. 22 & Monogr. i. p. 178; Leight. Lich. Fl. p. 74; ed. 3, p. 67.

Esicc. Bohl. nos. 15, 31; Croall n. 596; Johns. n. 56.

The podetia vary from smooth to being areolate-rough in high altitudes or in exposed situations. The forms recorded below are more nearly growth conditions, though the extreme stages are widely separated. The apex of the podetium is often minutely

furcate-spinose or with several short points, but there are no true scyphi. It is usually sterile.

Hab. On the ground among mosses (frequent in boggy places) on moorlands and mountains.—*Distr.* General and common throughout the British Isles.—*B. M.* St. Mary, Scilly Isles; near Respring, Cornwall; Hay Tor, Dartmoor, Devon; Tilgate, Sussex; near Tunbridge Wells, Kent; Charnwood Forest, Leicestershire; Hartlebury Common, Worcestershire; Barmouth and Rhewgreidden, Merioneth; Snowdon and Capel Curig, Carnarvonshire; Ingleby Park and Ayton, Cleveland, Yorkshire; Alston, Cumberland; Kirkhope Law, Swinhope Fell and The Cheviots, Northumberland; New Galloway, Kirkcudbrightshire; Ben Lomond, Dumbartonshire; Craig Calliach and Rannoch Moor, Perthshire; Sidlaw Hills, Rossie Moor and Clova, Forfarshire; Hill of Ardo, near Aberdeen; Glen Callater and Ben Macdhui, Braemar, Aberdeenshire; near Rothiemurchus and Ben Nevis, Invernessshire; Hills of Applecross, Rossshire; Coachford near Cork; Killarney, Kerry; Kylemore, Galway; Erris, Glandarry Mt., Slieve More Mt. and Mallaranny, Mayo.

Form *bolacina* Nyl. Lich. Scand. p. 58 (1861).—*Podetia* short, slender, usually very much and intricately branched.—*C. stellata* f. *gracilis* Mudd Brit. Clad. p. 26 (1865). *Cenomyce uncialis* var. *bolacina* Ach. Lich. Univ. p. 559 (1810). *Cladina uncialis* var. *bolacina* Cromb. Lich. Brit. p. 22 (1870) & f. *bolacina* Monogr. i. p. 178 (1894).

Æsicc. Johns. n. 301; Leight. n. 58; Mudd n. 17 & Clad. n. 61.

The extreme examples are very slender, but there is a gradual transition to forms that more nearly approach the species. Generally the growth is more compact and pulvinate. It represents a form of the species in very dry situations as f. *elatio*r represents the growth in more moist localities.

Hab. In dry places among mosses or moorlands in upland districts.—*Distr.* Chiefly in N. England, N. Wales, among the Scottish Grampians and in W. Ireland.—*B. M.* Hay Tor, Dartmoor, Devon; Haughmond Hill, Shropshire; Rhewgreidden, Merioneth; Farndale, Guisboro' and Ayton Moors, Cleveland, Yorkshire; Rannoch, Perthshire; Morrone, Braemar, Aberdeenshire; Corraun Mt., Mayo.

Form *elatio*r Fr. Lich. Eur. p. 244 (1831) (incl. f. *turgescens*).

—*Podetia* elongate, stout, sparingly branched, the branches subfastigiate, subulate, furcate or spreading-dentate at the apices, usually sterile.—Mudd Man. p. 59 (incl. f. *turgescens*); var. *adunca* S. F. Gray Nat. Arr. i. p. 415 (1821); var. *turgida* Schaer. Lich. Helv. Spicil. p. 43 (1823); Hook. in Sm. Engl. Fl. v. p. 235 (1833). *C. stellata* var. *adunca* Koerb. Syst. Lich. Germ. p. 37 (1855); Mudd Brit. Clad. p. 27 (incl. f. *turgescens*). *Lichenoides tubulosum*, *caliculis mollioribus et crassioribus*, *majus* Dill. in Ray Syn. ed. 3, p. 67, n. 20 (1724). *Coralloides perforatum majus*, *molle et crassum* Dill. Hist. Musc. p. 98, t. 16, fig. 21 (1741). *Coralloides imperforatum corniculis brevissimis crispis* Dill. tom. cit. p. 100, t. 16, fig. 24. *Lichen uncialis*

var. *β*. Lightf. Fl. Scot. ii. p. 880 (1777); Huds. Fl. Angl. ed. 2, p. 555; var. 2, With. Arr. ed. 3, iv. p. 44 (1796). *Bæomyces aduncus* Ach. Meth. Lich. p. 353 (1803). *Cenomyce uncialis* var. *obtusata* Ach. Lich. Univ. p. 559 (1810); var. *adunca* Hook. Fl. Scot. ii. p. 64 (1821). *Cladina uncialis* ff. *turgescens* and *adunca* Leight. Lich. Fl. p. 75 (1871); ed. 3, p. 68 (incl. f. *obtusata*); f. *adunca* Cromb. in Grevillea xi. p. 115 (1883) & Monogr. i. p. 179 (incl. ff. *turgescens* and *obtusata*).

Exsicc. Johns. n. 217; Mudd n. 21 & Clad. n. 62.

The podetia are sometimes very long (up to 4 inches) and stouter than in the species. In some instances they are short and swollen, with a deformed appearance (f. *turgescens*), or distorted and obtuse at the apices (f. *obtusata*); these forms are intimately connected with f. *elatior*.

Hab. On the ground in damp places or on turf-walls (f. *turgescens*) in upland moorlands and hilly regions.—*Distr.* Probably general in Great Britain and Ireland.—*B. M.* Near Penzance and Withiel, Cornwall; Dartmoor, Devon; Aldershot, Hants; Cwm Bychan, Merioneth; Battersby and Ayton Moors, Cleveland, Yorkshire; The Chevriots and Swinhope Fell, Northumberland; New Galloway, Kirk cudbrightshire; Ben Lomond, Dumbartonshire; Ben Cruachan, Argyll; Craig Calliach and Ben Lawers, Perthshire; Clova Mts. and Sidlaw Hills, Forfarshire; Hill of Ardo, near Aberdeen, Glen Candlic and Ben Macdhui, Braemar, Aberdeenshire; Glen Nevis, Invernessshire; Kilminster Moss, Caithness; Doneraile Mts., Cork; Achavanagh, Wicklow; Kylemore, Galway.

Podetia occasionally scyphiferous.

5. *C. amaurocræa* Schær. Lich. Helv. Spic. p. 34 (1823).—Primary thallus soon evanescent; podetia elongate, slender or stoutish, variously branched, rarely perforate at the axils, smooth, the branches tapering or furcate, or becoming scyphiferous, the scyphi dentate-cristate or spinulose at the margins, often proliferous, straw-coloured or whitish-straw-coloured (K —, K(CaCl) + yellow). Apothecia rather small, brown or pale-reddish-brown; spores oblong, 9–12 μ long, 3·5 μ thick.—Mudd Brit. Clad. p. 27 (incl. f. *myriocræa*); var. *myriocræa* Floerk. Clad. Comm. p. 124 (1828). *Capitularia amaurocræa* Floerk. in Web. & Mohr Beitr. Naturk. ii. p. 334 (1810). *Cladina amaurocræa* Nyl. in Not. Sällsk. Faun. & Fl. Fenn. p. 111 (1866); Cromb. Lich. Brit. p. 22 & Monogr. i. p. 180; Leight. Lich. Fl. p. 74; ed. 3, p. 67.

Exsicc. Larb. Lich. Hb. (without a number); Mudd Clad. n. 63.

Closely allied to the preceding, but distinguished by the occurrence of scyphi-bearing podetia mixed with the subulate podetia. The scyphi are cristate, and resemble somewhat the blunt end of a podetium growing out on all sides.

Hab. On the ground in moist places amongst heaths in upland and sub-alpine regions.—*Distr.* Rare in N. England, among the

Grampians, Scotland, and in W. Ireland.—*B. M.* Guisboro' Moor, Cleveland, Yorkshire; Rannoch Moor, Perthshire; Ben-naboord and Glen Dee, Braemar, Aberdeenshire; near Kylemore, Galway.

6. *C. dstricta* Nyl. ex Wain. Mon. Clad. i. p. 252 (1887).—Podetia rather short, from 3 to 6 cm. in height, greyish-green or occasionally straw-coloured, corticate-areolate and rather warted, repeatedly branched, usually decumbent or of straggling growth, ascyphous, or with scyphi when very well developed, the tapering branches lighter-coloured at the tips. Apothecia not seen; spermatogones blackish.—*C. amaurocraea* f. *dstricta* Nyl. Lich. Scand. p. 59 (1861); f. *depressa* Mudd Brit. Clad. p. 28 (1865). *Cladina amaurocraea* subsp. *dstricta* Nyl. ex Norrl. in Not. Sällsk. Faun. & Fl. Fenn. Förh. xii. p. 321 (1873); Cromb. in Journ. Bot. xiv. p. 360 (1876) & Monogr. i. p. 180.

Exsicc. Mudd n. 18; Clad. n. 64.

Often regarded as a subspecies, or even a form of the preceding, but distinguished by the more slender warted entangled podetia and by the presence of dextrictinic acid, which gives a reddish tinge to the paper enclosing the lichen. According to Crombie (Monogr. i. p. 181) it often constitutes along with *Lycopodium Selago*, the scanty vegetation of granitic and schistose detritus.

Hab. On bare moorlands and mountains from upland to alpine regions.—*Distr.* Rare in N. Wales, N. England and S. Scotland, more abundant among the Grampians.—*B. M.* Guisboro' and Baysdale Moors, Yorkshire; New Galloway, Kirkcudbrightshire; Craig Calliach and Ben Lawers, Perthshire; Sidlaw Hills, Forfarshire; Morrone and Cairngorm, Braemar, Aberdeenshire; Ben Nevis, Invernesshire.

Subgenus ii. PYCNOTHELIA Leight. Lich. Fl. p. 55 (1871). *Cenomyce* Sect. *Pycnothelia* Ach. Lich. Univ. p. 571 (1810). *Pycnothelia* Duf. in Ann. Gén. Sci. Phys. viii. p. 45 (1821); S. F. Gray Nat. Arr. i. p. 424 (1821); Hook. in Sm. Engl. Fl. v. p. 241; Cromb. Monogr. i. 124.—Primary thallus crustaceous, persistent; podetia short, like papillæ.

7. *C. papillaria* Hoffm. Deutschl. Fl. ii. p. 117 (1795).—Thallus crustaceous, granular, forming a crust, whitish or pale-yellowish-green; podetia very short, papilla-like, clavate-cylindrical, inflated, very fragile, glabrous, simple or rarely divided, white or glaucous-green (K + yellowish, CaCl—). Apothecia rare, small, terminal, solitary or aggregate, at first somewhat plane and marginate, becoming convex, brown or reddish-brown, spores ellipsoid, 9–14 μ long, 4.5 μ thick. Spermatogones frequent, usually terminal, conical, with slightly arcuate spores acute at the ends.—Mudd Man. p. 59 & Brit. Clad. p. 34. *Coralloides minimum fragile, madreporæ instar nascens* Dill. Hist. Musc. p. 107, t. 16, fig. 28 (1741). *Lichen papillaria* Ehrh. Phyt. n. 100 (1780); Dicks. Pl. Crypt. fasc. i. p. 13 (1785); With.

Arr. ed. 3, iv. p. 45; Engl. Bot. t. 907. *Pycnothelia papillaria* Duf. in Ann. Gén. Sci. Phys. viii. p. 46 (1821); S. F. Gray Nat. Arr. i. p. 424 (1821); Hook. in Sm. Engl. Fl. v. p. 241; Cromb. Lich. Brit. p. 18 & Monogr. i. p. 124; Leight. Lich. Fl. p. 55; ed. 3, p. 52. *Cenomyce papillaria* Ach. Lich. Univ. p. 571 (1810); Tayl. in Mackay Fl. Hib. ii. p. 82.

Exsicc. Cromb. n. 121; Croall n. 602; Leight. n. 208; Mudd n. 22 & Clad. n. 80.

The crustaceous, persistent thallus distinguishes this species from other *Cladoniæ*; the hollow, thin walled podetia somewhat suggest a minute *C. uncialis*, they are usually scattered, though sometimes crowded.

Hab. On the ground in dry exposed places.—*Distr.* General, but not common, mostly in the hilly and mountainous tracts of Great Britain and Ireland—*B. M.* St. Breock and Cardinham, Cornwall; Dorset; Bournemouth, Hants; Ardingly Rocks and Broadwater Forest, Sussex; Llandrindod Hill, Radnorshire; Baysdale and Ayton, Cleveland, Yorkshire; Egglestone, Durham; New Galloway, Kirkcudbrightshire; Appin, Argyll; Ben Lawers and Rannoch, Perthshire; Clova, Forfar; Ben-naboord, Morrone and above Loch Callater, Braemar, Aberdeenshire; Ben Nevis, Invernessshire; Applecross, Rossshire; near Lairg, Sutherland; Doneraile Mts., Cork; Kilkee, Clare; Killarney, Kerry; Glendarry Mt., Corraun Mt., Cushleeka Mt., and Slieve More Mt., Achill, Mayo.

Var. *molariformis* Nyl. Lich. Scand. p. 50 (1861).—Podetia stouter, longer, and branched towards the apices, the branches subfastigiata.—Subsp. *molariformis* Hoffm. Deutschl. Fl. ii. p. 117 (1795). *Pycnothelia papillaria* var. *molariformis* Cromb. Lich. Brit. p. 18 (1870); form *molariformis* Cromb. in Grevillea xi. p. 111 (1883) & Monogr. i. p. 125.

A robust luxuriant variety with the podetia crowded and branched, and the horizontal thallus but little visible. Apothecia have not been found on our specimens and spermogones are rare.

Hab. On the ground among rocks, plentiful where it occurs.—*B. M.* Ardingly Rocks, Sussex.

Var. *apoda* Nyl. in Flora, xlvi. p. 211 (1878), note.—Thallus thinly crustaceous, white or whitish; podetia small, or scarcely formed. Apothecia sessile, small, often aggregate, immarginate, rusty-red or ochraceous; spores fusiform-oblong, 7-10 μ long, 1 μ thick. *Pycnothelia apoda* Nyl. in Flora, lxi. p. 24 (1878); Cromb. in Grevillea, vii. p. 97 (1879) & Monogr. i. p. 125; Leight. Lich. Fl. ed. 3, p. 544. Specimen not seen.

Described as differing in the reduced podetia, instances of which are also sparingly met with on the species. Nylander records that the spermogones commonly occur in the hymenium.

Hab. On the ground in a maritime district in N.W. Ireland (Kylemore, Galway).

Subgenus iii. *CENOMYCE* Th. Fr. Lich. Scand. p. 64 (1871). *Cenomyce* Ach. Lich. Univ. p. 105 (1810); Hook. Fl. Scot. ii. p. 61; Grev. Fl. Edin. p. 342; Tayl. in Mackay Fl. Hib. ii. p. 79. —Primary thallus squamulose or foliaceous, usually persistent; podetia mostly well-developed, scyphous or ascyphous. Apothecia pale- or dark-brown, or red-coloured.

The *Cladonia* of the subgenus *Cenomyce* are found mostly on undisturbed mossy earth or on sandy soil on the ground or on rocks. A few species grow by preference on old stumps or trunks of trees, as, for instance, *C. parasitica* and *C. macilenta*. The species spread widely, and are often intermingled. In certain conditions the superficial granules or cortical areolæ of the podetia grow out into squamules somewhat similar to those of the primary thallus, and thus many species have a squamulose variety or form.

In the following synopsis "large" squamules are from 1 to 3 cm. in length, with less width; "medium"-sized are about 1 cm. long or less; and "small," about 2 to 5 mm. The podetia when short are a few mm. in length, medium-sized 2 to 3 cm., and elongate or tall more than 3 cm.

The species are arranged in two series according to the colours of the apothecia:—

Apothecia brown	A. PHÆOCARPEÆ.
Apothecia red.....	B. COCCIFERÆ.

Series A. PHÆOCARPEÆ. Apothecia brown-coloured.

I. *Podetia without perforations at tips or axils, mostly scyphiferous.*

1. *Podetia not or only partly corticate.*

Basal squamules large, sometimes almost foliaceous.

8. *C. foliacea* Willd. Fl. Berol. p. 363 (1787) emend. Wain. Clad. Univ. p. 384 (1894).—Squamules of primary thallus crowded rather large and rigid at the base, almost palmately divided, crenate and somewhat turned up at the tips, frequently blackish fibrillose at the margins, pale- or yellowish-green above, beneath yellowish or white; podetia arising from the upper surface of the laciniaë, often several from one frond, usually rather short, simple, opening gradually to form irregular shallow scyphi, or sometimes ascyphous (Kf + yellowish, K(CaCl) + deeper yellow). Apothecia terminal or marginal on the scyphi, convex, moderate in size, reddish-brown; spores oblong, 8–14 μ long, 2–4 μ thick.—*C. alcornis* Floerk. Clad. Comm. p. 23 (1828). Cromb. Lich. Brit. p. 18 & Monogr. i. p. 127; f. *graciliscens* Cromb. in Grevillea xi. p. 111 (1883); Leight. Lich. Fl. p. 59; ed. 3, p. 56. *C. endiviæfolia* var. *alcornis* Mudd Man. p. 52 (1861) & Brit. Clad. p. 3. *C. firma* f. *graciliscens* Cromb. Monogr. i. p. 128 (1894). *Lichenoïdes cartilagosum, tubulis et pyxidulis exiguis* Dill. in Ray Syn. ed. 3, p. 70, n. 38 (1724). *Coralloïdes scyphiforme, foliis alcorniformibus cartilagosus* Dill. Hist. Musc. p. 87, t. 14, fig. 12 A (1741). *Lichen foliaceus* Huds.

Fl. Angl. p. 457 (1762); With. Arr. ed. 3, iv. p. 35. *L. alcicornis* Lightf. Fl. Scot. ii. p. 872 (1777) pro parte; Engl. Bot. t. 1392. *Cenomyce alcicornis* Ach. Syn. Lich. p. 250 (1814); Hook. Fl. Scot. ii. p. 62; Grev. Fl. Edin. p. 343. *Scyphophora alcicornis* S. F. Gray Nat. Arr. i. p. 418 (1821); Hook. in Sm. Engl. Fl. v. p. 238.

Exsicc. Larb. Lich. Caesar. n. 56 & Lich. Cantab. n. 1 Leight. n. 15; Mudd Clad. n. 1.

Distinguished by the large yellowish-green congested squamules and by the black rhizinose fibrillæ which are present though not abundant on any part of the plant possibly in response to contact. The spermogones are frequently sessile on the squamules. A rare plant with slender lobes (f. *gracilescens*), found only once in S. Wales, has been referred by Wainio (Monogr. Clad. ii. p. 393) to the species as a sport or growth form.

Hab. In dry sandy places amongst mosses and heaths in maritime and inland districts.—*Distr.* Rather uncommon throughout Great Britain and the Channel Islands, rare in S.W. Ireland.—*B. M.* Quenvais, Jersey; Sark; L'Anresse Bay, Guernsey; I. of Wight; Scilly Islands; Withiel, Cornwall; near Torquay, Devon; the Downs and near Brighton, Sussex; Romney Marsh, Lydd and West Wickham, Kent; Epping Forest, Essex; Charnwood Forest, Leicestershire; Haughmond Hill, Shropshire; Barmouth, Merioneth; Lydstep, Pembrokeshire (f. *gracilescens*); Malvern Hills, Worcestershire; Aldgrove and Thetford Warren, Suffolk; Hunstanton, Norfolk; near Great Ayton, Cleveland, Yorkshire; Pentland Hills, Edinburgh; Lismore, Argyll; Bay of Nigg, Kincardineshire; Findhorn, Elginshire; Glengariff, Cork.

Var. *firma* Wain. Mon. Clad. Univ. ii. p. 400 (1894).—Thalline squamules large, lacinate, crowded and suberect, crenate especially at the apices and occasionally fibrillose, pale or yellowish-green above, pale-yellowish or whitish or rarely rose-coloured and white-suffused beneath; podetia small, scyphiferous. Apothecia more or less confluent, brown.—*Cladonia alcicornis* var. *firma* Nyl. Syn. Lich. p. 191 (1860). *C. firma* Nyl. in Bot Zeit. xix. p. 352 (1861) pro parte; Cromb. Monogr. i. p. 128 (excl. f. *gracilescens*).

Exsicc. Cromb. n. 122; Larb. Caesar. n. 57.

Differs from the species in the more crowded upright growth or the less divided lacinie.

Hab. On sandy soil and on the ground among rocks in maritime districts.—*Distr.* Local and scarce in the Channel Islands and S. England.—*B. M.* Noirmont Warren and Quenvais, Jersey; Jerbourg, Le Gouffre and Icart Point, Guernsey; Chateau Point, Sark; Start Point, Devon; Brighton Downs and Newhaven, Sussex; Lydd, Kent.

Var. *endiviæfolia* Schær. Lich. Helv. Spic. p. 295 (1833).—Thallus lobes large and rigid, divided into long rather broad lacinie generally crenulate at the apices, not fibrillose, usually yellowish beneath; podetia small, simple, rather rare. Apothecia

and spores as in the species.—*C. endiviæfolia* Fr. Lich. Eur. p. 212 (1831); Mudd Man. p. 52 & Brit. Clad. p. 2; Cromb. Lich. Brit. p. 18 & Monogr. i. p. 127; Leight. Lich. Fl. p. 55; ed. 3, p. 53. *Lichen Endivifolius* Dicks. Pl. Crypt. fasc. iii. p. 17 (1793); With. Arr. ed. 3, iv. p. 60; Engl. Bot. t. 2361. *Cenomyce endiviæfolia* Ach. Syn. Lich. p. 250 (1814); Hook. Fl. Scot. p. 62. *Scyphophora endiviæfolia* S. F. Gray Nat. Arr. i. p. 418; Hook. in Sm. Engl. Fl. p. 238.

Exsicc. Dicks. Hort. Sicc. ix. n. 24.

Differs from the species in the very large spreading laciniae, which are turned up in dry weather, and in the absence of fibrillae.

Hab. On dry sandy (usually calcareous) soil among mosses and short grasses chiefly in maritime districts.—*Distr.* Local and scarce in a few localities in N.E. and S. England.—*B. M.* Newhaven, Sussex; Banstead Downs, Surrey; Hemsby, near Yarmouth, Suffolk; Ayton Moor, Cleveland, Yorkshire.

9. *C. strepsilis* Wain. Mon. Clad. Univ. ii. p. 403 (1894).—Primary thallus of large or small squamules, somewhat linear and sinuous, rather fragile, glaucous- or olivaceous-green above, beneath white or yellowish; podetia rising from or near the apices of the squamules, short, corticate, areolate, ascyphous, much branched above (K + yellowish, CaCl + bright-green). Apothecia small, crowded on the tips of the podetial branches.—*C. degenerans* subsp. *coralloidea* Nyl. Lich. Scand. p. 54 (1861); Cromb. in Grevillea xv. p. 45 & Monogr. i. p. 148. *C. coralloidea* Mudd Brit. Clad. p. 5 (1865) (non Th. Fr.). *C. furcata* subsp. *coralloidea* Cromb. in Grevillea xi. p. 113 (1883). *Bæomyces strepsilis* Ach. Meth. Lich. Suppl. p. 52 (1803). *Cenomyce coralloidea* Ach. Lich. Univ. p. 528 (1810).

Exsicc. Mudd Clad. n. 4.

The cortex of the podetia is almost continuous, but uneven from the somewhat turgid areolæ. The coralloid appearance is due to the crowded apothecia.

Hab. On the ground on wet heaths in mountainous districts.—*Distr.* Rare in N. England and S. Grampians, Scotland.—*B. M.* Baysdale Moor, Cleveland, Yorkshire; Ben Lawers, Perthshire.

Basal squamules medium-sized or small, thickish.

10. *C. pyxidata* Hoffm. Deutschl. Fl. p. 121 (1795) pro parte; Fr. Nov. Sched. Crit. p. 21 (1826).—Primary thallus squamulose, the squamules rather small, firm, thickish, variously incised or crenate, glaucous-green or greyish, whitish beneath; podetia mostly rather short, wine-glass to funnel-shaped, gradually widening upwards to a rather broad scyphus, continuously corticate or coarsely granular, the granules frequently growing out in small squamules, the scyphi sometimes proliferous, rarely squamulose at the margins (K —, CaCl —). Apothecia moderate in size,

brown or reddish-brown sometimes coalescing; spores oblong, 8–14 μ long, 3–4.5 μ thick.—Mudd Man. pp. 53–54 pro parte (incl. ff. *simplex*, *marginalis*, and var. *neglecta*) & Brit. Clad. pp. 7–8 pro parte (incl. ff. *neglecta*, *simplex*, *staphylea*, *syntheta* and *lophyra*); Cromb. Lich. Brit. p. 18 pro parte (incl. var. *symphicarpa*) & in Grevillea xi. p. 111 (1883) (incl. f. *lophyra* and var. *symphicarpa*) & Monogr. i. p. 129 (incl. f. *lophyra*); Leight. Lich. Fl. p. 60; ed. 3, p. 56 pro parte (excl. vars., incl. f. *costata*); subsp. *simplex* and *marginalis* Hoffm. Deutschl. Fl. ii. pp. 121–3 (1795); var. *costata* Floerk. Clad. Comm. p. 66 (1828). *Lichenoides tubulosum pyxidatum cinereum* Dill. in Ray Syn. ed. 3, p. 68, n. 28 (1724) pro parte. *Coralloides scyphiforme, tuberculis fuscis* Dill. Hist. Muse. p. 79, t. 14, figs. 6 C and I–M (1741). *Lichen pyxidatus* Linn. Sp. Pl. p. 1151 (1753) pro parte; Huds. Fl. Angl. p. 456; Lightf. Fl. Scot. ii. p. 869 pro parte; With. Arr. ed. 3, iv. p. 36 (excl. var. 2); Engl. Bot. t. 1393. *L. simplex* Roth Tent. Fl. Germ. p. 510 (1788)? *L. symphicarpus* Ach. Lich. Suec. Prodr. p. 198 (1798). *Scyphophorus pyxidatus* DC. Fl. Fr. ii. p. 339 (1805) (excl. vars.); S. F. Gray Nat. Arr. i. p. 419; Hook. in Sm. Engl. Fl. v. p. 238. *Bæomyces pyxidatus* var. *staphyleus* Ach. Meth. Lich. p. 339 (1803). *B. fimbriatus* var. *synthetus* Ach. tom. cit. 342. *Capitularia neglecta* Floerk. ex Web. & Mohr Beitr. Nat. ii. p. 306 (1810). *Cenomyce pyxidata* Ach. Lich. Univ. p. 534 (1810) pro parte (incl. var. *lophyra*, p. 535); Hook. Fl. Scot. p. 62; Grev. Fl. Edin. p. 343. *C. coccifera* Tayl. in Mackay Fl. Hib. ii. p. 81 (1836) pro parte.

Esicc. Bohl. n. 32; Johns. nos. 10, 213, 214; Leight. n. 407; Mudd Clad. n. 6.

Distinguished by the rather short podetia which gradually widen out into a broad scyphus up to 1 cm. wide, and also by the coarse granules with which usually it is covered, especially on the inside of the scyphus. It is an extremely variable species with many forms and varieties, which are to be regarded rather as growth forms since more than one may be represented on the same specimen. Among those forms that have been observed in our country f. *simplex* has very broad coarsely granular scyphi bearing only pyrenidia; f. *neglecta* and f. *symphicarpa* have confluent apothecia, but the former has short granulate-verrucose podetia, these being smoother in f. *symphicarpa*; the apothecia are pedicellate and podetia long in f. *staphylea*; in f. *syntheta* the margins of the scyphi are proliferous, in f. *lophyra* they are fringed with small squamules, while in f. *costata* the podetium is decorticate and bare.

Hab. On the ground, old walls, rocks and about the roots of trees.—*Distr.* General and common throughout Great Britain, rare in the Channel Islands.—*B. M.* Guernsey; St. Breock, St. Breward and near Bodmin, Cornwall; Becky Falls and Dartmoor, Devon; New Forest, Hants; St. Leonards, Hassocks and Wolstonbury, Sussex; Putney, Surrey; Hanwell and Hampstead Heath, Middlesex; Epping Forest, Essex; Shropshire; Charnwood Forest, Leicestershire; Buxton, Derbyshire; Aberdovey and Dolgelly, Merioneth; Carnedd Dafydd, Carnarvonshire; Golfa, N. Wales; Kildale Moor and Ayton, Cleve-

land, Yorkshire; Alston and Bassenthwaite Lake, Cumberland; Appin, Argyll; Killin, Blair Athole and Kenmore, Perthshire; Durris, Kincardineshire; Countesswells and Castleton of Braemar, Aberdeenshire; Rothiemay House, Banffshire; near Fort William, Invernessshire; Lairg, Sutherland; Slieve More Mt., Achill Island, Achill Sound and Clare Island, Mayo.

Form *epiphylla* Schær. Enum. p. 191 (1850).—Basal squamules present; podetia extremely reduced or wanting. Apothecia conglomerate, subsessile on the squamules.—Mudd Man. p. 53; Cromb. Monogr. i. p. 130; var. *epiphylla* Cromb. Lich. Brit. p. 18 (1870); var. *chlorophæa* f. *epiphylla* Mudd Brit. Clad. p. 9 (1865). *Lichen epiphyllus* Ach. Lich. Suec. Prodr. p. 185 (1798).

A curious and rare form of doubtful affinity. The apothecia are more or less sessile on the basal thallus. In the specimen collected by Mudd in Yorkshire the apothecia are scarcely visible.

Hab. On the ground in inland places.—*Distr.* Rare in E. and N. England, not recently found.—*B. M.* Epping Forest, Essex; Ayton, Cleveland, Yorkshire (doubtful).

Var. *pocillum* Fr. Summ. Veg. p. 110 (1846).—Basal squamules deeply crenate, firm, often closely appressed, greyish or usually greyish-tawny; podetia very short, closely granulate-verrucose.—Cromb. Lich. Brit. p. 18 & Monogr. i. p. 130; f. *pocillum* Mudd Man. p. 53 (1861) & Brit. Clad. p. 7. *Bæomyces pocillum* Ach. Meth. Lich. p. 336, t. 8, fig. 6 (1803).

Exsicc. Johns. n. 286.

The basal thallus is occasionally orbicular and partly crustaceous. Apothecia are rare.

Hab. On bare soil on banks and heaths maritime and inland.—*Distr.* Seen only from a few localities in the Channel Islands, England and Scotland, but probably common.—*B. M.* The Vale, Guernsey; near Bodmin, Cornwall; Bathampton Downs, Somerset; Charnwood Forest, Leicestershire; Barmouth, Merioneth; Redcar and near Ayton, Cleveland, Yorkshire; Tongland, Kirkeudbrightshire; Killin and Rannoch, Perthshire; Durris, Kincardineshire; Countesswells and Castleton of Braemar, Aberdeenshire; Glen Nevis, Invernessshire.

Var. *chlorophæa* Floerk. Clad. Comm. p. 70 (1828).—Basal squamules rather small, often pulverulent at the margins; podetia rather long, mostly granular below and becoming pulverulent upwards, greenish or sulphur-coloured, the scyphi usually narrow and often slightly contracted at the margin, sometimes proliferous.—Mudd Brit. Clad. p. 8 (incl. ff. *simplex*, *vulgaris*, *varia* and *infuscata*); Leight. Lich. Fl. p. 60; ed. 3, p. 57. *Cenomyce chlorophæa* Floerk. ex Sommerf. Suppl. Fl. (Lapp. p. 130 (1826)).

Exsicc. Johns. n. 48; Lerb. Lich. Hb. n. 206 & Lich. Cantab. n. 2; Leight. n. 399; Mudd Clad. nos. 7–10.

Differs from the species in the general breaking down of the granules to a sorediose powder on the upper part of the podetium.

It might easily be confused with *C. fimbriata*, but the latter is pulverulent throughout.

Hab. Among mosses on the ground and on old walls.—*Distr.* General and common in Great Britain, rare in the Channel Islands, reported from Ireland.—*B. M.* Guernsey; near Penzance and near Withiel, Cornwall; near Hunter Tor, Lustleigh Cleeve, Dartmoor, Devon; Chislehurst, Kent; Leith Hill, Surrey; Epping Forest, Essex; Hale End, Malvern, Worcestershire; Shrewsbury, Shropshire; Aberdovey and Dolgelly, Merioneth; Mildenhall, Suffolk; Wootton Common, Norfolk; Ayton, Newton and Kildale, Cleveland, Yorkshire; Morpeth, Northumberland; Egremont, Cumberland; New Galloway, Kirkcudbrightshire; Pentland Hills, Edinburgh; Appin, Argyll; near Tummel Bridge, Rannoch and Blair Athole, Perthshire; Durris, Kincardineshire; Countesswells, Aberdeenshire; Loche Linnhe, Invernessshire; Lairg, Sutherland.

Form *lepidophora* Floerk. Clad. Comm. p. 75 (1828).—Podetia densely covered with minute crowded crenate squamules, glaucous grey. —Cromb. in Grevillea xi. p. 111 (1883) & Monogr. i. p. 131; *C. fimbriata* var. *chlorophæa* f. *phyllophora* Koerb. Syst. Lich. Germ. p. 23 (1855); Mudd Brit. Clad. p. 9.

Somewhat resembling *C. squamosa*, but the younger podetia are granular-farinose like those of var. *chlorophæa*. Probably a growth form due to excessive moisture.

Hab. On old brick walls and thatched roofs in lowland districts.—*Distr.* Seen only from Central and W. England, N. Wales and N.E. Scotland.—*B. M.* Lechlade, Oxfordshire; Conway, Carnarvonshire; Kinnordy, Forfarshire; Cults, near Aberdeen.

Form *tuberculosa* Mudd Brit. Clad. p. 9 (1865) (? Hoffm.).—Podetia and scyphi more or less studded with short, often spermo-goniferous, projections.

Essicc. Mudd Clad. n. 11.

A very unusual form: the podetial stalks look as if dotted with nails. Mudd refers to Coemans' Clad. Belg. Exs. n. 40, which I have not been able to see.

Hab. In pastures.—*B. M.* Black Banks, Ayton, Cleveland.

Form *myriocarpa* Cromb. in Grevillea xi. p. 111 (1883) & Monogr. i. p. 131.—Podetia rather short, the scyphi with numerous narrow proliferations tipped with small solitary or aggregate apothecia. *Cladonia pyxidata* var. *fimbriata* f. *myriocarpa* Coem. Clad. Belg. n. 53 (1863) fide Cromb.; Mudd Brit. Clad. p. 10.

Essicc. Larb. Cæsar. n. 58.

Distinguished by the proliferations of the scyphi in form like apothecial stalks.

Hab. On the ground and on wall tops in maritime and inland situations.—*Distr.* Local and scarce in the Channel Islands, W. England and in S. and N. Scotland.—*B. M.* St. Ouen's Bay, Jersey;

Ogleworth Park, Gloucestershire; Malvern and Bewdley, Worcestershire; Castle Douglas, Kirkcudbrightshire; Achmore, Killin, Perthshire; Glen Cluny, Braemar, Aberdeenshire.

11. *C. fimbriata* Fr. Lich. Eur. p. 222 (1831).—Basal squamules rather small, greyish-green, white beneath, sometimes evanescent; podetia varying in length from 3 mm. upwards, decorticate and finely pulverulent, very rarely corticate and sometimes with minute squamules near the base, scyphiferous, the scyphi widening somewhat abruptly, erect and rather regular in form, crenate or denticulate or proliferous at the margins (K — or faintly yellow, CaCl —). Apothecia moderate in size, sometimes coalescing, brown or reddish-brown; spores fusiform or oblong, 8–14 μ long, 3–4.5 μ thick.—Cromb. Lich. Brit. p. 19 & Monogr. i. p. 134. *C. pyxidata* var. *denticulata* Floerk. Clad. Comm. p. 55, var. *costata*, p. 66, and var. *pterygota*, p. 69 (1828). *C. pyxidata* var. *fimbriata* Mudd Man. p. 53 (1861) (incl. ff. *prolifera*, *denticulata* and *carpophora*) & Brit. Clad. p. 9 (incl. ff. *carpophora*, *prolifera*, *costata*, *denticulata* and *pterygota*); Leight. Lich. Fl. p. 61; ed. 3, p. 57 (incl. f. *costata*). *Lichenoides tubulosum proliferum*, *marginibus serratis* Dill. in Ray Syn. ed. 3, p. 69, n. 30 (1724). *Coralloides scyphiforme*, *tuberculis fuscis* Dill. Hist. Musc. p. 79, t. 14, fig. 6 A, B (1741) & *Cor. scyphiforme gracile marginibus serratis*, p. 84, t. 14, fig. 8. *Lichen fimbriatus* L. Sp. Pl. p. 1152 (1753); Huds. Fl. Angl. p. 456; Lightf. Fl. Scot. ii. p. 870; With. Arr. ed. 3, iv. p. 57; Engl. Bot. t. 2438; var. *prolifer* Retz. Fl. Scand. p. 232 (1779). *Capitularia carpophora* Floerk. in Berl. Mag. ii. p. 147 (1808). *Cenomyce fimbriata* Ach. Syn. Lich. p. 254 (1814); Hook. Fl. Scot. ii. p. 62; Tayl. in Mackay Fl. Hib. ii. p. 81. *Scyphophorus fimbriatus* S. F. Gray Nat. Arr. i. p. 419 (1821) (incl. var. *prolifera*); Hook. in Sm. Engl. Fl. v. p. 239.

Ersicc. Bohl. n. 24; Johns. nos. 11 and 172; Leight. n. 325; Mudd n. 8 & Clad. nos. 15, 17, 18.

Differs from the preceding in the more abruptly widening scyphi, and from other *Cladonia* in the finely furfuraceous covering of the podetia distinctive of all the varieties and forms which rarely become sparsely squamulose. It is a very variable species, hence the number of growth forms that have been recorded. Sometimes the podetia are denudate (f. *costata*), or more than once proliferous (f. *prolifera*). If the scyphi are more denticulate than fimbriate it is f. *denticulata*, and when squamules are formed on the margin it is the somewhat rare f. *pterygota*. The apothecia are rare and usually sessile, but if they are borne on stalk-like projections it is f. *carpophora*.

Hab. On the ground, roots of trees, and among mosses on old walls in maritime, lowland and upland districts.—*Distr.* General and common throughout the British Isles.—*B. M.* Dartmoor, Devon; Sherborne and New Forest, Hants; Hassocks, Sussex; Tunbridge Wells and near Thong, Kent; Dorking, Surrey; Epping Forest, Essex; Tadmarton Heath, Oxfordshire; Tenby, Pembrokeshire; Barmouth.

Merioneth; Aber, Carnarvonshire; Over, Cheshire; Newmarket Heath, Cambridgeshire; Ayton and Bilsdale, Cleveland, Yorkshire; Windermere, Westmoreland; Hale, Cumberland; Wark-on-Tyne, Northumberland; New Galloway, Kirkeudbrightshire; Royal Botanic Gardens and Braid Hills, Edinburgh; Barcaldine, Appin, Argyll; Killin and Glen Lochay, Blair Athole, Perthshire; Baldovan Woods, Forfarshire; Countesswells Woods, Aberdeenshire; Rothiemurchus, Invernesshire; Lairg, Sutherland; Kylemore, Galway.

Var. *simplex* Wainio Monogr. Clad. Univ. ii. p. 256 (1894).—Podetia short or somewhat elongate, finely pulverulent, whitish or greenish-grey, the stalks slender, cylindrical, the scyphi rather narrow, the margins entire or slightly crenulate or denticulate, not proliferous.—Var. *tubæformis* Cromb. Lich. Brit. p. 19 (1810) & Monogr. i. p. 136 (incl. f. *macra*); var. *conista* and f. *exigua* Cromb. in Grevillea xi. p. 112 (1883) & Monogr. i. pp. 135, 136. *C. pyxidata* subsp. *exilis* and *tubæformis* Hoffm. Deutschl. Fl. ii. pp. 121, 122 (1795); var. *fimbriata* ff. *tubæformis* and *macra* Mudd Man. p. 54 (1861) & ff. *macra*, *conista*, *tubæformis* and *megaphyllina* Brit. Clad. pp. 9, 10 (1865); f. *tubæformis* Leight. Lich. Fl. p. 62; ed. 3, p. 58. *Coralloides scyphis humilibus, intus fuscis* Dill. Hist. Musc. p. 86, t. 14, fig. 11 (1741). *Lichen filiformis* Huds. Fl. Angl. p. 456 (1762)? var. 2 With. Arr. ed. 3, iv. p. 39 (1796). *L. pyxidatus* var. *simplex* Weis Pl. Crypt. Fl. Gotting. p. 84 (1770). *L. pyxidatus* var. *exiguus* Huds. Fl. Angl. ed. 2, p. 552 (1778). *Capitularia pyxidata* var. *macra* Floerk. in Web. & Mohr Beitr. Nat. ii. p. 290 (1810). *Cenomyce fimbriata* var. *conista* Ach. Syn. p. 257 (1814). *Scyphophora conista* S. F. Gray Nat. Arr. i. p. 421 (1821) (incl. var. *exilis*).

Exsicc. Johns. n. 290; Leight. n. 377; Mudd n. 7 & Clad. nos. 12, 13, 14.

In this variety the basal squamules are well developed; the podetia (large in f. *megaphyllina*) are usually uniform in size and smaller; the scyphi are narrower, with the margin entire or only slightly crenate; they are small and slender (f. *macra*) and occasionally reddish-brown in the hollow of the cup (f. *exigua*). Apothecia are rare.

Hab. Similar to that of the species.—*Distr.* Not infrequent throughout Great Britain, evidently rare in Ireland.—*B. M.* Lanivet and St. Breward, near Bodmin, Cornwall; near Bovey Tracey, Devon; New Forest, Hants; Epping Forest, Essex; Charnwood Forest, Leicestershire; near Worcester; Shrewsbury, Shropshire; Barmouth and Aberdovey, Merioneth; near Silverdale, Lancashire; Easby and Ayton, Cleveland, Yorkshire; Eastgate, Weardale, Durham; New Galloway, Kirkeudbrightshire; Barcaldine, Argyll; Killin, Glen Lochay and Rannoch, Perthshire; Castlemartyr, Cork; Clare Island and Achill Island, Mayo.

Subsp. *fibula* Nyl. ex Norrl. in Medd. Sällsk. Faun. & Fl. Fenn. i. p. 12 (1876).—Podetia elongate, slender, subcylindrical, simple, with narrow scyphi or asephyous, white-pulverulent. Apothecia small, brown, usually aggregate.—Cromb. in Grevillea xi. p. 112 & Monogr. i. p. 137 (incl. f. *abortiva*). *C. pyxidata*

var. *cornuta* f. *fibula* Mudd Brit. Clad. p. 13 (1865); var. *fimbriata* f. *abortiva* Mudd tom. cit. p. 11. *Lichen fibula* Ach. Lich. Suec. Prodr. p. 194 (1798). *Capitularia pyxidata* var. *longipes* f. *abortiva* Floerk. in Web. & Mohr Beitr. Nat. ii. p. 294 (1810). *Scyphophora fimbriata* vars. *abortiva* and *fibularia* S. F. Gray Nat. Arr. i. p. 420 (1821).

Exsicc. Johns. n. 173.

Distinguished from the species by the elongate podetia scarcely widening to form the scyphi and mixed with ascyphous branches. In f. *abortiva* the scyphi when formed are subrenate or lacerate and the podetia are generally slightly stouter.

Hab. On decaying stumps and on the ground among mosses in wooded districts.—*Distr.* Rather rare in S.W. England, S. Scotland and the S. and S.W. Highlands.—*B. M.* Hunter Tor, Dartmoor, Devon; Lounsdale, Ayton and Broughton Bank, Cleveland, Yorkshire; Moffat, Dumfriesshire; Barcaldine, Argyll.

Form *nemoxyna* A. L. Sm.—Podetia slender, elongate, scyphiferous, the scyphi narrow, irregularly radiate or the podetia with variously long subulate branches. Apothecia not seen.—Var. *subcornuta* f. *nemoxyna* Nyl. ex Cromb. in Grevillea xi. p. 112 (1883) & Monogr. i. p. 138. *C. pyxidata* var. *cornuta* f. *nemoxyna* Mudd Brit. Clad. p. 13 (1865). *Coralloides scyphi-forme cornutum* Dill. Hist. Musc. p. 92, t. 15, fig. 16 B, D, E (1741). *Beomyces radiatus* var. *nemoxynus* Ach. Meth. Lich. p. 342 (1803). *Scyphophora fimbriata* var. *nemoxyna* S. F. Gray Nat. Arr. i. p. 420 (1821).

Differs from subsp. *fibula* in the slender straggling branches. It has been made a species by Zopf (Ber. Deutsch. Bot. Ges. xxvi. p. 110 (1908)) on account of the colourless nemoxynic acid which he extracted from it.

Hab. On the ground among heaths in upland districts.—*Distr.* Rare in E. and N. England and S. Grampians, Scotland.—*B. M.* Epping Forest, Essex; Ayton Moor, Cleveland, Yorkshire; Killin, Perthshire.

Var. *radiata* Cromb. in Grevillea xi. p. 112 (1883) & Monogr. i. p. 139—Podetia elongate, subulate at the tips or usually scyphiferous, the scyphi narrow and radiate from the margins.—*C. fimbriata* var. *radiata* Cromb. Lich. Brit. p. 19 (1870). *C. pyxidata* var. *fimbriata* f. *radiata* Mudd Man. p. 53 (1861); f. *cornuto-radiata* Leight. Lich. Fl. p. 62; ed. 3, p. 58; var. *cornuta* f. *radiata* Mudd Brit. Clad. p. 13 (1865). *Museus lichiniformis corniculis* &c. Buddle Hort. Sicc. ii. fol. 3, n. 4, in Herb. Sloane. *Coralloides scyphi-forme cornutum* Dill. Hist. Musc. p. 92, t. 15, figs. 16 c, f, g (1740). *Lichen radiatus* Schreb. Spic. Fl. Lips. p. 122 (1771); With. Arr. ed. 3, iv. p. 38; Engl. Bot. t. 1835. *L. pyxidatus* var. *p.* Huds. Fl. Angl. ed. 2, p. 555 (1778). *Cenomyce radiata* Ach. Lich. Univ. p. 547 (1810);

Tayl. in Mackay Fl. Hib. ii. p. 81. *Scyphophora fimbriata* var. *radiata* S. F. Gray Nat. Arr. i. p. 420 (1821).

Exsicc. Bohl. n. 47; Johns. n. 175; Leight. n. 376; Mudd Clad. nos. 22, 24.

Differs from the subspecies in the more or less elongate radiating branches arising from the margins of the scyphi and in these being occasionally somewhat expanded. Spermogones only are present on the British specimens.

Hab. On the ground in upland districts.—*Distr.* Probably general in the hilly regions of Great Britain and Ireland, though as yet recorded from comparatively few localities.—*B. M.* St. Breock, Cornwall; Hampstead, London (18th century); Essex; Malvern, Worcestershire; Barmouth, Merioneth; Moel-y-golfa, Montgomeryshire; Westerdale, Kildale, Broughton Bank and Roseberry, Cleveland, Yorkshire; Tongland, Kirkcudbrightshire; Glen Lochay and Rannoch, Perthshire; Durris, Kincardineshire; Countesswells, Aberdeenshire; Aghalee bog, Lough Neagh, Londonderry; Killarney, Kerry.

Var. *subcornuta* Nyl. ex Cromb. in Grevillea xi. p. 112 (1883) & Monogr. i. p. 138 (incl. f. *tortuosa*).—Podetia usually slender, more or less elongate, ascyphous, simple or branched, horn-like, tapering upwards, almost entirely decorticate and finely furfuraceous, sometimes sparsely squamulose towards the base.—*C. pyxidata* var. *cornuta* Floerk. Clad. Comm. p. 59 (incl. f. *dendroides*, p. 60) (1828); Mudd Clad. p. 12 pro parte (incl. ff. *vulgaris*, *antilopea*, *tortuosa*, *clavarioidea*, *subulata*, *isidiosa*, *dendroides*, *intricata* and *fastigiata*); var. *fimbriata* ff. *cornuta* and *dendroides* Mudd Man. p. 53 (1861). *Muscus lichiniiformis corniculis* &c. Buddle Hort. Sicc. ii. fol. 3, n. 5, in Herb. Sloane. *Coralloides viz ramosum, scyphus obscuris* Dill. Hist. Musc. p. 90, t. 15, fig. 14 D, E (1741). *Lichen subulatus* L. Sp. Plant. p. 1153 (1753) pro parte (secund. Herb. Linn. fide Wainio). *L. cornutus* var. δ . Lightf. Fl. Scot. ii. p. 876 (1777); Engl. Bot. t. 1836. *Scyphophora fimbriata* vars. *cornuta* and *abortiva* S. F. Gray Nat. Arr. i. p. 420 (1821). *Cenomyce antilopea* Del. ex DC. Bot. Gall. p. 626 (1830)? *C. cornuta* var. *tortuosa* Del. tom. cit. p. 628? *C. isidiosa* Del. l. c.

Exsicc. Bohl. n. 48; Croall n. 598; Johns. n. 174; Mudd Clad. nos. 19, 20, 21.

Though in some instances approaching very near to the subsp. *fibula*, distinguished by the constantly ascyphous condition of the podetia. The various forms recorded by Mudd represent growth phases. In three of these the podetia are more or less squamulose below:—f. *tortuosa*, unbranched and stout, the tips curved and subulate; f. *isidiosa* (error. *insidiosa*), with the tips blunt and dentate, and f. *antilopea*, which is branched above with the branches curved. The remaining forms are naked or furfuraceous:—f. *clavarioidea*, rather long and inflated upwards, but the apex attenuated; f. *subulata*, short and subulate; f. *dendroides*, long and variously branched above; f. *intricata*, with branches curved and entangled, and f. *fastigiata*,

with short fastigiate branches towards the tips. Wainio has adopted the Linnean name and records the above as *C. fimbriata* var. *subulata* (Clad. Univ. ii. p. 282 (1894)); the varietal name *cornuta* is confused with *C. cornuta*.

Hab. On the ground among mosses in upland districts.—*Distr.* General but not common in Great Britain and Ireland.—*B. M.* Tilgate and West Grinstead, Sussex; Hampstead, London (18th century); Epping Forest, Essex; Charnwood Forest, Leicestershire; Lounsdale, Kildale, Ayton and Baysdale, Cleveland, Yorkshire; Teesdale, Durham; Hale, Cumberland; Leadhills, Lanarkshire; Killin, Perthshire; Durris, Kincardineshire; Morrone, Braemar, Aberdeenshire; near Cork; Blaris Bridge, Belfast, Antrim; Kylemore, Connemara, Galway; Achill Island, Mayo.

Basal squamules minute and scattered.

12. *C. leptophylla* Floerk. Clad. Comm. p. 19 (1828).—Basal squamules small, rather scattered, round, entire or slightly crenate, pale-greenish; podetia rather rare, short, slender, glabrous, sometimes bifid, decorticate or partly corticate, ascyphous (K—, CaCl—). Apothecia turgid on the tips of the podetia, brown; spores 10–12 μ long, 3–3.5 μ thick.—Cromb. in Grevillea xi. p. 111 (1883) & Monogr. i. p. 131. *C. squamosa* var. *leptophylla* Schaer. Enum. p. 199 (1850); Mudd Man. p. 57. *C. cariosa* var. *leptophylla* Coem. Clad. Belg. n. 22 (1863) ex Mudd Brit. Clad. p. 6 (1865). *C. pyxidata* subsp. *leptophylla* Cromb. Lich. Brit. p. 18 (1870); var. *leptophylla* Leight. Lich. Fl. p. 61 (1871); ed. 3, p. 57. *Lichen microphyllus* Sm. Engl. Bot. t. 1782 (1807) (non Ach.). *Helopodium leptophyllum* S. F. Gray Nat. Arr. i. p. 416 (1821). *Scyphophorus microphyllus* Hook. in Sm. Engl. Fl. v. p. 237 (1833).

Distinguished by the neat rounded squamules and the short ascyphous podetia, which are often ribbed or split, especially when dry, thus resembling *C. cariosa*.

Hab. In moist places among heaths in wooded inland tracts.—*Distr.* Rare in S. England and S.W. Scotland.—*B. M.* Sussex; New Galloway, Kirkcudbrightshire.

2. *Podetia sometimes imperfectly corticate in parts ; squamules medium-sized.*

13. *C. ochrochlora* Floerk. Clad. Comm. p. 75 (1828).—Primary thallus of laciniately divided greenish squamules, white beneath; podetia rather short or moderate in size, rarely up to 4 cm. in height, cylindrical, corticate and smooth below, greenish-grey, becoming whitish-pulverulent above, obtuse and truncate at the apices, or with narrow scyphi, dentate-radiate at the margins (K—, CaCl—). Apothecia small, sometimes confluent, pale-brown; spores fusiform or oblong, 8–15 μ long, 3–4 μ thick (fide Wainio).—Cromb. in Grevillea xi. p. 112 & Monogr. i. p. 142. *C. carneola* Mudd Man. p. 56 (1861) (non

Fr.). *C. fimbriata* var. *carneo-pallida* Nyl. Syn. i. p. 195 (1860); Cromb. in Grevillea xi. p. 112 & Monogr. i. p. 137. *C. pyxidata* var. *carneopallida* and var. *ochrochlora* Mudd Brit. Clad. pp. 11, 14 (1865) (incl. forms). *C. gracilis* var. *ochrochlora* Leight. Lich. Fl. p. 63 (1871); ed. 3, p. 59. *Capitularia pyxidata* var. *carneo-pallida* Floerk. in Web. & Mohr Beitr. Nat. ii. p. 304 (1810). *Cenomyces fimbriata* var. *carneo-pallida* Ach. Syn. Lich. p. 258 (1814) pro parte.

Exsicc. Johns. n. 291 (var. *phyllostrota*); Mudd Clad. nos. 25, 26.

Considered by Wainio (Clad. Univ. ii. p. 319) as a variety of *C. fimbriata*. It resembles the subsp. *fibula* in the form of the podetia and also *C. gracilis* in being partly corticate. Here also squamules are occasionally formed on the podetia (var. *phyllostrota* Floerk. tom. cit. p. 79; Mudd Brit. Clad. p. 15). Several forms recorded by Floerke (tom. cit. pp. 77 and 78) and cited by Mudd (tom. cit. pp. 14 and 15) as occurring in this country are: f. *truncata* with the podetia dilated above and truncate; f. *odontota* with the scyphi, dentate at the margins; and f. *paraphyonema* with long podetia and proliferous scyphi. Mudd records two others, f. *abortiva* with somewhat deformed podetia and f. *ramosa* glabrous and branched above.

Hab. On decaying trunks and turfy soil.—*Distr.* Local and scarce throughout England.—*B. M.* Near Bodmin, Cornwall; Becky Falls, Devon; Amberley, Sussex; Snaresbrook, Epping Forest, Essex; Malvern, Worcestershire; Dolgelly, Merioneth; Cleveland, Yorkshire; Windermere, Westmoreland; Ashgill, Cumberland; New Galloway, Kirkeudbrightshire; Barcaldine, Argyll; Loch Katrine, Perthshire; S. of Fort William, Invernesshire.

Form *ceratodes* Floerk. Clad. Comm. p. 77 (1828). Podetia short, rather swollen below, tapering upwards to subulate tips.—Cromb. in Grevillea xi. p. 112 & Monogr. i. p. 142. *C. pyxidata* var. *ochrochlora* f. *ceratodes* Mudd Brit. Clad. p. 14 (1865).

Exsicc. Johns. n. 292; Mudd Clad. n. 23.

Differs from the species in the ascyphous subulate podetia which are rarely branched, but sometimes squamulose.

Hab. On decaying trunks and turfy ground in shady localities.—*Distr.* Apparently local and rare in S.W. and N. England, and among the Central Scottish Grampians.—*B. M.* Near Bodmin, Cornwall, Becky Falls, Devon; Lounsdale, Cleveland, Yorkshire; Cumberland; Rannoch, Perthshire; Loch Linnhe, Invernesshire.

14. *C. pityrea* Fr. Nov. Sched. Crit. p. 21 (1826).—Primary thallus squamulose, often evanescent; the squamules small, rather thin, greyish-green, white beneath; podetia with thin walls, rather short, corticate or entirely decorticate and granular-sorediate or with a few squamules, greyish-white, the scyphi narrow, irregularly formed, fimbriate and often proliferous at the margins (K —, CaCl —). Apothecia rather small, subpedicellate or sessile, on the edges of the scyphi or terminal on the branches, pale or dark-brown; paraphyses scarcely thickened at

the tips.—Cromb. in Grevillea xi. p. 112 & Monogr. i. p. 132. *C. pyxidata* var. *pityrea* Nyl. ex Le Jolis in Mem. Soc. Sci. Nat. Cherb. vi. p. 241 (1858); Mudd Brit. Clad. p. 15 (incl. ff. *scyphifera*, *fascicularis*, *fimbriatula* and *phyllophora*); Leight. Lich. Fl. p. 60; ed. 3, p. 57 (incl. var. *decorticata*); var. *symphicarpa* Cromb. (non Ach.) & subsp. *pityrea* Cromb. Lich. Brit. p. 18 (1870). *C. squamosa* var. *decorticata* Mudd Man. p. 56 (1861) (? Schær.). *C. Lamarkii* Nyl. in Flora lviii. p. 447 (1875); Cromb. in Journ. Bot. xiv. p. 360 (1876) & Monogr. i. p. 133; Leight. Lich. Fl. ed. 3, p. 54. *Coralloides parum ramosum, tuberculis fuscis* Dill. Hist. Musc. p. 97, t. 15, fig. 20 (1741). *Capitularia pityrea* Floerk. in Mag. Naturf. Fr. Berlin ii. p. 135 (1808). *Cenomyces pityrea* f. *decorticata* Ach. Syn. Lich. p. 254 (1814).

Exsicc. Johns. nos. 287, 289 (f. *denudata*); Larb. Cæsar n. 8; Mudd Clad. n. 16 pro parte, 27–29 and 38.

A variable species with somewhat naked whitish podetia, it is not unlike a small form of *C. squamosa* in general habit, but frequently scyphiferous. The podetia are usually narrow and more furfuraceous than those of *C. pyxidata* and more granular than *C. fimbriata*. The apothecia are small and sessile, or subpedicellate and large. Johnson's specimen, f. *denudata*, includes podetia very similar to those of *C. pityrea* with others that are sparsely squamulose. There is no specific difference between the two species *C. pityrea* and *C. Lamarkii* except a slight reaction with potash recorded for the latter. The respective forms *hololepis* and *Isigny* are also alike in being more squamulose than the species.

Hab. On the ground among mosses and on dead stumps of trees.—*Distr.* Local and scarce throughout the British Isles.—*B. M.* Noirmont, Jersey; Helmentor and Bodinn, Cornwall; Dartmoor, Devon; New Forest, Hants; Chiddingfold and Tunbridge Wells, Sussex; Lounsdale, near Roseberry, Ayton Moor and Black Banks, Cleveland, Yorkshire; Weardale, Durham; New Galloway, Kirkcudbrightshire; Appin, Argyll; Rannoch, Perthshire; near Ballater, Aberdeenshire; Loch Linnhe, Invernessshire; Kylemore, Galway.

Form *hololepis* Cromb. in Grevillea xi. p. 112 (1883) & Monogr. i. p. 133.—Podetia short, squamulose-furfuraceous, the squamules fragile and more or less pulverulent.—Var. *hololepis* Floerk. Clad. Comm. p. 83 (1828). *C. pyxidata* var. *pityrea* ff. *hololepis* and *d'Isigny* Mudd Brit. Clad. p. 16 (1865) (non exs. n. 33). *C. Lamarkii* f. *Isigny* Nyl. in Flora lviii. p. 447 (1875); Cromb. Monogr. i. p. 134. *Cenomyce Isigny* Del. ex Nyl. l. c.

Exsicc. Johns. n. 288; Larb. Lich. Hb. without a number.

Hab. On the ground among heaths or mosses in maritime and upland regions.—*Distr.* Rare in the Channel Islands, N. England and the Grampians, Scotland.—*B. M.* Grisnez Common, Jersey; Turner's Hill, Sussex; Eastgate, Weardale, Durham; near Falls of Tummel and Glen Lochay, Killin, Perthshire; Barcaldine, Argyll.

15. *C. acuminata* Norrl. in Medd. Sällsk. Faun. & Fl. Fenn. i. p. 12 (1876).—Primary thallus of thickish squamules, some-

times large but usually small, greenish-grey above, white beneath; podetia slender, elongate, rather cylindrical, simple or branched, ascyphous, irregularly branched, acuminate at the apices, decorticate and granular-furfuraceous; greyish-white (K + yellowish, CaCl -). Apothecia terminal, small, brown; spores fusiform or ovoid, 10-16 μ long, 3-4 μ thick.—Cromb. in Grevillea xi. p. 112 & Monogr. i. p. 133. *Coralloides corniculis brevioribus et crebrioribus* Dill. Hist. Musc. p. 104, t. 16, fig. 27 E (1741). *Cenomyce pityrea* f. *acuminata* Ach. Syn. Lich. p. 256 (1814). *C. pyxidata* var. *pityrea* f. *acuminata* Mudd Brit. Clad. p. 15 (1865).

Near to *C. pityrea*, but distinct in the constantly pointed branches.

Hab. On the ground among mosses in subalpine districts.—*Distr.* Local and scarce among the Grampians, Scotland, and in N.W. Ireland (Galway).—*B. M.* Head of Glen Callater, Braemar, Aberdeenshire.

3. *Podetia* partly or entirely corticate, often ascyphous.

Basal squamules rather large.

16. *C. degenerans* Spreng. Syst. Veg. iv. p. 273 (1827).—Primary thallus rather scanty, the squamules small, crenate at the margins, glaucous-green above, white beneath; podetia moderate in size, smooth at first then warted, uneven, and tomentose between the scattered corticate areolæ, rarely squamulose, whitish or pale-greenish, becoming black, especially at the base and then punctate (maculate) with the light-coloured areolæ scyphiferous, the scyphi often radiate or proliferous at the margins (K -, CaCl -). Apothecia rather large, brown; paraphyses clavate at the tips; spores 10-11 μ long, 3.5 μ thick.—Mudd Brit. Clad. p. 17 (incl. ff. *haplolea* and *euphorea*); Cromb. Lich. Brit. p. 19 (incl. var. *haplolea*) & Monogr. i. p. 146 (incl. ff. *haplolea* and *granulifera*); Leight. Lich. Fl. p. 64; ed. 3, p. 59; ff. *haplolea* and *euphorea* Floerk. Clad. Comm. pp. 42, 43 (1828); f. *granulifera* Cromb. in Grevillea xi. p. 113 (1883). *C. gracilis* var. *degenerans* Mudd Man. p. 55 (1861) (incl. ff. *haplolea* and *euphorea*). *Capitularia degenerans* Floerk. in Web. & Mohr Beitr. Nat. ii. p. 308 (1810). *Cenomyce gonorega* f. *aplolea* Ach. Syn. Lich. p. 258 (1814).

The distinguishing though sometimes obscure character of this and the following species is the blackening of the subcortical layer of the podetium, especially at the base, while the scattered particles of the cortex remain unchanged. In f. *granulifera* the cortical areolæ are swollen and partly squamulose, giving the podetium a coarsely granular appearance. Forms *haplolea* and *euphorea* represent states when the scyphi are more or less proliferous or cristate at the margins.

Hab. On the ground in alpine and subalpine regions.—*Distr.* Rather rare among the Scottish Grampians.—*B. M.* Pass of Leny, Perthshire; Ben-naboord, Upper Glen Dee and Cairngorm, Braemar, Aberdeenshire.

Var. *anomæa* Cromb. Lich. Brit. p. 20 (1870, & Monogr. i. p. 147.—Podetia short, slender, usually more or less thickly beset with squamules; scyphi usually radiately divided. Apothecia sessile or pedicellate, dark-brown.—Form *anomæa* Floerk. Clad. Comm. p. 43 (1828); Mudd Brit. Clad. p. 18; Leight. Lich. Fl. p. 64; ed. 3, p. 60; ff. *phyllophora* and *phyllocephala* Koerb. Syst. Lich. Germ. p. 20 (1855); Mudd l. c.; f. *pleolepidia* Nyl. Lich. Scand. p. 54 (1861); Cromb. Monogr. i. p. 147. *C. gracilis* var. *degenerans* ff. *anomæa* and *phyllophora* Mudd Man. p. 55 (1861). *Lichen phyllophorus* Ehrh. Pl. Crypt. n. 287 (1793) (fide Wainio Clad. Univ. ii. p. 151 (1894)). *L. anomæus* Sm. Engl. Bot. t. 1867 (1808). *Patellaria fusca* var. *degenerans* f. *phyllocephalum* Wallr. Saulch.-Flecht. p. 130 (1829). *Cenomyce anomæa* Hook. Fl. Scot. ii. p. 63 (1821). *Scyphophorus anomæus* Hook. in Sm. Engl. Fl. v. p. 238 (1833).

Exsicc. Mudd Clad. n. 32 (as *C. pyxidata* var. *pityrea* f. *squamulosa*).

Distinguished by the squamulose character, and not to be confused with *C. squamosa*, in which the podetia and squamules are somewhat furfuraceous and the scyphi perforated. The blackening of the podetia is not constant. Form *pleolepidea*, with small ascyphous squamulose podetia, dark-coloured and white-punctate, is evidently a growth form of the variety, though it has been referred by Wainio to *C. squamosa* (Clad. Univ. ii. p. 137).

Hab. On the ground in heaths, and on rotten wood.—*Distr.* Somewhat scarce in S.W. and N. England, in S. and Central Scotland and among the Grampians.—*B. M.* Near Hurstpierpoint, Sussex; Dartmoor, Devon; Malvern, Worcestershire; Burton Head, Cleveland, Yorkshire; Pentland Hills, near Edinburgh; Sidlaw Hills, Forfarshire; Glen Quoich, Glen Callater and Morrone, Braemar, Aberdeenshire.

Subsp. *trachyna* Nyl. ex Norrl. in Not. Sällsk. Faun. & Fl. Fenn. Förh. xiii. p. 319 (1873).—Podetia slender, cylindrical, usually smooth, greyish-white, areolate and tomentose in the interstices, proliferous at the margins of the denticulate radiate scyphi, forming several tiers of short podetia. Apothecia minute, brown.—Cromb. in Grevillea xi. p. 113 & Monogr. i. p. 147; f. *trachyna* Floerk. Clad. Comm. p. 44 (1828); Mudd Brit. Clad. p. 18. *Bæomyces trachynus* Ach. Meth. Lich. p. 348 (1803).

The blackening at the base of the podetia is scarcely evident, but the corticate areolæ with the tomentose interstices show the affinity with the species.

Hab. On heathy ground amongst moss in upland regions.—*Distr.* Rare among the Scottish Grampians.—*B. M.* Cairntoul and Benaboard, Braemar, Aberdeenshire.

Form *subfurcata* Nyl. ex Norrl. tom. cit. p. 320.—Podetia elongate, ascyphous, branched, fastigiate, the areolæ giving a granular unequal surface, brownish. Apothecia not seen.—Cromb. in Grevillea xi. p. 113 (1883) & Monogr. i. p. 148.

The granular-like areolæ mark the difference between this form and *C. furcata* to which it bears a strong resemblance.

Hab. On moist peaty ground in subalpine tracts.—*B. M.* Upper Glen Dee, Braemar, Aberdeenshire.

17. *C. lepidota* Nyl. in Not. Sällsk. Faun. & Fl. Fenn. Förh. n. ser. v. p. 176 (1866) (non Ach.).—Primary thallus of large, crenate squamules, pale-glaucous above, areolæ more or less beset with large squamules at the blackened pale-spotted base, the scyphi narrow, irregular, difform or cristate (K + yellow, CaCl —). Apothecia small, conglomerate brown; spores fusiform-oblong, 9–15 μ long, 3–4 μ thick.—Cromb. Monogr. i. p. 19.

Distinguished by the large squamules. The species has been recorded by Wainio (Clad. Univ. ii. p. 159 (1894)) as *C. gracilescens*. He includes *Cenomyce gonorega* f. *lepidota* Ach. Syn. Lich. p. 259 (1814) as a form of *C. degenerans* (tom. cit. p. 153). The species has not been recorded in the British Isles, only the following form.

Form *hypophylla* Cromb. in Grevillea xi. p. 113 (1883) & Monogr. i. p. 148.—Basal squamules rather large, crowded, greyish-white or greenish-grey, white beneath, rising from a stalk-like base which is often black, with scattered white spots; podetia short or long, more or less squamose, ascyphous but often irregularly branching, and foliaceous, the edges studded with brown ovoid or subglobose pycnidia.—*C. degenerans* f. *hypophylla* Nyl. Lich. Scand. p. 54 (1861); Mudd Brit. Clad. p. 18.

Exsicc. Mudd n. 9 pro parte & Clad. n. 39.

A very peculiar form, the podetia having the appearance of enlarged squamules. It approaches very near to some growth forms of *C. cervicornis*. Mudd's *C. cervicornis* f. *prodiga* belongs possibly to this form (Brit. Clad. p. 4).

Hab. On the ground among rocks in upland districts.—*Distr.* Not uncommon where it occurs in S. and N. England and Wales, S. Scotland and among the Grampians.—*B. M.* Dartmoor, Devon; Llanwrtydd Wells, Brecknockshire; Plinlimmon, Cardiganshire; Dolgelly, Rhewgreidden and Maes-y-garnedd, Merioneth; Carnedd Dafydd and Bettws-y-Coed, Carnarvonshire; Battersby, Ingleby and Ayton Moors, Cleveland, Yorkshire; Ennerdale, Cumberland; New Galloway, Kirkeudbrightshire; Dennyat, near Stirling; Craig Calliach, Perthshire; Lion's Face and Glen Quoich, Braemar, Aberdeenshire; Slieve More, Achill Island, Mayo.

18. *C. cervicornis* Schaer. Enum. p. 195 (1850) pro parte.—Primary thallus of large crowded squamules variously multifid ascending, firm, crenate, dark olive- or glaucous-green above, whitish or brownish-black beneath; podetia short, corticate, smooth or uneven, scyphiferous, the scyphi simple or irregularly proliferous from the margins, more rarely from the centre of the scyphus, sometimes squamulose (K + indistinctly yellowish or —, CaCl. —). Apothecia small, reddish or blackish-brown; spores

oblong-fusiform, 7–16 μ long, 3 μ thick.—Mudd Brit. Clad. p. 4 (incl. f. *prodiga*? excl. var. *verticillata*); Leight. Lich. Fl. p. 57; ed. 3, p. 54; Cromb. Monogr. i. p. 144; f. *stipata* Nyl. in Flora lix. p. 239 (1876); Cromb. in Journ. Bot. xiv. p. 360 (1876); Leight. Lich. Fl. ed. 3, p. 55. *C. gracilis* var. *cervicornis* Schær. Lich. Helv. Spic. p. 297 (1833) pro parte; Mudd Man. p. 54; var. *sobolifera* and subsp. *cervicornis* Cromb. Lich. Brit. p. 19 (1871). *C. verticillata* var. *sobolifera* Leight. in Ann. Mag. Nat. Hist. ser. 3, xviii. p. 411 (1866) & Lich. Fl. p. 64; ed. 3, p. 59. *C. sobolifera* Nyl. in Bull. Soc. Linn. Norm. ser. 2, vi. p. 282 (1872); Cromb. in Grevillea xi. p. 113 (1883) & Monogr. i. p. 144. *Lichenoides pyxidatum marginibus eleganter foliatis* Dill. in Ray Syn. ed. 3, p. 69, n. 33 (1724). *Coralloides scyphiforme, marginibus radiatis et foliatis* Dill. Hist. Musc. p. 85, t. 14, figs. 9 A, B and *foliis alcicornibus cartilaginosis* p. 87, t. 14, fig. 12 B (1741). *Lichen cervicornis* Ach. Lich. Suec. Prodr. p. 184 (1798); Engl. Bot. t. 2574. *Cenomyce cervicornis* Ach. Lich. Univ. p. 531 (1810) (incl. var. *prodiga*); Tayl. in Mackay Fl. Hib. ii. p. 81. *C. cladomorpha* var. *sobolifera* Del. in Duby Bot. Gall. p. 631 (1830). *Scyphophorus cervicornis* S. F. Gray Nat. Arr. i. p. 418 (1821); Hook. in Sm. Engl. Fl. v. p. 238. *Exsicc.* Croall n. 597; Johns. n. 12; Larb. Lich. Hb. n. 322; Leight. n. 14; Mudd n. 9 pro parte & Clad. n. 2.

Agrees with the following in the occasional central branching of the podetia, which are however shorter and more irregular in form and sometimes squamulose (f. *prodiga*). It differs in the more highly developed primary thallus; the squamules vary in size and form and are sometimes very long and narrow (f. *stipata*). It is so frequently sterile that the more fertile condition in which the basal thallus is less pronounced has been sometimes considered a separate species (*C. sobolifera*).

Hab. On the ground and on mossy boulders and rocks in maritime and upland districts.—*Distr.* General in hilly and mountainous regions, rare in the Channel Islands.—*B. M.* Grosnez and Quenvais, Jersey; Pleinmont, Guernsey; St. Breock, Helmington, Withiel, Penzance and near Wadebridge, Cornwall; Dartmoor and Bolt Head, Devonshire; Bathampton, Somerset; Malvern, Worcestershire; Rhewgreidden, Dolgelly and Aberdovey, Merioneth; Llanberis, Cardiganshire; near Capel Curig, Carnarvonshire; Anglesea; Buxton, Derbyshire; Ayton and Ingleby Moor, Cleveland, Yorkshire; Teesdale, Durham; Windermere, Westmoreland; New Galloway, Kirkcudbrightshire; Moffat, Dumfriesshire; Pentland Hills, near Edinburgh; Barcaldine and Appin, Argyll; Glen Lochay, Ben Ledi, The Trossachs, Rannoch and Craig Calliach, Perthshire; Ben-naboord, Braemar and Countesswells, Aberdeenshire; Glen Nevis, Invernesshire; Applecross, Rossshire; Laing, Sutherland; Ballyedmond, Cork; Killarney and Carig Mt., Kerry; Kylemore, Galway; Achill and Clare Islands, Mayo.

19. *C. verticillata* Floerk. Clad. Comm. p. 26 (1828).—Primary thallus somewhat scanty, the squamules rather narrow

crenate, dark-olive or greyish-green; podetia corticate, smooth, glaucous- or brownish-green, scyphiferous, the scyphi regular, denticulate at the margins, repeatedly proliferous from the centre of the cups. Apothecia moderate, brown or reddish, spores oblong or rarely ovoid-oblong, 7–16 μ long, 2–3 μ thick.—Leight. Lich. Fl. p. 63; ed. 3, p. 59; Cromb. Monogr. i. p. 143. *C. pyxidata* subsp. *verticillata* Hoffm. Deutschl. Fl. ii. p. 122 (1795). *C. gracilis* var. *verticillata* Fr. Lich. Eur. p. 219 (1831) pro parte; Mudd Man. p. 54. Subsp. *verticillata* Cromb. Lich. Brit. p. 19 (1870). *C. cervicornis* var. *verticillata* Flot. in Uebers. Schles. Ges. 1805, p. 105; Mudd Brit. Clad. p. 5. *Lichenoides tubulosum pyxidatum proliferum* Dill. in Ray Syn. ed. 3, p. 69, n. 29 (1724). *Coralloides scyphiforme, tuberculis fuscis* Dill. Hist. Musc. p. 79, t. 14, fig. 6 D–H (1741). *Lichen pyxidatus* var. L. Sp. Pl. p. 1151, n. 59 (1753); Huds. Fl. Angl. ed. 2, p. 551; With. Arr. ed. 3, iv. p. 36. *Scyphophora verticillata* S. F. Gray Nat. Arr. i. p. 418 (1821).

Excicc. Mudd Clad. n. 3.

Easily recognized by the frequent central proliferations forming up to five tiers of podetia. British forms are rarely fertile.

Hab. On mossy rocks and boulders in maritime and inland districts.—*Distr.* Local and scarce throughout the British Isles.—*B. M.* Noirmont, Jersey, St. Breock, Cornwall; Broadwater Forest, Tunbridge Wells and Maresfield Common, Surrey; near Shirley, Surrey; Delamere Forest, Cheshire; Ayton Moor and Baysdale and Farndale, Yorkshire; Glen Lochay, Killin, Perthshire; Moor of Morrone, Braemar, Aberdeenshire.

Form *laciniolata* Nyl. ex Cromb. in Grevillea xi. p. 112 (1883).—Primary squamules elongate and narrow; podetia with the scyphi squamulose at the margins; probably due to excessive moisture.—Cromb. Monogr. i. p. 143.

Hab. On exposed rocks in moist places.—*Distr.* Found only sparingly in S.W. England and the S.W. Highlands of Scotland.—*B. M.* Carn Galva, Penzance, Cornwall; Barcaldine, Argyll.

Basil squamules small, scanty, scattered.

20. *C. gracilis* Willd. Fl. Berol. p. 363 (1787).—Primary thallus scanty, the squamules rather small, olive-green or brownish above, whitish beneath, often evanescent; podetia usually numerous and crowded, elongate, slender, entirely corticate and smooth, simple or branched, scyphiferous or tapering to a point, the scyphi narrow or rarely dilated, forming a rather deep cup which is denticulate or proliferous at the margins, pale-greyish or greenish or sometimes brown (K–, CaCl–). Apothecia on the tips of the denticulations, rarely sessile on asecyphous podetia, brown or reddish; spores oblong, 9–12 μ long, 3–4 μ thick.—Schær. Lich. Helv. Spic. p. 32 (1823) (incl. vars. *chordalis* and *abortiva*); Koerb. Syst. Lich. Germ. p. 18 (1855) (incl. var.

vulgaris ff. *ceratostelis* and *proboscidea*); Mudd Man. p. 54 (incl. f. *chordalis*) & Brit. Clad. p. 16 (incl. ff. *ceratostelis*, *proboscidea*, *abortiva* and *chordalis*); Cromb. Lich. Brit. p. 19 (incl. f. *chordalis*) & Monogr. i. p. 139 (incl. subsp. *gracillima*); Leight. Lich. Fl. p. 62; ed. 3, p. 58 (incl. vars. *chordalis* and *abortiva*). *Corallina montana tubulosa* &c. Buddle Hort. Sicc. ii. fol. i. nos. 10 & 12, in Herb. Sloane. *Lichenoides pyxidatum cinereum elatius, ramulis pyxidatim desinentibus* Dill. in Ray Syn. ed. 3, p. 69, n. 32 (1724). *Coralloides scyphiforme serratum elatius, caulibus gracilibus glabris* Dill. Hist. Musc. p. 88, t. 14, fig. 13 c, d (1741). *Lichen gracilis* L. Sp. Pl. p. 1152 (1753); Huds. Fl. Angl. p. 457; Lightf. Fl. Scot. ii. p. 873; With. Arr. ed. 3, iv. p. 37; Engl. Bot. t. 1284. *Capitularia gracilis* f. *chordalis* Floerk. in Web. & Mohr Beitr. Nat. ii. p. 324 (1810). *Cenomyce ecmocyna* Ach. Lich. Univ. p. 549 (1810) (incl. var. *gracilis*). *C. gracilis* Hook. Fl. Scot. ii. p. 63 (1821); Tayl. in Mackay Fl. Hib. ii. p. 82. *Scyphophora ecmocyna* (incl. var. *gracilis*) S. F. Gray Nat. Arr. i. p. 421 (1821).

Excise. Johns. n. 49; Larb. Hb. n. 207 & Lich. Cantab. n. 3; Leight. n. 296; Mudd nos. 10, 11; Clad. nos. 34-37.

Many varieties and forms of this lichen have been recorded; chief among them var. *chordalis* with proliferous scyphi, recognized by Floerke (l. c.) as probably a growth form and here included with the species; f. *abortiva*, a rather rare form, has the slender podetia terminated and occasionally distorted by the apothecia; f. *ceratostelis* is wholly ascyphous and sterile, a state of the podetia continually associated with those bearing scyphi. A very slender form, issued by Norrlin as subsp. *gracillima* (Hb. Lich. Fenn. ix. n. 424 (1882); Cromb. in Grevillea xi. p. 112 (1883) & Monogr. i. p. 141) has been determined by Wainio (Monogr. Clad. Univ. iii. p. 251 (1898)) as a modification or growth form with much branched podetia.

As a rule the podetia of *C. gracilis* grow in crowded and often quite extensive clumps; they are more or less slender and elegant in form, about 5-10 cm. long; they tend to become blackish and to die off at the base.

Hab. Among mosses on the ground and on rocks.—*Distr.* General and common in most parts of Great Britain and Ireland; rare in the Channel Islands.—*B. M.* Guernsey; Sark; near Penzance, Cornwall; Dartmoor, Devon; Ardingly Rocks, Sussex; Lydd, Kent; High Down near Godalming, Surrey; Hampstead, London (18th century); Wokingham Heath, Berks; Charnwood Forest, Leicestershire; Worcester Beacon; Barmouth and Dolgelly, Merioneth; Llandona, Anglesea; Hazelbeech, Northamptonshire; Epping Forrest, Essex; Thetford Warren, Suffolk; Wootton Common, Norfolk; Chesterfield, Derbyshire; Ingleby Park, Ayton Moor and Highcliffe, Cleveland and Farndale, Yorkshire; Egglestone, Durham; The Cheviots, Northumberland; Lamplugh, Cumberland; New Galloway, Kirkeudbrightshire; Manor Head, Peebleshire; Barcaldine, Argyll; Glen Lochay, Glen Ample, Blair Athole and Rannoch, Perthshire; Sidlaw Hill, Kinnordy and Kirriemuir, Forfarshire; Durriss, Kincardineshire; Glen Dee, Braemar and Countesswell's Wood, Aberdeenshire; Rothiemurchus and Glen Nevis, Invernessshire; Cawdor Wood, Nairnshire;

Forres, Elginshire; Applecross, Rossshire; near Cork; Tore Mt. and Killarney, Kerry; Ballynascreen Mts., Tyrone.

Form *spinulifera* Cromb. Monogr. i. p. 140 (1894).—Podetia slender, dark-brown, somewhat wrinkled, the stalks beset with short spinules; scyphi with the margins spinulose.

Hab. On moors.—*B. M.* Near Newton Abbot, Devon.

Var. *hybrida* Schær. Lich. Helv. Spic. p. 32 (1823).—Podetia more or less elongate, robust, sparingly branched, usually scyphiferous, the scyphi narrow or dilated, simple or proliferous at the margins. Apothecia rare.—Mudd Man. p. 55 (? incl. *f. simplex*) & Brit. Clad. p. 17 (incl. var. *macroceras*); Cromb. Monogr. i. p. 141; var. *macroceras* Floerk. Clad. Comm. p. 38 (1828). *C. hybrida* Hoffm. Deutschl. Fl. ii. p. 119 (1798). *C. gracilis f. elongata* Cromb. Lich. Brit. p. 19 (1870). *Coralloides scyphiforme* etc. Dill. tom. cit. fig. 13 A, B. *Lichen elongatus* Jacq. Misc. ii. p. 368, t. 2, fig. 1 (1781). *Capitularia gracilis* var. *macroceras* Floerk. in Web. & Mohr Beitr. Nat. ii. p. 330 (1810) (incl. *f. elongata*).

A robust plant, with the podetia usually scyphiferous. There is no sufficient reason for dividing the variety, as Wainio has done, into var. *declatata* and var. *elongata*, and var. *hybrida* is the oldest varietal name.

Hab. On mossy rocks and among mosses on the ground in high or mountainous districts.—*Distr.* In upland regions of N. England and Scotland.—*B. M.* Ayton Moor, Cleveland, Yorkshire; Sidlaw Hills, Forfarshire; Killin, Perthshire.

Var. *aspera* Floerk. Clad. Comm. p. 40 (1828).—Podetia rather slender, mostly ascyphous, more or less squamulose, the squamules crenate at the margin.—Form *aspera* Cromb. in Grevillea p. 112 (1883) & Monogr. i. p. 141. *Capitularia gracilis* var. *aspera* Floerk. in Web. & Mohr Beitr. ii. p. 333 (1810).

Exsicc. Leight. n. 402.

Differs from the species in the presence of squamules on the podetia.

Hab. On the ground in inland situations.—*Distr.* Local and scarce in Central and N. England.—*B. M.* Charnwood Forest, Leicestershire; Ingleby Park, Cleveland, Yorkshire; Windermere, Westmoreland.

21. *C. cornuta* Fr. Lich. Eur. p. 225 (1831).—Primary thallus of scattered squamules or none, the squamules small, lobate-crenate; podetia elongate, corticate and smooth below, pulverulent towards the apices, tapering to a point or sometimes with narrow scyphi (K —, CaCl —). Apothecia small, brown; spores oblong, 9–12 μ long, 3–4 μ thick.—Cromb. Lich. Brit. p. 19 & Monogr. i. p. 141. *Lichen cornutus* L. Sp. Pl. p. 1152 (1753).

Distinguished by the scanty squamules and by the semi-corticate podetia, which are 5 to 10 cm. high. Apothecia and spermatogones are very rare in British specimens.

Hab. Among mosses on the ground, on heather, and in woods in upland tracts.—*Distr.* Rather rare in N. England and the Grampians, Scotland.—*B. M.* Ayton Moor, Cleveland, Yorkshire; Sheriffmuir, Stirlingshire; Rannoch and Killiecrankie, Perthshire; Ballochbuie Forest, Braemar, Aberdeenshire; Rothiemurchus, Invernesshire.

Form *clavulus* Fr. Lich. Eur. p. 225 (1831).—Podetia short, turgid, curved, granular-furfuraceous, corticate in small areas or near the base, without scyphi.—Cromb. Monogr. i. p. 142.

Hardly to be distinguished from "cornute" forms of *C. fimbriata* except by the corticate areas. It is evidently a sterile form.

Hab. On turf walls in upland districts.—*Distr.* Local and scarce among the Central and N. Grampians, Scotland.—*B. M.* Rannoch, Perthshire; Glen Quoich, Braemar, Aberdeenshire.

4. *Podetia fissured or latticed.*

22. *C. macrophylla* Stenh. in Öfvers. K. Vet. Akad. Förh. 1865, p. 231.—Primary thallus of rather large squamules, glaucous-green above, whitish beneath, crenate at the margins; podetia moderate in size, cylindrical, rough with small squamulose outgrowths from the areolæ of the cortex, ascyphous or with narrow scyphi, becoming fissured (K + yellowish, CaCl -). Apothecia often rather large and confluent, brown; spores 8-11 μ long, 3.5 μ thick.—Cromb. in Grevillea xi. p. 113 (1883) & Monogr. i. p. 145. *C. ventricosa* var. *macrophylla* Schær. Lich. Helv. Spic. p. 316 (1833).

Approaches *C. cariosa* in the splitting of the podetia. It has been confounded with a continental species, *C. decorticata*, from which it differs in the character both of squamules and podetia.

Hab. On earth-covered boulders and ledges of rocks in wooded mountainous regions.—*Distr.* Rare among the Grampians, Scotland.—*B. M.* Head of Glen Quoich, Braemar, Aberdeenshire (recorded also from Craig Calliach, Perthshire).

23. *C. cariosa* Spreng. Syst. Veg. iv. p. 272 (1827).—Squamules of primary thallus usually small (rarely large), rounded and crenate, scattered or crowded, greyish-glaucous, white beneath; podetia rather short to medium length, simple or branched, smooth and partly denudate then granular, white or greyish-glaucous, becoming latticed and open as if carious, the scyphi when present dividing into subfastigate branches (K + yellow, CaCl -). Apothecia turgid, overtopping the branches, brown; spores 9-13 μ long, 4-5 μ thick.—Engl. Bot. Suppl. t. 2761; Mudd Brit. Clad. p. 6; Cromb. Lich. Brit. p. 19 & Monogr. i. p. 134; Leight. Lich. Fl. p. 57; ed. 3, p. 55. *C. gracilis* var. *degenerans* f. *cariosa* Mudd Man. p. 55 (1861).

Coralloides fungiforme fuscum, basi foliacea Dill. Hist. Musc. p. 77, t. 14, fig. 2 (1741). *Lichen cariosus* Ach. Lich. Suec. Prodr. p. 198 (1798). *Cenomyce cariosa* Ach. Lich. Univ. p. 567 (1810); Tayl. in Mackay Fl. Hib. ii. p. 80.

Exsicc. Mudd Clad. n. 5; Johns. n. 243? (possibly *C. degenerans*).

Distinguished by the cancellate podetia and by the reaction. The basal squamules are mostly very small, not unlike those of *C. leptophylla*.

Hab. On clayey and sandy soil in maritime and inland wooded districts.—*Distr.* Apparently local and scarce in S.W. and N. England, W. Highlands of Scotland and S.W. Ireland.—*B. M.* Vale of Ecclesbourne, Sussex; Horsemonden, Kent; Wyre Forest and Bewdley, Worcestershire; Ayton, Cleveland, Yorkshire; Barcaldine, Argyll; Loch Katrine, Perthshire; Lochaber, Invernesshire.

II. *Podetia with perforations at the axils of branches, at tips or in scyphi.*

1. *Podetia corticate, smooth, mostly ascyphous.*

Basal squamules rather large or medium-sized.

24. *C. turgida* Hoffm. Deutschl. Fl. ii. p. 124 (1795).—Primary thallus of rather large laciniate lobate squamules, entire or crenate at the margins, glaucous-green or whitish above, white beneath, sometimes few or evanescent; podetia one or more rising from the surface of the squamules, elongate, turgid or subcylindrical, sometimes sparsely squamulose, ascyphous or obsoletely scyphiferous, dentate-radiate at the margins, generally perforate at the tips, in the scyphi, or in the axils, smoothly corticate, glaucous or pale-green (Kf + yellowish, CaCl -). Apothecia rather small, brownish-red or pale; spores oblong or rarely fusiform-oblong, 8-18 μ long, 3-4 μ thick.—Cromb. Lich. Brit. p. 20 & Monogr. i. p. 149; Leight. Lich. Fl. p. 56; ed. 3, p. 54. *Lichen turgidus* Ehrh. Pl. Crypt. n. 297 (1793) nomen nudum.

Hab. On the ground among heather in subalpine regions.—*B. M.* Head of Glen Quoich, Braemar, Aberdeenshire.

25. *C. crispata* Flot. in Nees v. Esenb. in Wendt Therm. Warmb. Breslau, p. 93 (1840).—Primary thallus of rather large or small squamules, deeply crenate or sublaciniate, ascending, glaucous or brownish above, white below, sometimes evanescent; podetia moderately long, often scyphiferous, rather turgid, pale-greyish or brownish, sometimes with squamules, corticate and smooth or with discontinuous areolæ, usually repeatedly branched, the apices and axils pervious, with the apertures cristate at the margins (K -, CaCl -). Apothecia small, brown or reddish.—Cromb. Lich. Brit. p. 20 & Monogr. i. p. 154; Leight. Lich. Fl.

p. 65; ed. 3, p. 61. *C. furcata* var. *crispata* Floerk. Clad. Comm. p. 148 (1828); Mudd Man. p. 57 & Brit. Clad. p. 22. *Coralloides perforatum minus, molle et tenue* Dill. Hist. Musc. p. 99, t. 16, fig. 22 B (1741). *Bæomyces turbinatus* var. *crispatus* Ach. Meth. Lich. p. 341 (1803).

Exsicc. Mudd Clad. n. 45.

The denticulate-cristate margins of the scyphi and of the openings both at the axils and tips of the podetia distinguish this species from all others. The spermogones contain red colouring substance.

Hab. On the ground among mosses in moorland districts.—*Distr.* Local and rare in N. England and among the Scottish Grampians.—*B. M.* Kildare Moor and Lounsdale, Cleveland, Yorkshire; Ben-y-gloe, Perthshire; Ben-naboord and Upper Glen Dee, Braemar, Aberdeenshire.

Var. infundibulifera Wain. Clad. Univ. i. p. 382 (1887).—Podetia smooth, rather slender, repeatedly branched, open at the axils but not cristate, scyphiferous, the scyphi dentate-cristate at the margins. Subsp. *furcatiformis* Cromb. in Grevillea xi. p. 113 (1883) (non Nyl.) & Monogr. p. 155. *C. ceranoides* f. *infundibulifera* Scher. Enum. p. 197 (1850).

Exsicc. Mudd n. 12.

Distinguished as in the species by the denticulate processes on the margin of the scyphi, though they are absent at the axils. Nylander's subsp. *furcatiformis* is, according to Wainio (tom. cit. p. 253), a form of *C. amaurocrea*.

Hab. On the ground among mosses in upland districts.—*B. M.* Ingleby Park, Cleveland, Yorkshire.

Var. cetrariæformis Wain. Clad. Univ. i. p. 392 (1887).—Podetia scyphiferous or scarcely dilated above but always pervious, the scyphi shortly dentate-radiate, rather darker in colour.—*Cenomyce gracilis* f. *cetrariæformis* Del. in Dub. Bot. Gall. p. 625 (1830). *Coralloides scyphiforme serratum elatius, caulibus gracilibus glabris* Dill. Hist. Musc. p. 88, t. 14, fig. 13 E (1741).

Referred by Wainio (l. c.) to this variety; the scyphi are less distinctly cristate than in the previous variety. A small specimen from the Dillenian herbarium is preserved in the British Museum. It has not again been collected in the British Isles.

Hab. In sterile shady places.—*B. M.* Mt. Stiperstones, Shropshire.

Basal squamules small, soon evanescent.

26. *C. furcata* Schrad. Spic. Fl. Germ. p. 107 (1794).—Primary thallus of small crenate lacinate squamules, usually obsolete; podetia in tufts, elongate, rather slender, subcylindrical, corticate, smooth or somewhat uneven, sometimes sparsely sorediose or with a few squamules especially towards the base, often with longitudinal fissures, glaucous-white or brownish-green, branched, usually perforate at the axils, the branches somewhat erect, dichotomous or subradiate and corymbose.

attenuate-subulate, and spreading-furcate at the apices (K —, CaCl —). Apothecia small, subglobose, brown; spores 10–13 μ long, 3–4 μ thick.—S. F. Gray Nat. Arr. i. p. 414; Hook. in Sm. Engl. Fl. v. p. 236 (incl. var. *subulata*); Mudd Man. p. 57 (incl. var. *racemosa* f. *erecta*, and var. *subulata*, excl. var. *crispata*) & Brit. Clad. p. 21 (incl. var. *subulata*, with ff. *cymosa*, *truncata* (non Floerk.) and *exilis*); Cromb. Lich. Brit. p. 20 (incl. vars. *corymbosa* and *tenuissima*) & Monogr. i. p. 149 (incl. f. *exilis* and var. *corymbosa*); Leight. Lich. Fl. p. 65; ed. 3, p. 60; ff. *subulata*, *tenuissima*, and *cymosa* Floerk. Clad. Comm. pp. 143, 144 (1828). *C. subulata* Wigg. Prim. Fl. Hols. p. 90 (1780); S. F. Gray Nat. Arr. p. 414. *C. racemosa* Hoffm. Deutschl. Fl. ii. p. 114 (1795). *C. arborea* Stirton in Scott. Nat. ix. p. 121 (1885)? *Lichenoides tubulosum cinereum*, minus crustaceum minusque ramosum Dill. in Ray Syn. ed. 3, p. 67, n. 17 (1724). *Coralloides corniculis longioribus et rarioribus* Dill. Hist. Musc. p. 102, fig. 26 (1741) & *Coralloides corniculis brevioribus et crebrioribus* tom. cit. p. 104, t. 16, fig. 27A?, B pro parte, c. *Lichen furcatus* Huds. Fl. Angl. p. 458 (1762) pro parte & *L. subulatus*, p. 459 (non L.); Lightf. Fl. Scot. ii. p. 881; With. Arr. ed. 3, iv. p. 42. *Cenomyce allotropa* var. *corymbosa* Ach. Lich. Univ. p. 556 (1810). *C. furcata* Ach. Syn. Lich. p. 276 (1814) (incl. var. *subulata*); Hook. Fl. Scot. ii. p. 64; Tayl. in Mackay Fl. Hib. ii. p. 80.

Exsicc. Bohl. n. 23; Leight. n. 401; Mudd n. 16 pro parte & Clad. nos. 46, 50, 51, 53.

Distinguished by the smooth corticate podetia and the furcate tips; differing from *C. gracilis* in the absence of scyphi. The variety known either as *corymbosa*, *racemosa* or *subulata* appears to be only a growth form of the species occurring more frequently in higher latitudes; it is rather stouter and less distinctly furcate. Hudson's *Lichen furcatus* refers partly to this species and in a minor degree to the squamulose var. *pinnata*. A small rather dark erect form (f. *exilis*) grows in upland districts. On chalky soil the podetia are almost white (f. *epermena* Ach.).

Three forms have been distinguished by Stirton (Scott. Nat. ix. p. 121 (1885)) under the names of *diffissa*, *contexta* and *commixta*. It is impossible to deal with them in the absence of specimens. Another specimen with larger apothecia has been described by the same writer subsp. *dispansa* (Scott. Nat. n. s. iii. p. 308 (1888)).

Hab. On the ground on moorlands, and on turf-walls in wooded upland districts.—*Distr.* Probably general and common throughout Great Britain and Ireland.—*B. M.* Temple Moor, Withiel and near Penzance, Cornwall; near Torquay, Becky Falls, near Widdicombe and Bovey Tracey, Devon; Winchfield, Hants; Beeding, Sussex; Greenhithe, Kent; near Shiere, Surrey; Epping Forest and Galleywood, Essex; Charnwood Forest, Leicestershire; Barmouth, Dolgelly and Aberdovey, Merioneth; Snowdon, Carnarvonshire; Malvern, Worcestershire; near Ayton, Kildale, Guisboro' and Cliffrigg, Cleveland, Yorkshire; Windermere, Westmoreland; The Cheviots, Northumberland; New Galloway, Kirkcudbrightshire; West Water

Fife; Baldovan, Sidlaw Hills and Clova, Forfarshire, Appin, Argyll; Killin and Glen Lochay, Perthshire; Craig Cluny, Glen Dee and Glen Callater, Braemar, Hill of Fare and Countesswells, Aberdeenshire; near Cork; Killarney, Kerry; Castle Connel, Limerick; Malaranny and Clare Island, Mayo.

Var. *spinosa* Leight. in Ann. Mag. Nat. Hist. ser. 3, xviii. p. 413 (1866) (? Hook.).—Podetia rigid, glabrous, decumbent, and often entangled, slender or stoutish, the branches curved and flexuose, here and there spinulose. Apothecia small, dark-brown.—Leight. Lich. Fl. p. 65; ed. 3, p. 60 pro parte; Cromb. Monogr. i. p. 151; *C. furcata* var. *pungens* f. *spinulosa* Mudd Brit. Clad. p. 24 (1865)? *Coralloides sparsum caulibus tortuosis et spinosis* Dill. Hist. Musc. p. 101, t. 16, fig. 25 (1741). *Lichen spinosus* Huds. Fl. Angl. p. 459 (1762); Lightf. Fl. Scot. ii. p. 882; With. Arr. ed. 3, iv. p. 45.

Distinguished by the rather lax irregularly branched and curved podetia, and by the presence of the short erect or recurved spines. It is often very dark in colour.

Hab. On the ground in moorlands and on turf-walls in upland districts.—*Distr.* Fairly common throughout Great Britain and Ireland.—*B. M.* Dartmoor, Devon; Lavington Common and Downs, Sussex; Epping Forest, Essex; Bardon Hill, Leicestershire; Ardovoy, Merioneth; Anglesea; Newmarket Heath, Cambridge; Ingleby Park, Cleveland, Yorkshire; Harris Moor, Cumberland; The Cheviots, Northumberland; Craig Calliach and Rannoch, Perthshire; Baldovan and Sidlaw Hills, Forfarshire; Glen Muick and near Inverary, Braemar and Countesswells, Aberdeenshire; Glen Nevis, Invernessshire; Seymourhill Bog, near Belfast, Antrim.

Var. *palamæa* Nyl. ex Zwackh Lich. Heidelb. p. 12 (1883).—Podetia stoutish, curved, nodulose-rugose or smooth, usually somewhat dilated and branched at the apices.—*C. furcata* var. *spadicea* Floerk. Clad. Comm. p. 146 (1828); var. *subulata* f. *spadicea* Mudd Brit. Clad. p. 23 (1865); subsp. *racemosa* f. *palamæa* Cromb. in Grevillea xii. p. 91 (1884) & Monogr. i. p. 152. *Bæomyces spinosus* var. *palamæus* Ach. Meth. Lich. p. 359 (1803).

Essicc. Mudd Clad. n. 52.

Not unlike var. *spinosa* but generally darker in colour and destitute of spines. The cortex is subcontinuous and the areolæ are swollen.

Hab. On the ground in upland localities.—*Distr.* Very rare in S.W. and N. England.—*B. M.* Brighton Downs, Sussex; near Shiere, Surrey; Bathampton Downs, Somerset; Guisboro' Moor, Cleveland, Yorkshire,

Var. *pinnata* Wain. Mon. Clad. Univ. i. p. 332 (1887).—Podetia more or less thickly beset with squamules, elongate, stoutish, often fissured, the branches erect, furcate at the apices, perforate or closed at the axils. Apothecia minute, brown.—*C. furcata* var. *racemosa* ff. *regalis* and *polyphylla* Floerk. Clad.

Comm. pp. 154, 155 (1828); Mudd Brit. Clad. p. 22; var. *subulata* f. *truncata* Mudd tom. cit. p. 23; var. *racemosa* Cromb. Lich. Brit. p. 20 (1870) (non Floerke); Leight. Lich. Fl. p. 65; ed. 3, p. 60; subsp. *racemosa* Nyl. ex Norrl. in Not. Sällsk. Faun. & Fl. Fenn. Förh. n. ser. x. p. 320 (1873); Cromb. in Grevillea xi. p. 113 (1883) & Monogr. i. p. 151. *Lichenoides tubulosum cinereum, ramosius et crustaceum* Dill. in Ray Syn. ed. 3, p. 67, n. 18 (1724). *Coralloides corniculis brevioribus et crebrioribus* Dill. Hist. Musc. p. 104, t. 16, fig. 27 B (1741) pro parte. *Lichen furcatus* Huds. Fl. Angl. p. 458 (1762) pro parte; Lightf. Fl. Scot. ii. p. 881? With. Arr. ed. 3, iv. p. 45. *Cenomyce racemosa* Hook. Fl. Scot. ii. p. 64 (1821) (non Ach.). *C. racemosa* var. *pinnata* Floerk. in Schleich. Cat. Omn. Pl. p. 47 (1821) fide Wainio (Clad. Univ. i. p. 334).

Exsicc. Mudd Clad. nos. 47, 48.

Distinguished by the stoutish podetia which are sparsely squamulose throughout their entire length with fairly large squamules.

Hab. On the ground in moorlands, usually on damp peaty soil in upland districts.—*Distr.* Local and scarce in Great Britain and S.W. Ireland.—*B.* M. Becky Falls, Devon; Malvern, Worcestershire; Aberdovey, Dolgelly and Rhewgreidden, Merioneth; Guisboro' Moor and Ingleby Moor, Cleveland, Yorkshire; New Galloway, Kirkcudbrightshire; Barcaldine, Argyll; Glen Lochay and Rannoch, Perthshire; Glen Callater, Braemar, Aberdeenshire; Glen Nevis, Invernessshire; Killarney, Kerry.

Var. *recurva* Hoffm. Deutschl. Fl. ii. p. 115 (1795).—Podetia slender, erect or curved, often denuded of cortex especially upwards, scabrid and more or less beset with minute squamules, the branches divergent, often recurved and furcate at the apices.—Mudd Brit. Clad. p. 22 (incl. f. *thyrsoides*); Leight. Lich. Fl. p. 65; ed. 3, p. 60; var. *adpersa* Floerk. Deutschl. Lich. x. p. 14 (1821); Leight. tom. cit. p. 61; var. *racemosa* f. *surrectea* Floerk. Clad. Comm. p. 154 (1828); f. *recurva* Mudd Man. p. 58 (1861); var. *spinosa* Hook. in Sm. Engl. Fl. p. 236 (1833) (non Huds.) e descript.; Tayl. in Mackay Fl. Hib. ii. p. 80 e descript.; subsp. *racemosa* f. *recurva* Cromb. in Grevillea xi. p. 113 (1883) & Monogr. i. p. 152. *C. racemosa* S. F. Gray Nat. Arr. i. p. 414 (1821) pro parte. *C. scabriuscula* Nyl. in Flora lviii. p. 447 (1875); Cromb. in Journ. Bot. xiv. p. 360 (1876) & Monogr. i. p. 156; Leight. Lich. Fl. ed. 3, p. 61. *C. adpersa* Cromb. in Journ. Bot. xiv. p. 360 (1876). *C. squamosa* subsp. *adpersa* Nyl. ex Cromb. in Grevillea xi. p. 114 (1883) & Monogr. i. p. 158. *Lichenoides tubulosum virescens, ramosius et foliosum, summitatibus arcuatis* Dill. in Ray Syn. ed. 3, p. 67, n. 19 (1724). *Coralloides corniculis brevioribus et crebrioribus* Dill. Hist. Musc. p. 104, t. 16, f. 27 D (1741). *Lichen furcatus* var. β . Lightf. Fl. Scot. ii. p. 882 (1777); var. 2, With. Arr. ed. 3, iv. p. 45. *Cenomyce furcata* var. *adpersa* Floerk. Deutschl. Lich. x. p. 14

(1827). *C. scabriuscula* Del. in Dub. Bot. Gall. ii. p. 623 (1830).

Exsicc. Johns. n. 50; Mudd Clad. n. 49 (dark-brown form).

In some respects this variety is a transition between *C. furcata* and *C. squamosa*; it is characterized by the podetia being generally scabrid and beset with minute squamules and by being frequently decorticate, recurved or of somewhat tangled growth. The branches vary from very slender to rather stoutish. The reaction for *C. scabriuscula* is given as K + yellowish; but there is frequently in *C. furcata* sp. & var. a slight yellowish reaction which quickly turns to fusciscent. (See Leight. in Ann. Mag. Nat. Hist. ser. 3, xviii. p. 413 (1866).)

Hab. On moorlands, mossy rocks and old turf-walls in maritime and upland districts.—*Distr.* Rather rare in the Channel Islands, England, Scotland and Ireland.—*B. M.* Noirmont, Jersey; near Penzance, Cornwall; Shanklin Downs, I. of Wight; Bolt Head, Torquay, Becky Falls and Dartmoor, Devon; Hassocks Gate and Haymond's Heath, Sussex; Epping Forest, Essex; Charnwood Forest, Leicestershire; Ennerdale Lake, Cumberland; Farndale Moor, Cleveland, Yorkshire; New Galloway, Kirkcudbrightshire; Barcaldine, Argyll; Rannoch, Perthshire; near Kincardine; Glen Muick, Braemar and Countesswells, Aberdeenshire; Loch Linnhe, Invernesshire; Kylemore, Galway.

27. *C. rangiformis* Hoffm. Deutschl. Fl. ii. p. 114 (1795).—Primary thallus of rather small crenate squamules, soon evanescent; podetia slender, erect, much branched, repeatedly dichotomous, rarely sorediose, smooth, but the cortex areolate, greyish or sometimes brownish-white, the branches intricate, spreading, furcate and gradually attenuate at the apices which are often reddish-brown, closed or sometimes perforate at the axils; ascyphous (K + yellow, CaCl—). Apothecia small, brownish; spores 10–13 μ long, 3–4 μ thick.—*C. pungens* Floerk. Clad. Comm. p. 156 (1828); S. F. Gray Nat. Arr. i. p. 415; Hook. in Sm. Engl. Fl. v. p. 235; Leight. Lich. Fl. p. 56; ed. 3, p. 53; Cromb. in Grevillea xi. p. 113 & Monogr. i. p. 153 (incl. f. *nivea*); f. *nivea* Koerb. Syst. Lich. Germ. p. 35 (1855); Cromb. in Grevillea xv. p. 45. *C. furcata* var. *pungens* Mudd Man. p. 58 & Brit. Clad. p. 23 (incl. f. *tenella*); Cromb. Lich. Brit. p. 20. *Lichenoides tubulosum ramosissimum, fruticuli specie candicans, corniculis rufescentibus* Dill. in Ray Syn. ed. 3, p. 67, n. 15 (1724). *Coralloides fruticuli specie candicans, corniculis rufescentibus* Dill. Hist. Musc. p. 110, t. 16, fig. 30 A (1741). *Lichen pungens* Ach. Lich. Succ. Prodr. p. 202 (1798); Engl. Fl. t. 2444. *L. rangiferinus* var. β Huds. Fl. Angl. p. 458 (1762); Lightf. Fl. Scot. ii. p. 879 (fide Cromb. Monogr. i. p. 153); var. 2, With. Arr. ed. 3, iv. p. 42. *Bzomyces pungens* var. *niveus* Ach. Meth. p. 354 (1803).

Exsicc. Cromb. n. 123; Leight. n. 16; Mudd n. 16 pro parte & Clad. nos. 54, 55.

Easily confused with *C. furcata* on the one hand and *C. sylvatica* on the other. From the former it differs in the habit of growth, due

to the dichotomous branching forming densely congested somewhat thyrsoid tufts, in the lighter colour and in the distinctly yellow reaction with potash. From *C. sylvatica* it is distinguished by the erect tips and other characters. The apothecia are generally rare, though sometimes abundant and conglomerate.

Hab. On the ground among mosses and short grass in maritime and inland situations.—*Distr.* Common in most parts of the British Isles.—*B. M.* Island of Sark; near Penzance and St. Mervyn, Cornwall; Dartmoor, Devonshire; Isle of Wight; Shoreham, Sussex; Lydd, Kent; Esher, Surrey; Epping Forest, Essex; Bretch, Oxfordshire; Charnwood Forest, Leicestershire; Aberdovey, Merioneth; Haughmond Hill, Shropshire; Delamere Forest, Cheshire; Dovedale and Buxton, Derbyshire; Ingleby Park, Ayton and Cliffrig, Cleveland, Yorkshire; Windermere, Westmoreland, St. Bees, Cumberland; Barcaldine, Argyll; Countesswells Wood, Aberdeenshire; Warrenscourt and Macroon, Cork; Clare Island and Achill Island, Mayo.

Var. *foliosa* Wain. Mon. Clad. Univ. i. p. 366 (1887).—Podetia erect or decumbent, slender, more or less sprinkled with squamules, rarely fertile, otherwise similar to the species.—*C. furcata* var. *pungens* f. *foliosa* Mudd Brit. Clad. p. 54. *C. pungens* f. *foliosa* Leight. Fl. p. 56; ed. 3, p. 54 pro parte; Cromb. in Grevillea xi. p. 113 & Monogr. i. p. 154. *Corallina fusca foliosa* Buddle Hort. Sicc. ii. fol. 1, n. 6, in Herb. Sloane. *Coralloides fruticuli specie candicans, corniculis rufescentibus* Dill. Hist. Musc. p. 110, t. 16, fig. 30, c, d (1741). *Cenomyce rangiformis* var. *foliosa* Floerk. Deutsch. Lich. viii. p. 15 (1821).
Essicc. Johns. n. 13; Leight. n. 374; Mudd Clad. n. 56.

Hab. On the ground in upland situations.—*Distr.* Somewhat local in England and Ireland.—*B. M.* Basingstoke, Hants; Shiere, Surrey; Lydd, Kent; Hampstead, London (18th century); near Cheltenham, Gloucestershire; Cumberland; Tuam, Galway.

Var. *muricata* Arn. in Flora lxvii. p. 88 (1884).—Podetia somewhat stout, the cortex often uneven from the turgid areolæ, obtuse, or shortly furcate at the apices, rather sparingly squamulose towards the base. —*C. pungens* subsp. *muricata* Cromb. in Grevillea xi. p. 113 (1883) & Monogr. i. p. 154. *Lichenoides tubulosum magis ramosum maxime difforme* Dill. in Ray Syn. ed. 3, p. 68, n. 23 (1724) (spec. in Buddle Hort. Sicc. ii. fol. 2, n. 3, in Herb. Sloane). *Coralloides crassius subincanum, calicibus dentatus* Dill. Hist. Musc. p. 95, t. 15, fig. 18, b (1741) (deformed state). *Cenomyce muricata* Del. in Dub. Bot. Gall. ii. p. 622 (1830).
Essicc. Leight. n. 369.

A robust variety, less branched than the species and occasionally difform. Not to be confused with *C. furcata* var. *pinnata*, from which it may be distinguished by the reaction (K + yellow).

Hab. On the ground in upland situations.—*Distr.* Rather rare in S. Central and W. England.—*B. M.* Basingstoke, Hants; Downs and near Amberley, Sussex; Shiere, Surrey; Tetbury, Gloucestershire; Bathampton Downs, Somerset; Charnwood Forest, Leicestershire.

2. *Podetia* mostly decorticate, usually scyphiferous and generally pervious.

Basal squamules small, often evanescent.

28. *C. cenotea* Schær. Lich. Helv. Spic. p. 35 (1823).—Primary thallus of a few usually small lobate-crenate squamules, or evanescent; podetia of medium height, subcylindrical or irregularly turgescens, scyphiferous, repeatedly proliferous, the axils and scyphi pervious, whitish or greyish pulverulent throughout or partly corticate, and sometimes minutely squamulose at the base (K—, CaCl—). Apothecia small, brown or pale; spores 2–8 μ long, 2.5–3.5 μ thick.—Cromb. in Grevillea xi. p. 113 & Monogr. i. p. 155. *Bæomyces cenoteus* Ach. Meth. Lich. p. 347 (1805).

The pulverulent podetia recall *C. fimbriata*, but it differs from that species in the pervious scyphi and axils; the repeated rather dainty proliferations of the scyphus give a branched appearance.

Hab. On putrid stumps of trees and on the ground in wooded upland situations.—*Distr.* Local and scarce in N. England and among the Grampians, Scotland, in the old Caledonian Forest.—*B. M.* High Force, Yorkshire; Black Wood of Rannoch, Perthshire; Ballochbuie Forest, Ballater, Aberdeenshire.

Var. *glauca* Leight. in Ann. Mag. Nat. Hist. ser. 3, xviii. p. 414 (1866).—Podetia rather long, somewhat glaucous, rarely forming scyphi, the tips of the branches prolonged in subulate proliferations.—Cromb. in Grevillea xv. p. 45 & Monogr. i. p. 155. *C. glauca* Floerk. Clad. Comm. p. 140 (1828).

Wainio has included as a growth form *C. pyxidata* var. *fastigiata* Floerke (tom. cit. p. 62), a form recorded by Mudd under *C. pyxidata* var. *cornuta* f. *fastigiata* (Brit. Clad. p. 13 (1865)) as "podetia elongated, simple, the apex branched; branches short, attenuated, fastigate," and he suggests that here also should be placed *C. squamosa* var. *polychonia* f. *ferulacea* Floerk. (tom. cit. p. 137), quoted by Mudd as *C. squamosa* var. *ventricosa*, f. *ferulacea* (tom. cit. p. 20).

Hab. On decaying stumps among mosses in mountainous districts.—*Distr.* Rare in N. Wales and (fide Crombie) in S.W. Highlands of Scotland.—*B. M.* Rhewgreidden, Merioneth.

29. *C. squamosa* Hoffm. Deutschl. Fl. ii. p. 125 (1795).—Primary thallus of short crenate somewhat wedge-shaped squamules, greyish-white or pale above, white beneath, sometimes evanescent; podetia subcylindrical, usually scyphiferous, branched or proliferous, the scyphi and axils pervious, granulose and decorticate or unequally warted, areolate-corticate, more or less covered with small squamules, the apices sometimes furcate or cristate when fertile (K—, CaCl—). Apothecia small, pale- or reddish-brown; spores 8–14 μ long, 3–4 μ thick.—Mudd Man. p. 56 (incl. var. *ventricosa* and f. *attenuata*) & Brit. Clad. p. 19 (incl.

var. *ventricosa* and ff. *asperella*, *ferulacea?* and *polychonia*); Cromb. Lich. Brit. p. 20 (excl. subsp. *cæspitica*) & Monogr. i. p. 156 (incl. f. *ventricosa*); Leight. Lich. Fl. p. 66; ed. 3, p. 61 pro parte; var. *asperella* Floerk. Clad. Comm. p. 132 (1828); var. *attenuata* Fr. Lich. Eur. p. 231 (1831) (non Hoffm.); var. *ventricosa* Fr. l. c. (non Huds.). *C. speciosa* Cromb. in Grevillea xi. p. 114 (1883). *C. asperella* Cromb. Monogr. i. p. 159 (1894) (incl. f. *polychonia*). *Bæomyces sparassus* (incl. var. *ventricosus*) Ach. Meth. Lich. p. 347 (1803). *Lichen sparassus* Sm. Engl. Bot. t. 2362 (1811). *Cenomyce sparassa* Ach. Syn. Lich. p. 273 (1814); Hook. Fl. Scot. ii. p. 64; Tayl. in Mackay Fl. Hib. ii. p. 80. *Schasmaria sparassa* S. F. Gray Nat. Arr. i. p. 416 (1821).

Æsicc. Cromb. n. 124; Johns. nos. 176 and 293; Larb. Caesar. n. 10 pro parte; Mudd n. 13 & Clad. nos. 31, 40 (pro parte), 41, 42.

Distinguished chiefly by the generally decorticate squamulose podetia, which vary in size from 1 to about 5 cm. in height. Though usually naked between the squamules, they are sometimes covered with a warted brown cortex spotted with white, like injured places. The podetia are sometimes stout and swollen, especially at the axils (f. *ventricosa*), or they may be narrow and almost without squamules (ff. *attenuata*, *asperella* and *polychonia*). The scyphi, when formed, are pervious and ragged-looking with the unequal proliferations. Stirton records a specimen, evidently of *C. squamosa*, as *C. confertula* n. sp. in which he obtained a greenish-blue and ultimately a yellowish reaction with CaCl (Scott. Nat. n. s. iii. p. 308 (1888)).

Hab. Among mosses on the ground and on rocks in wooded, maritime and inland regions.—*Distr.* General and usually common where it occurs, chiefly in the hilly regions of the British Isles.—*B. M.* Noirmont Bay, Jersey; St. Breock, Cornwall; Bovey Tracey and near Becky Falls, Devon; Eridge, Sussex; Epping Forest, Essex; Charnwood Forest, Leicestershire; Dolgelly and Aberdovey, Merioneth; Conway Falls, Carnarvonshire; Kildale Moor, Baysdale, Stogdale, Westerdale. Broughton, Guisboro' and Ingleby Park, Cleveland, Yorkshire; Windermere, Westmoreland; Juniper Fell, Teesdale, Durham; West Allen Carrs, Northumberland; New Galloway, Kirkcudbrightshire; Barcaldine, Argyll; Bracklin Bridge, Glen Lochay, Rannoch and Loch Tay, Perthshire; Durriss, Kincardineshire; Craig Cluny, Braemar, Aberdeenshire; Rothiemurehus Woods and Loch Linnhe, Invernessshire; Doneraile Mts., Cork; Killarney, Kerry; Kylemore, Galway; Achill Island, Mayo; Black Mountain, near Belfast, Antrim.

Subsp. *denticollis* Hoffm. Deutsehl. Fl. ii. p. 125 (1795).—Squamules of primary thallus and of podetia small or rather large and deeply laciniate-crenate or hooded, the podetia usually rather short, scyphiferous, mostly decorticate.—*C. squamosa* var. *asperella* f. *multibrachiata* Floerk. Clad. Comm. p. 133 (1828); var. *microphylla* Schaer. Enum. p. 198 (1850) (incl. ff. *simpliciuscula* and *prolifera*); Mudd Man. p. 56; var. *ventricosa* ff. *multibrachiata* and *cymosa* Mudd Brit. Clad. p. 20 (1865); form *cucullata* Cromb. in Journ. Bot. xiv. p. 360 (1876) & Monogr. i. p. 157. *C. ventricosa* var. *microphylla* Schaer. Lich. Helv. Spic. p. 316 (1833).

C. crispata f. *ventricosa* Cromb. in Journ. Linn. Soc. xvii. p. 560 (1880). *Coralloides scyphiforme, foliis aleicorniformibus cartilagineosis* Dill. Hist. Musc. p. 87, t. 14, fig. 12, D (1741). *Cor. pulchrum, geniculis acetabuliformibus crispifoliosis* Dill. tom. cit. p. 100, t. 16, fig. 23. *Cenomyce cucullata* Del. in Dub. Bot. Gall. ii. p. 626 (1830). *C. crispata* var. *ventricosa* Del. in Dub. Bot. Gall. p. 627 (1830) fide Wain. Mon. Clad. Univ. i. p. 439 (1887).

Exsicc. Mudd n. 14 & Clad. nos. 30, 33 and 40 pro parte.

Perhaps more of a variety or form than a subspecies. It is frequently much branched above, but distinguished chiefly by the deeply and elegantly divided squamules, which tend to become hooded at the apices. Wainio has associated with the above *C. Lamarkii* f. *Isigny* Nyl., included here under *C. pityrea* f. *hololepis*.

Hab. On mossy boulders and decaying trunks of trees in wooded districts.—*Distr.* Rare in W. and N. England, N. Wales, S. and W. Scotland and N.W. Ireland.—*B. M.* Withiel, Cornwall; Balcombe, Sussex; Aberdovey and Dolgelly, Merioneth; Ingleby and near Battersby, Cleveland, Yorkshire; Tongland, Kirkcudbrightshire; Appin and Barcaldine, Argyll; Loch Linnhe, Invernessshire; Leenane, near Kylemore, Galway.

30. *C. subsquamosa* Nyl. ex Cromb. in Journ. Linn. Soc. xvii. p. 560 (1880) & Monogr. i. p. 158.—Primary thallus of small crenate squamules, pale or greyish-green above, white below; podetia usually rather short, branched, with or without scyphi, with axils and scyphi pervious, squamulose below, almost decorticate, granular upwards, furcate or radiate-cristate, the branches subcorymbose at the apices (K + yellow, then crimson, CaCl -). Apothecia small, solitary or aggregate, reddish-brown; spores oblong or fusiform-oblong, 8–12 μ long, 2.5–3 μ thick.—*C. delicata* var. *subsquamosa* Nyl. ex Leight. in Ann. Mag. Nat. Hist. ser. 3, xviii. p. 407 (1866); Cromb. Lich. Brit. p. 20; Leight. Lich. Fl. p. 59; ed. 3, p. 55.

Exsicc. Bohl. n. 16; Johns. n. 177; Larb. Cæsar. n. 10 pro parte; Leight. n. 405; Mudd n. 14.

Differs from the preceding chiefly in the reaction with potash, a swift vivid yellow changing after an interval to a dullish crimson. It is like *C. squamosa*, a very variable plant, no two specimens being exactly alike. A number of forms characterized by some peculiarity of growth have been published by J. Stirton (Scott. Nat. ix. p. 119 (1885)). These are ff. *delatata*, *sublactea*, *deflexa* and *compressula*, which I have not seen, and ff. *furfurosa*, *phyclina*, *cristata* and *spilota*, specimens of which have been loaned by J. M. Andrew.

Hab. On decaying stumps of trees and on mossy soil in maritime and inland districts.—*Distr.* Widely distributed, though not common, throughout the British Isles.—*B. M.* Noirmont Bay, Jersey; near Penzance, Cornwall; Bolt Head, Devon; Shanklin, I. of Wight; Eridge rocks, Sussex; Ightham Common, Kent; Hay Coppice, Herefordshire; Barmouth, Merioneth; Kildale and Ingleby, Cleveland, Yorkshire; Alston, Cumberland; Bellingham Woods, Northumber-

land; New Galloway, Kirkcudbrightshire; Appin, Argyll; Rannoch, Perthshire; Sidlaw Hills, Forfarshire; Loch Linnhe, Invernessshire; Kelly's Glen, near Dublin; Killarney, Kerry; Lecnane, Connemara, Galway.

Form *tumida* Cromb. in *Grevillea* xi. p. 114 (1883) & *Monogr.* i. p. 159.—*Podetia* turgid ventricose, the axils and apices dilated, infundibuliform.

Hab. On moist shady rocks among mosses in upland tracts.—*Distr.* Local and scarce in S. England, N. Wales, S. Scotland and in the S.W. Highlands.—*B. M.* High Rocks, near Tunbridge Wells, Kent; Dolgelly, Merioneth; New Galloway, Kirkcudbrightshire; Barcaldine, Argyll.

Basal squamules small, persistent crowded.

31. *C. cespiticia* Floerk. *Clad. Comm.* p. 8 (1828).—Primary thallus persistent, the squamules mostly crowded, rather small, irregular, somewhat laciniately divided or crenate, sometimes ascending, pale-green above, white beneath; podetia very short, naked, cylindrical, aseptuous, simple or divided (K —, CaCl —). Apothecia conglomerate, sometimes apparently sessile on the leaflets, flesh-coloured or reddish; spores oblong, 8–16 μ long, 3–4 μ thick.—Cromb. in *Grevillea* xi. p. 14 & *Monogr.* i. p. 159. *C. squamosa* var. *caespititia* Nyl. in *Act. Soc. Linn. Bord. sér.* 3, i. p. 284 (1856); *Mudd Man.* p. 57 & *Brit. Clad.* p. 21; subsp. *caespiticia* Nyl. *Syn. Lich.* p. 210 (1860); *Cromb. Lich. Brit.* p. 20. *C. pyxidata* var. *caespiticia* Leight. *Lich. Fl.* p. 60; ed. 3, p. 57. *Bæomyces cespiticius* Pers. in *Ust. Ann. Bot.* vii. p. 155 (1794). *Lichen cespiticius* Sm. *Engl. Bot.* t. 1796 (1807). *Scyphophora cespiticia* S. F. Gray, *Nat. Arr.* i. p. 417 (1821); *Hook.* in *Sm. Engl. Fl.* v. p. 236.

Exsicc. Bohl. n. 72; *Larb. Cæsar.* n. 9; *Leight.* n. 368; *Mudd Clad.* n. 44.

Approaches *C. squamosa* in the decorticate character of the very short podetium. No scyphi are formed, and it is either pervious or closed at the apex and surmounted by the conglomerate apothecia. At times these are almost sessile on the basal squamules, which gives it the appearance of a *Bæomyces*.

Hab. Among mosses on the trunks of trees, on ricks or thatched roofs, or on the ground in maritime and inland tracts.—*Distr.* General and common throughout Great Britain, rare in Ireland and the Channel Islands.—*B. M.* Beleroute Bay, Jersey; Guernsey; St. Breward, Cornwall; on the Dart and near Becky Falls, Devon; New Forest, Hants; St. Leonard's Forest, Eridge and Tilgate, Sussex; Oaksey, Wilts; Barmouth, Merioneth; Ludlow and Stableford, Shropshire; Malvern, Worcestershire; near Matlock, Derbyshire; Beaumaris, Anglesea; Cliffrigg, Cleveland, Yorkshire; New Galloway, Kirkcudbrightshire; Appin, Argyll; Rannoch, Perthshire; Countesswells Wood, near Aberdeen; Loch Linnhe, Invernessshire; Dunscombe Wood, Cork; Killarney, Kerry.

32. *C. parasitica* Hoffm. Deutchl. Fl. ii. p. 127 (1795).—Primary thallus of small narrowly erose-laciniate crowded squamules, sorediose at the margins and on the under surface, or becoming almost entirely a mass of soredia, greenish-white or brownish-grey above; podetia short, slender, somewhat thickened upwards, simple or irregularly branched, and splitting or entire at axils and tips, ascyphous, non-corticate, furfuraceous, usually squamulose (K + yellow, CaCl -). Apothecia small, usually conglomerate, brown or pale; spores oblong-fusiform, 10–15 μ long, 3·5–4 μ thick.—*C. delicata* Floerk. Clad. Comm. p. 7 (1828); Cromb. Lich. Brit. p. 20 (excl. var.) & Monogr. i. p. 160; Leight. Lich. Fl. p. 58; ed. 3, p. 55 (excl. var.). *C. squamosa* var. *delicata* Fr. Lich. Eur. p. 231 (1831); Mudd Man. p. 56 & Brit. Clad. p. 21. *Lichen parasiticus* Hoffm. Enum. p. 39, t. 8, fig. 4 (1784). *L. delicatus* Ehrh. Crypt. Exs. n. 247 (1793); Ach. Lich. Suec. Prodr. p. 199 (1798); Engl. Bot. t. 2052. *Cenomyce delicata* Ach. Syn. Lich. p. 274 (1814); Tayl. in Mackay Fl. Hib. ii. p. 80. *Helopodium delicatum* S. F. Gray Nat. Arr. i. p. 416 (1821). *Scyphophorus parasiticus* Hook. in Sm. Engl. Fl. v. p. 237 (1833).

Essicc. Leight. n. 382; Mudd n. 15 & Clad. n. 43.

Agrees with *C. subsquamosa* in the chemical reaction with potash, but is distinguished by the crowded sorediose basal squamules. In favourable situations it spreads extensively, and is generally fertile.

Hab. On rotten rails and stumps of trees, rarely on turfy soil in inland districts.—*Distr.* Somewhat scarce throughout England, rare in S. Scotland and S. and W. Highlands.—*B. M.* Lyndhurst and Brockenhurst, New Forest, Hants; St. Leonard's Forest, Sussex; Chelsfield, Kent; Thorndon Hall, Essex; Bagot's Park, Staffordshire; Aymestry, Herefordshire; Crown East Wood, near Worcester; Llandrindod, Radnorshire; Easby Wood and Kildale, Cleveland, Yorkshire; Wastdale, Cumberland; New Galloway, Kirkcudbrightshire; Barcaldine, Argyll; Craig Calliach, Perthshire.

B. COCCIFERÆ. Apothecia red-coloured.

1. *Podetia scyphiferous*.

Basal squamules large.

33. *C. luteoalba* Wils. & Wheld. in Trans. Liverp. Bot. Soc. i. p. 7 (1909).—Primary squamules rather large (up to 1 cm. long), irregularly crenate, incurved when dry, yellowish-green, becoming darker above, pale sulphureous and pulverulent beneath (Kf + yellow, CaCl -). Podetia rarely developed, very short, 3–5 mm. high, cylindrical, rising from the surface of the leaflets, scyphiferous, the scyphi narrow. Apothecia scarlet, minute, discrete on the margins.—*Journ. Bot.* xlvii. p. 324 (1909); A. L. Sm. Monogr. ii. p. 351.

Distinguished by the yellow colour of the under side of the basal squamules which takes on a deep orange tint on the application of potash if followed by calcium chloride.

Hab. On old mosses in high altitudes.—*B. M.* Graygarth Fell, Lancashire (without podetia).

34. *C. digitata* Hoffm. *Deutschl. Fl.* ii. p. 124 (1795)? Schær. p. 22 (1823).—Primary squamules rather large, roundly lobed or crenate, pale-green above, beneath usually whitish and pulverulent; podetia subcylindrical, rarely branched, unequally corticate at the base, white or yellow, pulverulent above, scyphiferous, the scyphi rather narrow with the margin incurved, irregularly divided and proliferous (K + yellow, CaCl -). Apothecia small and scattered or confluent; spores 9–11 μ long, 3.5–4 μ thick.—*Cromb. Lich. Brit.* p. 21 & *Monogr.* i. p. 166 (incl. f. *brachytes*); *Leight. Lich. Fl.* p. 68; ed. 3, p. 63 (excl. var. *macilenta*); f. *brachytes* *Nyl. Lich. Scand.* p. 61 (1861). *C. deformis* f. *digitato-radiata* Schær. *Enum.* p. 188 (1850). *C. coccifera* vars. *digitata* and *digitato-radiata* *Mudd Man.* p. 61 (1861) & *Brit. Clad.* p. 31. *Coralloides crassius subincanum, calicibus dentatis* *Dill. Hist. Musc.* p. 95, t. 15, fig. 18 A (not typical). *Lichen digitatus* *L. Sp. Pl.* p. 1152 (1753). *L. difformis* *Huds. Fl. Angl.* p. 458 (1762). *L. deformis* *Lightf. Fl. Scot.* ii. p. 876 (non L.); *With. Arr. ed.* 3, iv. p. 38. *Bæomyces bacillaris* f. *brachytes* *Ach. Meth. Lich.* p. 329 (1803). *Scyphophora digitata* *S. F. Gray Nat. Arr.* i. p. 422 (1821).

Exsicc. *Johns.* nos. 215, 216 and 295; *Mudd Clad.* n. 76 (young stage).

Somewhat like *C. deformis*, but sufficiently distinguished by the digitate branching, the more slender podetia (except in f. *monstrosa*), the incurved scyphi, and the pronounced yellow reaction with potash. In f. *brachytes* the podetia are slender with the basal squamules well developed.

Hab. On decaying trunks of trees among mosses in somewhat upland districts.—*Distr.* Local and rather scarce in the more hilly regions of the British Isles.—*B. M. S.* Devon; Rhewgreidden and Barmouth, Merioneth; Malvern, Worcestershire; Kildale Moor, Ingleby Park and Baysdale, Cleveland, Yorkshire; Windermere, Westmoreland; Wastdale and Ashgill, Cumberland; Fenton Hill, Northumberland; Barcaldine, Argyll; Craig Calliach, Perthshire; Mar Forest and Craig Cluny, Braemar, Aberdeenshire; Rothiemurchus Woods, Invernessshire, Achill Island, Mayo.

Form *monstrosa* *Nyl. Lich. Scand.* p. 61 (1861).—Podetia stout, irregularly ventricose, granular-pulverulent, sometimes squamulose, the scyphi difform and divided or proliferous, narrower than the podetium.—*Cromb.* in *Grevillea* xi. p. 114 (1883) & *Monogr.* i. p. 167 (incl. f. *cerucha*); f. *cerucha* *Nyl. l. c.* *C. coccifera* var. *macilenta* f. *monstrosa* *Mudd Brit. Clad.* p. 33 (1865). *Cenomyce digitata* vars. *cerucha* and *monstrosa* *Ach. Syn.*

p. 268 (1814). *Scyphophora digitata* var. *monstrosa* S. F. Gray Nat. Arr. i. p. 422 (1821).

Exsicc. Johns. n. 296; Mudd Clad. n. 69.

A turgid form of the species, rarely found fertile.

Hab. On decaying trunks of trees in wooded mountainous districts.—*Distr.* Local and scarce in N. England, S. Scotland and the Grampians, Scotland.—*B. M.* Battersby, Cleveland, Yorkshire; Windermere, Westmoreland; Ashgill Woods, Cumberland; New Galloway, Kirkcudbrightshire; Ben Lawers, Perthshire; Craig Coinnoch and Craig Cluny, Braemar, Aberdeenshire.

Basal squamules moderate in size.

35. *C. deformis* Hoffm. Deutschl. Fl. ii. p. 120 (1795).—Squamules of primary thallus moderate in size or rather large, crenate or lobate, ascending or adpressed, pale-green above, whitish beneath; podetia elongate (up to about 3 inches long) turgid, simple, without squamules, or rarely with minute squamules towards the base, partly corticate or sulphur-yellow-pulverulent, opening to a thin-walled scyphus which is regular or difform, crenate-dentate at the margins or irregularly proliferous (Kf + yellowish, K(CaCl) + yellow). Apothecia separate or aggregate; spores 8–10 μ long, 3–4 μ thick.—Cromb. Lich. Brit. p. 21 & Monogr. i. p. 165 (incl. ff. *gonecha* and *pulvinata*); Leight. Lich. Fl. p. 68; ed. 3, p. 63; f. *gonecha* Nyl. Syn. Lich. i. p. 222 (1860); Cromb. in Grevillea xi. p. 114; f. *pulvinata* Nyl. Lich. Scand. p. 60 (1861); Cromb. in Grevillea xv. p. 46. *C. coccifera* var. *deformis* Schær. Lich. Helv. Spic. p. 283 (1833); Mudd Man. p. 61 (incl. ff. *tubæformis* and *subulata*) & Brit. Clad. p. 30 (excl. f. *pleurota*). *C. deformis* f. *subulata* Schær. Enum. p. 188 (1850). *C. crenulata* var. *tubæformis* Koerb. Syn. Lich. Germ. p. 30 (1855) (fide Mudd). *Lichen deformis* L. Sp. Pl. p. 1152 (1753) pro parte; Engl. Bot. t. 1394 (non Hud.). *Cenomyce pulvinata* Ach. Lich. Univ. p. 544 (1810). *C. deformis* Ach. Syn. Lich. p. 268 (1814); Hook. Fl. Scot. ii. p. 63. *Scyphophora deformis* S. F. Gray Nat. Arr. i. p. 422 (1821); Hook. in Sm. Engl. Bot. v. p. 240.

Exsicc. Bohl. n. 39; Croall n. 200; Johns. nos. 14 and 294; Leight. n. 275; Mudd n. 25 and Clad. n. 68.

Easily distinguished by the rather large, yellow-coloured podetia; sometimes they are bent at the tips, more or less fissured and partly corticate. In f. *gonecha* the scyphi are somewhat more irregular, and in f. *pulvinata* the squamules and podetia are crowded together. The apothecia are rare in British specimens.

Hab. On the ground among heaths in wooded upland districts.—*Distr.* Not very general nor common in W. and N. England, more frequent in the Scottish Highlands, not seen from Ireland.—*B. M.* Hay Coppice, Herefordshire; Guisboro' Moor and Lonsdale, Cleveland, Yorkshire; Windermere, Westmoreland; Alston, Cumberland;

Egglestone, Durham; Appin, Argyll; Craig Calliach, Rannoch and Craig-y-Barns, Dunkeld, Perthshire; Ballochbuie Forest; Linn of Dee, Ben-naboord and Loch Phadrich, Braemar, Aberdeenshire; Rothiemurchus Woods and Ben Ferrag, near Loch Ericht, Invernessshire; near Forres, Elginshire.

36. *C. coccifera* Willd. Fl. Berol. p. 361 (1787).—Primary thallus of medium-sized or rather large firm squamules, lobate or deeply cut, greyish-green; podetia rather short, rarely divided, coarsely granular, the granules dispersed and sometimes sorediose or united into a verrucose cortex, occasionally squamulose opening to a wide often irregular scyphus which is sometimes proliferous from the margin, rarely from the centre (Kf + yellow or —, K(CaCl) + yellow). Apothecia pedicellate or usually sessile and often confluent; spores oblong or oblong-ellipsoid, 9–11 μ long, 3–4 μ thick (Kf + yellow, K(CaCl) + yellow).—Mudd Man. p. 60, t. 1, fig. 11 (incl. var. *cornucopioides* and f. *extensa*, excl. other vars. and forms) and Brit. Clad. p. 28 (incl. ff. *cornucopioides*, *extensa*, *innovata*, *asotea* and *phyllocoma*) (excl. other vars. and forms); Cromb. in Grevillea xi. p. 116 & Monogr. i. p. 161 (incl. ff. *asotea* and *cornucopioides*); f. *innovata* and var. *phyllocoma* Floerk. Clad. Comm. pp. 93, 94 (1828); f. *cornucopioides* Br. & Rostr. Lich. Dan. p. 42 (1869). *C. cornucopioides* Fr. Lich. Eur. p. 236 (1831); Cromb. Lich. Brit. p. 21; Leight. Lich. Fl. p. 66; ed. 3, p. 62 (incl. ff. *extensa* and *phyllophora*). *Lichenoides tubulosum pyxidatum, tuberculis amœne coccineis* Dill. in Ray Syn. ed. 3, n. 35, p. 69 (1724). *Coralloides scyphiforme, tuberculis coccineis* Dill. Hist. Musc. p. 82, t. 14, fig. 7 A–M (1741). *Lichen cocciferus* L. Sp. Pl. p. 1151 (1753) pro parte; Huds. Fl. Angl. ed. 2, p. 553; Lightf. Fl. Scot. ii. p. 866; With. Arr. ed. 3, iv. p. 39; Engl. Bot. t. 2051. *L. cornucopioides* Huds. Fl. Angl. p. 456 (1762) (non Linn. fide Wainio Mon. Clad. i. p. 154) pro parte; Lightf. Fl. Scot. ii. p. 868 pro parte; With. Arr. ed. 3, iv. p. 40 pro parte. *Bæomyces cocciferus* vars. *extensa* and *asotea* Ach. Meth. p. 332 (1803). *Cenomyce coccifera* Ach. Lich. Univ. p. 537 (1810); Hook. Fl. Scot. ii. p. 63 (incl. var. *cornucopioides*); Tayl. in Mackay Fl. Hib. ii. p. 81 pro parte. *Scyphophora coccifera* S. F. Gray Nat. Arr. i. p. 423 (1821) & *S. asotea* (incl. f. *cornucopioides*) l. c. *Scyphophorus cocciferus* Hook. in Sm. Engl. Fl. v. p. 240 (1833) pro parte.

Exsicc. Baxt. n. 69; Bohl. n. 40; Johns. nos. 51, 178, 179 and 180; Leight. nos. 375 and 404; Mudd n. 23 & Clad. nos. 65, 66 and 67 pro parte.

A variable species with podetia somewhat like those of *C. pyxidata*. The more squamulose podetia have been placed in f. *cornucopioides* by some lichenologists. If the squamules are much developed on the scyphus it is f. *phyllocoma*; when proliferous from the centre of the cup it is f. *asotea*; in f. *extensa* the podetia are elongate; none of these forms seem to be constant, and the characters pass from one to the other.

Hab. On the ground on moorlands and on turf walls from maritime to subalpine districts.—*Distr.* General and fairly common throughout the British Isles.—*B. M.* Le Gouffre, Guernsey; St. Breward and near Wadebridge, Cornwall; Hay Tor and Goodamoor, Devon; Shanklin, Isle of Wight; Epping Forest, Essex; Shotover Hill, Berks; Charnwood Forest, Leicestershire; Wrekin Hill and Stiperstones, Shropshire; Worcester Beacon; Gower, Pembrokeshire; Cwm Bychan, Dolgelly and Aberdovey, Merioneth; Capel Curig, Carnarvonshire; Towthorpe Moor, Battersby Moor, Ayton Moor, Baysdale and Kildale, Cleveland, Yorkshire; Alston, Cumberland; Teesdale, Durham; The Cheviots, Northumberland; New Galloway, Kirkcudbrightshire; Ben Lomond, Dumbartonshire; Appin, Argyll; Glen Lochay, near Tummel Bridge, and Rannoch Moor, Perthshire; Clova Mts. and Sidlaw Hills, Forfarshire; Countesswells and Scotstown Moor, near Aberdeen, Glen Clunie, Glen Callater and Ben-naboord, Braemar, Aberdeenshire; Ben Nevis, Invernessshire; Applecross, Rossshire; Lairg, Sutherlandshire; Doneraile Mts., Cork; Side Devis, near Belfast, Antrim; Kylesmore, Galway; Achill, Mayo.

Var. incrassata Laur. in Sturm Deutschl. Fl. ii. Heft. 28–29, p. 83 (1835).—Primary thallus minutely squamulose; podetia very short, verrucose-granulate, somewhat clavate, simple or sometimes divided above; scyphi absent or rarely developed. Apothecia small, crowded.—Cromb. in Grevillea xii. p. 92 (1884) & Monogr. i. p. 162. *C. incrassata* Floerk. Clad. Comm. p. 21 (1828). *C. coccifera* f. *epiphylla* Cromb. in Journ. Linn. Soc. xvii. p. 557 (1880). *C. macilentata* f. *deminuta* Cromb. in Grevillea xi. p. 115 (1883).

Included in *C. coccifera* on account of the granular podetia which very rarely become sorediose. The podetia are never more than 1.5 cm. in height, and the apothecia are numerous and confluent.

Hab. On peaty soil and decaying stumps of trees in mountainous districts.—*Distr.* Rare in S.W. and Central Highlands of Scotland.—*B. M.* Barcaldine, Argyll; Rannoch, Perthshire.

Subsp. pleurota Cromb. in Grevillea xi. p. 114 (1883) & Monogr. i. p. 163.—Podetia granular-sorediose or granular-corticate below and sorediose-pulverulent above, yellowish-white or pale-greenish; scyphi rather dilated, usually entire and rarely proliferous at the margins. Apothecia rare, solitary, subpedicellate.—*C. coccifera* var. *cornucopioides* f. *pleurota* Mudd Man. p. 60 (1861) & var. *deformis* f. *pleurota* Brit. Clad. p. 30 (1865). *C. cornucopioides* subsp. *pleurota* Cromb. Lich. Brit. p. 21 (1870); f. *pleurota* Leight. Lich. Fl. p. 67; ed. 3, p. 62. *Capitularia pleurota* Floerk. in Berl. Mag. ii. p. 218 (1808). *Scyphophora pleurota* S. F. Gray Nat. Arr. i. p. 424 (1821); Hook. in Sm. Engl. Fl. v. p. 240 (1833) pro parte.

Ezicc. Croall n. 600.

This subspecies bears somewhat the same relation to the species as does var. *chlorophæa* to *C. pyxidata*. From a study of the Lichen acids Zopf has considered it a distinct species more allied to *C. deformis* (Ber. Deutschl. Bot. Ges. xxvi. p. 109 (1908)).

Hab. On the ground among mosses in shady places.—*Distr.* Rather rare throughout the British Isles.—*B. M.* St. Breward and near Wade-bridge, Cornwall; Tilgate, Amberley and Ardingly, Sussex; Hindhead and Blackwater, Surrey; Ayton Moor, Cleveland, Yorkshire; Rannoch, Perthshire; Glen Muich, Aberdeenshire; Ben Ferrag by Loch Ericht, Invernesshire; Killarney, Kerry.

37. *C. bellidiflora* Schær. Lich. Helv. Spic. p. 21 (1823).—Primary thallus squamules moderate in size, rather firm, variously crenate or lacinate, often ascending, straw-coloured above, white beneath; podetia generally rather long, subsimple, cylindrical or somewhat ventricose, corticate and squamulose, scyphiferous or partly ascyphous, the scyphi narrow, sometimes imperfectly developed and divided, rarely proliferous (K —, CaCl —). Apothecia rather large, usually numerous and often conglomerate; spores 9–11 μ long, about 3.5 μ thick.—Cromb. Lich. Brit. p. 21 (incl. ff. *polycephala* and *gracilentia*) & Monogr. i. p. 163 (incl. f. *gracilentia*); Leight. Lich. Fl. p. 72; ed. 3, p. 65; ff. *ventricosa*, *polycephala* and *gracilentia* Floerk. Clad. Comm. pp. 97, 99 (1828); ff. *subuliformis* and *syncephala* Koerb. Syst. Lich. Germ. p. 29 (1855). *C. coccifera* var. *bellidiflora* Mudd Man. p. 60 (1861) & Brit. Clad. p. 29 (incl. ff. *subuliformis*, *gracilentia*, *ventricosa*, *syncephala* and *polycephala*). *C. vestita* Leight. in Ann. Mag. Nat. Hist. ser. 3, xix. p. 117 (1867) & Lich. Fl. p. 67; ed. 3, p. 62 pro parte. *Coralloides* *vix ramosum*, *scyphis obscuris* Dill. Hist. Musc. p. 90, t. 15, fig. 14 F (1740) & *Cor. scyphiforme*, *ossis femoris facie* tom. cit. p. 91, t. 15, fig. 15. *Lichen cornutus* var. Lightf. Fl. Scot. ii. p. 876 (1777). *L. bellidiflorus* Ach. Lich. Suec. Prodr. p. 194 (1798); Engl. Bot. t. 1894. *Cenomyce coccocephala* var. *vestita* pro parte and var. *gracilentia* Ach. Lich. Univ. pp. 541, 542 (1810). *C. bellidiflora* Ach. Syn. Lich. p. 270 (1814) (incl. vars. *ventricosa* and *polycephala*); Hook. Fl. Scot. ii. p. 64; Tayl. in Mackay Fl. Hib. ii. p. 82. *Scyphophora bellidiflora* S. F. Gray Nat. Arr. i. p. 424 (1821); Hook. in Sm. Engl. Fl. v. p. 240.

Æsicc. Croall. n. 601.

Essentially an upland lichen, it is one of the most beautiful species of Cladonia, with rather tall simple podetia and brilliantly coloured massive apothecia that generally close up the scyphus. It differs from the preceding in being corticate and more squamulose and in the narrower scyphi. The more slender forms have been designated as f. *gracilentia*.

Hab. On peaty soil chiefly in mountainous regions.—*Distr.* Rather scarce in the hilly districts of Great Britain and Ireland.—*B. M.* Hustyn Down, Cornwall; Diffwys, near Barmouth, Merioneth; Carnedd Dafydd, Carnarvonshire; Killhope Law and The Cheviots, Northumberland; Ben Cruachan, Argyll; Ben Lawers and Rannoch, Perthshire; near Loch Phadrich in Glen Callater, on Ben-naboord and on Cairngorm, Braemar, Aberdeenshire; Ben Nevis, Invernesshire; Croghaun Mt., Achill Island, Mayo.

Var. *Hookeri* Nyl. Syn. Lich. i. p. 221 (1860).—*Podetia* glabrous, unequally corticate, without squamules or only very few developed. Apothecia numerous, brightly coloured.—Cromb. in *Grevillea* xi. p. 114 & *Monogr.* i. p. 164. *C. Hookeri* Tuck. in *Proc. Amer. Acad.* i. p. 247 (1847).

Hab. On the ground in subalpine moorlands.—*Distr.* Very rare among the N. Graupians, Scotland.—*B. M.* Glen Candlic, Braemar, Aberdeenshire.

38. *C. flabelliformis* Wain. *Mon. Clad. Univ.* i. p. 113 (1887).—Primary squamules rather large or small, irregularly multifid and incised-crenate, pale-green or -olive above, white below or yellow towards the base; podetia of moderate length, somewhat widening upwards to the rather narrow scyphus, rarely ascyphous, often squamulose below, granular-pulverulent upwards, sometimes branched, the scyphus fringed by an irregular corona of proliferations of varying length (K + orange-yellow, CaCl -). Apothecia small, discrete, or conglomerate and blocking up the scyphi; spores oblong-fusiform, 9–11 μ long.—*C. polydactyla* Floerk. *Clad. Comm.* p. 108 (1828). *C. coccifera* var. *macilenta* f. *corymbiformis* Mudd *Man.* p. 62 (1861) & *Brit. Clad.* p. 32 (incl. ff. *tubæformis*, *corymbiformis* and f. *phyllophora*, p. 33). *C. digitata* var. *macilenta* f. *polydactyla* Leight. *Lich. Fl.* p. 70; ed. 3, p. 64 & f. *coronata*, p. 65. *C. macilenta* var. *coronata* Nyl. *Lich. Scand.* p. 62 (1861); Cromb. in *Grevillea* xv. p. 46 (1866) & *Monogr.* i. p. 169 (incl. f. *ventricosa*, excl. f. *carcata*). *Coralloides cornucopioides incanum*, *scyphis cristatis* Dill. *Hist. Musc.* p. 94, t. 15, fig. 17 A, B, C (1741). *Lichen digitatus* Huds. *Fl. Angl.* p. 457 (1762) (non Linn. fide Cromb. *Monogr.* i. p. 166); *Lightf. Fl. Scot.* ii. p. 874; *With. Arr. ed.* 3, iv. p. 39. *L. ventricosus* Huds. l. c.? *Lightf. tom. cit.* p. 875? *With. tom. cit.* p. 38? *L. pyxidatus* var. *digitatus* Huds. *Fl. Angl. ed.* 2, p. 554 (1778). *Capitularia flabelliformis* Floerk. in *Berl. Mag.* ii. p. 216 (1808) fide Wainio l. c. *Bæomyces digitatus* var. *coronatus* Ach. *Meth. Lich.* p. 333 (1803). *Cenomyce digitata* Hook. *Fl. Scot.* ii. p. 63 (1821) (non Ach.). *Scyphophorus digitatus* Hook. in *Sm. Engl. Fl.* v. p. 240 (1833) pro parte.

Exsicc. Bohl. nos. 7, 8; Johns. nos. 15, 299; Leight. nos. 274 pro parte, 297 in some specimens; Mudd nos. 27, 28 & *Clad.* nos. 72 pro parte, 76, 79.

Sometimes described as a variety of *C. macilenta*, with which it is closely connected, and with which it agrees in the white-pulverulent podetia and the reaction with potash; but distinguished by distinctly coronate scyphi. It is generally well-fruited. *Lichen ventricosus* doubtfully represents a form of this or of other species.

Hab. Among mosses on the ground, on boulders and about the roots of old trees.—*Distr.* General among the more hilly districts of the British Isles.—*B. M.* Near Bodmin, Cornwall; Ivy Bridge and near Totnes, Devon; New Forest, Hants; Epping Forest, Essex; Charnwood Forest, Leicestershire; Malvern, Worcestershire; Barmouth, Dolgelly and Aberdovey, Merioneth; Westerdale, Lonsdale,

Ingleby and Kildale, Cleveland, Yorkshire; Ashgill, Cumberland; Windermere, Westmoreland; Wark, Northumberland, New Galloway, Kirkeudbrightshire; Barcaldine, Argyll; Glen Lochay, Falls of Bruar and Loch Rannoch, Perthshire; Craig Cluny, Braemar, Aberdeenshire; Loch Linnhe and Rothiemurchus Woods, Invernessshire; Killarney, Kerry; Connemara, Galway; Slieve More Mt., Achill Island, Mayo; Devis Mt., Antrim.

Var. *polydactyla* Wain. tom. cit. p. 119.—Primary thallus persistent or evanescent; podetia repeatedly proliferous from the margins of the scyphi, the proliferations scyphiferous or more rarely cornute.—*C. coccifera* var. *macilenta* f. *polydactyla* Mudd Man. p. 62 (1861) & Brit. Clad. p. 32. *Cenomyce polydactyla* Floerk. Deutsch. Lich. x. p. 13 (1815).

Exsicc. Mudd n. 26 pro parte & Clad. nos. 75, 77, 78.

Differing from the species in the more elongate scyphiferous proliferations. Possibly only a growth form, as there are many transition stages between the species and the variety.

Hab. Among mosses on the trunks of trees, etc.—*Distr.* Rather rare in S.W. England, N. Wales and N. England.—*B. M.* Black Down and Treborough, Somerset; Dolgelly, Merioneth; Bilsdale, Baysdale and Ingleby, Cleveland, Yorkshire.

2. *Podetia ascyphous*.

K + yellow.

39. *C. macilenta* Hoffm. Deutschl. Fl. ii. p. 126 (1795).—Primary squamules rather small, laciniate, lobate or crenate, glaucous-greenish above, white beneath; podetia cylindrical, slender, simple or divided at the apices, ascyphous or frequently forming at the apex an imperfect scyphus, everywhere whitish-pulverulent (*K* + yellow, *CaCl* -). Apothecia small, terminal, solitary or confluent; spores oblong or fusiform-oblong, 8–15 μ long, 3–4 μ thick.—Cromb. Brit. p. 21 & Monogr. i. p. 167 (excl. var. *coronata*). *C. digitata* subsp. *macilenta* Th. Fr. Lich. Scand. p. 68 (1871); Leight. Lich. Fl. p. 69; ed. 3, p. 63. *C. coccifera* var. *macilenta* Mudd Man. p. 61 (1861) (incl. f. *filiiformis*, p. 62) & Brit. Clad. p. 31 (incl. ff. *filiiformis* and *syncephala*). *Coralloides scyphis gracilibus tubiformibus*, *Pedicularis folio* Dill. Hist. Musc. p. 85, t. 14, fig. 10 B (1740) & *Coralloides via ramosum*, *scyphis obscuris*, p. 90, t. 15, fig. 14 A. *Lichen tubiformis* Lightf. Fl. Scot. ii. p. 871 (1777) pro parte? *L. filiiformis* With. Arr. ed. 3, iv. p. 38 (1796) (non Huds. and non Relh.); Ach. Lich. Suec. Prodr. p. 193 (1798); Engl. Bot. t. 2028. *Cenomyce filiiformis* Hook. Fl. Scot. ii. p. 63 (1821); Tayl. in Mackay Fl. Hib. ii. p. 82 pro parte. *Sycephophora bacillaris* S. F. Gray Nat. Arr. i. p. 422 (1821) pro parte. *S. filiiformis* Hook. in Sm. Engl. Fl. v. p. 239 (1833) pro parte.

Exsicc. Johns: n. 297; Larb. Lich. Hb. n. 283; Mudd nos. 26 pro parte, 29 & Clad. n. 75 (in some specimens).

Distinguished chiefly by the rather small squamules, the slender white-pulverulent podetia and the yellow reaction with potash. The podetia taper towards a blunt tip, which at times approaches very near to the scyphus formation of *C. flabelliformis*. The apothecia are rarely well-developed.

Hab. Among mosses on old trunks of trees and on the ground in wooded districts.—*Distr.* General and not uncommon in most parts of the British Isles.—*B. M.* Jersey; Lustleigh and Bovey Tracey, Devon; New Forest, Hants; Epping Forest, Essex; Bradgate Park, Leicestershire; Cromford Moor, near Matlock, Derbyshire; Ayton and Ingleby, Cleveland, and Buckalan, Yorkshire; Windermere, Westmoreland; Ashgill, Cumberland; Sheriffmuir, near Stirling; Barcaldine, Argyll; Craig Calliach and Craig-y-Barns, near Dunkeld, Perthshire; Craig Cluny, Braemar, Aberdeenshire; Rothiemurchus Woods, Invernesshire.

Form *clavata* Cromb. in Grevillea xi. p. 114 (1883) & Monogr. i. p. 168.—Podetia thickish, subventricose, unbranched, narrowing and cornute upwards, granular-pulverulent, sometimes minutely squamulose close to the base.—*C. digitata* subsp. *macilenta* f. *clavata* Leight. Lich. Fl. p. 70 (1871); ed. 3, p. 64. *Coralloides vix ramosum scyphis obscuris* Dill. Hist. Musc. p. 90, t. 15, fig. 14 B, C (1741). *Lichen cornutus* var. β Lightf. Fl. Scot. ii. p. 876 (1777). *Bæomyces deformis* var. *clavatus* Ach. Meth. Lich. p. 334 (1803)?

Exsicc. Johns. n. 53; Leight. n. 403.

Retained under *C. macilenta* rather than *C. bacillaris*, because of the yellow reaction with potash of all the specimens. It is merely a stouter subventricose form of the species. Apothecia are rare.

Hab. On the ground among mosses on heaths and on the dead stumps of trees in wooded upland districts.—*Distr.* New Forest, Hants; Long Mynd, Shropshire; Craig Calliach and Rannoch, Perthshire; Mar Forest, Braemar, Aberdeenshire; Rothiemurchus, Invernesshire.

Form *scolecina* Nyl. Lich. Scand. p. 62 (1861) (incl. f. *styracella*).—Primary squamules crowded or scattered, rather thin, often more or less granular-sorediose when growing on wood: podetia small, tapering upwards, white- or greyish-pulverulent. Apothecia rare, minute, solitary or 2-3-aggregate.—Cromb. in Grevillea xi. p. 114 (1883) incl. f. *styracella* & Monogr. i. pp. 168 and 169; var. *scolecina* Cromb. Lich. Brit. p. 21 (1870). *C. coccifera* var. *macilenta* f. *subulata* Mudd Brit. Clad. p. 32 (1865). *Bæomyces scolecinus* Ach. Meth. Lich. p. 324 t. 7, fig. 2 (1803). *B. bacillaris* var. *styracellus* Ach. tom. cit. p. 330.

Exsicc. Johns. nos. 52 and 244; Leight. n. 297 (in some specimens); Mudd Clad. n. 74.

A small form of the species approaching f. *clavata* on the one hand and var. *ostreata* on the other, the specimens on wood being particularly liable to soredial formation as in var. *ostreata*.

Hab. On mossy trunks of old trees or on decaying wood.—*Distr.* Somewhat rare throughout the British Isles.—*B. M.* Withiel, Corn-

wall; Bovey Tracey, Devon; New Forest, Hants; Chichester, Sussex; Walthamstow, Essex; Gopsall Park, Leicestershire; Nesscliff, Shropshire; Lounsdale, Cleveland, Yorkshire; Whitehaven and Egremont, Cumberland; Barcaldine, Argyll; Loch Tummel, Perthshire; Rothiemurchus Woods, Invernessshire, Torc Mt., Killarney, Kerry.

Var. *scabrosa* Cromb. in Grevillea xii. p. 92 (1884) (incl. f. *incrassata*) & Monogr. i. 169 (incl. f. *intumescens*).—Primary thallus of crowded granular squamules, greyish or glaucous, white beneath; podetia short or medium-sized, simple or variously divided, ascyphous, but blunt at the tips, covered with minute squamules or rough with granules. Apothecia small, sometimes confluent.—Form *scabrosa* Cromb. in Grevillea xi. p. 115 (1883); var. *scabrosa* f. *intumescens* Cromb. in Grevillea v. p. 46 (1886). *Cladonia coccifera* var. *macilenta* f. *scabrosa* Mudd Brit. Clad. p. 32 (1865).

Exsicc. Johns. nos. 181 and 298; Mudd Clad. n. 73.

Somewhat similar to f. *scolecina* in the slighter forms, and gradually approaching to the more squamulose stouter condition (f. *intumescens*).

Hab. On decaying stumps and on turf-walls in wooded districts.—*Distr.* Local and scarce in S.W. and N. England, N. Wales and Ireland, frequent among the Scottish Grampians.—*B. M.* Near Bodmin, Cornwall; Ardingly, Sussex; near Gravesend, Kent; Malvern, Worcestershire; Dolgelly, Merioneth; Bridel Gill, Cleveland, Yorkshire; Ashgill, Cumberland; Wark-on-Tyne, Northumberland; New Galloway, Kirkcudbrightshire; Barcaldine, Argyll; Glen Lochay and Rannoch, Perthshire; near Inverey and Morrone, Braemar, Aberdeenshire; Rothiemurchus, Invernessshire; Glandarray and Dugort Road, Achill Island, Mayo.

Var. *ostreata* Nyl. Syn. Lich. i. p. 225 (1860).—Primary squamules crowded, ascending or subimbricate, usually rather sorediose on the margins and under surface; podetia short, stoutish, densely sorediose, obtuse at the apices. Apothecia minute, very rare.—Cromb. in Grevillea xi. p. 115 (1883) & Monogr. i. p. 17. *Cladonia digitata* subsp. *macilenta* f. *ostreatiformis* Leight. Lich. Fl. p. 70 (1871); ed. 3, p. 64.

Exsicc. Leight. n. 371.

The basal squamules are somewhat like those of *Lecidia ostreata*, but larger, and with a different reaction with potash. Leighton has suggested that *Lichen rubiformis* Sm. Engl. Bot. t. 2112 (1810) might be the same as this variety, but though the squamules bear some resemblance, the red "fruits" are rather those of some parasitic fungus. Hooker refers to it doubtfully as *Psora? rubiformis* (Sm. Engl. Fl. v. p. 193), and Mudd has recorded it as *Cladonia coccifera* var. *macilenta* f. *rubiformis* (Man. p. 62).

Hab. On old mossy stumps of trees.—*Distr.* Found sparingly here and there throughout England.—*B. M.* New Forest, Hants; Epping Forest, Essex; Wrekin Hill, Shropshire.

40. *C. bacillaris* Nyl. in Not. Sällsk. Faun. & Fl. Fenn. n.s. v. p. 179 (1866).—Basal squamules rather small, crenate or

laciniate, glaucous or whitish above, white beneath; podetia slender, subcylindrical, simple or shortly divided above, subulate or rather blunt at the apices, greyish-white, granular-pulverulent (K —, CaCl —). Apothecia small, sometimes confluent.—Cromb. in Grevillea xi. p. 115 (1883) & Monogr. i. p. 171. *C. Floerkeana* var. *bacillaris* Leight. in Ann. Mag. Nat. Hist. ser. 3, xviii. p. 417 (1866) pro parte & Lich. Fl. p. 71; ed. 3, p. 65 pro parte; Cromb. Lich. Brit. p. 21. *C. coccifera* var. *macilenta* f. *clavata* Mudd Brit. Clad. p. 32 (1865). *Coralloides ramulosum, tuberculis coccineis* Dill. Hist. Musc. p. 96, t. 15, fig. 19 c (1741). *Bæomyces bacillaris* Ach. Meth. p. 329 (1803) pro minore parte. *Scyphophora bacillaris* S. F. Gray Nat. Arr. i. p. 422 (1821) pro parte.

Exsicc. Johns. n. 245; Mudd Clad. n. 70.

Distinguished from the preceding species by the absence of reaction with potash. The British specimens are rarely fertile.

Hab. On the ground or on turf-walls in inland situations.—*Distr.* Rare in S. and N. England, the Scottish Grampians and N.W. Ireland.—*B. M.* Wadebridge, Cornwall; Ayton Moor, Cleveland, Yorkshire; West Allen Carrs, Northumberland; Appin, Argyll; Glen Lochay and Rannoch, Perthshire; hills at Nigg, Kincardineshire.

Form *pityropoda* Nyl. ex Cromb. in Grevillea xi. p. 115 (1883). Podetia stoutish, rugose or minutely and crowdedly squamulose.—Cromb. Monogr. i. p. 172.

Hab. On the ground and on turf-walls in upland districts.—*Distr.* Rare among the Scottish Grampians and in N.W. Ireland.—*B. M.* Rannoch, Perthshire; Appin, Argyll; Colin Glen, Antrim; Connemara, Galway.

Var. *subcoronata* Nyl. ex Cromb. in Grevillea xii. p. 92 (1884) & Monogr. i. p. 172.—Podetia rather stoutish, very granulose or squamulose, simple or digitately branched towards the apices.—*C. coccifera* var. *macilenta* f. *obtusa* Mudd Man. p. 62 (1861) & f. *polycephala* Mudd Brit. Clad. p. 32 (1865) pro parte. *C. macilenta* var. *filiformis* f. *polycephala* Flot. ex Koerb. Syst. Lich. Germ. p. 32 (1855). *Coralloides ramulosum, tuberculis coccineis* Dill. Hist. Musc. p. 96, t. 15, fig. 19 A, B (1741).

Exsicc. Mudd Clad. n. 72 pro parte.

Approaches var. *carcata* of the following species, but still more closely allied to *C. bacillaris* in the longer and more finely pulverulent podetia. The British specimens are well fertile.

Hab. On the ground in upland moorlands.—*Distr.* Rather rare in S.W. and N. England, the S. Grampians, Scotland, and N.W. Ireland.—*B. M.* St. Breward, Cornwall; near Hunter Tor, Dartmoor, Devon; Sullington Heath and Ardingly, Sussex; Kildale Moor and Ingleby Park, Cleveland, Yorkshire; Glen Lochay, Perthshire; Connemara, Galway.

41. *C. Floerkeana* Fr. Nov. Sched. Crit. p. 18 (1826).—Primary thallus of small scattered squamules, laciniate or crenate, greenish-white above, white beneath, often scarcely visible; podetia short, cylindrical, slender, corticate entirely or in parts, only rarely sorediose, greyish-white or -green or brownish, often blackish at the base; mostly ascyphous, but rather wider at the obtuse apex, or frequently shortly divided or branched (K—, CaCl—). Apothecia moderate in size, usually conglomerate and bulging over the tips of the podetia; spores 8–10 μ long, 3 μ thick.—Cromb. Lich. Brit. p. 21 pro parte & Monogr. i. p. 172; Leight. Lich. Fl. p. 71; ed. 3, p. 65 pro parte. *C. coccifera* var. *Floerkeana* Mudd Man. p. 61 (1861) & Brit. Clad. p. 33 pro parte. *Lichen digitatus* Sm. Engl. Bot. t. 2439 (1812) (non Huds.).

Æsicc. Bohl. n. 80; Johns. n. 246; Mudd n. 24.

Differs from *C. bacillaris* in the shorter slender corticate rough podetia, rather like some of *C. pityrea*, and in the abundant apothecia. Not unfrequently the podetia become roughly sorediose.

Hab. On peaty ground in upland moorlands.—*Distr.* Rather rare in the typically corticate condition in S. and N. England and among the Scottish Grampians.—*B. M.* Dartmoor, Devon; Ayton Moor, Cleveland, Yorkshire; Teesdale, Durham; Achosragan Hill, Argyll; Craig Calliach, Perthshire, Ben-naboord and Glen Callater, Braemar, Aberdeenshire.

Var. *carcata* Wainio Clad. Univ. i. p. 80 (1887).—Podetia short or medium-sized, multifid above, more or less verrucose-squamulose and often becoming sorediose.—Form *trachypoda* Nyl. ex Cromb. in Journ. Bot. xiv. p. 360 (1876) & Monogr. i. p. 173. *C. macilenta* var. *carcata* Nyl. Lich. Scand. p. 62 (1861); Cromb. Lich. Brit. p. 21 & f. *carcata* Monogr. i. p. 171; *C. coccifera* var. *macilenta* f. *carcata* Mudd Brit. Clad. p. 32 (1865). *C. digitata* subsp. *macilenta* f. *carcata* Leight. Lich. Fl. p. 70 (1871); ed. 3, p. 64 pro parte. *Cenomyce carcata* Ach. Lich. Univ. p. 568 (1810)?

Æsicc. Croall n. 599; Larb. Lich. Hb. n. 84; Leight. n. 56; Mudd Clad. nos. 67 pro parte and 71.

Scarcely distinguished from the species except by the squamules, which are usually rather scattered on the podetia; the squamules or verruce may become sorediose-pulverulent, and the apex is often multifid as in the species. *Cenomyce carcata* Ach. is of doubtful position, the description seems to refer more closely to *C. bacillaris*.

Hab. On peaty soil on the ground or on boulders in upland regions.—*Distr.* Not unfrequent throughout Great Britain and Ireland.—*B. M.* Ardingly Rocks, Sussex; Tunbridge Wells, Kent; Esher Common and Leith Hill, Surrey; Epping Forest, Essex; Bardon Hill, Leicestershire; Areoll Hill, Shropshire; Rhewgreidden, Merioneth; Battersby Bank and Baysdale, Cleveland, Yorkshire; New Galloway, Kirkeudbrightshire; Sheriffmuir, near Stirling;

Achosragan Hill, Appin, Argyll; Craig Tulloch and Rannoch, Perthshire; Canlochan Glen, Clova, and Sidlaw Hills, Forfarshire; Cairnma Earn, Kincardineshire; Ben-naboord, Hill of Fare and Morrone, Braemar, Aberdeenshire; Glen Nevis, Invernesshire; Applecross, Rossshire; Lairg, Sutherlandshire; Doneraile Mts., Cork; Killarney, Kerry; near Kylemore, Connemara, Galway.

ORDER XIX. **LECIDEACEÆ.** (Part 2, p. 2.)

GYALECTA Ach. (Part 2, p. 4.)

2. *G. cupularis* Schær. (Part 2, p. 5.)

Var. *marmorea* Boist. Nouv. Fl. Lich. Fr. pt. 2, p. 178 (1902).—Distinguished from the species by the entire margin and by the habitat.—W. G. Travis, Lanc. Nat. iii. p. 82 (1910).

Recorded by W. G. Travis on decayed moss. The condition of the margin seems, however, to be merely a growth phase that occurs in plants on limestone as well as in those on mosses.

Hab. On mosses or mortar of an old limestone wall at Downham, Lancashire.

4A. *Gyalecta rubra* Massal. Ric. Lich. Crost. p. 146 (1852).—Thallus effuse, thin, powdery or granulose, whitish, the hypothallus whitish, scarcely visible (K —). Apothecia moderate in size (rarely up to 1.5 mm. across), at first closed then open and concave, the disc rosy-red or reddish flesh-coloured, sometimes slightly pruinose, the outer margin prominent, persistent, crenulate; paraphyses stoutish, septate, clavate and red at the tips; spores oblong-ellipsoid, 3-septate, 15–23 μ long, 5–8 μ thick.—Mudd Man. p. 166, t. 3, fig. 58. *Patellaria rubra* Hoffm. Pl. Lich. i. p. 81, t. 17, fig. 2 (1790). *Parmelia rubra* Ach. Meth. Lich. p. 170 (1803); Leight. Angioc. Lich. p. 86, t. 14, fig. 1. *Lecanora rubra* Ach. Lich. Univ. p. 389 (1810); Hook. Fl. Scot. ii. p. 49 & in Sm. Engl. Fl. v. p. 190; Cromb. Lich. Brit. p. 58 & Monogr. i. p. 457; Leight. Lich. Fl. p. 230; ed. 3, p. 222. *Lichen Ulmi* Sm. Engl. Bot. t. 2218 (1810). *Rinodina rubra* S. F. Gray Nat. Arr. i. p. 457 (1821). *Phialopsis rubra* Koerb. Syst. Lich. Germ. p. 170 (1855); Mudd Man. p. 165.

Exsicc. Cromb. n. 168; Leight. n. 236; Mudd n. 138.

Forming a thin widely effuse scurf on the substratum of bark or moss. The apothecia are numerous and prominent and well marked by the white crenulate margin and the rose-red disc.

Though classified by various lichenologists under *Lecanora*, the structure of the thallus (with *Trentepohlia* gonidia), and of the apothecia, agree with the *Gyalecta*. The species should be inserted after *G. geolica*. (Part 2, p. 7.)

Hab. On old trunks of trees—oaks or elms, and on mosses on walls, &c.—*Distr.* Local or rare in S., W. and N. England and in the Scottish Highlands.—*B. M.* Beeding Priory, Sussex; Wigmors

Castle, Herefordshire; Craig-y-Rhiw, near Oswestry, Shropshire; near Rievaulx, Bilsdale and Greta Bridge, Yorkshire; Craig Tulloch, Blair Athole, Perthshire.

"*Phialopsis livida* Mudd Man. p. 166 (1861).—Thallus effuse, thinnish, subtartareous, granulose-verrucose, becoming somewhat leprose, white. Apothecia small, not numerous, scattered, sessile, the disc dull- or bluish-black, slightly concave then plane, the margin thickish, smooth, polished, white; hypothecium dark-red, grumous; spores 8 in the ascus, ellipsoid-oblong, irregularly 4-celled." Specimen not seen.

Mudd has stated that "this species somewhat resembles *Lecanora (Aspicilia) verrucosa* in its mode of expansion and outward appearance. It may be known by the colour of its hypothecium, stout paraphyses and by the internal organization of its spores." In the absence of specimens it is advisable to leave it where Mudd placed it—next to "*Phialopsis rubra*"—until the plant has been again collected.

Hab. On the trunks of old trees, Killarney, Kerry.

LECIDEA Ach. (Part 2, p. 10.)

Species overlooked, or issued since the publication of Part 2.

**L. prostratula* Stirt. in Scott. Nat. v. p. 218 (1880).—Thallus pale or pale-grey, thin, squamulose, the squamules adpressed, plane, scattered or contiguous with occasionally crenulate margins, on a black hypothallus (K —, CaCl + reddish). Apothecia black, sessile, about .6 mm. wide, plane, marginate, becoming convex and almost immarginate; hypothecium brownish-black; paraphyses somewhat irregular, medium-sized, distinct, conglutinate at the black clavate apices; spores colourless, ellipsoid, simple, 9–12 μ long, 5–6 μ thick; hymenial gelatine slightly bluish then wine-red with iodine.

From the squamulose thallus, the species should be placed near to *L. Friesii* (Part 2, p. 14).

Hab. On rocks, Craig Var, Kinloch Rannoch, Perthshire.

L. hypocyanea Stirt. l. c.—Thallus pallid or pallid cinereous, rugulose, squamulose-congested. Apothecia brown or brownish-black, small (.2–4 mm. wide), convex, immarginate, aggregate or congested (12–30 glomerulate); hypothecium red, the subhymenial stratum thickish, bluish or intensely blue; paraphyses not discrete, conglutinate at the apices, not clavate nor interspersed; spores 8 in saccate asci, ellipsoid, simple, 9–12 μ long, 6–7 μ thick.

Possibly akin to *L. endocyanea* Stirt. (Part 2, p. 17). Stirton states that the blue colour is lacking here and there, and that nitric acid applied gives at first a violaceous tint which ultimately vanishes.

Hab. On soil at the foot of Ben Lawers, Perthshire.

* Stirton's specimens have recently been sent for examination to the British Museum, where a set will be preserved. A revision of the species will be published in due course.

23. *L. coarctata* Nyl. (Part 2, p. 22.)

Instead of thallus CaCl+deep-red *insert*:—CaCl – or + reddish; and after spores ellipsoid *add*:—when young often tinged with pale rose-colour and with large oil globules, 14–26 μ long, 7–12 μ thick.

L. humigena Tayl. in Lond. Journ. Bot. vi. p. 150 (1847).—Substratum of the thallus cuticular, gelatinous, whitish with scattered minute roundish brown verrucæ; gemmæ (gonidia?) granular, crowded, minute, oblong, subangular. Apothecia greenish, hemispherical, subpellucid, pale-brown, immarginate, the disc scabrid.

Probably near to or synonymous with *L. vernalis* (Part 2, p. 33).. though Taylor says it can scarcely be confounded with that species.

Hab. On wet clay banks; Dunkerron, Kerry.

L. filamentosa Stirt. l. c.—Thallus whitish or pallid, rugulose, sometimes dispersed-areolate. Apothecia small ($\cdot 2$ – $\cdot 4$ mm. wide), brownish-black, plane, acutely marginate, becoming convex and scarcely marginate; hypothecium colourless; paraphyses slender, irregular, not well discrete, with sordid-brownish apices; spores 8 in the ascus, colourless, simple, oblong or oblong-ellipsoid, 11–16 μ long, 5–6 μ thick; hymenial gelatine blue then yellow with iodine.

Might be allied to *L. albohyalina* Nyl. in Sect. *Biatora* (Part 2, p. 39).

Hab. On fallen or worked wood near Killin, Perthshire.

112A. *L. petrosa* Arn. in Flora li. p. 36 (1868).—Thallus thinly crustaceous, whitish or bluish-white, sometimes finely cracked-areolate or almost obsolete. Apothecia sessile or adnate, solitary or two or three together, at first plane, with a prominent margin, brownish-black; hypothecium black; paraphyses stoutish, conglutinate, the hymenium faintly blue-green or cærulescent, the epithecium dark, purplish-, bluish- or greenish-brown; spores ellipsoid, large, 16–30 μ long, 9–13 μ thick; hymenial gelatine blue with iodine.

Distinguished by the cæruleous blue colour in the hymenium and by the large spores. A variety *albo-suffusa* (*L. cyaniza* Nyl. in Flora lv. p. 359 (1872)) has been recorded by Th. Fries (Lich. Scand. p. 512) with pruinose apothecia.

We are indebted for the discovery and determination of this interesting species to Mr. T. Hebden.

Hab. On calcareous rocks.—*B. M.* Malham, Yorkshire.

L. mersata Stirt. l. c.—Thallus pallid or pallid-glaucous, sometimes reddish-ferruginous, thin, almost continuous, smooth, here and there rimulose-areolate (K–, CaCl–). Apothecia

adnate, black, large, plane, narrowly marginate, becoming convex and almost immarginate, within cærulescent, especially upwards; hypothecium thick, brownish-black; paraphyses discrete, filiform, $2.5-3 \mu$ thick, the apices mostly blue, scarcely clavate; spores colourless, simple, ellipsoid or often fusiform-ellipsoid, $22-36 \mu$ long, $8-11 \mu$ thick; hymenial gelatine intensely blue, the asci yellowish, with iodine.

Evidently closely allied to if not identical with *Lecidea petrosa* Arn.; but considered by Stirton as "near to *L. cyanothalma* Nyl. (Flora lv. p. 358 (1872)), which scarcely differs from *L. contigua* Fr." (Part 2, p. 67).

Hab. On submerged rocks in Loch Rannoch, Perthshire.

116. *L. albocærulescens* Ach. (Part 2, p. 69.)

Var. *smaragdula* Knowles in litt.—Thallus continuous or dispersed, glaucous-white or white, with white hypothallus. Apothecia with slender, subcoherent paraphyses, clear-green or greenish-blue at the tips.

Differs from the species in the white hypothallus and chiefly in the clear green colour of the epithecium in section. These differences may possibly be due to the submerged habitat.

Hab. On coarse granite rocks, completely submerged except in summer—*B. M.* Shores of Lough Nahanaghan (1377 ft.), Wicklow. Collected by M. C. Knowles, Sept. 1914.

129A. *L. instratula* Nyl. in Flora lxi. p. 242 (1878).—Thallus dark-grey, thin, smooth, plane, minutely cracked-areolate, with a black hypothallus. Apothecia minute, black, innate and immarginate; hypothecium colourless; paraphyses distinct, but very coherent, the epithecium blackish-green; asci swollen; spores ellipsoid, $9-12 \mu$ long, $4-5 \mu$ thick.—*B. de Lesd.* in Bull. Soc. Bot. Fr. liv. p. 444 (1907); Lillie in Scott. Bot. Rev. i. p. 152 (1912). Specimen not seen.

Evidently nearly allied to *L. plana* (Part 1, p. 76). The description is taken from Nylander and from *B. de Lesdain*.

Hab. On granitic rocks. Collected by D. Lillie at Canister Cairns, Caithness.

L. recens Stirt. tom. cit. p. 219.—Thallus white or whitish, convex-areolate (areole contiguous or dispersed). Apothecia sessile, black, plane, with a black margin (margin mostly undulate), small, often aggregate; spores 8 in the ascus, colourless, simple, oblong, curved or arcuate, $10-14 \mu$ long, $3.5-4.5 \mu$ thick; hypothecium colourless; paraphyses sometimes irregular, thickish, with clavate brown tips; hymenial gelatine bluish with iodine.

Stirton suggests that the above may be a form of *L. rivulosa* (Part 2, p. 87).

Hab. On rocks, Craig Var, Perthshire.

L. amphiplecta Stirt. l. c.—Similar to *L. furvella* Nyl. (Part 2, p. 94), but with a colourless hypothecium, the paraphyses concrete and as if reticulate and the epithecium thick, conglutinate, brownish-black.

With potash the paraphyses become more distinct, as irregular, disjointed or nearly moniliform threads.

Hab. On rocks, Ben Lawers, Perthshire.

L. dasæa Stirt. l. c.—Thallus brown or brownish-black, loosely adherent, soft, granulate-furfuraceous or isidioid, diffract-areolate almost as in *L. furvella* Nyl., but sometimes thinner and more scattered. Apothecia brownish-black or black, small (.2-.3 mm. wide) concave, acutely marginate, becoming plane, with the margin depressed; within reddish-brown; hypothecium dark or reddish-brown; paraphyses irregular, not distinct, the apices concolorous, not clavate; spores 8 in the ascus, colourless, spherical, simple, 3.5-4.5 μ in diameter; hymenial gelatine unchanged with iodine.

Considered by Stirton as akin to *L. antiloga* Stirt. (Part 2, p. 100).

Hab. On fallen wood, near Ben Lawers, Perthshire.

L. sanguinaria Ach. (Part 2, p. 105.)

Subsp. *subsanguinaria* Stirt. tom. cit. p. 218.—Similar to the species, but the thallus within continuously or here and there reddish (K-, CaCl-). Spores occasionally 2 in the ascus, 70-120 μ long, 32-54 μ thick.

Hab. Corticolous, near Kinloch Rannoch, Perthshire.

BIATORELLA De Not. (Part 2, p. 107.)

§ i. **EUBIATORELLA** Th. Fr. Lich. Scand. p. 397 (1874).—Thallus evident or indistinct. Apothecia mostly soft and rather pale within (biatorine).

To include spp. 1-6 and also 4A **B. campestris** Th. Fr. (Part 2, p. 353).

§ ii. **SARCOGYNE** Th. Fr. tom. cit. p. 405. *Sarcogyne* Flot. in Bot. Zeit. viii. p. 382 (1850).—Thallus superficial or immersed. Apothecia more or less carbonaceous, with prominent proper margins.

The following species of *Biatorella* were classified by Crombie under *Lecanora* (Monogr. i. p. 487). They are transferred to the lecideine genus because of the absence of gonidia in the apothecium. They are numbered in succession to the *Biatorellæ* in Part 2.

Thallus evident.

7. **Biatorella pruinosa** Mudd Man. p. 191, t. 3, fig. 74 (1861) (incl. var. *regularis*).—Thallus thin, effuse, furfuraceous;

greenish when wet, greyish-white when dry (K —, CaCl —). Apothecia small or moderate in size, appressed, plane, reddish-black when moist, black, often bluish-grey-pruinose when dry, sometimes with a thin pseudo-margin; hypothecium pale; paraphyses slender, coherent, thickly septate, scarcely widened and brown towards the apices; spores many in the ascus, minutely ellipsoid or oblong, 3–5 μ long, about 2 μ thick; hymenial gelatine bluish then tawny with iodine.—*Lichen pruinus* Sm. Engl. Bot. t. 2244 (1811) (non Ach.). *Lecidea pruinosa* Hook. in Sm. Engl. Fl. v. p. 179 (1833) pro parte; Tayl. in Mackay Fl. Hib. ii. p. 125 pro parte. *Lecanora pruinosa* Cromb. Lich. Brit. p. 57 (1870) & Monogr. i. p. 487, fig. 68. *L. glaucocarpa* f. *pruinosa* Leight. Lich. Fl. p. 183 (1871); ed. 3, p. 168.

Exsicc. Johns. n. 420; Leight. n. 300; Mudd n. 160.

Distinguished from allied species by the habitat and by the frequently pruinose disc of the apothecium. The thallus is sometimes immersed and scarcely visible.

Hooker (in Sm. Engl. Fl. l. c.) has quoted as a synonym *Lichen pruinatus* Dicks. (errore *L. pruinus*), published in Pl. Crypt. fasc. iii. p. 15, t. 9, fig. 4 (1793). According to the description, that species has a ferruginous thallus and may possibly be a form of *Lecidea confluens*.

Hab. On calcareous rocks and mortar of walls from maritime to upland regions.—*Distr.* General and common in the British Isles.—*B. M.* Near Penzance, Cornwall; Shanklin, I. of Wight; Lewes and Malling, Sussex; Shiere, Surrey; Cirencester, Gloucestershire; near Hereford; Harboro' Magna and Polesworth, Warwickshire; near Malvern and Whittington, Worcestershire; near Corwen, Merioneth; near Shrewsbury, Shropshire; Ingleton and Bilsdale, Cleveland, Yorkshire; near Gainford, Durham; Leven's Park and Staveley, Westmoreland; Appin, Argyll; King's Park, Stirling; Craig Tulloch, Blair Athole, Perthshire; near Aberdeen; Dunkathal, Cork; White Park Bay, Antrim.

Form *nuda* A. L. Sm.—Thallus little visible or entirely immersed. Apothecia reddish-brown, epruinose.—*Lecanora pruinosa* f. *nuda* Nyl. ex Lamy in Bull. Soc. Bot. Fr. p. 423 (1878); Cromb. in Grevillea xix. p. 58 (1891) & Monogr. i. p. 488.

Lamy found this form abundant on the granitic stones of old buildings, and remarks on the regular well-opened epruinose apothecia. It is often difficult to distinguish it from the species.

Hab. On rocks chiefly calcareous, rarely siliceous and on mortar of walls in upland regions.—*Distr.* Widely distributed but rather rare in the British Isles.—*B. M.* Near Bovey Tracey, Devon; Egerton, Kent; Cirencester, Gloucestershire; Malvern, Worcestershire; Appin, Argyll; Ben Lawers and Craig Tulloch, Blair Athole, Perthshire; Applecross, Rossshire.

Var. *albocincta* A. L. Sm.—Thallus immersed. Apothecia thinly pruinose or naked, with a white pruinose pseudo-

margin.—*Lecanora pruinosa* var. *albocincta* Cromb. Monogr. i. p. 488 (1894).

Hab. On the mortar of a wall in an upland district.—*B. M.* Mathon, Malvern Hills, Worcestershire (the only record).

8. *B. hypophæa* A. L. Sm.—Thallus effuse, thickish, unequally granulate, greyish- or dull yellowish-green (K—). Apothecia rather small, plane, dark-red or blackish, the proper margin unequal or subcrenulate, becoming excluded; hypothecium pale or brownish; paraphyses rather stout, thickly septate, variously widened at the yellowish-brown apices; spores many, oblong, 5–6 μ long, 1.5 μ thick; hymenial gelatine bluish then wine-red or tawny with iodine.—*Lecanora hypophæa* Nyl. in Flora liii. p. 34 (1870); Cromb. in Journ. Bot. viii. p. 97 (1870) & Monogr. i. p. 489; Leight. Lich. Fl. p. 186; ed. 3, p. 172.

Differs from *B. privigna*, with which it is closely allied, in the presence of the superficial thallus and in the somewhat different spores; the paraphyses are exactly alike.

Hab. On granitic stones of a wall.—*B. M.* Old Machar Cathedral, Aberdeen (the only record).

9. *B. flava* A. L. Sm. ex Johns. in Naturalist 1917, p. 88.—Thallus effuse, thickish, unequally granulate-cracked or scattered and furfuraceous, dull ochraceous-brown (K—). Apothecia rather small (about .5 mm. in diam.), sessile or subinnate, sometimes circumscribed, plane or rarely convex, dark reddish-brown or black, the thalline margin indistinct or disappearing; hypothecium and hymenium colourless; paraphyses slender, conglutinate above, flexuose, sparsely septate except near the tips which are slightly clavate and bright-brown; spores many, minute, oblong-ellipsoid, about 3 μ long, 1–2 μ thick; hymenial gelatine persistently blue with iodine.—*Lecanora privigna* var. *flava* Johns. in litt.

The thallus is not unlike that of *B. hypophæa*, but in the internal structure it differs from that species as also from *B. privigna*.

Hab. On limestone in a quarry.—*B. M.* Near the Church, Forest, Teesdale, Durham.

Thallus not evident.

10. *B. clavus* Th. Fr. Lich. Scand. p. 409 (1874).—Thallus very reduced, occasionally a few granules only visible below the apothecia. Apothecia large, often aggregate, attached at a central point, sometimes several connate in a common attachment, concave then plane, dark-reddish or almost black, with a prominent proper margin which is persistent and crenulate; hypothecium thin, blackish-brown; paraphyses conglutinate, stoutish, septate, scarcely widened at the tips, the epithecium dark-brown; spores many, oblong-ellipsoid 4–5 μ long, about 2 μ thick; hymenial gelatine deep blue with iodine.—*Patellaria*

clavus DC. Fl. Fr. ii. p. 348 (1805). *Lecidea eucarpa* Nyl. in Bot. Not. 1853, p. 163. *Lecanora eucarpa* Stizenb. Lich. Helv. p. 134 (1881-2); Cromb. in Grevillea xix. p. 58 (1891) & Monogr. i. p. 488. *L. glaucocarpa* f. *eucarpa* Leight. Lich. Fl. p. 183 (1871); ed. 3, p. 168. *Cathisia concinna* Stirt. in Scott. Nat. iii. p. 307 (1888).

Distinguished by the large apothecia with rugose margins.

Hab. On granitic rocks in maritime districts or by inland waters.—*Distr.* Rare in the Channel Islands and in Scilly, and among the Scottish Grampians.—*B. M.* West Coast of Guernsey; St. Mary's, Scilly; Loch Rannoch, Perthshire.

11. *B. privigna* A. L. Sm.—Thallus indistinct or obsolete. Apothecia moderate in size, generally congregate, rounded or angular from pressure, the disc plane, reddish when moist, blackish when dry, brick-red under the outer black crust, the margin prominent, persistent, generally entire; hypothecium pale-coloured; paraphyses slender, conglutinate, thickly septate, reddish-brown upwards; spores many, minutely ellipsoid, 3-4 μ long, 1.5 μ thick; hymenial gelatine blue then dull-greenish or tawny with iodine.—*Lichen simplex* Sm. Engl. Bot. t. 2152 (two right hand figs.) (1810) (non Dav.). *Lecidea privigna* Ach. Meth. Lich. p. 49 (1803); Hook. in Sm. Engl. Fl. v. p. 184. *Endocarpon smaragdulum* var. *privigna* Leight. Angioc. Lich. p. 16 (1851). *Lecanora fuscata* var. *privigna* Cromb. Lich. Brit. p. 56 (1810). *L. squamulosa* f. *privigna* Leight. Lich. Fl. p. 185; ed. 3, p. 170. *L. privigna* Nyl. in Bull. Soc. Linn. Norm. sér. 2, vi. p. 288 (1872); Cromb. Monogr. i. p. 489.

Exsicc. Johns. n. 277; Larb. Lich. Hb. n. 254.

Distinguished from *B. clavus* especially by the smaller apothecia and by the pale colour of the hypothecium.

Hab. On arenaceous and granitic rocks in maritime and upland districts.—*Distr.* Rare but widely distributed in the British Isles.—*B. M.* Alderney; St. Brelade's, Jersey; Shanklin, I. of Wight; Bywell, Northumberland; Bay of Nigg, Kincardineshire; Woodside, near Aberdeen.

12. *B. simplex* Br. & Rostr. Lich. Dan. p. 115 (1869).—Thallus deeply immersed. Apothecia minute, concave or plane, variously corrugate, black, the margin prominent, flexuose and irregularly crenate; paraphyses very slender, flexuose, sometimes branched and septate, slightly clavate and brown at the tips; spores many in the ascus, minute, ellipsoid, 3-4 μ long, 1-2 μ thick; hymenial gelatine blue then quickly wine-red with iodine.—*Lichen simplex* Dav. in Trans. Linn. Soc. ii. p. 283, t. 28, fig. 2 (1794); With. Arr. ed. 3, iv. p. 5; Engl. Bot. t. 2152 (two left-hand figs.). *L. simplex* Hook. in Sm. Engl. Fl. v. p. 179 (1833); Tayl. in Mackay Fl. Hib. ii. p. 124. *Rinodina privigna* S. F. Gray Nat. Arr. i. p. 450 (1821). *Acarospora cervina* var.

simplex Mudd Man. p. 160 (1861). *Lecanora simplex* Nyl. ex Cromb. Lich. Brit. p. 57 (1870) & Monogr. i. p. 490 (incl. f. *herpes*) (1894). *L. squamulosa* f. *simplex* Leight. Lich. Fl. p. 185; ed. 3, p. 170.

Esicc. Johns. nos. 418, 419; Larb. Lich. Hb. without a number; Leight. nos. 272, 273.

The thallus is only rarely visible as a thin scurf; it is, however, present within the substratum. The species in this and other respects is nearly allied to *B. pruinosa*, though the apothecia are smaller and more irregular in form; a form with extremely wrinkled apothecia has been classified as *Opegrapha Persoonii* var. *strepsodina* Ach. (Lich. Univ. p. 247); if angulose and gyrose-plicate it is *Lecanora simplex* f. *complicata* Cromb. in Grevillea xix. p. 58 (1891).

Hab. On rocks chiefly schistose and calcareous in maritime and mountainous regions.—*Distr.* Not uncommon throughout the British Isles.—*B. M.* La Moye, Jersey; Chateau Point, Sark; Tintagel, Withiel and Penzance, Cornwall; Buckfastleigh, Ashburton and Ilfracombe, Devon; Aberdovey, Barmouth and Dolgelly, Merioneth; Bangor, Carnarvonshire; Anglesea; north of Douglas, Isle of Man; Hexham and Bywell, Northumberland; Barcaldine, Ballachulish and Glencoe, Argyll; Craig Calliach, Ben Lawers and Craig Tulloch, Blair Athole, Perthshire; Bay of Nigg, Kincardineshire; Craig Guie and Morrone, Braemar, Aberdeenshire; Dunkerron, Kerry; Glencorbot, Connemara, Galway.

BILIMBIA De Not. (Part 2, p. 133.)

B. ilyophora Wheld. & Wils. in Journ. Bot. liii. Suppl. p. 63 (1915).—Thallus black, sometimes gelatinous, thin. Apothecia black, small ($\cdot 2$ – $\cdot 4$ mm. wide), convex, immarginate, at length hemispherical, rugulose, within entirely violaceous as in *Lecanora atra* (K + bluish-green); hypothecium concolorous; paraphyses not distinct, sometimes irregular; spores 8 in the ascus, colourless, acute at one end, sometimes curved, 1–3-septate, 14–20 μ long, 4–5 μ thick; hymenial gelatine dirty-blue with iodine.—*Lecidea ilyophora* Stirt. in Scott. Nat. v. p. 220 (1880).

Considered by Stirton to be allied to *Bilimbium* (*Lecidea*) *melæna* Arnold, and from the description might be the same plant.

Hab. On dead wood, Kinloch Rannoch, Perthshire.

BACIDIA De Not. (Part 2, p. 149.)

8A. *B. latebricola* Wheld. & Trav. in Journ. Linn. Soc. Bot. xliii. p. 127 (1915).—Thallus greenish-yellow, granular-leprose, effuse (K —, CaCl —). Apothecia minute, rare, at first flesh-coloured, then livid, and blackish when old; epithecium colourless; hypothecium almost colourless; hymenium colourless and not at first blue with iodine; asci cylindrical-clavate, 35–45 μ long; paraphyses clavate; spores narrowly linear-clavate, mostly obtuse at one end, narrowing at the other, variously curved,

rarely straight, very slender, with 5 to 11 thin septa, 26–43 μ long, 1–2 μ thick.

Near to *B. effusa* and *B. herbarum*, but differing in the characters of thallus and apothecia; with the latter and with *B. arceutina* var. *hypnæa* it agrees in habitat, though it differs in the colour of the thallus and in other particulars.

Hab. Creeping over decayed mosses and thin dry humus on sand-dunes or on broken sandy banks overhung by herbage.—*Distr.* Rare in W. England (Lancashire) and N. Wales (Anglesea).—*B. M. Formby*, Lancashire.

17. *B. arceutina* Branth & Rostr. (Part 2, p. 157.)

Form *deminuta* Th. Fr. Lich. Scand. p. 353 (1874).—Apothecia small; plane or concave and marginate.—*Lecidea arceutina* f. *deminuta* Stirt. Scott. Nat. v. p. 220 (1880).

Stirton notes that the spores are 45–60 μ long, 1–1.5 μ thick, and scarcely septate.

Form *brevispora* Wheld. & Trav. in Journ. Linn. Soc. Bot. xliii. p. 127 (1915).—Differs from the species in the shorter more strongly curved spores; they measure 25–38 μ long, 1.2–2.5 μ thick, and are usually obscurely 7-septate.

Hab. Incrusting decayed mosses on sand-dunes.—*Distr.* W. England (Lancashire).

17A. *B. salicicola* Wheld. & Trav. tom. cit. p. 128.—Thallus scanty or evanescent. Apothecia rather small, varying from red to black, soon immarginate; hypothecium colourless; epithecium brown; spores cylindrical or fusiform, often attenuate at one end, generally curved, 29–35 μ long, 2–3.5 μ thick; hymenial gelatine blue then slowly wine-red with iodine.

Differing from *B. arceutina* in the shorter stouter spores and smaller apothecia, from *B. Beckhausii* in the often fusiform spores and other characters.

Hab. On dead twigs and exposed underground stems of *Salix repens* on the coastal sand-hills.—*Distr.* Not uncommon on dunes in W. England.—*B. M. Formby*, Lancashire.

17B. *B. epiphylla* Wheld. & Trav. l. c.—Thallus almost evanescent, consisting of a few granules, green when fresh, cinereous when dry. Apothecia very minute, black, sessile, plane then convex, soon immarginate, colourless within; epithecium pale-brown; paraphyses clavate, mostly colourless at the tips, slightly coherent; hypothecium pale yellowish-brown; asci narrow, 47 μ long; spores slender, acicular, often curved at one end, multiseptate, 33–45 μ long, 1–2 μ thick.

Considered by the authors to be akin to *B. arceutina*, but distinct in the smaller apothecia, the absence of a red tinge, shorter spores and peculiar habitat.

Hab. On fallen leaves of *Salix repens* on sand-dunes.—*Distr.* Rare in W. England (Ainsdale, Lancashire).

21. **B. muscorum** Mudd. (Part 2, p. 159.)

Var. *atriseda* Wheld. & Trav. tom. cit. p. 129.—Thallus effuse, granulose, the granules bright green when moist, cinereous when dry, scattered over a black hypothallus. Apothecia solitary or aggregate, at first pale-tawny, becoming black, with a thin margin soon disappearing, at length convex and difform; epithecium blackish; hymenium brownish; hypothecium reddish-brown; spores straight or slightly curved, acute at one, or both poles sometimes with an appendage, 30–39 μ long, 2–3 μ thick.

Forming patches which appear blackish owing to the black hypothallus, it differs from the species in colour and habitat. (The appendages suggest germination of the spores.)

Hab. On decaying mosses and thin moist humus on bare low *Salix repens* dunes associated with *Cladonia pyxidata*.

BUELLIA De Not. (Part 2, p. 165.)

Page 168. Under *B. biloculata* A. L. Sm. *add.*:—synonym *Lecanora biloculata* Nyl. in *Flora* lxi. p. 248 (1878); *Cromb. Monogr.* i. p. 383.

RHIZOCARPON Ramond. (Part 2, p. 187.)

3A. *Rh. lotum* Stizenb. ex Bausch *Flecht.* Baden, p. 152 (1869).—Thallus effuse, thin, pulverulent, pale ochraceous or cinereous-grey. Apothecia minute, scattered or congregate, black, with a persistent margin; hypothecium reddish-brown; paraphyses coherent, the epithecium blackish-brown; spores halonate, sparsely muriform, colourless then pale-brown, 18–22 μ long, 8–10 μ thick.—B. de Lesd. in *Bull. Soc. Bot. Fr.* liii. p. 517 (1906); Lillie in *Scott. Bot. Rev.* p. 153 (1912).

Near to *Rh. alboatrum* (Part 2, p. 188).

Hab.—On granitic rocks. Collected by D. Lillie at Houstry, Dunbeath, Caithness.

ORDER XX. **DIRINACEÆ.** (Part 2, p. 200.)

Thallus crustaceous, attached by hyphæ, corticate on the upper surface, the cortex of closely packed upright hyphal branches disposed at right angles to the surface (fastigate). Algal cells *Trentepohlia*. Apothecia discoid or somewhat elongate, with proper and thalline margins; hypothecium and disc dark-coloured; spores elongate, septate. Spermogones with simple sterigmata and acicular bent acrogenous spermatia.

A small family represented in the British Isles by a single genus and species. It is classified under Graphidineæ on account both of thalline and apothecial characters, and is nearly allied to Roccellaceæ, as was pointed out by Crombie in Monogr. i. p. 491 (1894).

Spores fusiform, 3-septate, colourless..... **Dirina.**

DIRINA Fr. Syst. Orb. Veg. p. 244 (1825). (Pl. 69.)

Thallus crustaceous, continuous or cracked. Apothecia discoid or somewhat irregular or elongate, subimmersed in the areolæ or superficial, with a distinct thalline margin; hypothecium thickish, black; spores 8 in the ascus, elongate-fusiform, 4–8-septate, colourless.

A maritime genus of few species but of wide distribution in warm or subtropical regions.

1. **D. repanda** Nyl. in Mém. Soc. Sci. Nat. Cherb. v. p. 116 (1857).—Thallus determinate and subeffigurate, thick, continuous or areolate, generally unequal and coarsely warted-granulate, greyish-white with a soft farinose surface and a white hypothallus (Kf + yellow, CaCl + rose-red). Apothecia moderate in size (up to 2 mm. across), at first closed then plane, black, covered generally with a white pruina, the thalline margin thick, obtuse, more or less inflexed; hypothecium thick, black; paraphyses simple, slightly widened or irregular upwards; spores fusiform, often slightly bent, 3-septate, generally about 22 μ long, 5 μ thick, but sometimes smaller or larger; hymenial gelatine wine-red with iodine.—Cromb. in Journ. Bot. ix. p. 178 (1871) & Monogr. i. p. 491, fig. 69; Leight. Lich. Fl. p. 235; ed. 3, p. 226. *Parmelia repanda* Fr. Lich. Eur. p. 177 (1831).

Exsicc. Johns. n. 421.

A Mediterranean plant chiefly. The apothecia are often crowded and become difform, with the margin flexuose. Spermogones are abundant.

Hab. On rocks in maritime districts.—*Distr.* Rare in the Channel Islands, S.W. England and N. Wales.—*B. M.* La Coupe and Rozel, Jersey; Portland Island, Dorset; Great Orme's Head, Carnarvonshire.

ORDER XXI. ROCCELLACEÆ. (Part 2, p. 200.)

Thallus mostly fruticose, of strap-shaped or rounded branching fronds, attached to the substratum by a basal sheath, corticate, with a central medulla generally of loosely interwoven hyphæ. Algal cells *Trentepohlia*. Apothecia discoid or somewhat elongate, usually with proper and thalline margins; spores 8 in the ascus, colourless or rarely brownish, elongate, septate. Spermogones with simple or sparingly branched sterigmata and straight or curved acrogenous spermatia.

With the exception of *Roccella*, the genera of Roccellaceæ contain few species. All of them inhabit mainly the sea-coasts of warm countries. There is only one genus represented in Europe.

Thallus cylindrical or strap-shaped, branched..... *Roccella*.

ROCCELLA DC. Fl. Fr. ii. p. 334 (1805). (Pl. 70.)

Thallus fruticose of simple or branching fronds, greenish- or bluish-grey, mostly sorediate; cortex of closely packed hyphal branches disposed at right angles to the surface (fastigiate); medullary hyphæ more or less parallel with the long axis; gonidia in a zone within the cortex. Apothecia lateral on the fronds, mostly discoid, with a proper margin, and with or without a thalline margin; hypothecium thick, black; paraphyses branched; spores elongate-oblong or fusiform, mostly 3-septate, colourless.

The species of *Roccella* have a wide distribution, but only two are found as far north as the British Isles. They yield in more or less abundance a purple dye, the orseille or orchil of commerce. *R. tinctoria*, which is not British, is the best known and was one of the earliest recorded lichens.

1. *R. fucoides* Wain. in Welw. Cat. Afric. Plants, ii. 2, p. 433 (1901).—Thallus of densely caespitose thickly and repeatedly branched fronds, rounded or slightly compressed, rather short (generally about 3–5 cm. high), more or less sorediate, basal sheath small, light bluish-grey (outer cortex CaCl + orange-red, inner tissue and soredia —, medulla I + blue). Apothecia small, somewhat prominent, black, without a thalline margin; paraphyses uneven, rather wider, branched and dark at the tips; spores oblong-fusiform, 3-septate, 12–16 μ long (or longer), 3–4 μ thick.—*R. phycopsis* Ach. Lich. Univ. p. 440 (1810); S. F. Gray Nat. Arr. i. p. 426; Cromb. Lich. Brit. p. 22 & Monogr. i. p. 182, fig. 37; Leight. Lich. Fl. p. 81; ed. 3, p. 74. *R. tinctoria* Hook. in Sm. Engl. Fl. v. p. 221 (1833) (non DC.); Mudd Man. p. 75 (incl. var. *phycopsis*); Leight. ll. c. *Lichen fucoides* Dicks. Pl. Crypt. fasc. ii. p. 22 (1790) & *L. Roccella* op. cit. fasc. iii. p. 19 (1793) (non Linn.); Engl. Bot. t. 211; With. Arr. ed. 3, iv. p. 42 (1796).

Exsicc. Cromb. n. 14; Lerb. Caesar. n. 11 & Lich. Hb. n. 122; Mudd n. 48.

A rather stunted-looking bushy plant, abundantly sorediate and very rarely fertile. Spermogones are occasionally present, with spermatia 13–16 μ long, 1 μ thick. By earlier lichenologists it was confused with *Lichen Roccella* L. Sp. Pl. p. 1154, the well-known dye lichen, *Roccella tinctoria* DC. Fl. Fr. ii. p. 354 (1805). The figure in English Botany was drawn from a specimen collected on Portland Island.

Hab. On rocks, rarely on walls, in maritime localities.—*Distr.* Uncommon on the southern coasts of the British Isles, very rare in

the Clyde area, Scotland.—*B. M.* St. Brelade's Bay, La Moye and Noirmont, Jersey; Petit-Pot Bay, Guernsey; Sark; St. Mary's, Scilly Islands; The Lizard, Tintagel Castle, Lamorna, Pentire and St. Minver, Cornwall; Kingswear, Bolt Head, Ilfracombe, Lynmouth and Lynton, Devon; Portland Island, Dorset; Bembridge and Godshill Church, I. of Wight; Millport, Cumbrae Island, Firth of Clyde.

Form *tenuior* A. L. Sm.—Thallus of longer slender fronds much branched at the apices.—*R. phycopsis* f. *tenuior* Nyl. ex Leight. Lich. Fl. ed. 3, p. 74 (1879); Cromb. Monogr. i. p. 183. *R. fuciformis* (errore) f. *tenuior* Cromb. in Grevillea xv. p. 47 (1886).

Differs in the long slender fronds, almost 10 cm. high. Leighton, who first published this form, ascribed it to *Larbalestier*, by whom it was collected, but on the herbarium specimen *Larbalestier* has written f. *tenuior* Nylander, to whom it had evidently been submitted.

Hab. On rocks in a maritime situation.—*B. M.* La Moye, Jersey.

2. *R. fuciformis* DC. Fl. Fr. ii. p. 335 (1805).—Thallus of compressed short or long fronds narrow or wide, irregularly branched, frequently proliferate and more or less sorediate at the margins, the soredia solitary or in dense masses, glaucous-white or -brownish (CaCl surface and medulla —, soredia + rose-red, medulla I+ blue). Apothecia not uncommon, discoid, prominent, rather small, scattered or crowded, the disc black, at first pruinose, the thalline margin irregular in outline, at length almost excluded; paraphyses stoutish with brown tips, the whole hymenium deep brown in thick section; spores oblong-fusiform, 20–30 μ long, 4–6 μ thick.—S. F. Gray Nat. Arr. i. p. 426; Hook. in Sm. Engl. Fl. v. p. 222; Mudd Man. p. 76, t. 1, fig. 18; Cromb. Lich. Brit. p. 23 & Monogr. i. p. 183; Leight. Lich. Fl. p. 82; ed. 3, p. 74. *Lichenoides fuciforme tinctorium, corniculis longioribus et acutioribus* Dill. Hist. Musc. p. 168, tt. 22, 23, fig. 61A–D (1741). *Lichen fuciformis* L. Sp. Pl. p. 1147 (1753); Dicks. Pl. Crypt. fasc. iii. p. 17; With. Arr. ed. 3, iv. p. 51; Engl. Bot. t. 728.

Esicc. Cromb. nos. 15, 125; *Larb. Caesar.* n. 12 & *Lich. Hb.* n. 123; *Leight.* n. 171.

Generally found growing with the previous species, but very distinct in form and attaining a much larger size up to 6 inches in length, with the ribbon-like fronds from less than a line to nearly half an inch in width. Only the soredia in this species are stained with chloride of lime, the outer cortex and medulla are unaffected.

Hab. On rocks in maritime districts.—*Distr.* Local though fairly plentiful on the southern coasts; rare in S.W. and W. Ireland.—*B. M.* St. Ouen's Bay, St. Brelade's Bay and St. Martin's, Jersey; Guernsey; St. Mary's, Scilly Islands; Logan Rocks, near Land's End, Tintagel, The Lizard, Penzance and Lamorna Cove, Cornwall; Bolt Head, Lynton and Ilfracombe, Devon.

ORDER XXIII. **ARTHONIACEÆ.** (Part 2, p. 205.)

Arthonia Lilliei B. de Lesd. in Bull. Soc. Bot. Fr. lvii. (1910).—Thallus blackish, leprose, very slight. Apothecia black, minute, about 0·1–0·2 mm. in diam., round, persistently plane; hypothecium colourless; hymenium colourless or pale-brown; paraphyses closely coherent, the apices free and capitate, the epithecium olivaceous; asci ventricose; spores 8 in the ascus, colourless, oblong or ellipsoid, 1-septate, scarcely constricted and the loculi equal, 10–12 μ long, 4–5 μ thick; hymenial gelatine wine-red with iodine.—Lillie in Scott. Bot. Rev. i. p. 153 (1912). Specimen not seen.

Somewhat difficult to place in the lack of information as to the gonidia; it seems to agree with § *Lecideopsis* (Part 2, p. 217) rather than with § *Euarthonia* (p. 211).

Hab. On siliceous rocks. Collected by D. Lillie at Achastle, Caithness.

ORDER XXVI. **PYRENIDIACEÆ.** (Part 2, p. 264.)

PYRENIDIUM Nyl. in Flora xlviii. p. 210 (1865); Cromb. Monogr. i. p. 81 (1894); Leight. Lich. Fl. p. 36 (1871). (Pl. 71.)

Thallus minutely fruticose, rising from a crustaceous base, with a distinct plectenchymatous cortex. Algal cells *Nostoc*. Perithecia innate opening by a pore; spores oblong-ellipsoid, brownish, septate.

A most interesting and unique lichen, being the only example of fruticose growth among the blue-green Pyrenocarpei. Crombie has suggested that the fruits may be parasitic fungi; unfortunately the specimens in the herbarium of the British Museum seem to be sterile. There is no record of any recent collection of the plant.

1. **P. actinellum** Nyl. l. c.—Thallus adnate and crustaceous at the base, or sward-like with upright or semi-prostrate branching fronds which are somewhat nodulose, but generally cylindrical, dark olive-brown in colour; cortex very distinct, one cell thick; gonidia in short chains or in groups scattered through the medulla. Perithecia “minute, scarcely prominent, almost entirely innate, the pyrenium entirely black”; spores 4 in the ascus (as figured), “3-septate, brownish, 20–24 μ long, 8–9 μ thick.”—Carroll in Journ. Bot. iii. p. 286 (1865); Cromb. Lich. Brit. p. 10 & Monogr. i. p. 81; Leight. Lich. Fl. p. 36; ed. 3, p. 37.

Hab. On cretaceous and calcareous pebbles in moist maritime and upland districts.—*Distr.* Rare in S. and S.W. England.—*B. M.* Anstey's Cove, Torquay, Devon; near Brighton, Sussex; Bexley Hill, Kent; Shiere, Surrey.

PYRENOCOCCUS Wheld. & Wils. in Journ. Bot. liii. Suppl. p. 69 (1915).

Thallus none. Perithecia simple, coloured, subimmersed in the tissues of a host-plant containing Cyanophyceæ, opening by a pore; spores 8 in the ascus, ellipsoid, septate, fuscous.

Considered by the above authors as allied to *Obryzum* but differing in the shape and colour of the spores. It has been based on *Endococcus exoriens* Stirt., but the description suggests rather a parasitic fungus belonging to the genus *Melanomma*.

P. exoriens Wheld. & Wils. l. c.—Thallus none. Perithecia in the thallus of *Pannariæ*, semi-immersed, small, fuscous to fuscous-black; paraphyses none; spores ellipsoid, brown, 3-septate, 9–11 μ long, 6 μ thick; hymenial gelatine wine-red with iodine.—*Endococcus exoriens* Stirt. in Scott. Nat. v. p. 220 (1880). Specimen not seen.

Hab. Parasitic on the thallus of *Pannariæ*, probably *P. brunnea* (*P. pezizoides* Leight.), Craig Var near Kinloch-Rannoch, Perthshire, the only record.

ORDER XXVIII. **VERRUCARIACEÆ.** (Part 2, p. 275.)

VERRUCARIA Pers. (Part 2, p. 276.)

3A. *V. Lorrain-Smithiæ* Knowles in Sci. Proc. Roy. Dubl. Soc. xiv. p. 138 (1913).—Thallus blackish-green, gelatinous, thin, continuous or sometimes almost evanescent. Perithecia excessively minute, about 120–180 μ in diam., scattered, hemispherical, shining, opening by a minute pore 15–20 μ in diam., dimidiate; ascus elliptical, 20–25 μ long, 10–12 μ wide; spores 8 in the ascus, simple, rod-like, oblong-elongate or slightly curved, 15–18 μ long, 2–4 μ thick.

Characterized by the minute prominent perithecia.

Hab. On limestone rock, below neap-range or more abundant near low-water mark.—*B. M.* Balcadden Bay, Howth, Dublin. (M. C. Knowles, Sept. & Dec., 1913.)

4. *V. striatula* Wahlenb. f. *continua* Knowles tom. cit. p. 137.—Thallus more continuous than in the species, sometimes radiate, with scattered small dots and ridges.

Hab. On maritime rocks in more sheltered situations than the species.—*B. M.* Needles, Howth, Dublin. (M. C. Knowles, July, 1910.)

THELIDIUM Massal. (Part 2, p. 297.)

2A. *Th. explicatum* Wheld. & Wils. in Journ. Bot. liii. Suppl. p. 70 (1915).—Thallus pale or pale-grey, thin, often dispersed. Perithecia black, prominent, 2–3.5 mm. wide, entire; para-

physes wanting; spores 4–8 in the ascus, colourless, ellipsoid or oblong-ellipsoid, sometimes larger at one end (*gibbosulæ*), 1-septate, 24–34 μ long, 10–13 μ thick; hymenial gelatine wine-red with iodine.—*Verrucaria explicata* Stirt. in Scott. Nat. v. p. 220 (1880). Specimen not seen.

Stirton suggests that this species may be identical with *V. subrimulata* Nyl., a Pyrenæan species.

Hab. On schistose rocks at the summit of Ben Lawers.

4A. *Th. terrestre* Wats. in Journ. Bot. lv. p. 107, fig. B (1917).—Thallus thin, effuse, crustaceous or leprose, green or darker. Perithecia minute, black, scattered, semi-immersed, at length more or less sessile, dimidiate; outer wall dark-brown, inner pale-brown, the minute ostiole not depressed; hymenium without algal cells; ostiolar filaments few or none; paraphyses disappearing or absent; asci clavate; spores 8 in the ascus, colourless or greyish, granular, ellipsoid, one end usually narrower, 1-septate, lightly constricted in the middle, 16–28 μ long, 7–11 μ thick.

Closely allied to *Th. Nylanderii*. Watson considers it to be near *Th. Zwackhii* Hepp, a saxicolous species, the spores of which are 1–3-septate.

Hab. On soil of hedge-bank among mosses.—*B. M.* Cheddon Fitzpaine, Somerset.

POLYBLASTIA Massal. (Part 2, p. 300.)

10A. *P. mortensis* Wats. in Journ. Bot. lv. p. 108, fig. A (1917).—Thallus thin, crustaceous, minutely granulose, effuse, continuous, greyish or greenish-grey or olivaceous, sometimes darker or evanescent, not gelatinous when moist. Perithecia small or moderate, semi-immersed with the upper third emergent, convex, shining; wall black at the base, thin and brown; ostiole slightly depressed; hymenium without algal cells; ostiolar filaments few or none; asci clavate, somewhat inflated; paraphyses few or none, mucilaginous; hymenial gelatine wine-red with iodine; spores oblong, 8 in the ascus, colourless, becoming brownish, muralilocular, with 7–14 transverse rows of small cells, 40–50 μ long, 16–20 μ thick.

Hab. On soil-cap of walls or on mortar, often on decaying mosses such as *Tortula muralis* near the sea.—*B. M.* Morte, Devon (December, 1913).

16A. *P. addubitans* Wheld. & Wils. in Journ. Bot. liii. Suppl. p. 71 (1915).—Thallus whitish, very scanty. Perithecia black, large, .8–1.4 mm. wide, prominent, round or often oblong, the peridium black, dimidiate; paraphyses long, crowded, granular-inspersed, tubular and filled with interrupted masses of protoplasm; spores 4–8 in the ascus, ellipsoid, colourless then brown, 3–5-septate, with irregular longitudinal septa; hymenial gelatine

not tinged with iodine.—*Verrucaria addubitans* Stirt. in Scott. Nat. v. p. 220 (1880).

On decorticated wood near Kinloch Rannoch, Perthshire.

MICROGLÆNA Koerb. (Part 2, p. 308.)

3A. *M. nuda* Wheld. & Trav. in Journ. Linn. Soc. xliii. p. 132 (1915).—Thallus obsolete or reduced to a few cinereous granules at the base of the perithecia. Perithecia minute, black, superficial, dimidiate, with a distinct somewhat depressed ostiole; paraphyses subpersistent, visible until the spores are fully formed, branched, slender; asci subcylindrical; spores 8 in the ascus, irregularly arranged in the ascus, 2–3-septate and after a time sparingly and irregularly septate longitudinally, colourless or pale-greenish, oblong-ellipsoid, obtuse at both ends, the separate cells unequal, 16–20 μ long, 6–7.5 μ thick. Specimen not seen.

Hab. On half-buried gritstone pebbles in glacial drift on the banks of the Ribble at Chatburn (March, 1913).

3B. *M. breadalbanensis* Wheld. & Wils. in Journ. Bot. liii. Suppl. p. 71 (1915).—Thallus pale citrine-yellow, smooth, broken into scattered or more contiguous subangular fragments, each bearing one or rarely two perithecia. Perithecia small, subglobose, slightly immersed at the base, black; peridium black, thick above, thinner towards the base where it forms a thin brown line; ostiole poriform, slightly protuberant but hardly papillaform; spores 6–8 in the ascus irregularly biseriata, colourless, ellipsoid-oblong, obtuse at one or both ends, 6–7-septate with 1–3 longitudinal septa, 18–20 μ long, 10 μ thick. Specimen not seen.

Hab. On mica-schist rocks, growing amongst *Lecidea contigua* in larger or smaller patches. Collected by A. Wilson at Ben Cruichben, near Killin, Perthshire, June, 1913.

ORDER XXIX. **PYRENULACEÆ.** (Part 2, p. 312.)

ACROCORDIA Massal. (Part 2, p. 313.)

4A. *A. monensis* Wheld. in Lanc. Nat. viii. p. 196, Pl. 3 (1915).—Thallus greyish-white, thin, tartareous, pulverulent, or nearly obsolete when it consists of a few granules round the base of the perithecia. Perithecia black, nearly globose, very small, prominent, slightly immersed at the base or sessile, smooth, scattered; ostiole poriform; peridium entire, black, brown internally; paraphyses numerous, slender, lax, distant; asci cylindrical, elongate, 99–120 μ long; spores uniseriate or partly biseriata, fusiform-ellipsoid, colourless, 1-septate, constricted at

the septum, rather large, 20–33 μ long, 6–10 μ thick. Specimen not seen.

Considered by Wheldon to be allied to *A. Salweii*, but distinct in the small perithecia and the large spores; these may have one cell rather larger than the other.

Hab. On mortar mixed with many fine quartz particles, on a wall in Glen Maye, I. of Man, June, 1914. Collected by J. W. Hartley and J. A. Wheldon.

ARTHOPYRENIA Massal. (Part 2, p. 315.)

Page 323. For *Arthopyrenia arenicola* A. L. Sm., read—*A. argilospila* A. L. Sm., and add to synonymy:—*Verrucaria argilospila* Nyl. in *Flora* lvii. p. 15 (1874). *Magmopsis argilospila* Nyl. ex Cromb. in *Grevillea* xv. p. 10 (1886) & *Monogr.* i. p. 30.

An examination of the specimens placed in *Magmopsis* and from the same locality as "*A. arenicola*" leaves no doubt as to their identity. There is on the thallus the overgrowth of the blue-green algæ, in the fruits the entire perithecial wall with the minute pore at the apex, and the arthopyrenial characters of paraphyses, asci and spores. In more developed fruits I have found spores measuring up to 26 μ in length, and on one spore a third septum was formed near the base. Otherwise they are as described.

Magmopsis was placed by Nylander under the Tribe Pyrenidei (*Flora* lviii. p. 103 (1875)).

ADDITIONAL SPECIES RECEIVED AFTER THE APPENDIX HAD BEEN PRINTED

(Part 2, p. 7.)

5A. *Gyalecta derivata* A. L. Sm.—Thallus effuse, thin, finely furfuraceous, greyish or greenish. Apothecia small, urceolate, the disc pale-reddish, the margin whitish, thick, entire or broken here and there; hypothecium colourless; spores 8 in the ascus, 7–12-septate and sparingly muriform, 27–30 μ long, 5–6 μ thick.—*Lecidea derivata* Nyl. in *Flora* xlvi. p. 603 (1865).

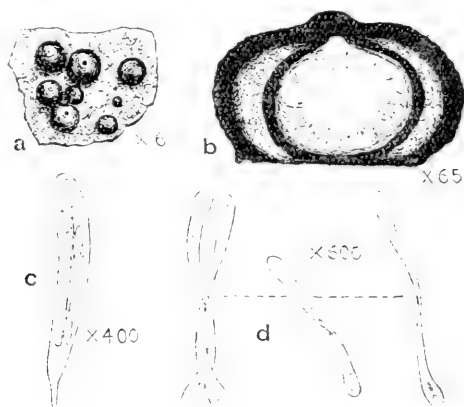
Nearly related to *G. truncigena*, but differing in character of the spores.

Hab. On tree trunks.—B. M. Navan, Meath. Collected by M. C. Knowles, August, 1915.

(Part 2, p. 297, after *Verrucaria*.)

Sarcopyrenia Nyl. in *Maine & Loire Mém. Soc. Acad.* iv. p. 69 (1858).—Thallus crustaceous. Algal cells *Protococcus*.

Perithecia simple, scattered, with a black peridium, opening by an ostiole; periphyses slender; paraphyses disappearing; asci elongate-clavate, soon disappearing, 8-spored; spores one-celled, colourless, cylindrical-vermiform, slightly flexuose or twisted in the middle, the ends clavately thickened.



Sarcopyrenia gibba Nyl.—a, Plant on rock, with perithecia. b, Vertical section of perithecium. c, Ascus. d, Spores.

A monotypic genus recorded first from Constantine in Algiers, then from Switzerland, and from S.W. Germany. It is distinguished by the long vermiform spores. We are indebted to Rev. W. Johnson for this interesting lichen collected by him in November, 1880; it escaped recognition until recently, and was sent to the British Museum for determination in December, 1917. In the system of classification adopted it should follow *Verrucaria*.

S. gibba Nyl. l. c.—Thallus effuse, thin, yellowish-grey, mostly obsolete or immersed in the rock. Perithecia black, scattered or congregate, $\cdot 5$ mm. in diam. or less, hemispherical, with a minute papillate ostiole, or depressed and Lecidea-like, the outer peridium thickish, dimidiate but incurved at the base, the inner wall dark-brown; asci cylindrical fusiform, about 70μ long, 10μ thick, 8-spored; spores $30-40 \mu$ long, $3-3\cdot 5 \mu$ thick.—*Verrucaria gibba* Nyl. in *Cherb. Mém. Soc. Sci. Nat.* ii. p. 342 (1854).

In the specimen on sandstone from St. Bees the thallus is extremely scanty, Johnson, however, finds that it is "reddish or whitish-brown, thin, furfuraceous, occasionally cracked-areolate and mostly evanescent; hypothallus white or whitish." The spores seem to be almost flat at the centre where they are generally half-twisted over.

Hab.—On arenaceous rocks.—*B. M.* St. Bees, Cumberland.

PART I., ADDENDA AND CORRIGENDA

Page 9. *Chænotheca melanophæa* Zwackh, insert—

Var. *flavocitrina* Paulson in Journ. Bot. lv. p. 195 (1917).—Thallus granular, effuse, varying in colour from cinereous-grey to deep-yellow. Apothecia numerous, similar in structure to those of the species.

This lichen was found spreading widely on oak and ash trees and also on dead ivy stems where it showed as a deep-yellow film. The whole colouring was in places deep enough to suggest var. *ferruginea*, but the apothecia have longer stalks than in that variety and the habitat "on trees" is different. The reaction with potash, as in the species, is purplish-red due to the presence of salazinic acid, and the woody tissues in contact with the lichen take the stain the most deeply. The hyphæ are generally unaffected.

Hab. On bark of trees.—*B. M.* Bricket Wood, near St. Albans, Herts. Collected by R. Paulson, May, 1917.

Page 23. For *Sphærophorus globosus* A. L. Sm., read *S. globosus* Wain. Exp. Antarct. Belge, Lich. p. 35 (1903).

Page 26.

After Order XV., insert XV A. **CHRYSOTHRICACEÆ.**

Page 35. Under *Ephebe lanata*, Hab., add rarely on trees. (Note supplied by W. Watson, Taunton.)

Page 42. Add 4. *Psorotichia lugubris* Dalle Torre & Sarnth. Flecht. Tirol. p. 592 (1902). *Lecidea lugubris* Sommerf. Part 2, p. 16.

This species was doubtfully included under *Lecidea*. The late Mr. W. West, to whom a specimen was submitted, determined the gonidia as *Gloeocapsa* algæ.

Page 47. After *Physma chalazanum*, insert—

2A. *Ph. chalazanellum* A. L. Sm. Similar to *Ph. chalazanum* but with smaller thallus and apothecia, the latter .2 mm. in diam. and spores 12–19 μ long, 6–10 μ thick.—*Collema chalazanellum* Nyl. in Flora lix. p. 231 (1876); Wats. in Journ. Bot. lv. p. 109 (1917).

Hab. On limestone wall near Taunton, Somerset.

Page 67. *Insert*—

3A. *Leptogium andegavense* Hy Essai sur les Lich. d'Anjou, p. 28 (1893) fide Harm. Lich. Fr. 1, p. 106 (1905).—Thallus lobate, turgid, sometimes obscured by the crowded apothecia. Apothecia scarcely 1 mm. in diam.; hypothecium of stratified plectenchyma, the cells more crowded in the upper layers; spores 25 μ long or more, often narrower at one end, 4–5 septate, with a few longitudinal septa.—*Collemodium andegavense* Wats. in Journ. Bot. iv. p. 110 (1917). Specimen not seen.

Similar to *L. turgidum* but less plicated and with the appearance of a small *Collema pulposum*.

Hab. On limestone walls near Taunton.

Page 74. *Under Leptogium sinuatum, delete* 3-septate.

Page 104. *Under Solorina saccata, after* spores reddish-brown, *add* with warted epispore.

Page 118. *Under Candelaria concolor Exsicc., add* Larb. Lich. Cantab. n. 16.

Page 157. *Under Cetraria islandica Exsicc., add* Johns. n. 441 (Teesdale, Durham).

Page 223. *Insert*—

36A. *Placodium Pollinii* A. L. Sm.—Thallus thin, white then greyish, smooth, continuous or indistinctly cracked-areolate, with a darker hypothallus. Apothecia rather large, scattered or crowded, plane, becoming convex, at first brick-red with a brown tinge becoming blackish; hypothecium dingy-ochraceous; paraphyses slender, septate, slightly thicker at the tips; spores fusiform-ellipsoid, 15–16 μ long, 8–9 μ thick.—*Blastenia Pollinii* Massal. in Flora xxxv. p. 575 (1852). *Lecanora Pollinii* Masee in Grevillea xxi. p. 60, figs. 1–8 and 5 (1882).

The thallus evidently gives no reaction with potash (Hepp Exs. n. 402). The apothecia have a distinct proper margin; the spores vary greatly in size from 9 μ long upwards, and from 5 μ thick.

Hab. On the bark of trees.—Specimen from Yorkshire in the Leighton Herbarium, Kew.

Page 233. *Physcia fusca* A. L. Sm., *insert*—

Var. *cæsio-pruinosa* A. L. Sm. Differs from the species in the bluish tinge of some of the lobes, chiefly towards the centre.—*Ph. aquila* var. *cæsio-pruinosa* B. de Lesd. in Bull. Soc. Bot. Fr. lvii. p. 31 (1910); Lillie in Scott. Bot. Rev. 1, p. 149 (1912). Specimen not seen.

Noted by Lamy (Bull. Soc. Bot. Fr. xxv. p. 383 (1878)) as a growth form or appearance only. Found by D. Lillie at E. Clyth, Caithness.

Page 244. *Insert*—

12A. *Physcia cæsitia* Hue Add. Nov. Lich. Eur. p. 319 (1888).—*Ph. cæsia* subsp. *cæsitia* Nyl. ex Norrl. in Not. Sällsk. Faun. & Fl. Fenn. Förh. xiii. p. 326 (1873).

Differs from *Ph. cæsia* in the thalline reaction ($K \pm$ yellow).

Originally described only from Lapland, it has been reported by Hue (l. c.) as occurring in Scotland.

Pages 259 and 352. *For* ICMADOPHILUS, *read* ICMADOPHILA.

Page 291. *For* Lecanora farinaria Borr., *read* L. conizæa Nyl. (as the name of the species).

Page 311. *For* Lecanora gemimpara, *read* L. geminipara.

Page 319. *Insert*—

69A. *Lecanora Lilliei* Lillie in Scott. Bot. Rev. i. p. 151 (1912).—Thallus crustaceous, tartareous, cracked-areolate, white, yellow within ($K -$, $CaCl -$). Apothecia minute, black, rounded-diform or elongate, immersed in the areolæ; hypothecium colourless; paraphyses gelatinous-concrete, the epithecium olivaceous; asci narrowly clavate; spores 4–6 in the ascus, ellipsoid, 13–15 μ long, 5–6 μ thick; hymenial gelatine deep blue with iodine.—*Aspicilia Lilliei* B. de Lesd. in Bull. Soc. Bot. liii. p. 515 (1906).

Considered by de Lesdain as very similar to *Lecanora calcarea*, but differing in the yellow colour internally and in the smaller spores.

Page 389. *Insert*—

1A. *Gyrophora stipitata* Branth in Meddel. Grønl. iii. p. 491 (1887).—Thallus dark greyish-brown or sometimes paler, firm, crowdedly corrugate-tuberculose or rugose; beneath paler grey, subsmooth, on a short dark-brown stalk, 10–15 mm. high, almost the whole lower surface densely covered with pale-grey fibrils. Apothecia with a plane disc; spores 8 in the ascus, colourless, ellipsoid, 10–13 μ long, 8–9 μ thick. Lillie in Scott. Bot. Rev. i. p. 50 (1912).—*Umbilicaria stipitata* Nyl. Lich. Scand. p. 289 (1861) & in Flora xlvi. p. 604 (1865) note. Specimen not seen.

Recently this plant has been published by Zahlbruckner (Ann. K. K. Nat. Hofm. xxvi. p. 170 (1912)) as a variety of *G. rugifera* Hue (Lich. Exot. p. 117 (1892)), a species placed under the section with gyrose discs, but Nylander notes that the irregularities are due to aggregation of apothecia (Syn. Lich. ii. p. 14 (1885)).

Recorded by D. Lillie from Ben-na-bad, Caithness.

INDEX

The genera of lichens have undergone so many changes at the hands of systematists of divergent views, that the specific name has come to be recognized as the best clue to the plants. In preparing the Index, the aim has been to facilitate the tracing of any name that has been used; specific names, along with those of orders and genera, &c., are listed; varietal and well-established form-names are also included unless specific synonyms are recorded by which they can easily be identified: redundant entries are thus avoided as far as possible. Synonyms are indicated by *italics*.

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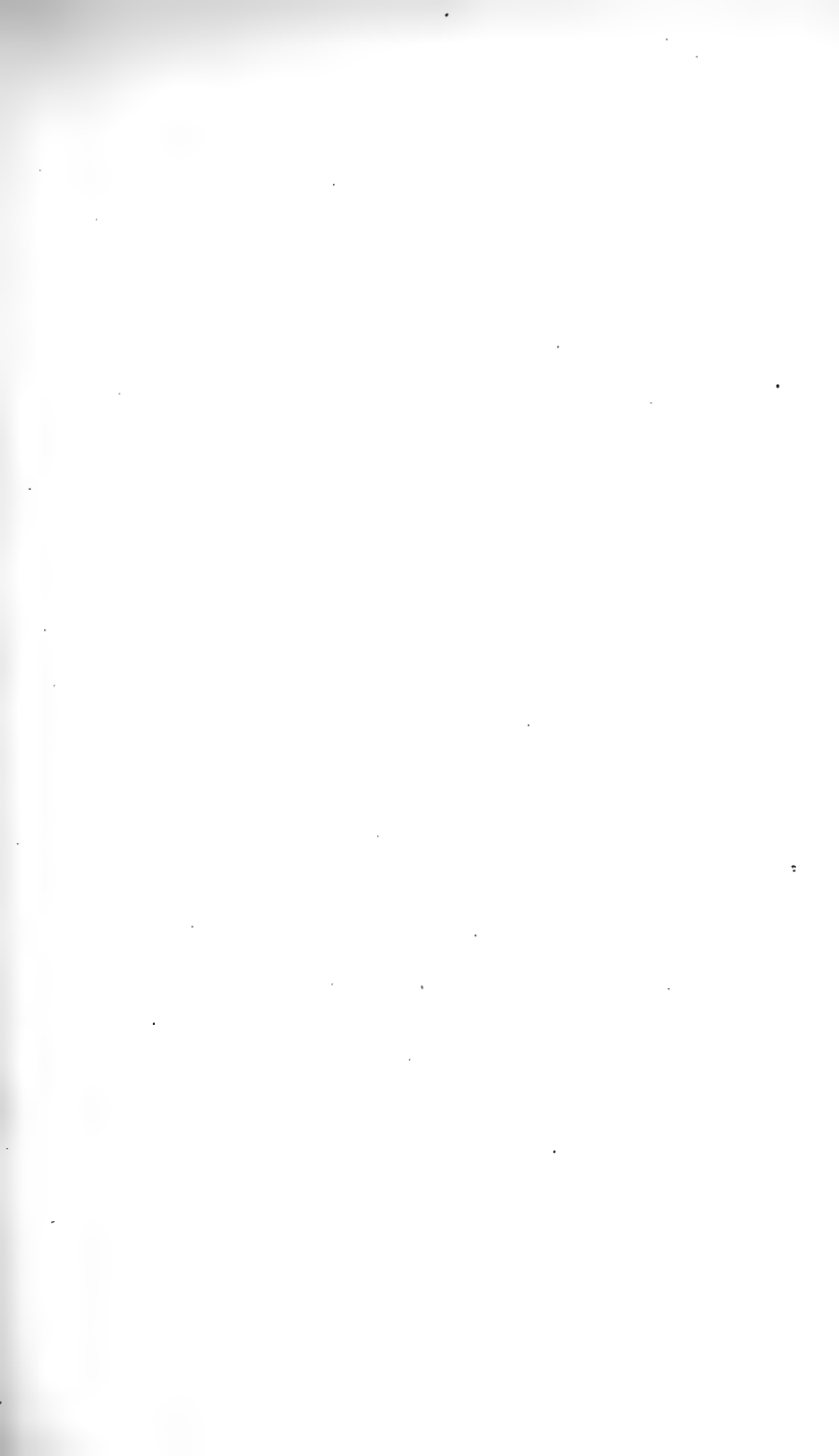
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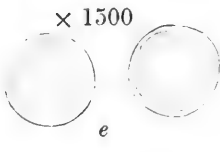
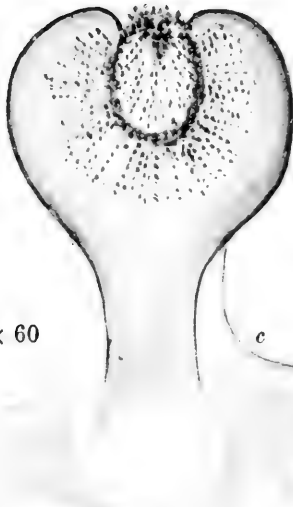
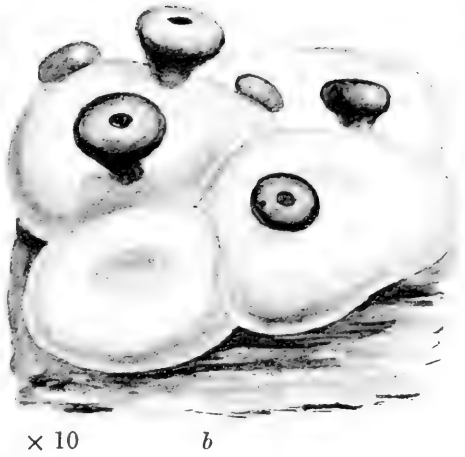
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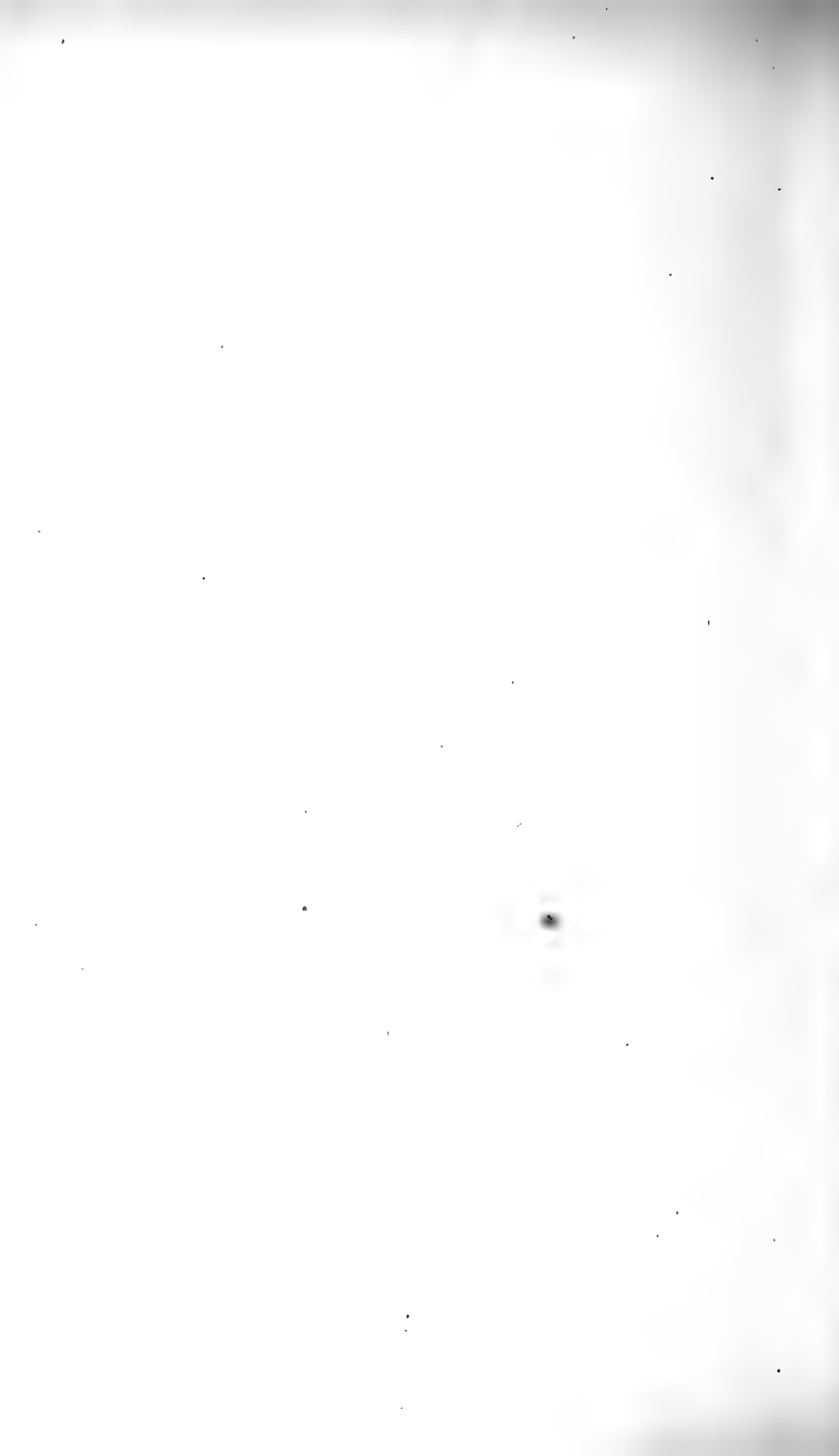


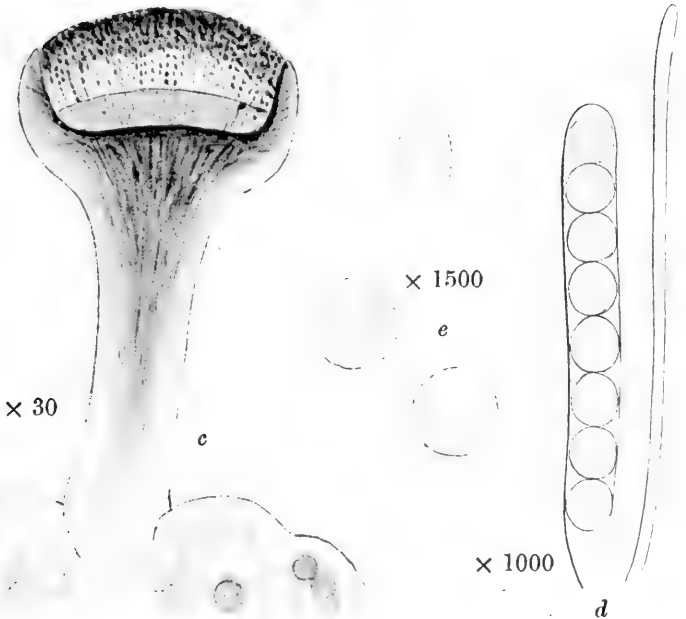
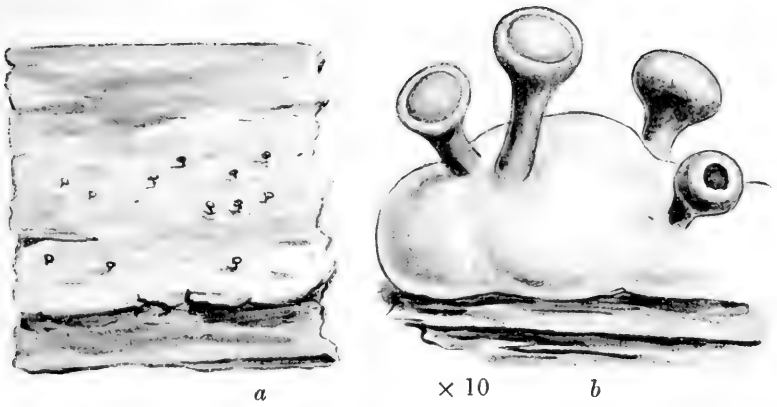




SPHINCTRINA TURBINATA Fr.

a. Plant on *Pertusaria communis*. b. Apothecia. c. Vertical section of apothecium and spermatogone. d. Ascus and paraphysis. e. Ascospores. f. Spermata.

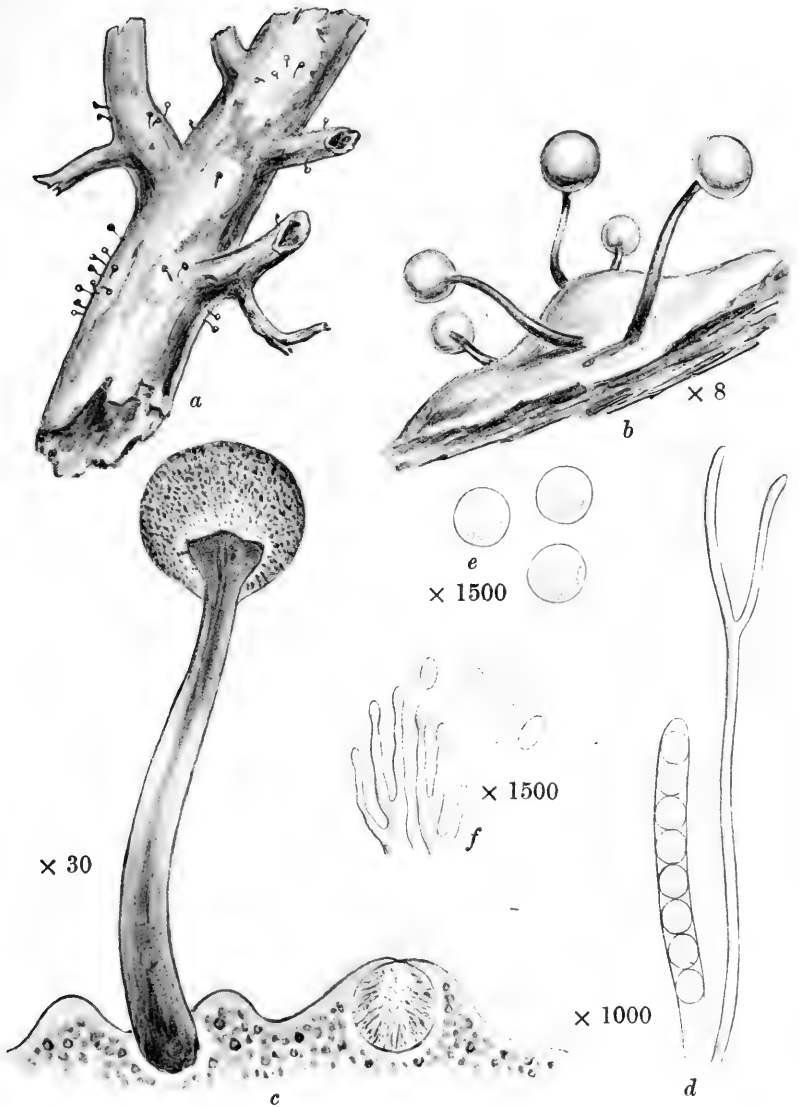




CHAENOTHECA TRABINELLA A. L. Sm.

a. Plant on wood. *b.* Portion of plant. *c.* Vertical section of apothecium.
d. Ascus and paraphysis. *e.* Spores.





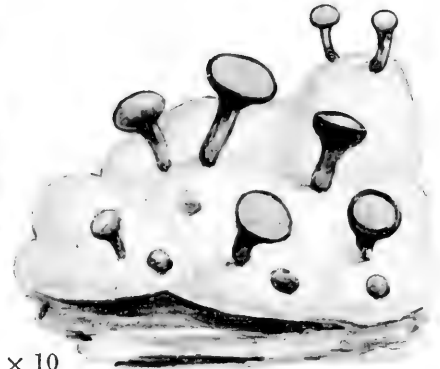
CONIOCYBE FURFURACEA Ach.

- a. Plant on dead branch. b. Portion of plant. c. Vertical section of thallus, apothecium and spermogone. d. Ascus and paraphysis. e. Ascospores. f. Sterigmata and spermatia.



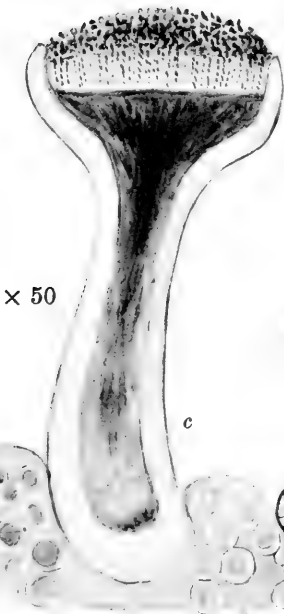


a



× 10

b



× 50

c



e

× 1500



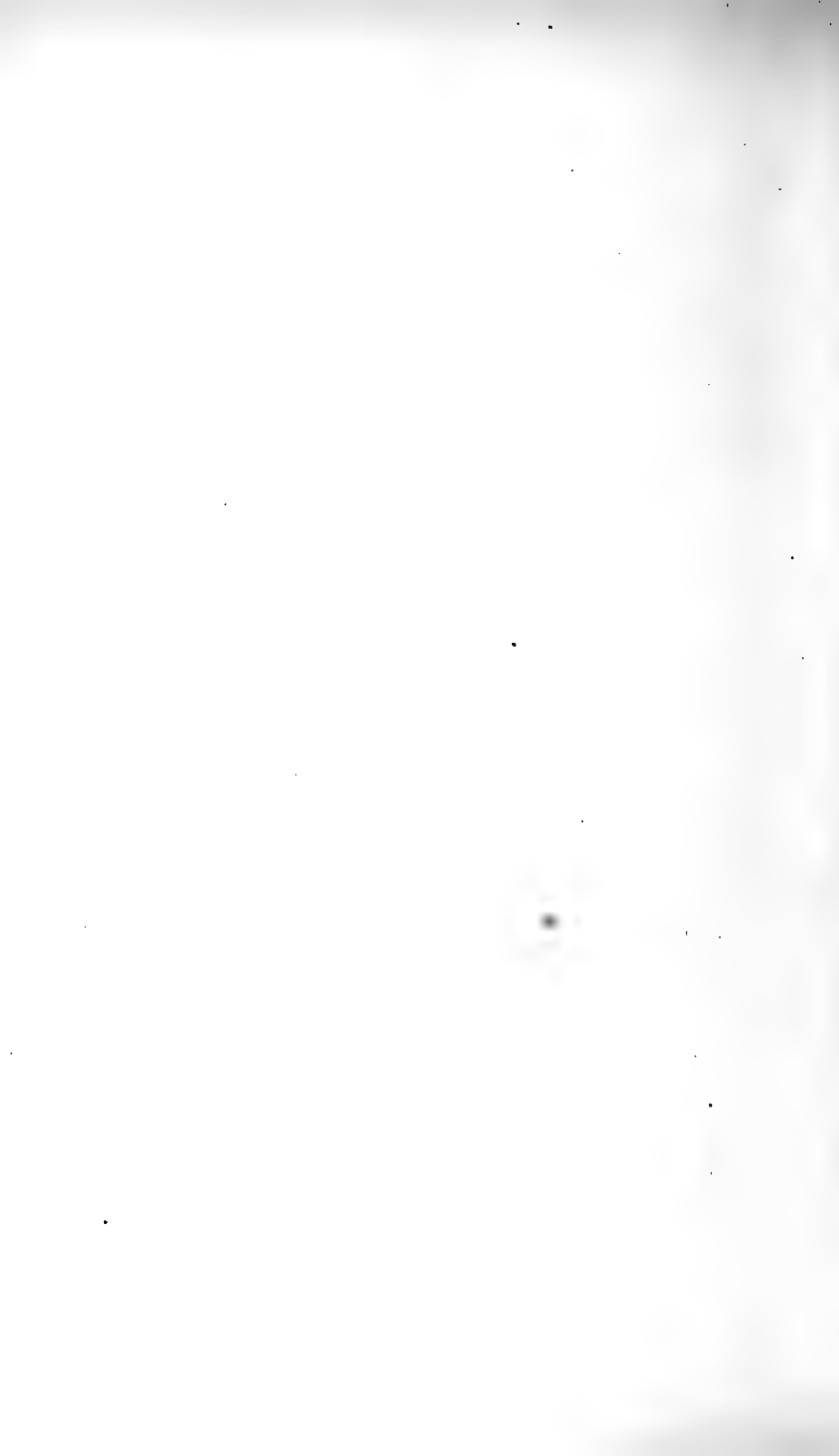
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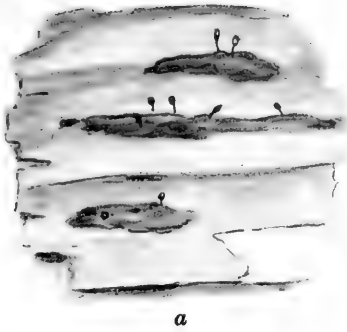
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d

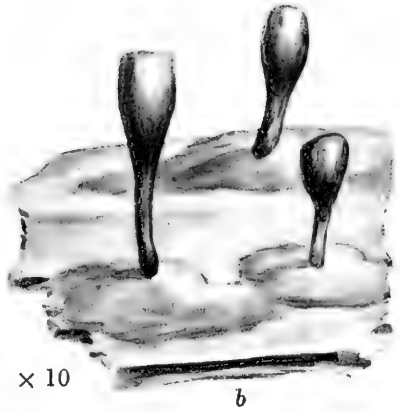
CALICIUM QUERCINUM Pers.

- a. Plant on old paling. b. Portion of plant. c. Vertical section of thallus, apothecium and spermogone. d. Ascus and paraphysis. e. Ascospores. f. Sterigmata and spermatia.



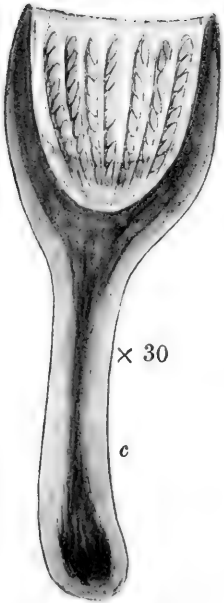


a



$\times 10$

b



$\times 30$

c



$\times 600$

e



$\times 350$

d

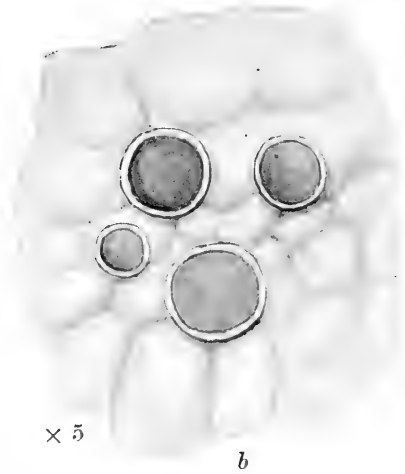
STENOCYBE SEPTATA Rehm.

a. Plant on bark. *b.* Portion of plant. *c.* Section of apothecium.
d. Ascus and paraphysis. *e.* Ascospores.





a

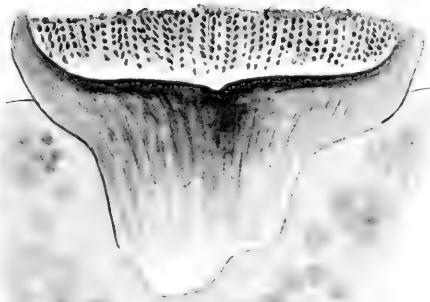


× 5

b

× 1500

c



× 1500

g

× 30

e

f



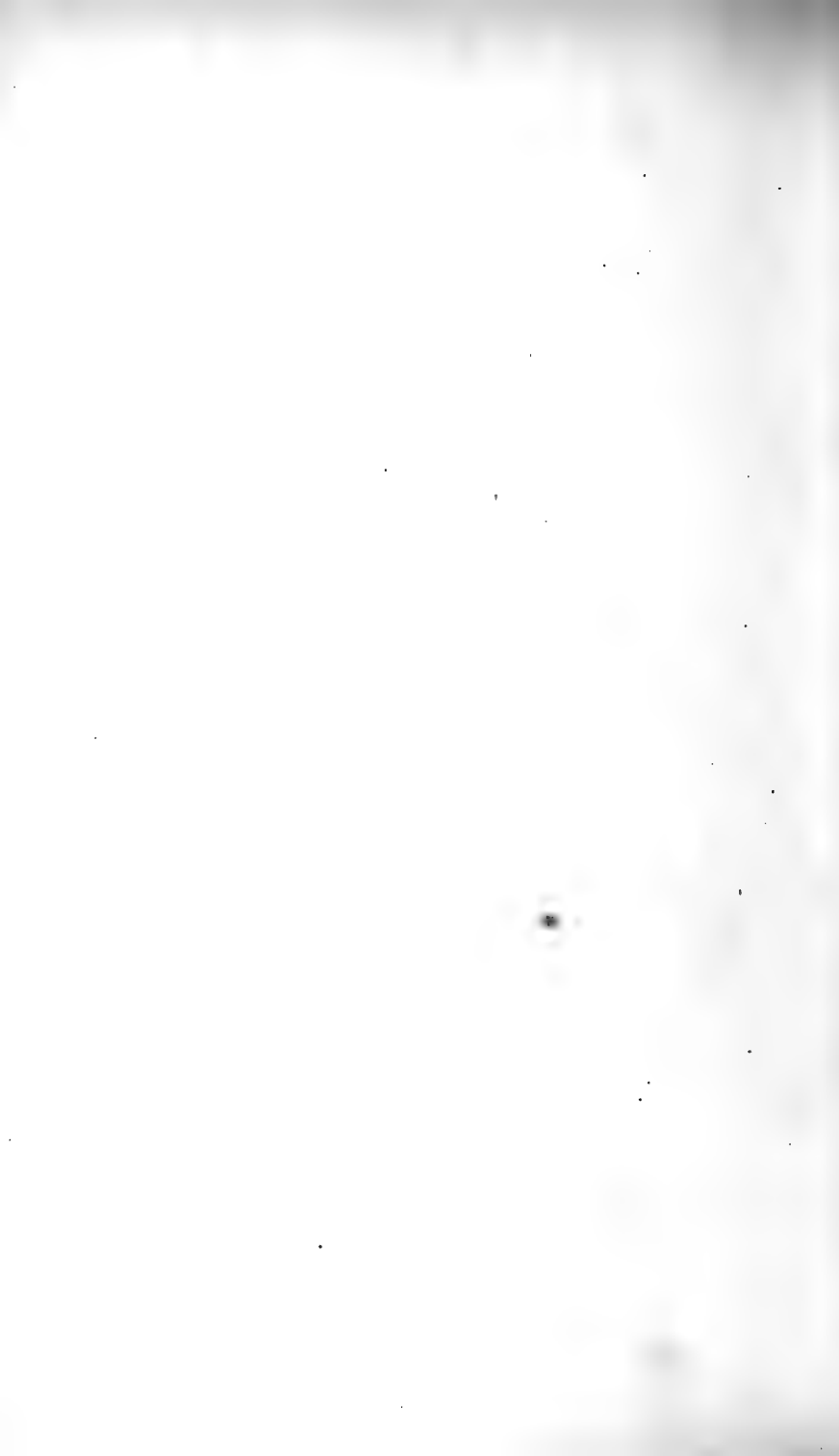
× 30

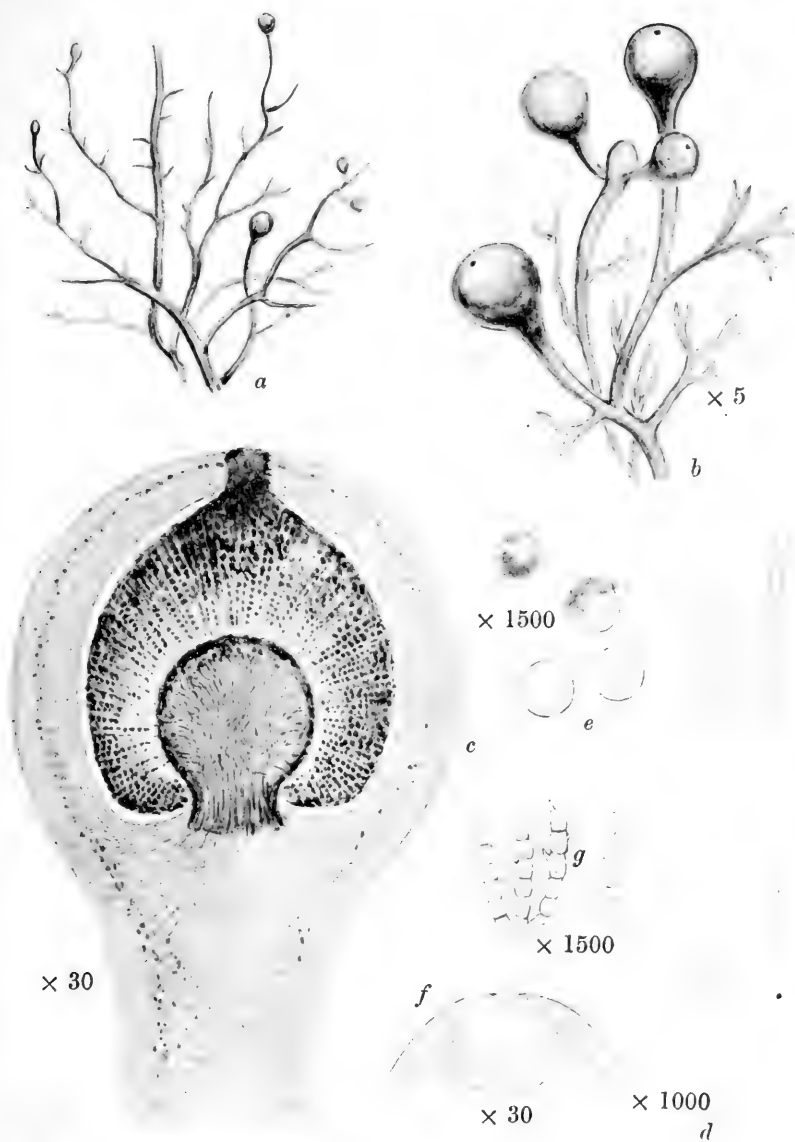
× 1000

d

CYPHELIUM INQUINANS Trev.

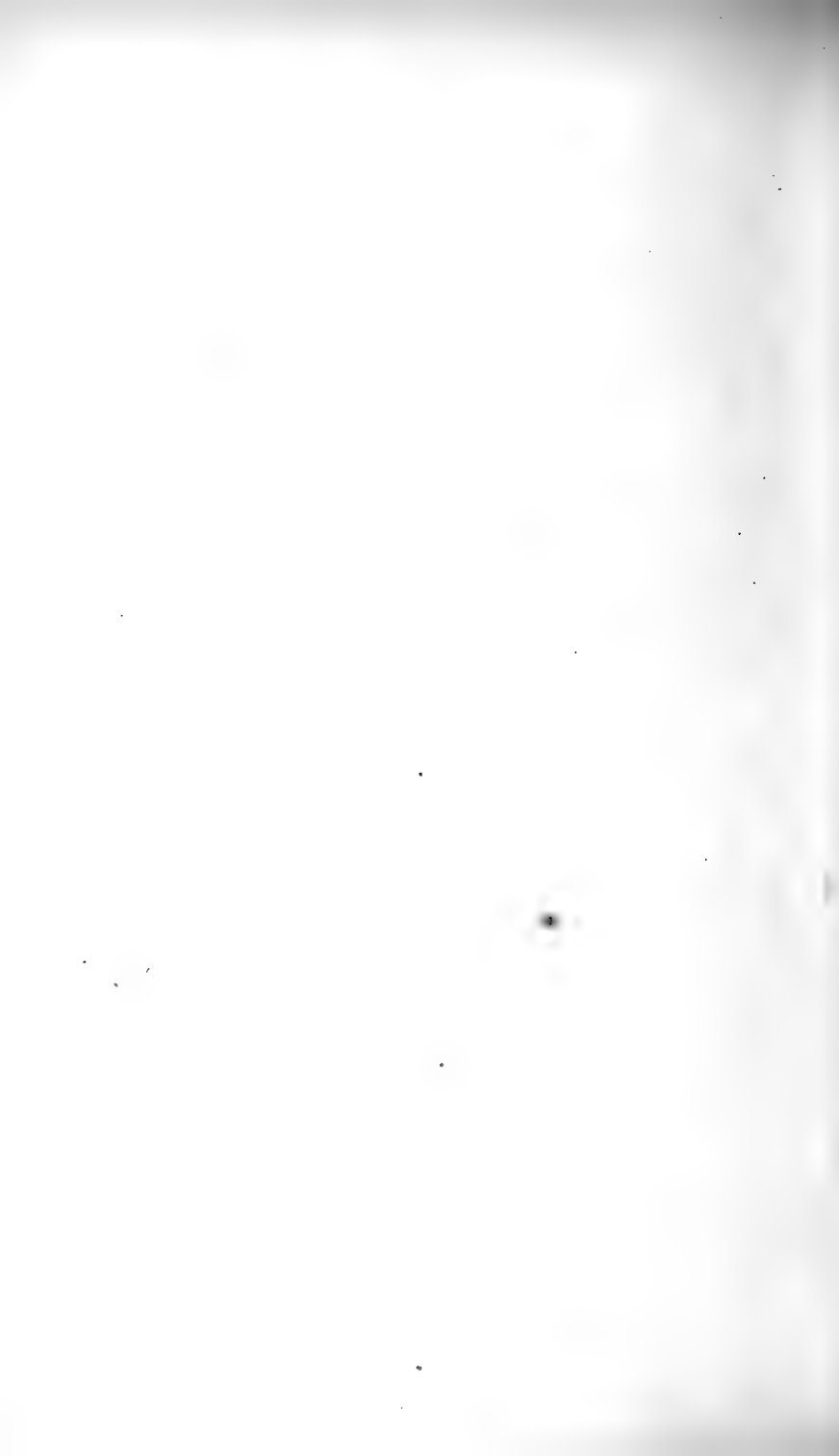
a. Plant on old wood. *b.* Portion of plant. *c.* Vertical section of thallus and apothecium. *d.* Ascus and paraphysis. *e.* Ascospores. *f.* Section of empty spermatogone. *g.* Sterigmata and spermatia.

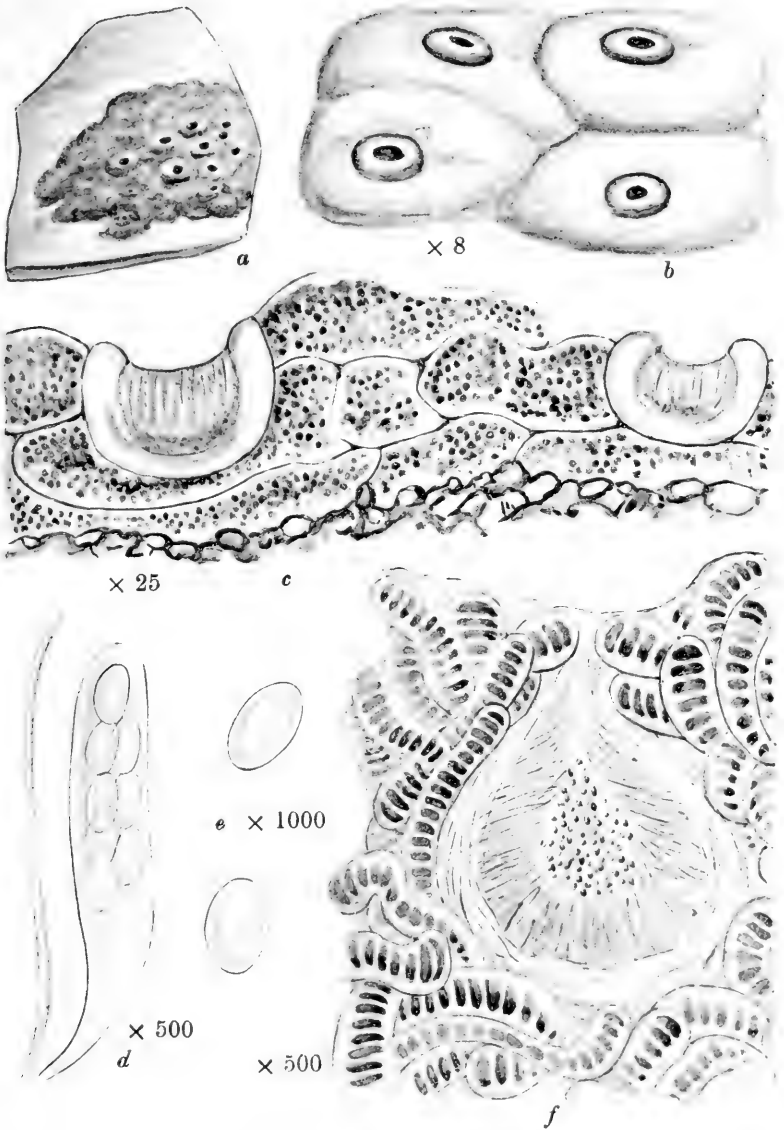




SPHAEROPHORUS GLOBOSUS A. L. Sm.

- a.* Plant. *b.* Portion of plant. *c.* Vertical section of apothecium. *d.* Ascus and paraphysis. *e.* Ascospores. *f.* Vertical section of spermatium. *g.* Sterigmata and spermatia.





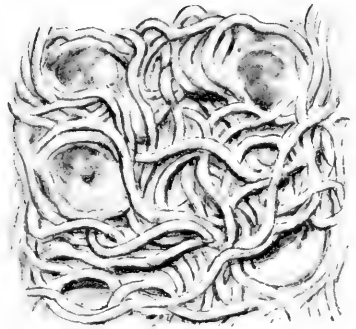
POROCYPHUS AREOLATUS, Koerb.

- a.** Plant on rock. **b.** Portion of plant. **c.** Vertical section of thallus and apothecia.
d. Ascus and paraphysis. **e.** Spores. **f.** Vertical section of spermatogone.

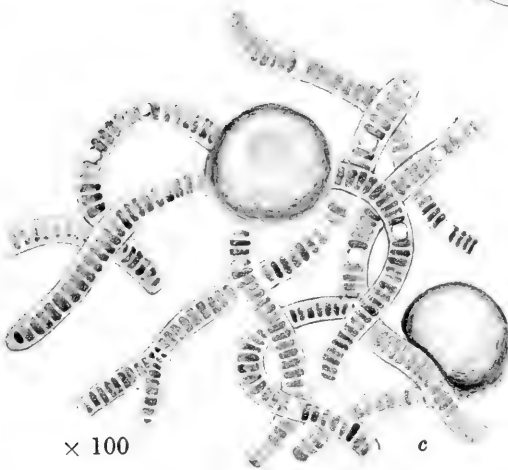




a

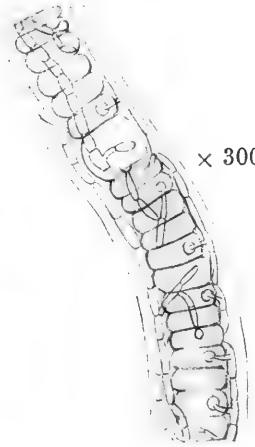


b × 20



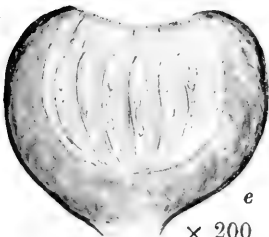
× 100

c



× 300

d



× 200

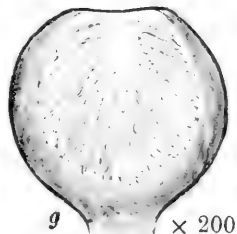
e



× 700

f

h

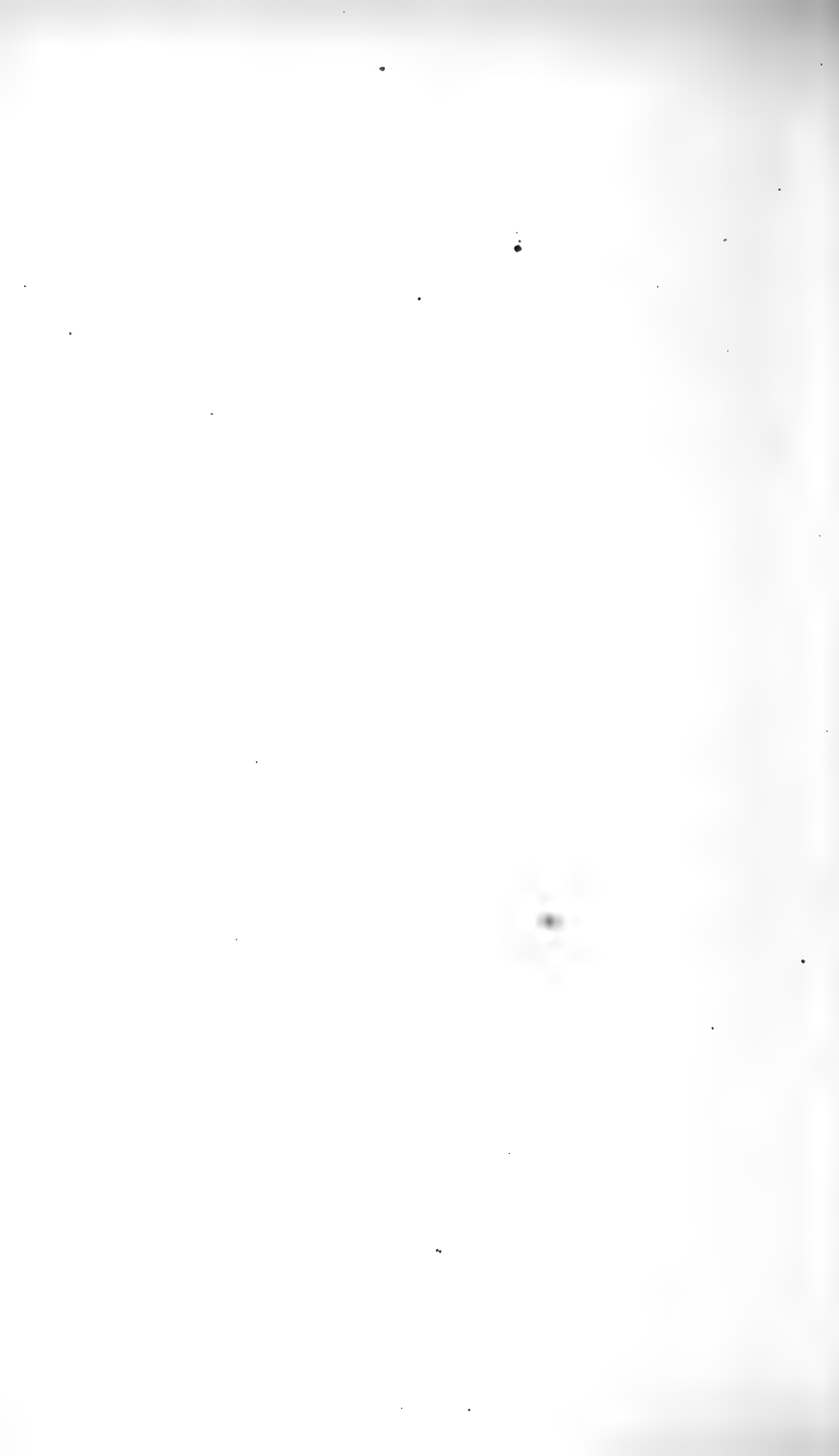


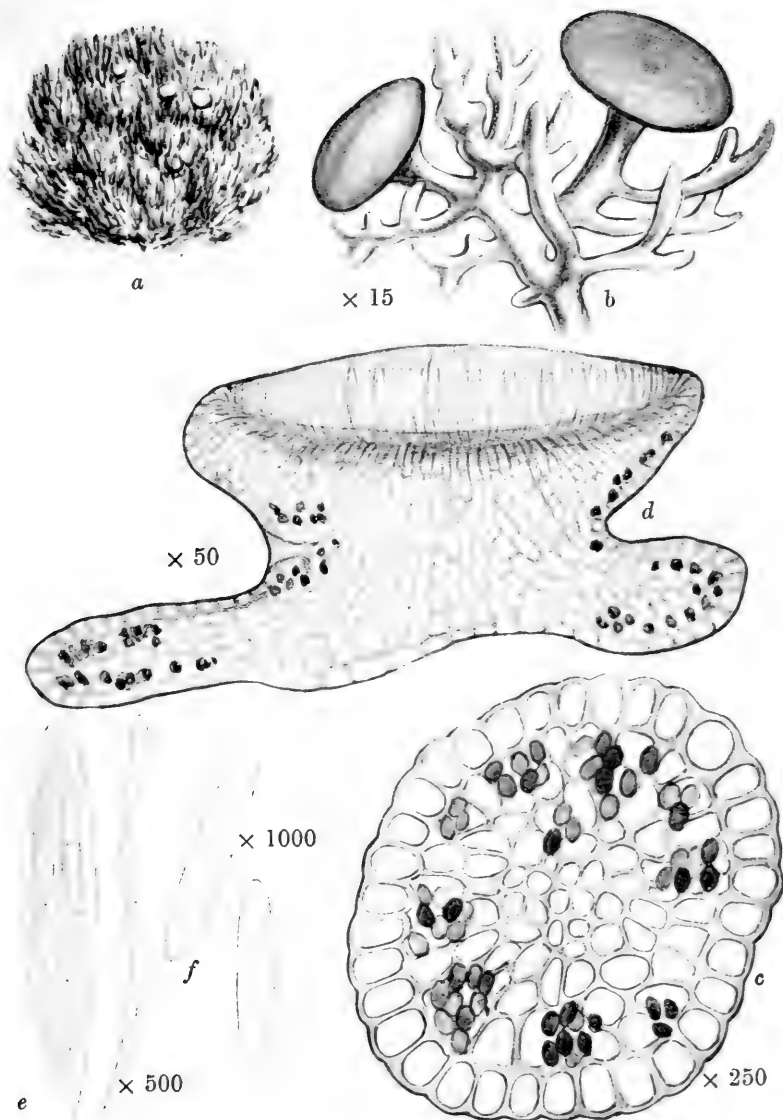
× 200

g

THERMUTIS VELUTINA Th. Fr.

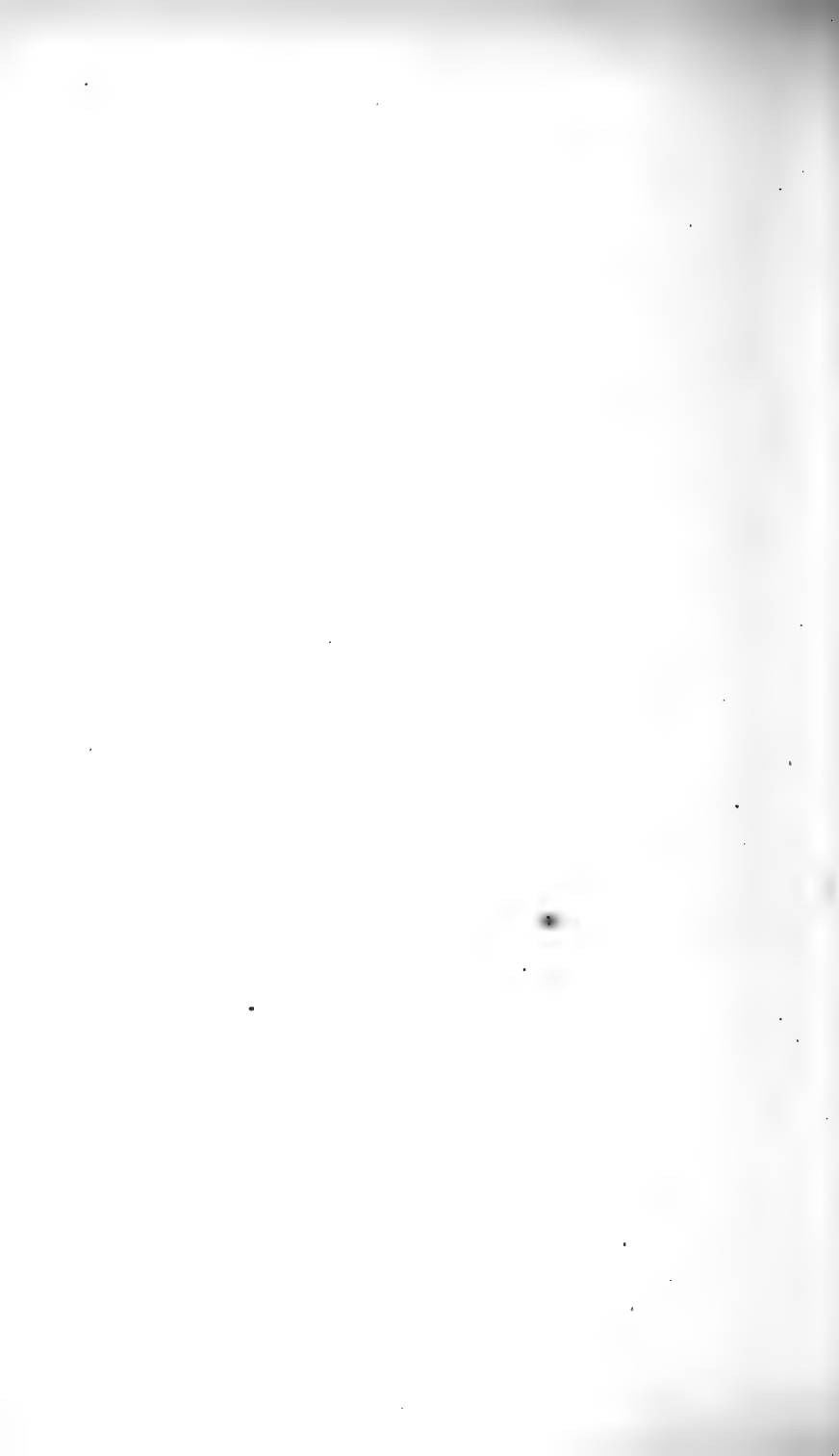
a. Plant on rock. b. Portion of plant. c. Plant with apothecia. d. Portion of thallus.
 e. Vertical section of apothecium. f. Ascus and paraphyses. g. Vertical section of spermatogone. h. Sterigmata and spermatia.

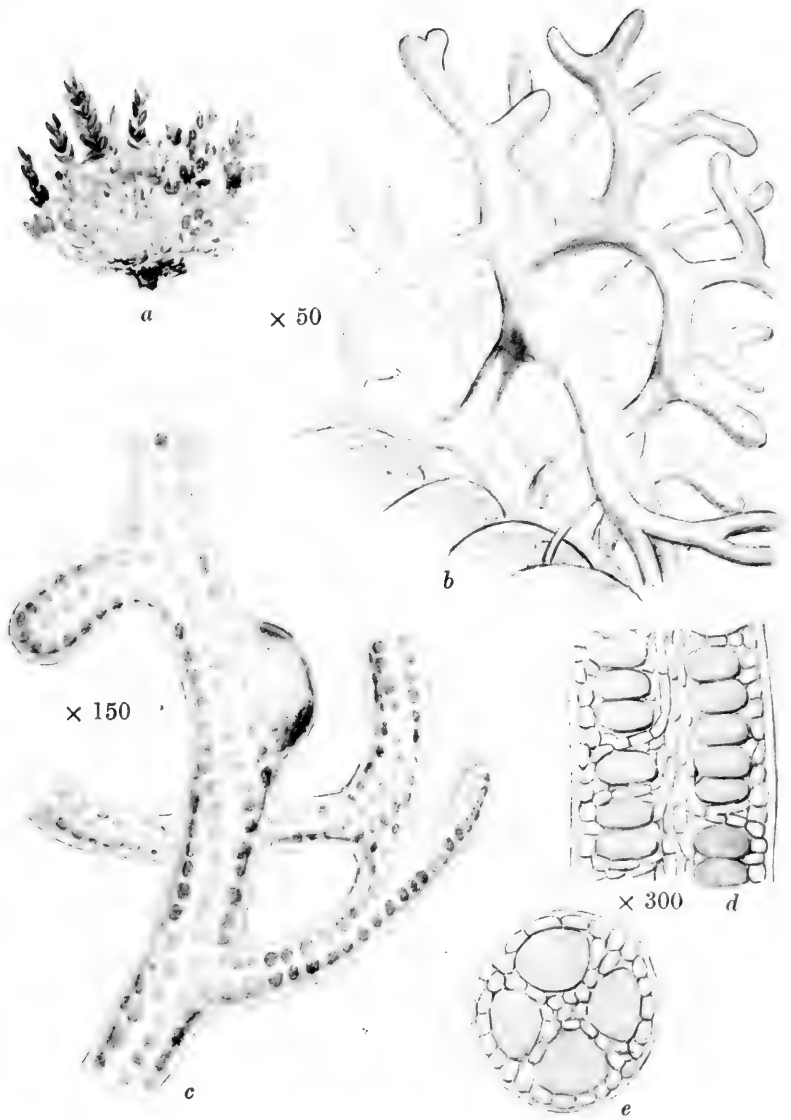




POLYCHIDIUM MUSCICOLUM S. F. Gray.

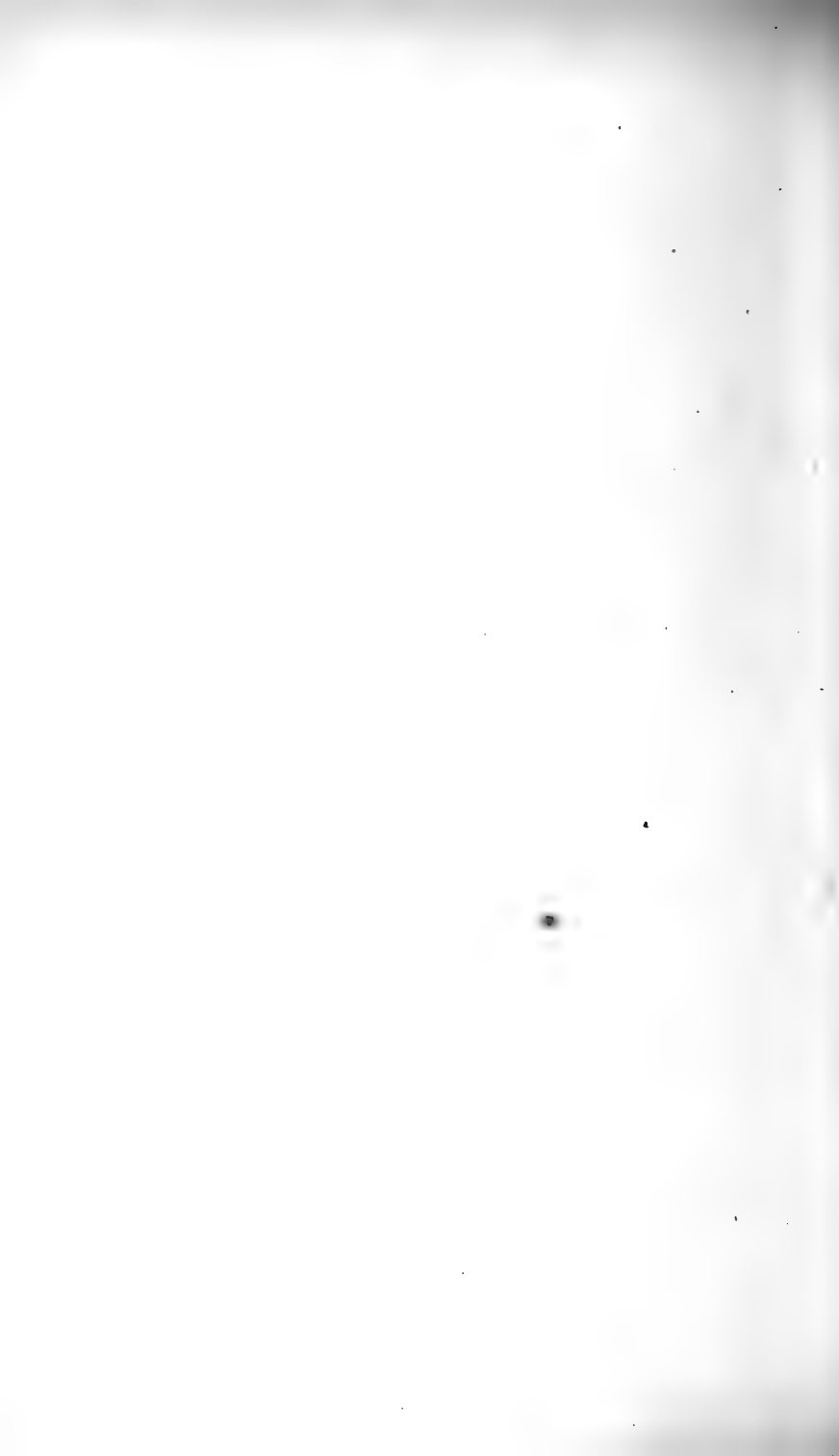
- a. Plant among mosses. b. Portion of plant. c. Transverse section of thallus.
 d. Vertical section of apothecium. e. Ascus and paraphysis. f. Spores.

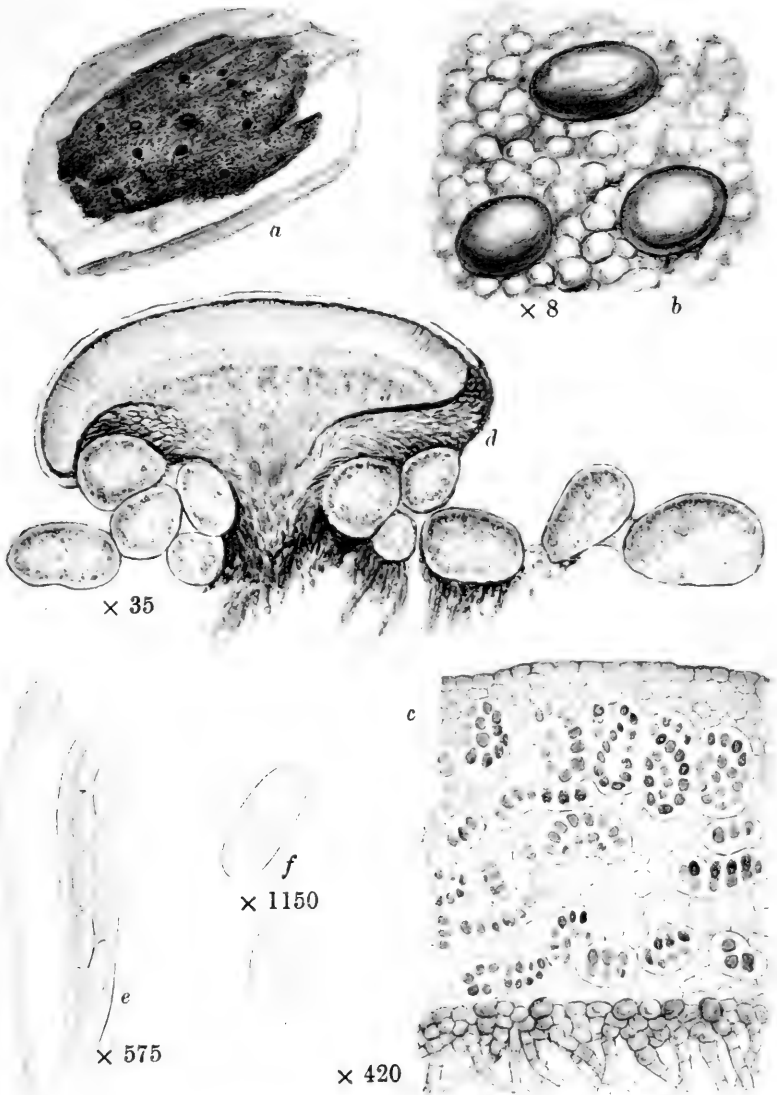




LEPTOGIDIUM DENDRISCUM Nyl.

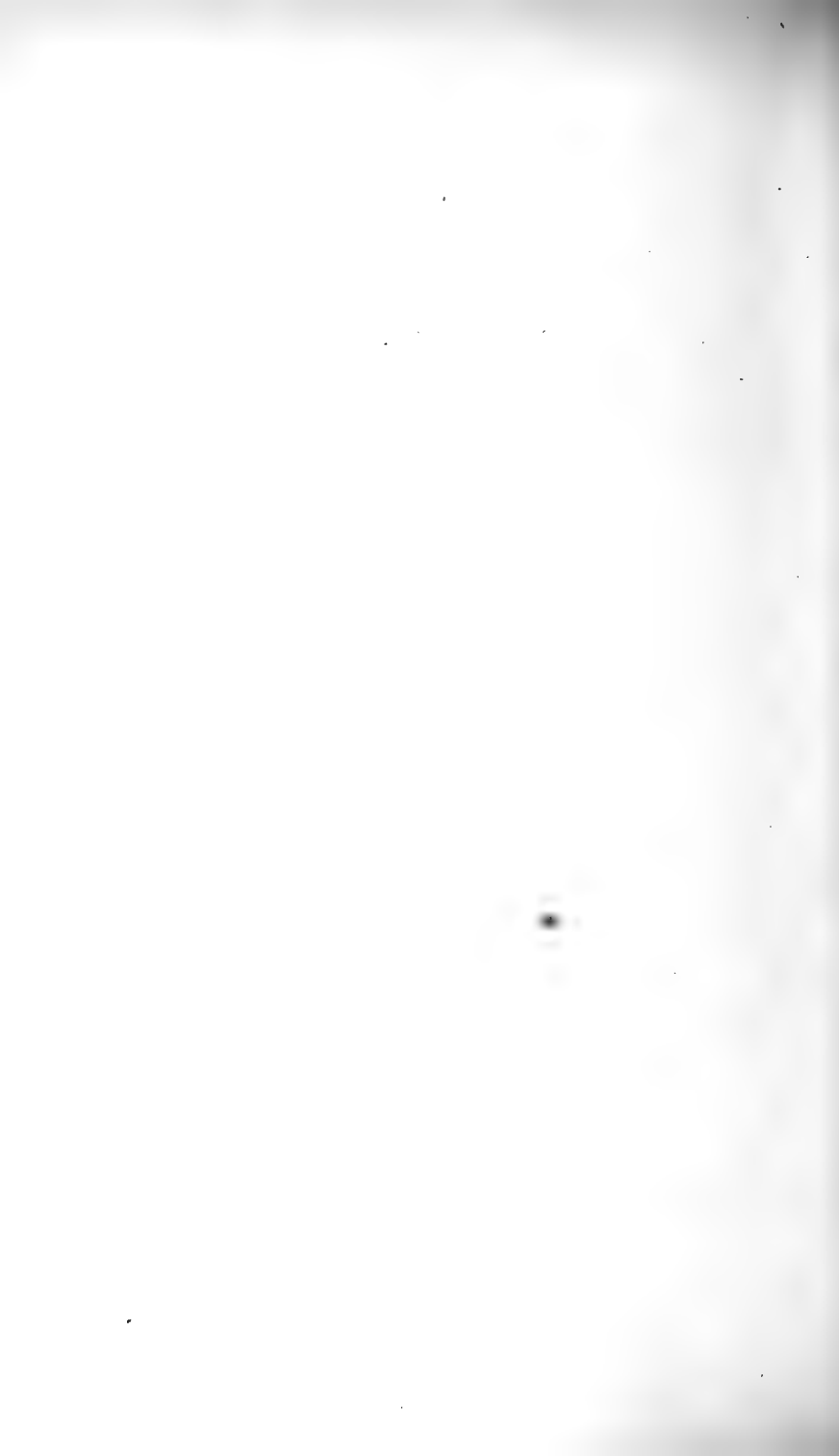
a. Plant on moss. b. Portion of plant. c. Branching filament. d. Thallus in vertical section. e. Thallus in transverse section.

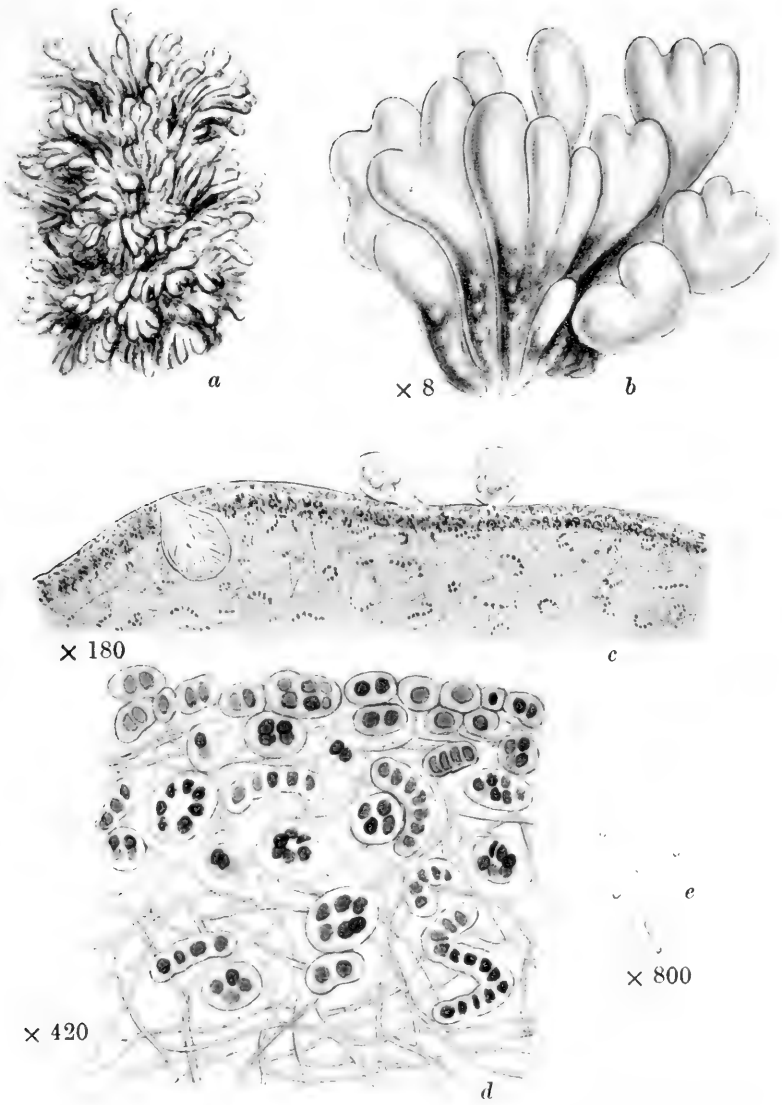




PLACYNTHIUM NIGRUM S. F. Gray.

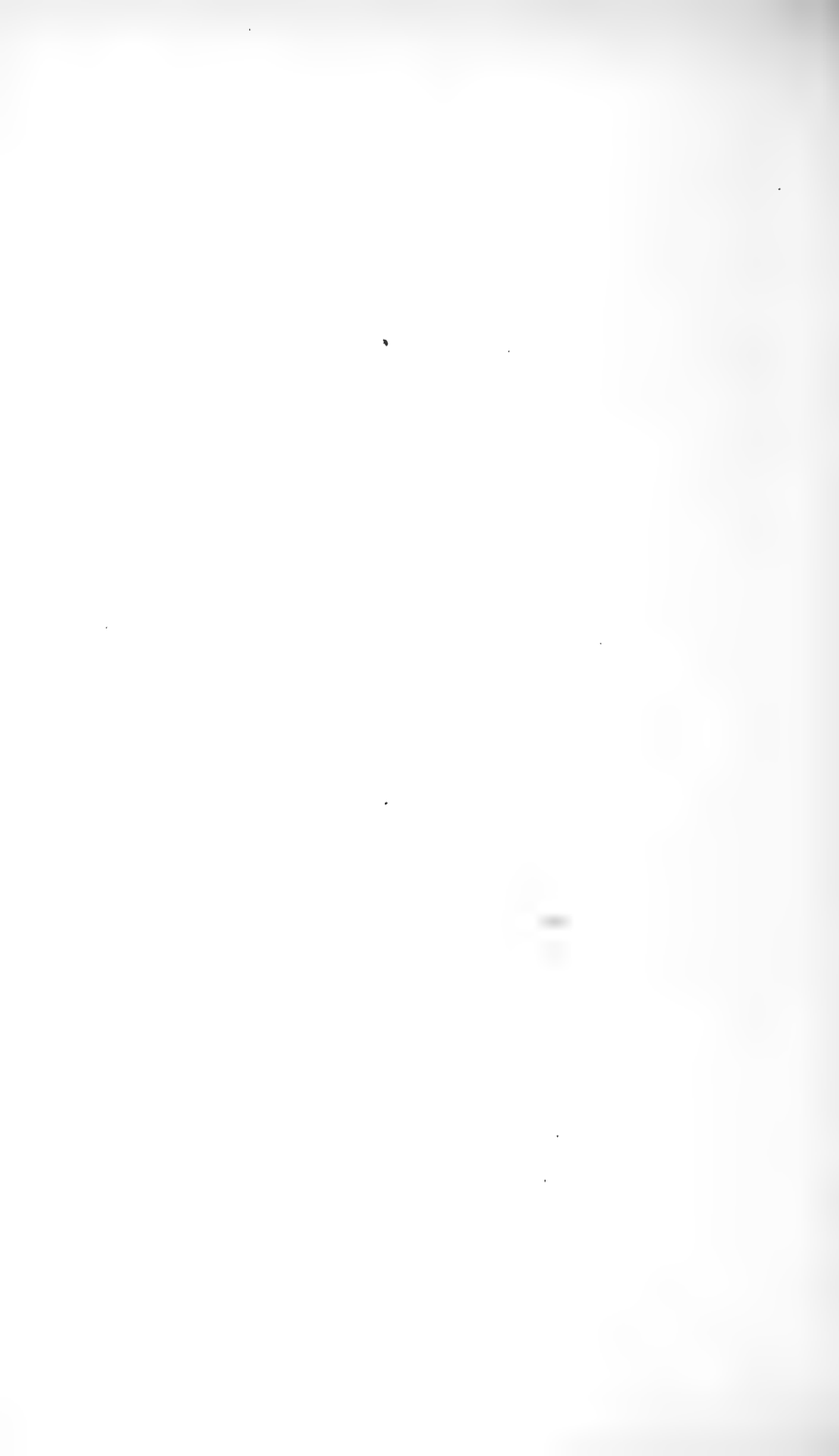
a. Plant on rock. b. Portion of plant. c. Section of thallus. d. Vertical section of apothecium. e. Ascus and paraphysis. f. Spores.

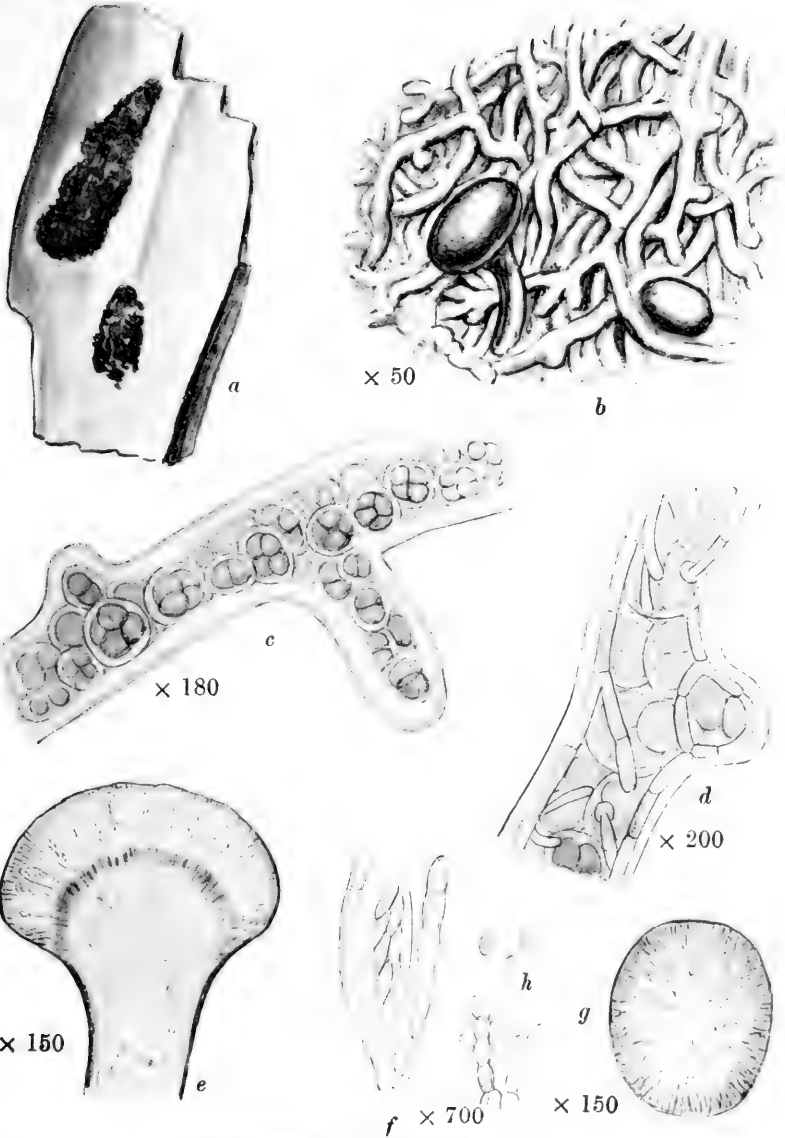




SCHIZOMA LICHENODEUM Nyl.

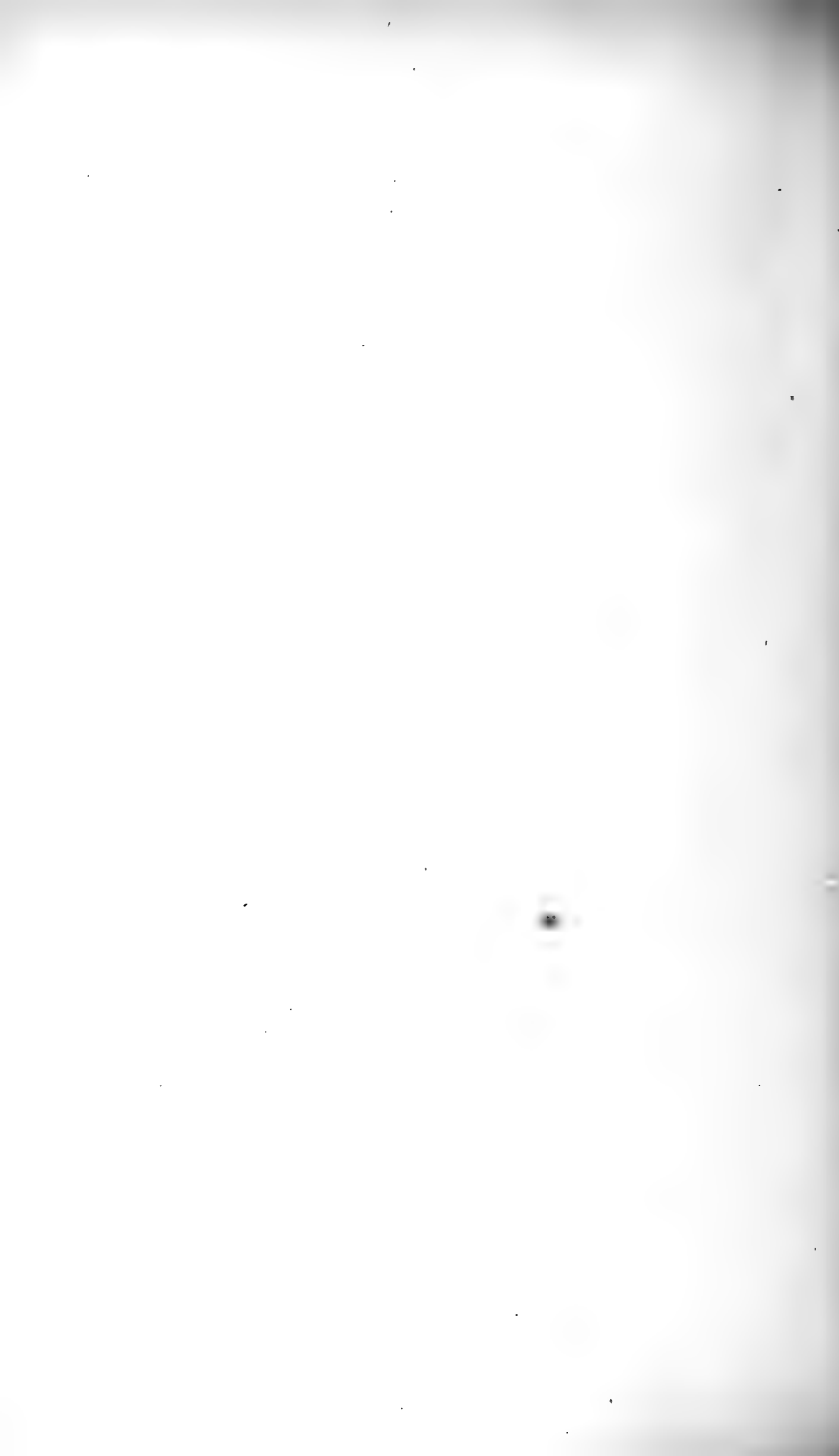
- a.* Plant on the ground. *b.* Portion of plant. *c.* Section of lobe and of spermogone.
d. Section of thallus. *e.* Spermata.

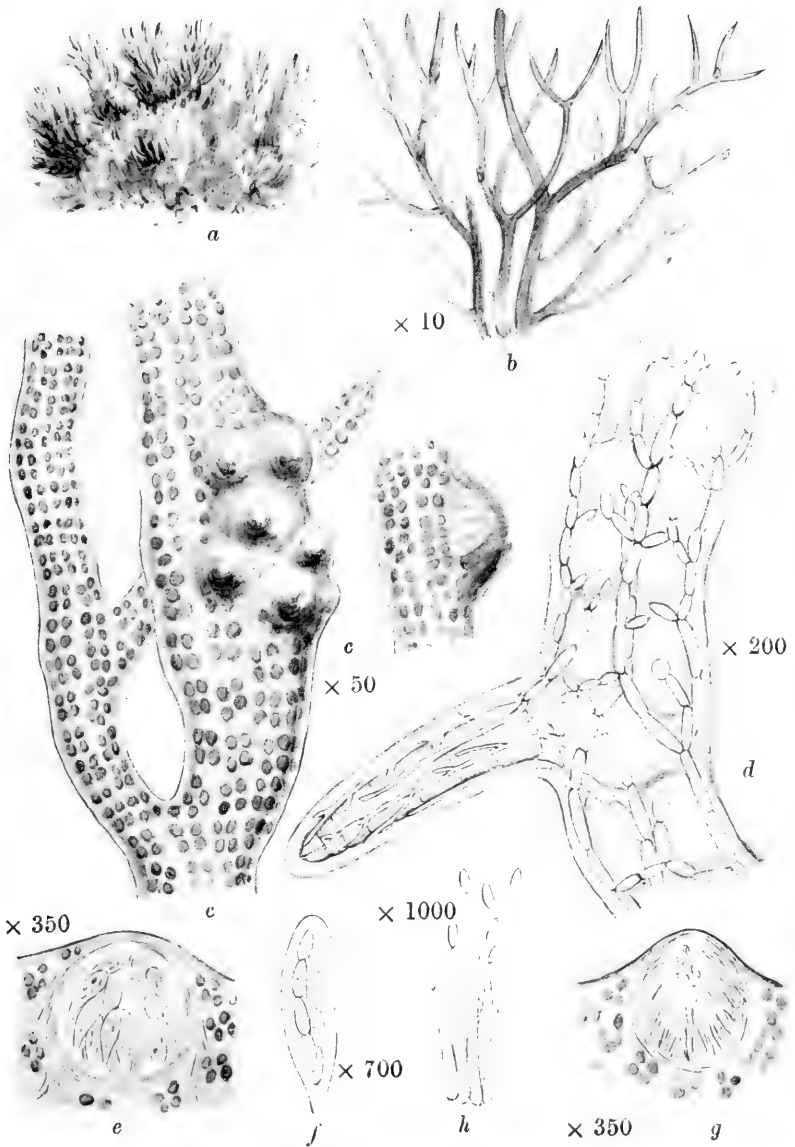




SYLONEMA PARADOXUM Born.

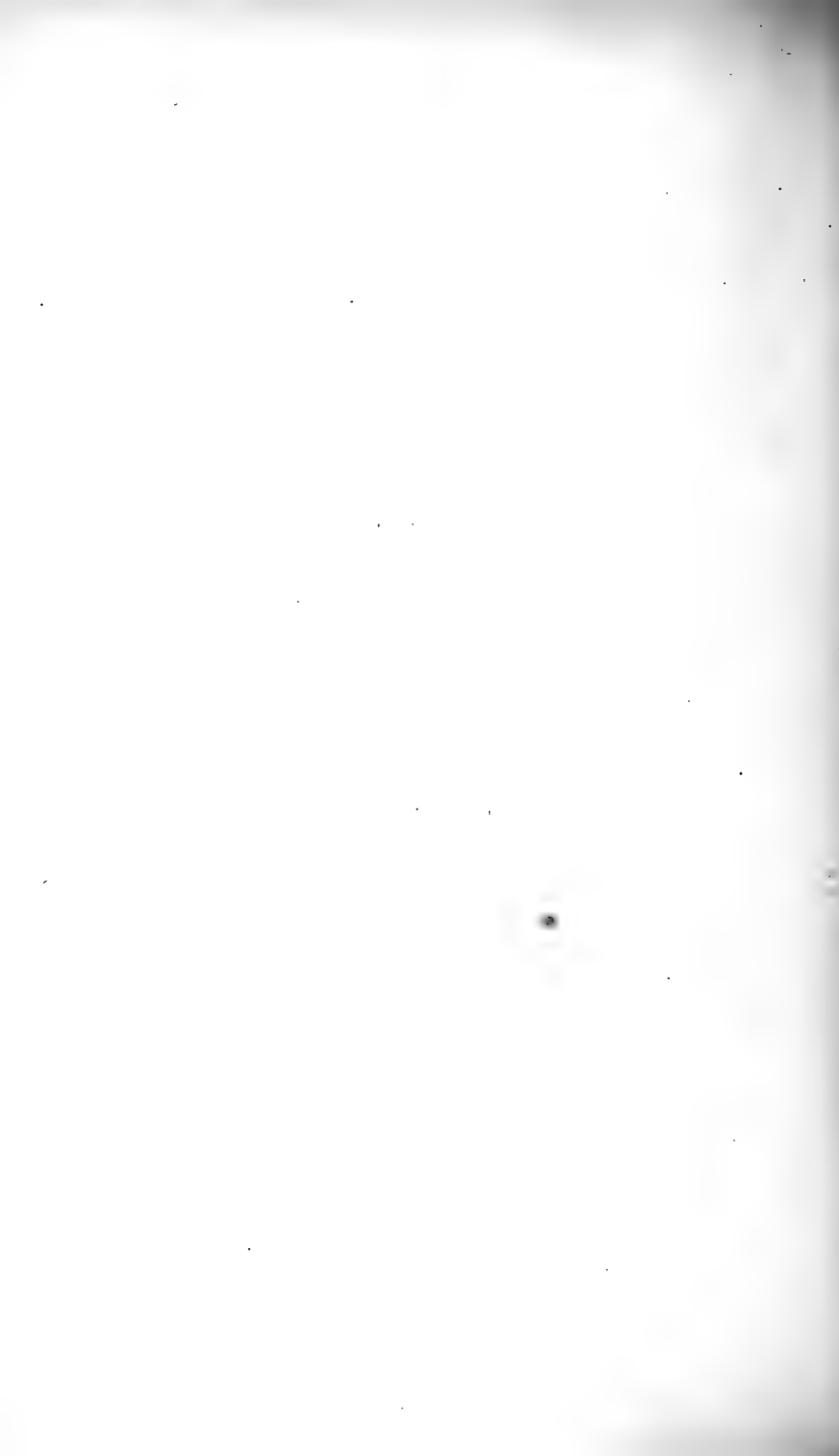
- a. Plant on rock. b. Portion of plant. c. Portion of alga. d. Portion of thallus.
 e. Vertical section of apothecium. f. Ascus and paraphyses. g. Section
 of spermatogone. h. Sterigmata and spermatia.

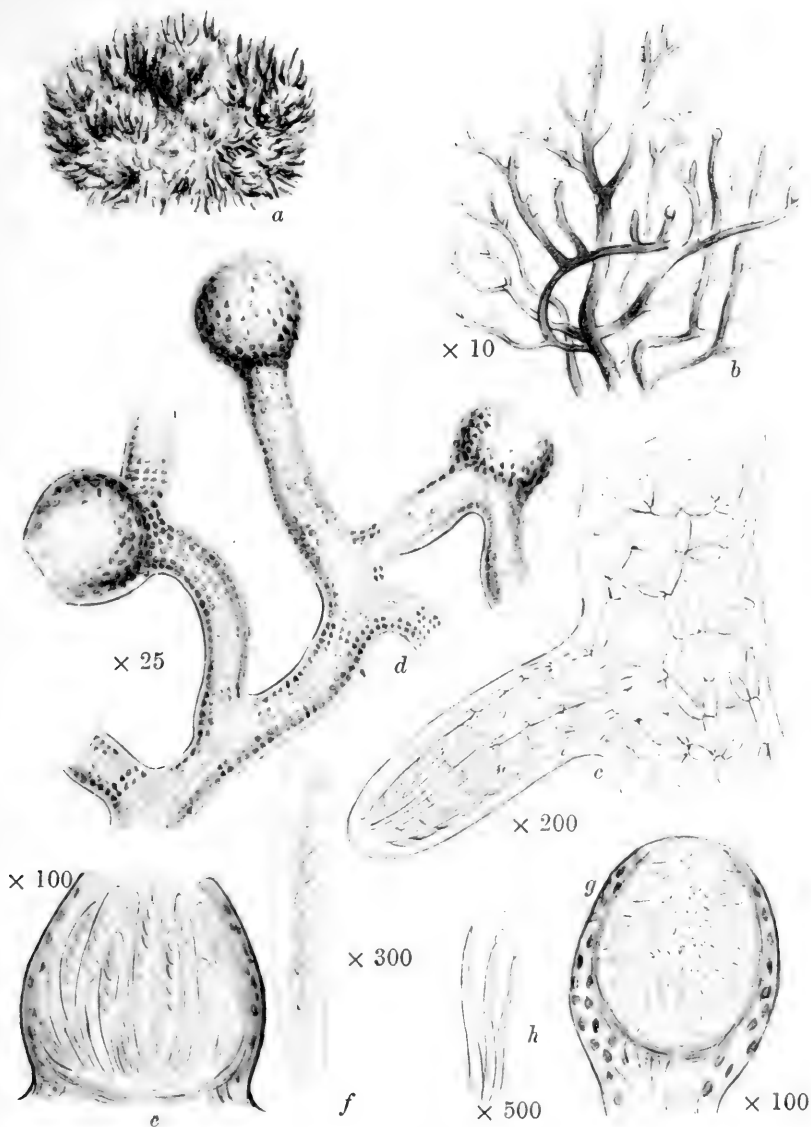




EPHEBE LANATA Wain.

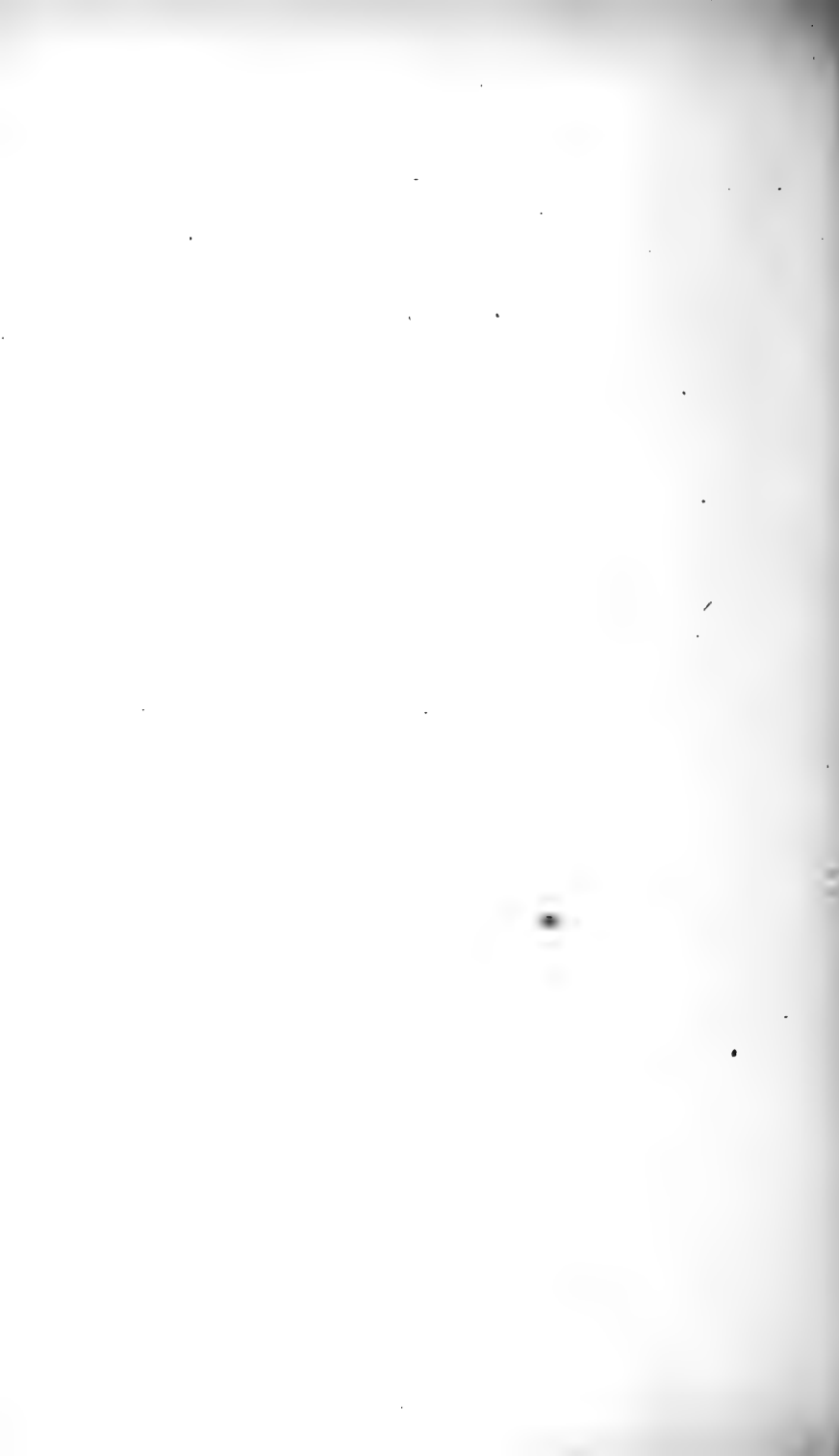
a. Plant on rock. *b* and *c.* Portion of plant. *d.* Portion of thallus. *e.* Vertical section of apothecium. *f.* Ascus with spores. *g.* Vertical section of spermatogone. *h.* Sterigmata and spermatia.

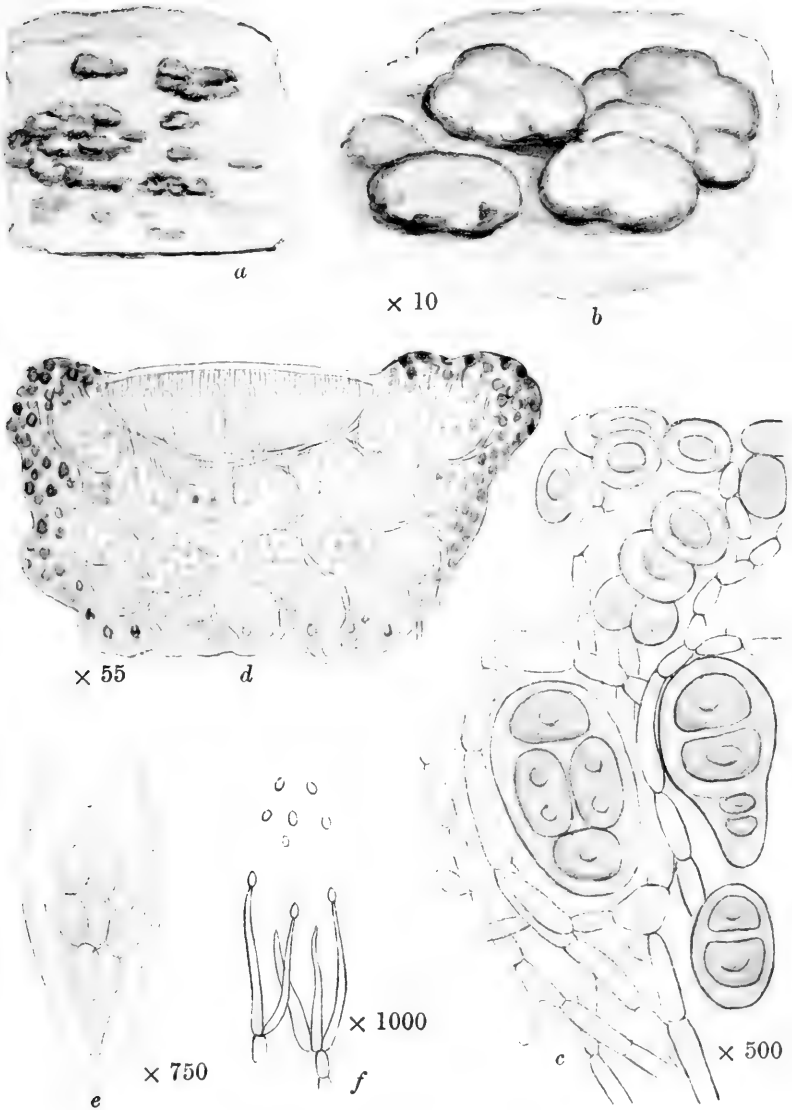




EPHEBEIA HISPIDULA Nyl.

- a. Plant on rock. b. Portion of plant. c. Thallus in vertical section. d. Fertile thallus. e. Vertical section of apothecium. f. Ascus and paraphysis. g. Vertical section of spermogone. h. Sterigmata and spermatia.

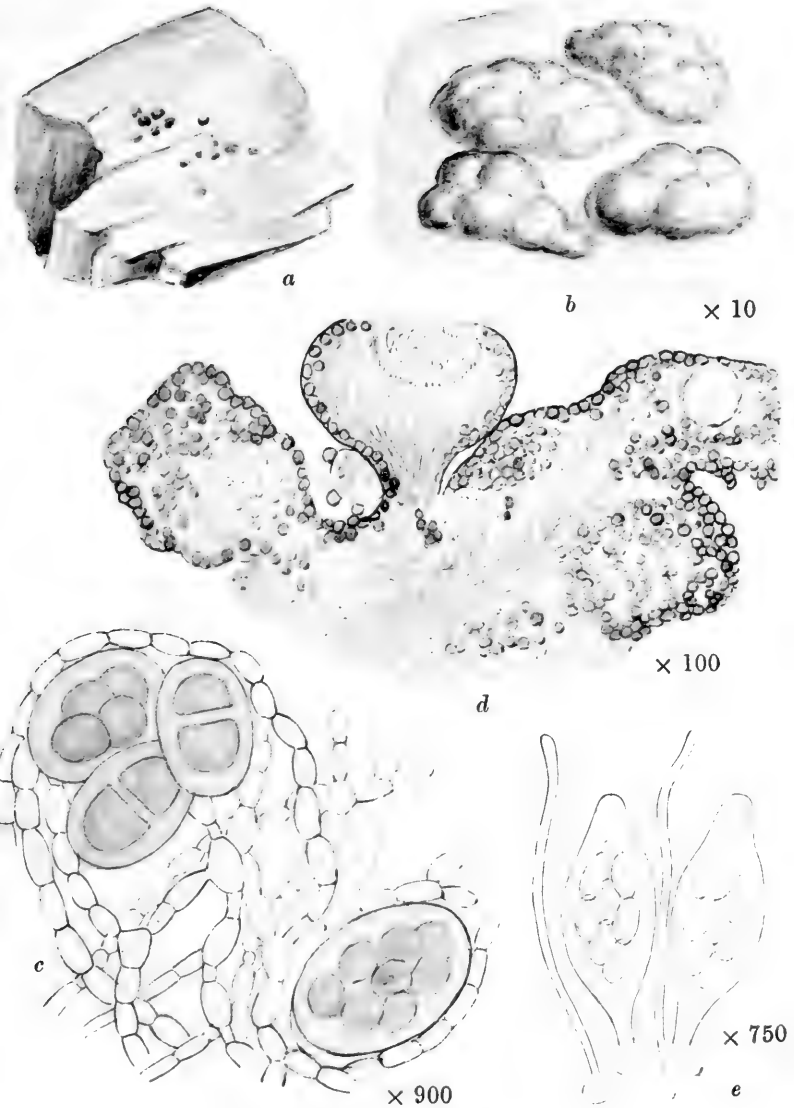




EUOPSIS PULVINATA Wain.

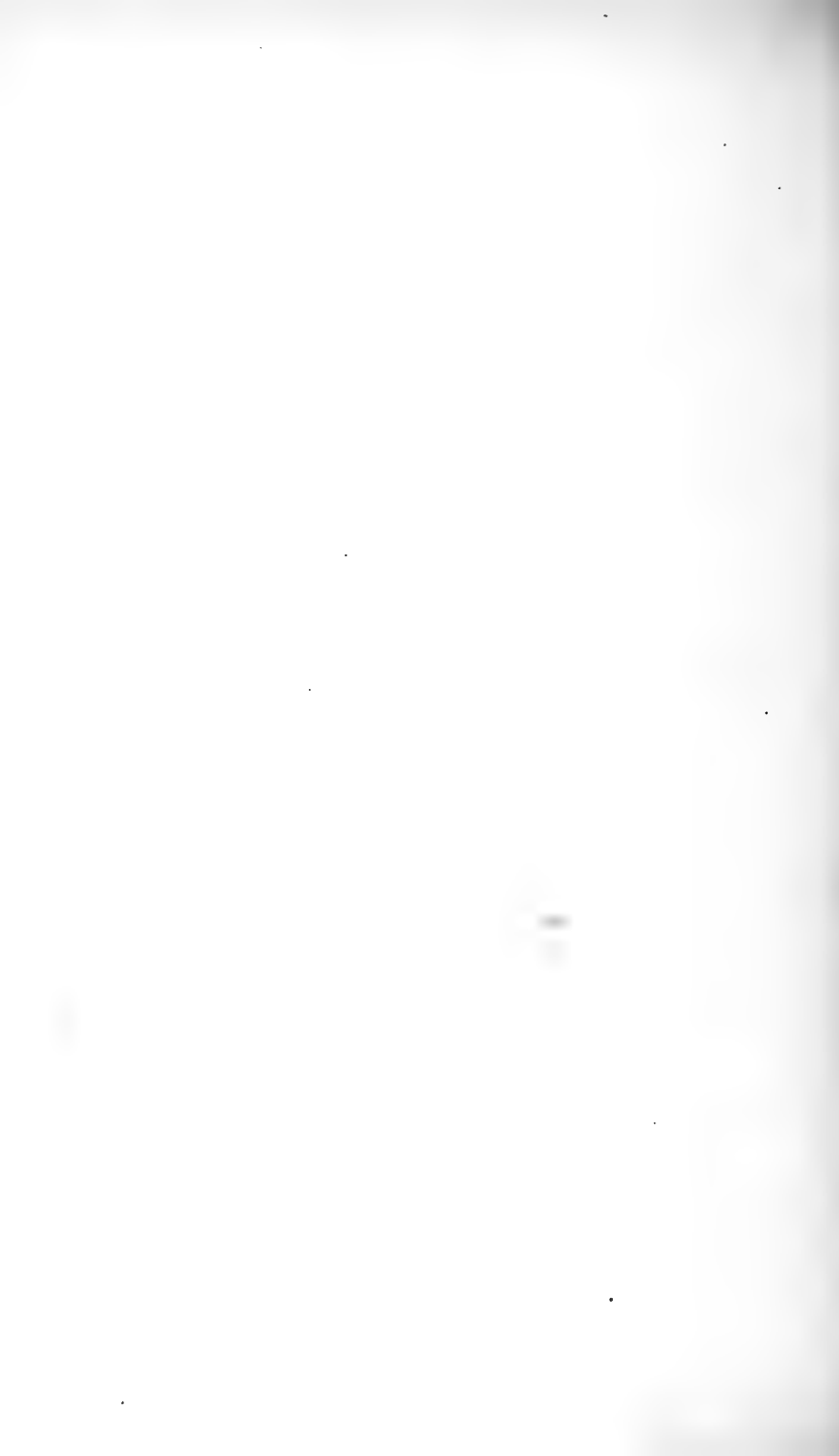
a. Plant on rock. *b.* Portion of plant. *c.* Section of thallus. *d.* Vertical section of apothecium. *e.* Ascus and paraphyses. *f.* Sterigmata and spermatia.

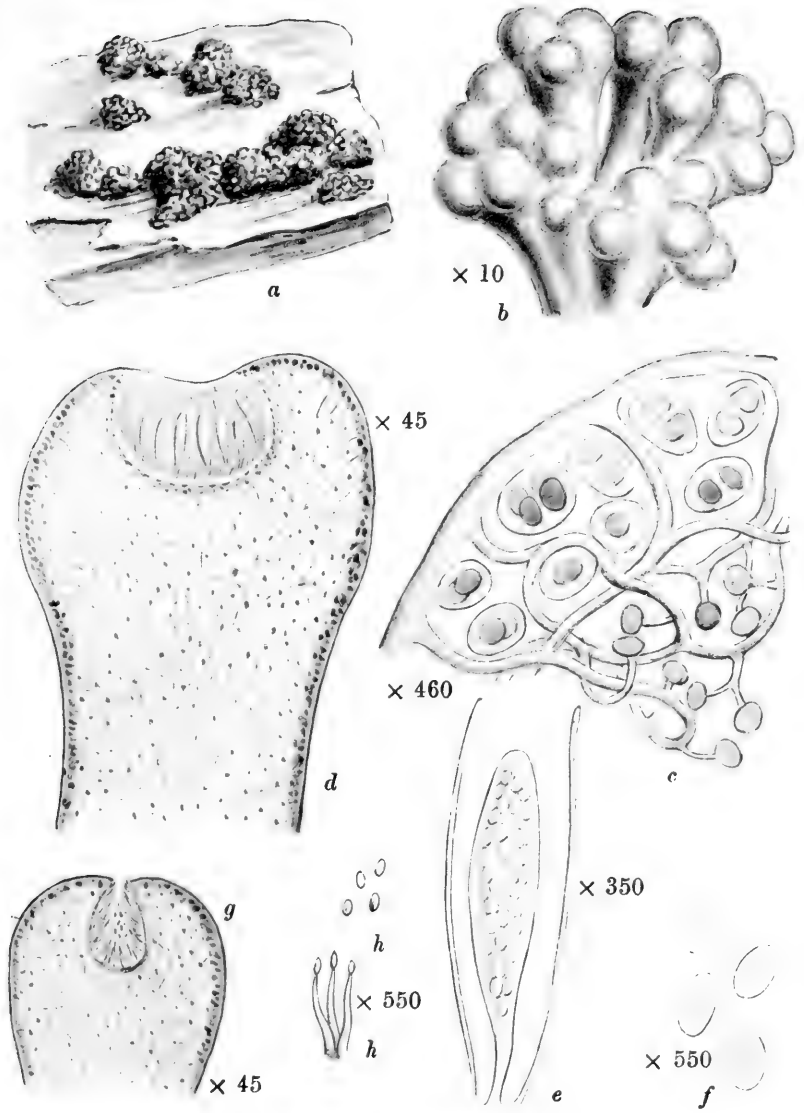




PYRENOPSIS PHYLLISCELLA Nyl.

a. Plant on boulder. *b.* Portion of plant. *c.* Section of thallus. *d.* Vertical section of thallus, with apothecium and spermatogone. *e.* Asci with spores and paraphyses.

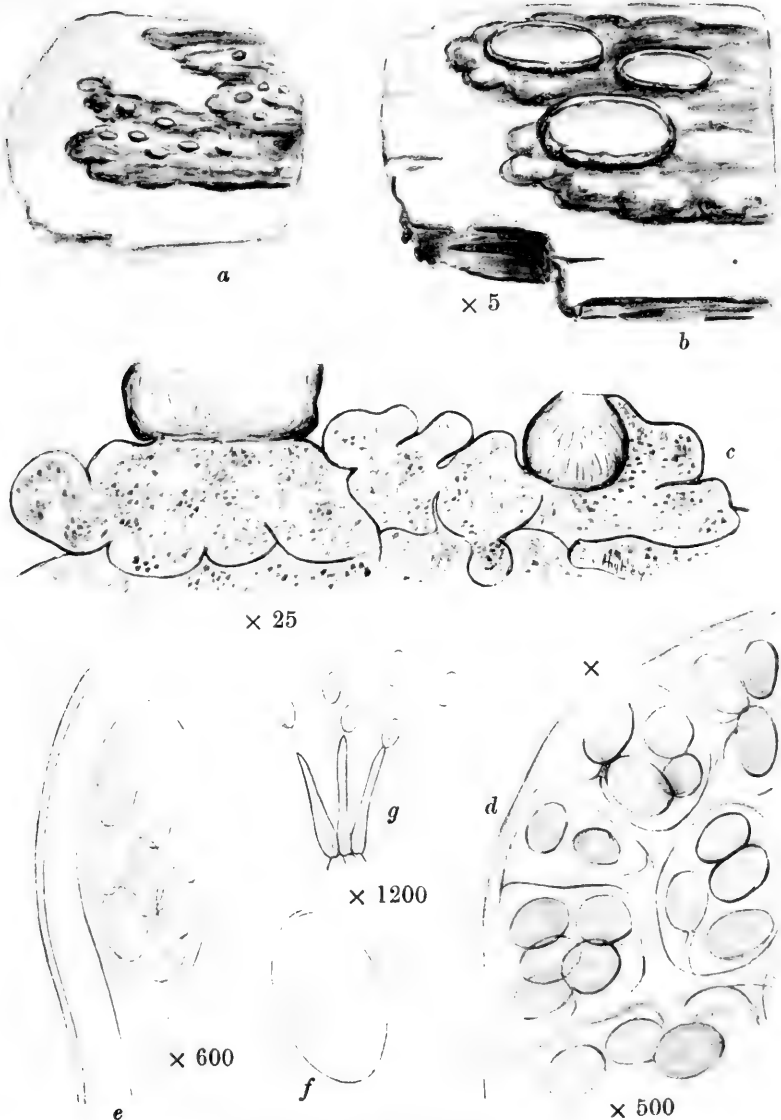




SYNALISSA RAMULOSA Fr.

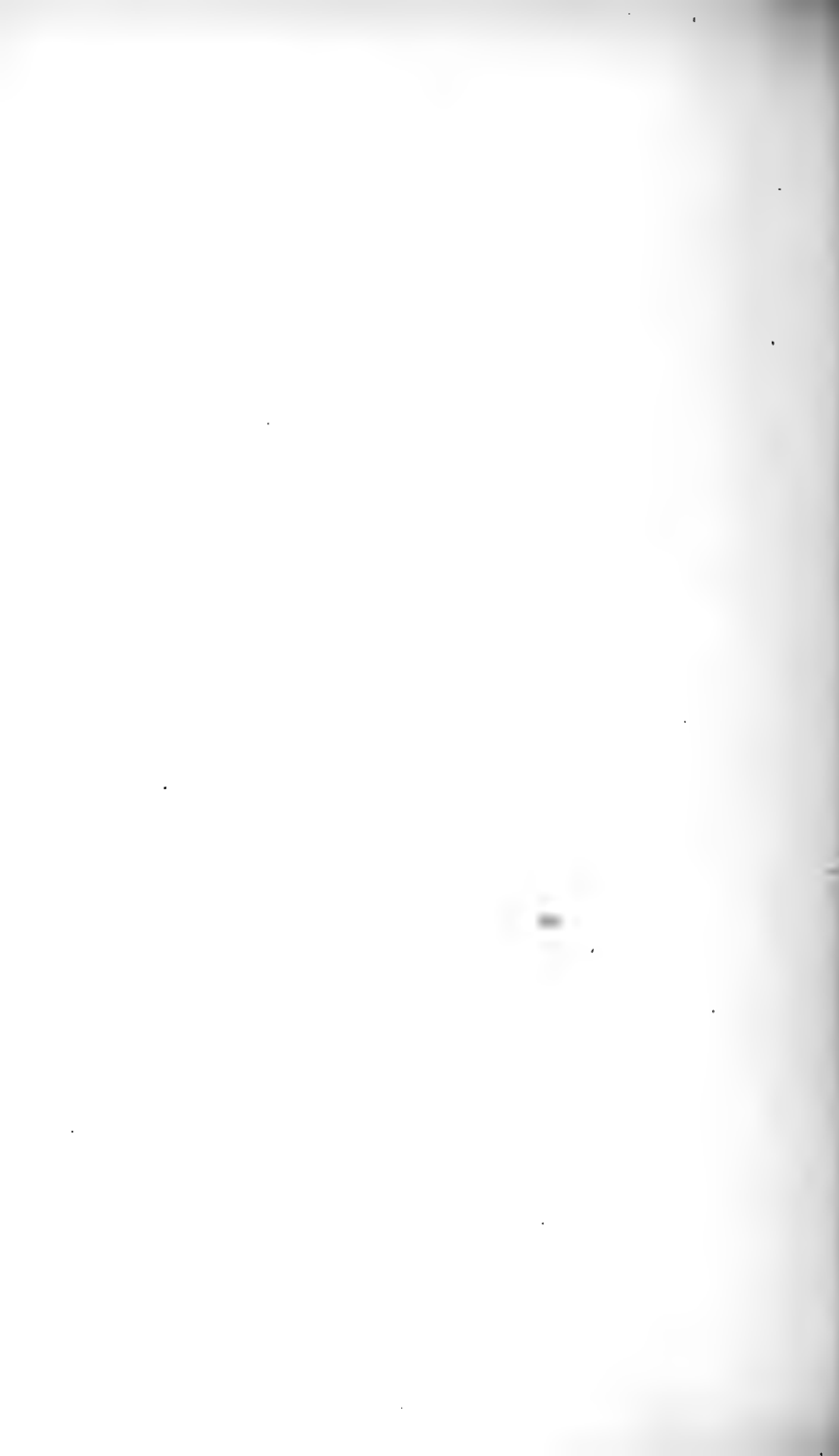
a. Plant on rock. b. Portion of plant. c. Section of thallus. d. Vertical section of branch with apothecium. e. Ascus and paraphyses. f. Spores. g. Vertical section of spermatogone. h. Sterigmata and spermatia

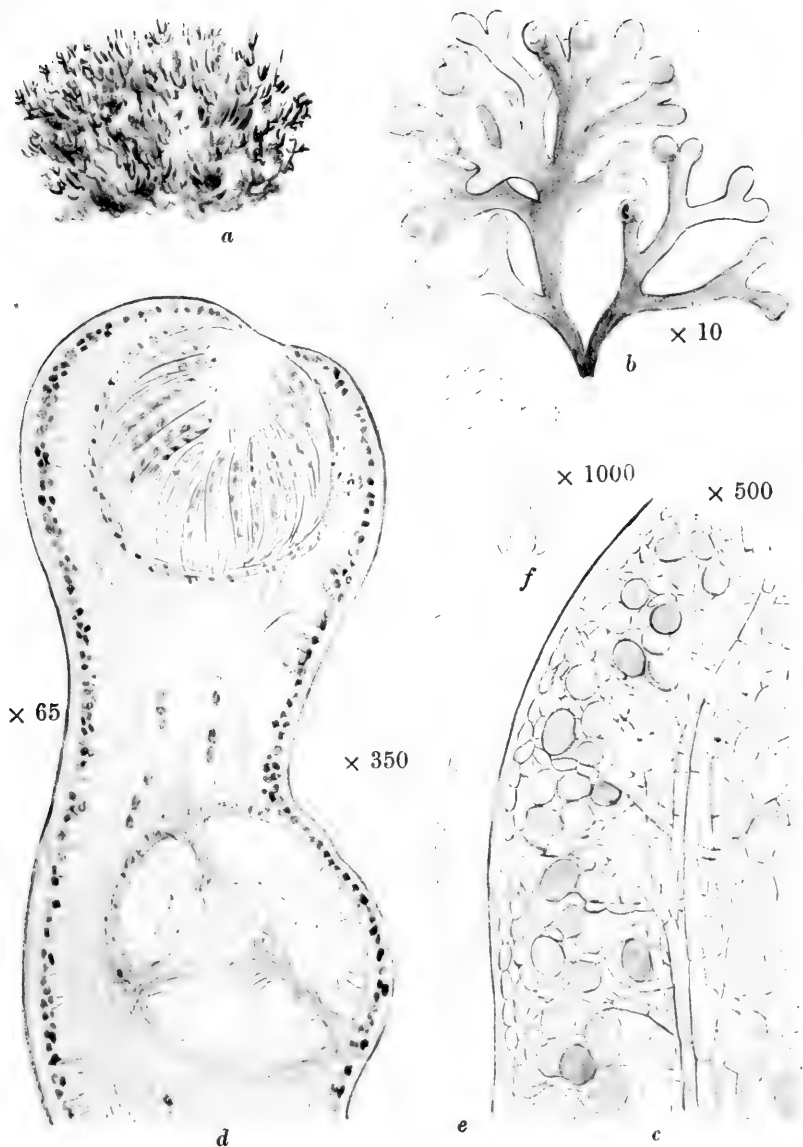




PSOROTICHIA SCHAERERI Arn.

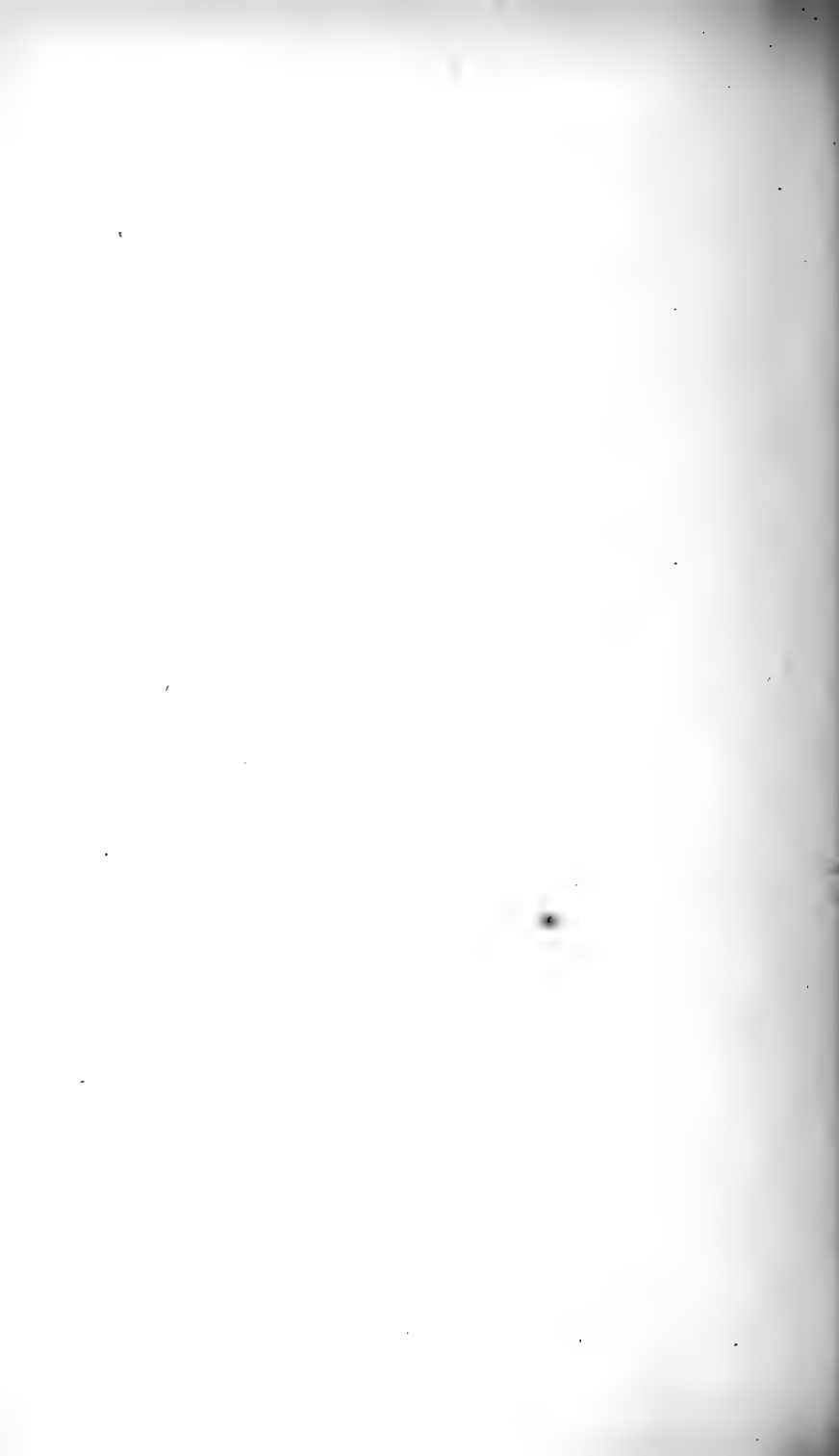
- a.* Plant on rock. *b.* Portion of plant. *c.* Vertical section of thallus, apothecium and spermatogone. *d.* Section of thallus. *e.* Ascus and paraphysis. *f.* Spore. *g.* Sterigmata and spermatia.

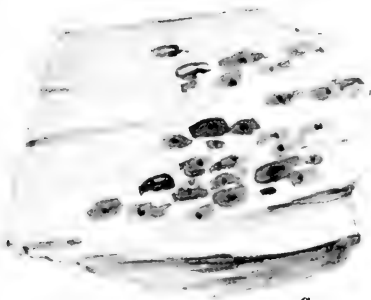




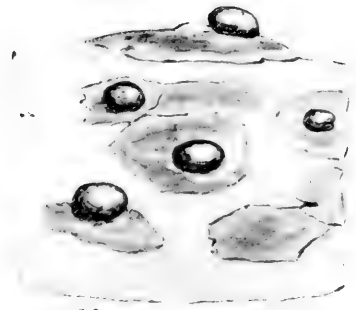
LICHINA PYGMAEA Ag.

a. Plant on rock. b. Portion of plant. c. Section of thallus. d. Section of fertile branch with apothecium and spermogone. e. Ascus with spores and paraphysis. f. Sterigmata and spermatia.



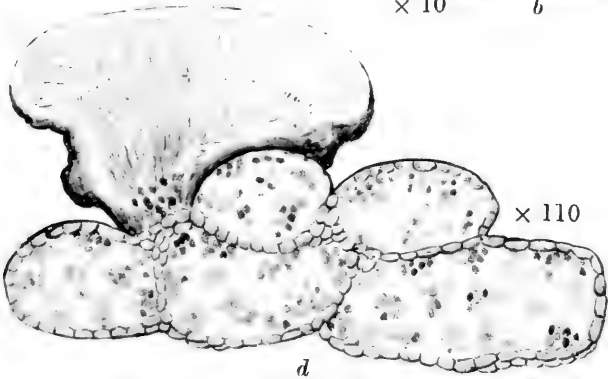


a



$\times 10$

b



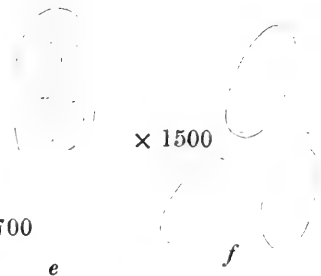
$\times 110$

d



$\times 450$

c



$\times 700$

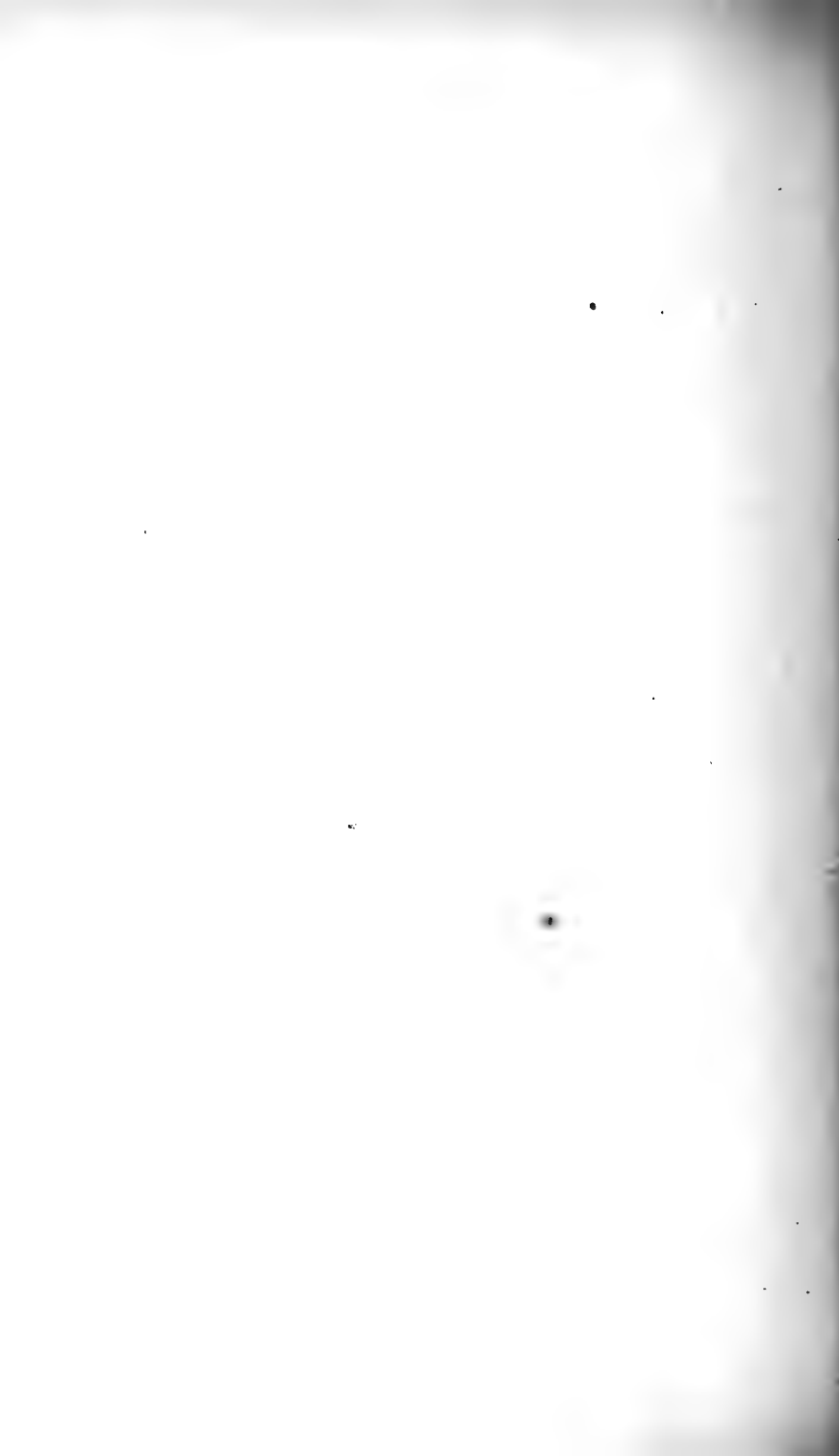
e

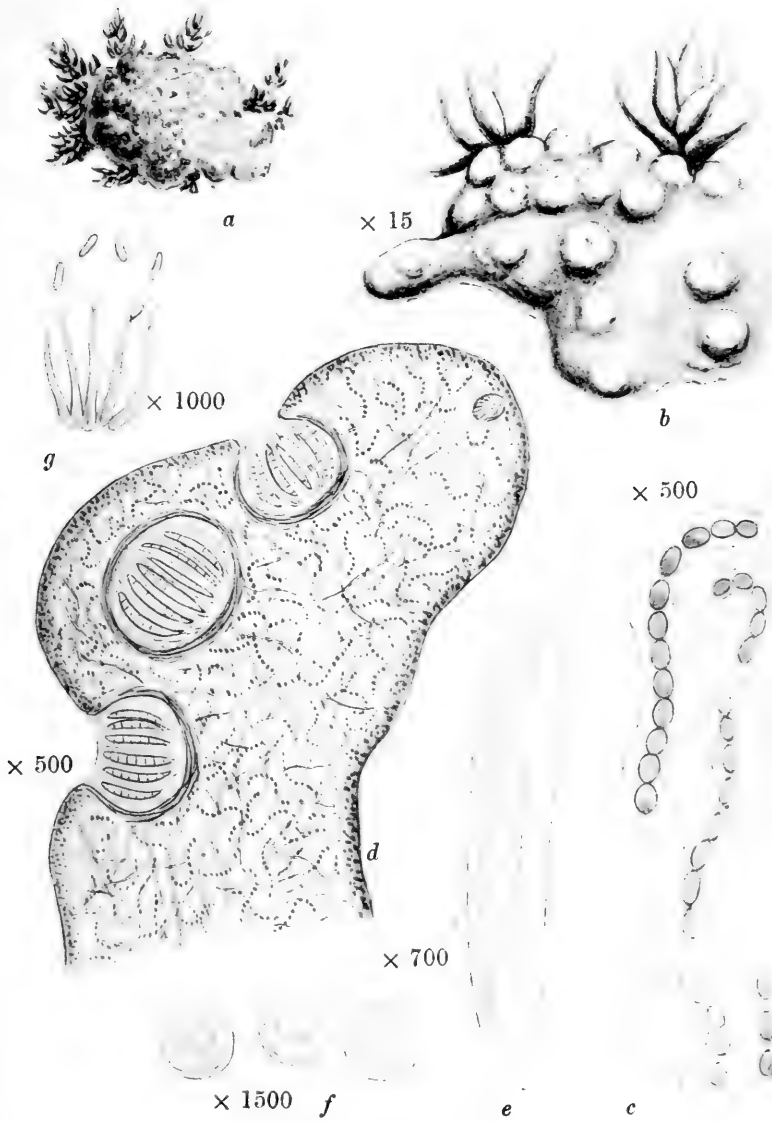
$\times 1500$

f

PTERYGIUM LISMORENSE Cromb.

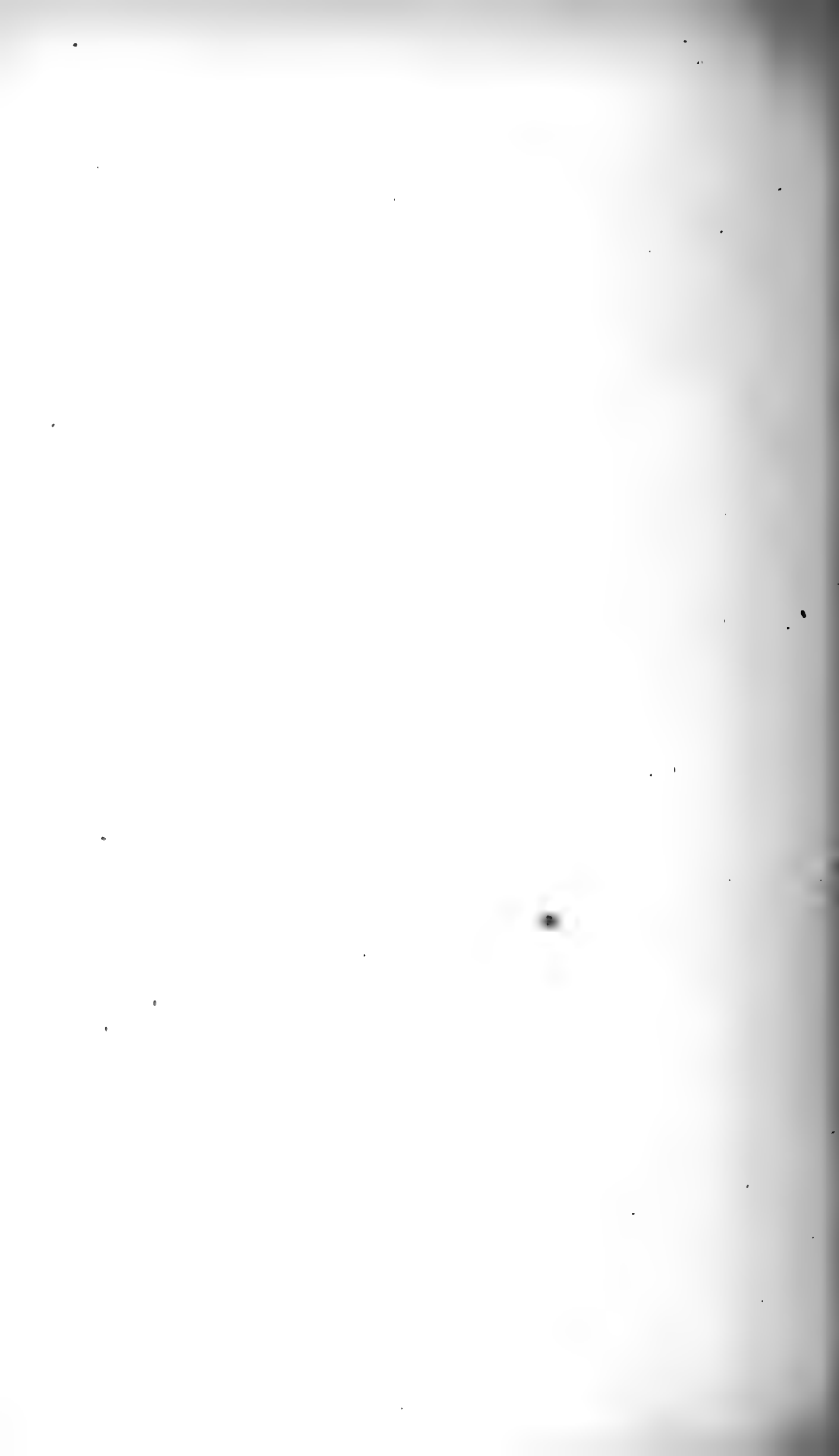
a. Plant on rock. *b.* Portion of plant. *c.* Section of thallus. *d.* Vertical section of thallus and apothecium. *e.* Ascus. *f.* Spores.

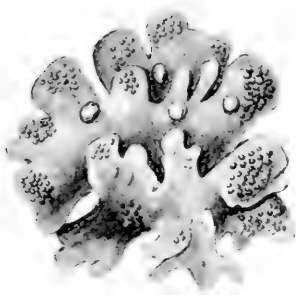




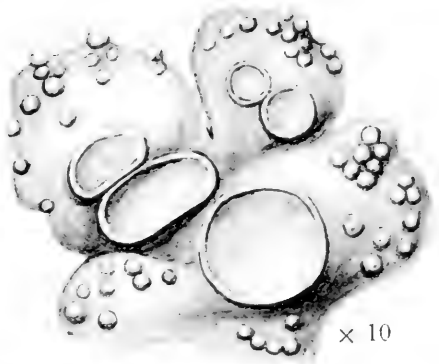
PHYSMA POLYANTHES Arn.

- a.* Whole plant. *b.* Portion of plant. *c.* Section of thallus. *d.* Section of thallus with apothecia. *e.* Ascus and paraphysis. *f.* Ascospores. *g.* Sterigmata and spermatia.



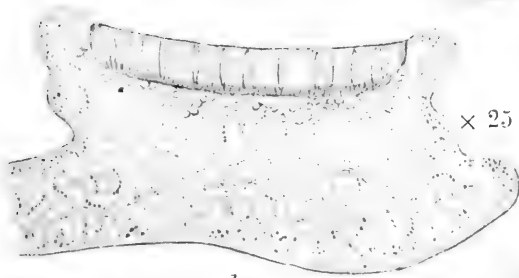


a



× 10

b



× 25

d

× 450



× 60

c

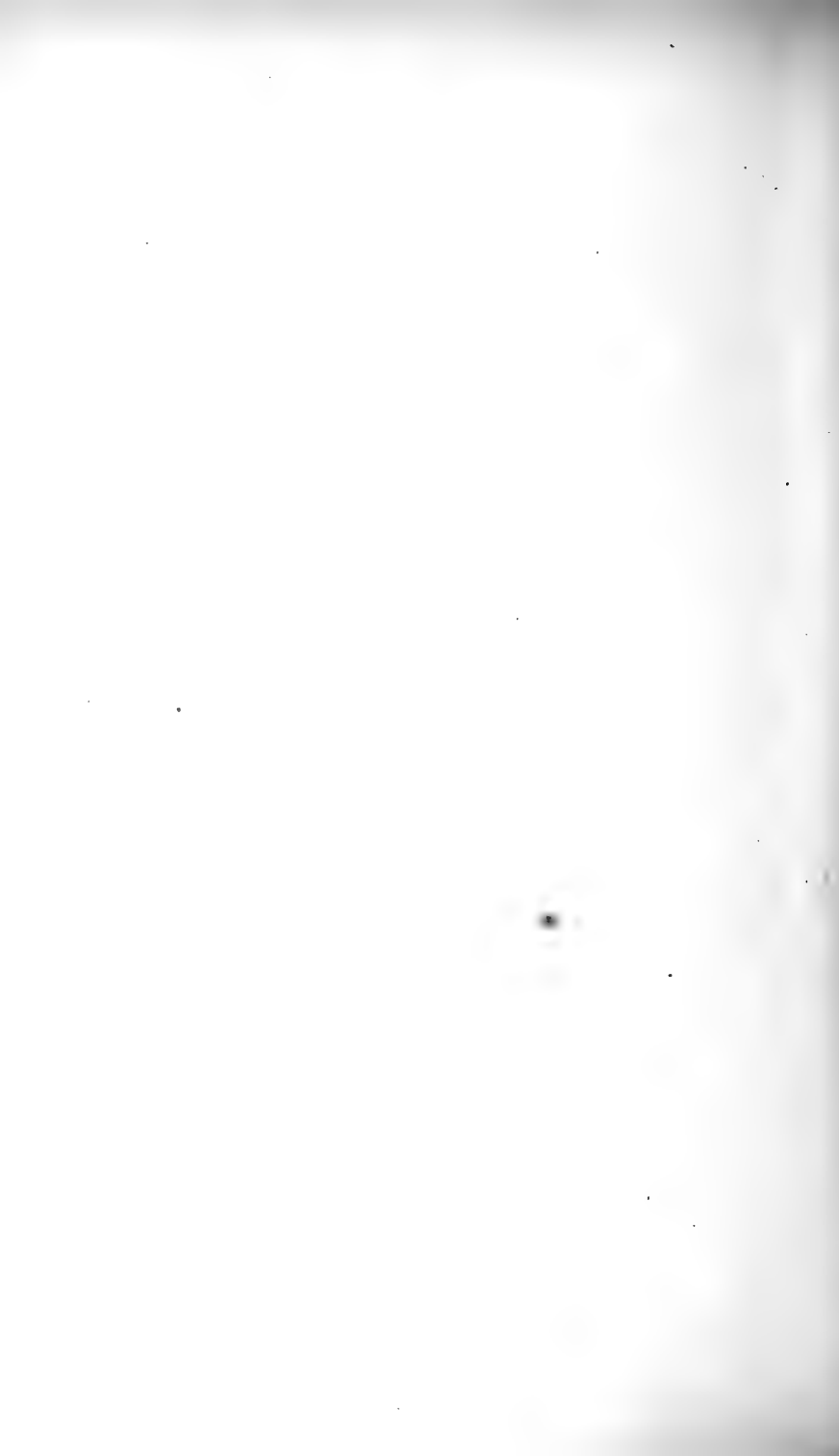
f

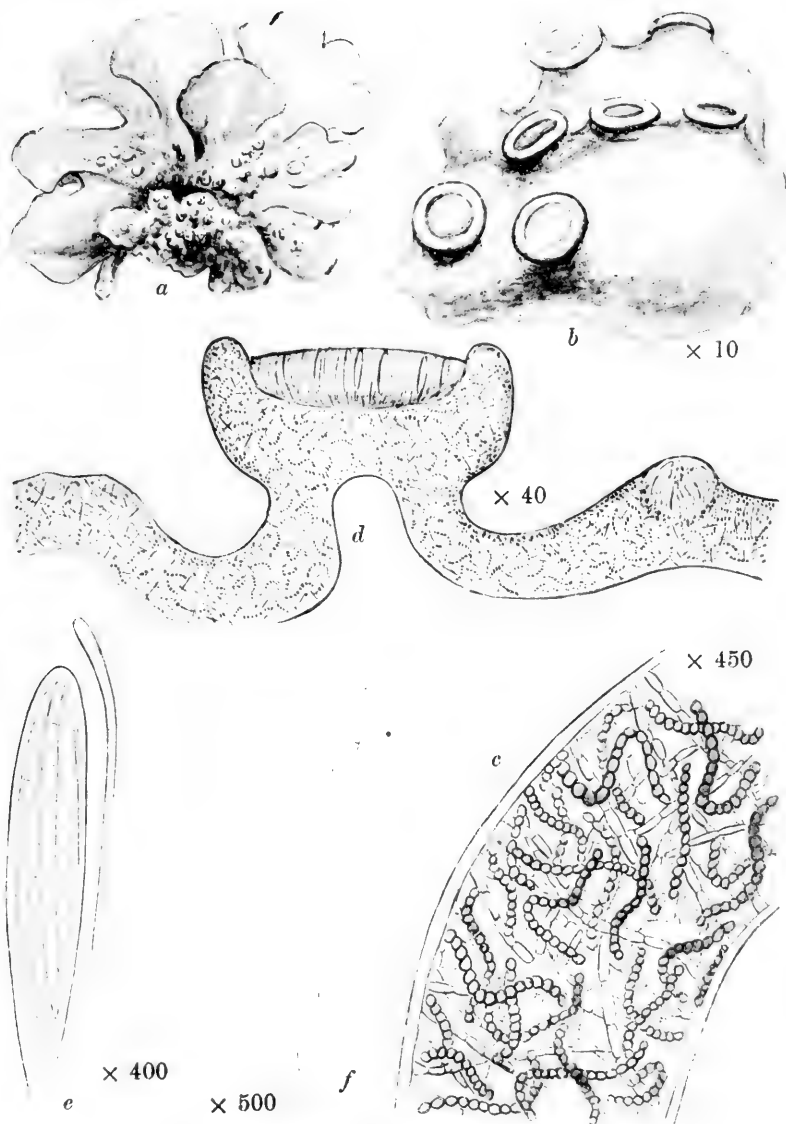
× 300

e

COLLEMA GRANULIFERUM Nyl.

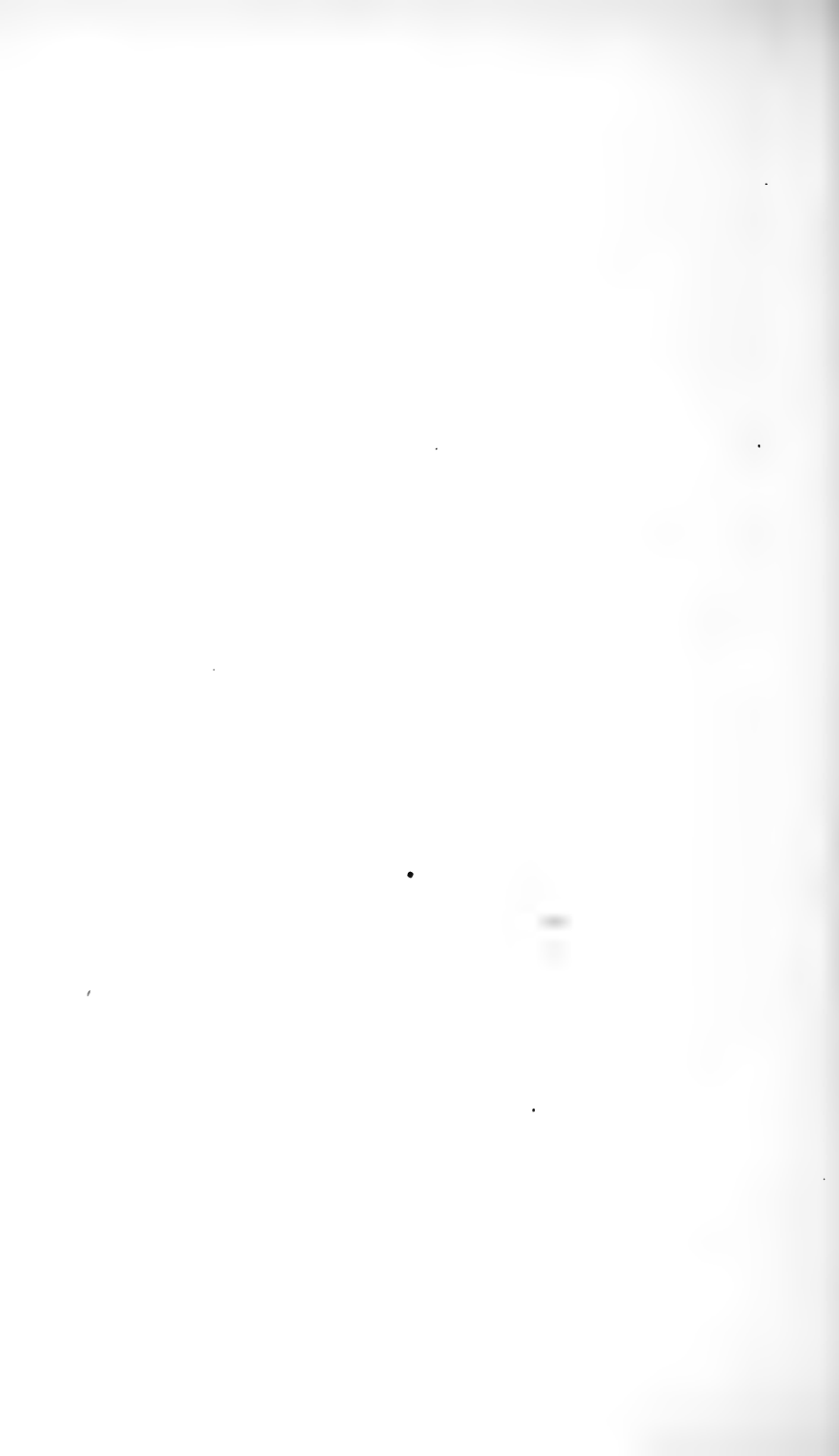
a. Whole plant. *b.* Portion of plant. *c.* Section of thallus. *d.* Vertical section of apothecium. *e.* Ascus and paraphysis. *f.* Ascospores.

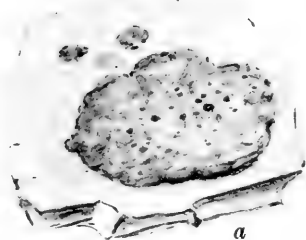




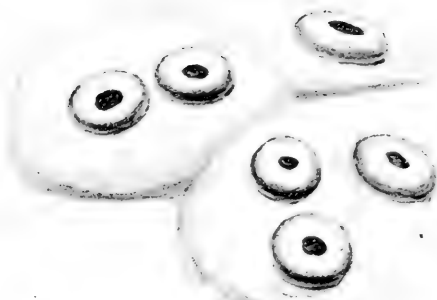
SYNECHOBLASTUS NIGRESCENS Anzi.

a. Plant. *b.* Portion of plant. *c.* Vertical section of thallus. *d.* Vertical section of thallus and apothecium. *e.* Ascus and paraphysis. *f.* Ascospores.



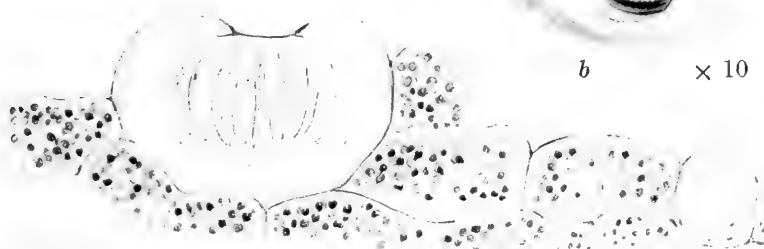


a



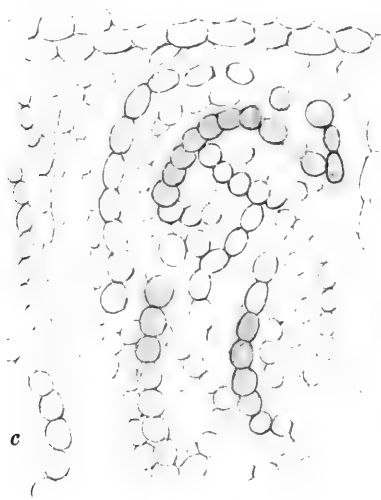
b

× 10



d

× 50



c

× 420

× 840

× 420

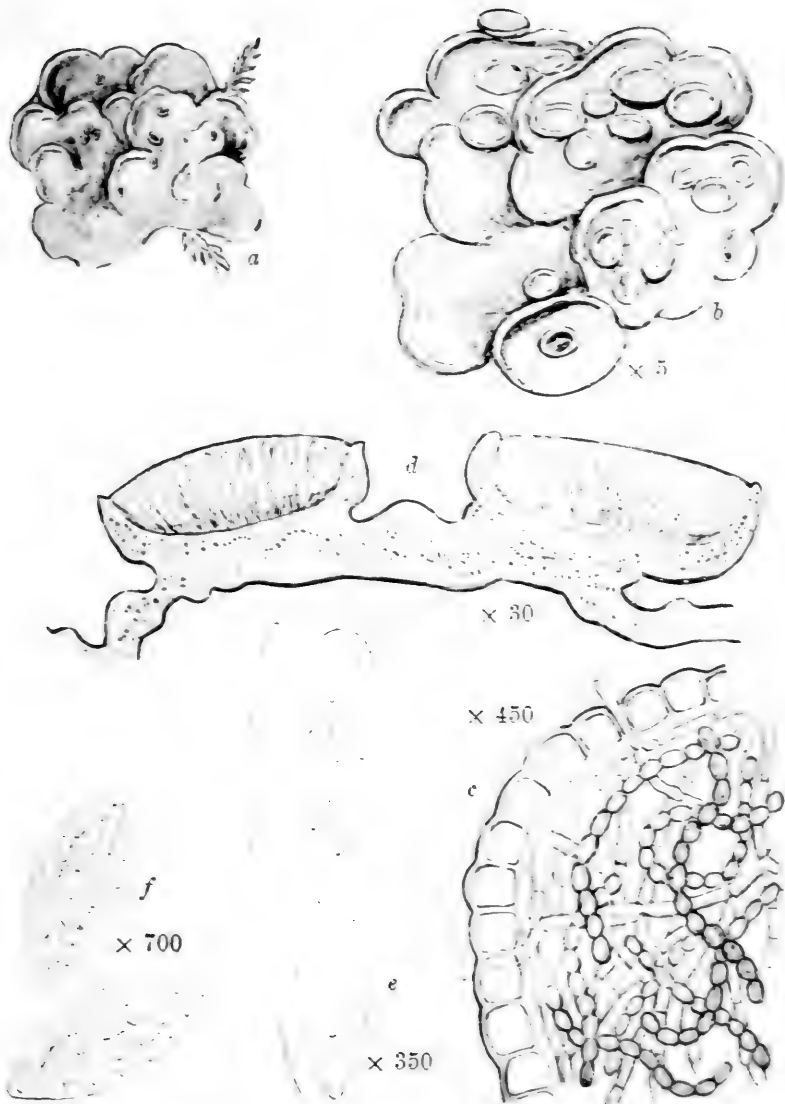
f

e

LEMMOPSIS ARNOLDIANA A. Zahlbr.

a. Plant on rock. *b.* Portion of plant. *c.* Section of thallus. *d.* Vertical section of thallus, apothecium and spermatogone. *e.* Ascus and paraphysis. *f.* Ascospores.

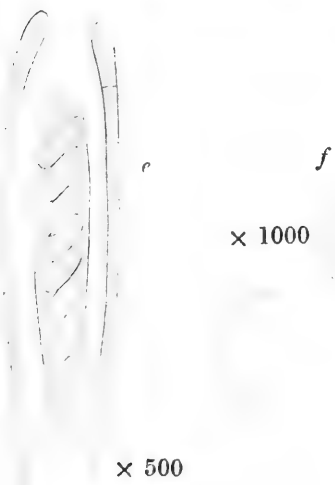
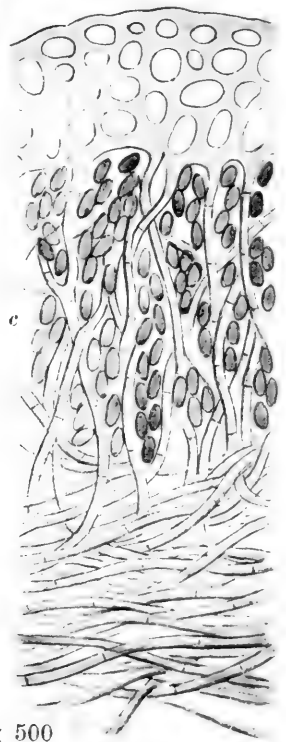
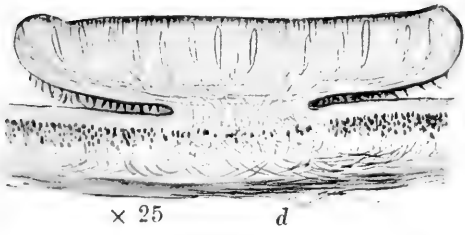
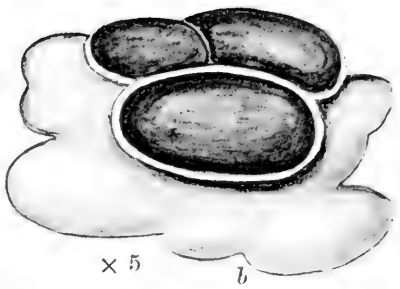
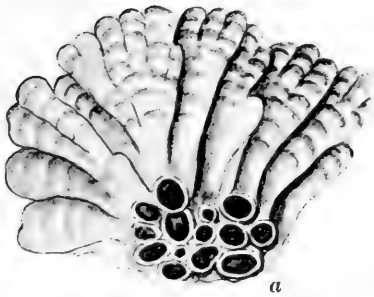




LEPTOGIUM SINUATUM VAR. SCOTINUM Koerb.

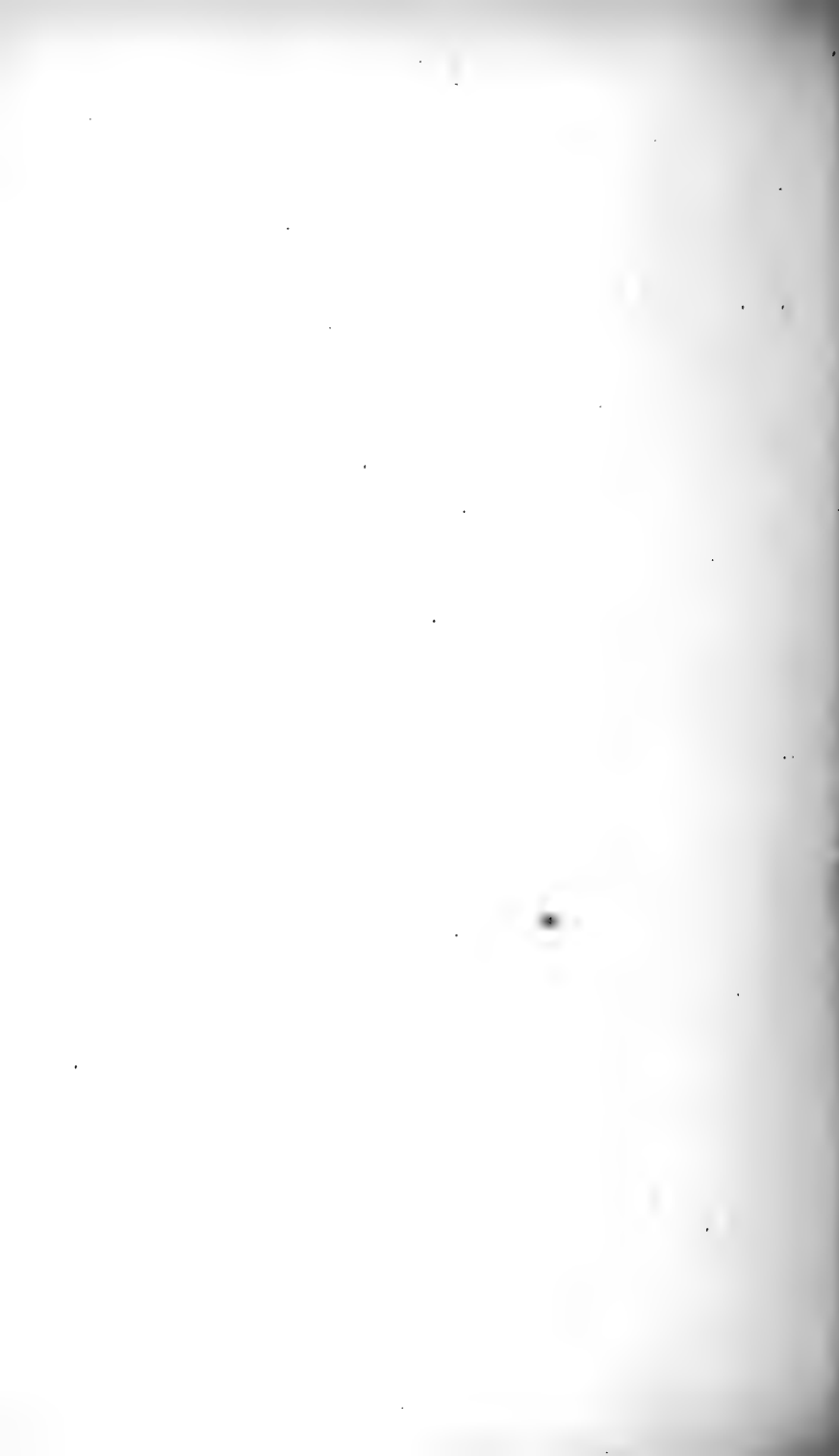
a. Plant among moss. b. Portion of plant. c. Vertical section of thallus. d. Vertical section of apothecia. e. Ascus and paraphysis. f. Ascospores.

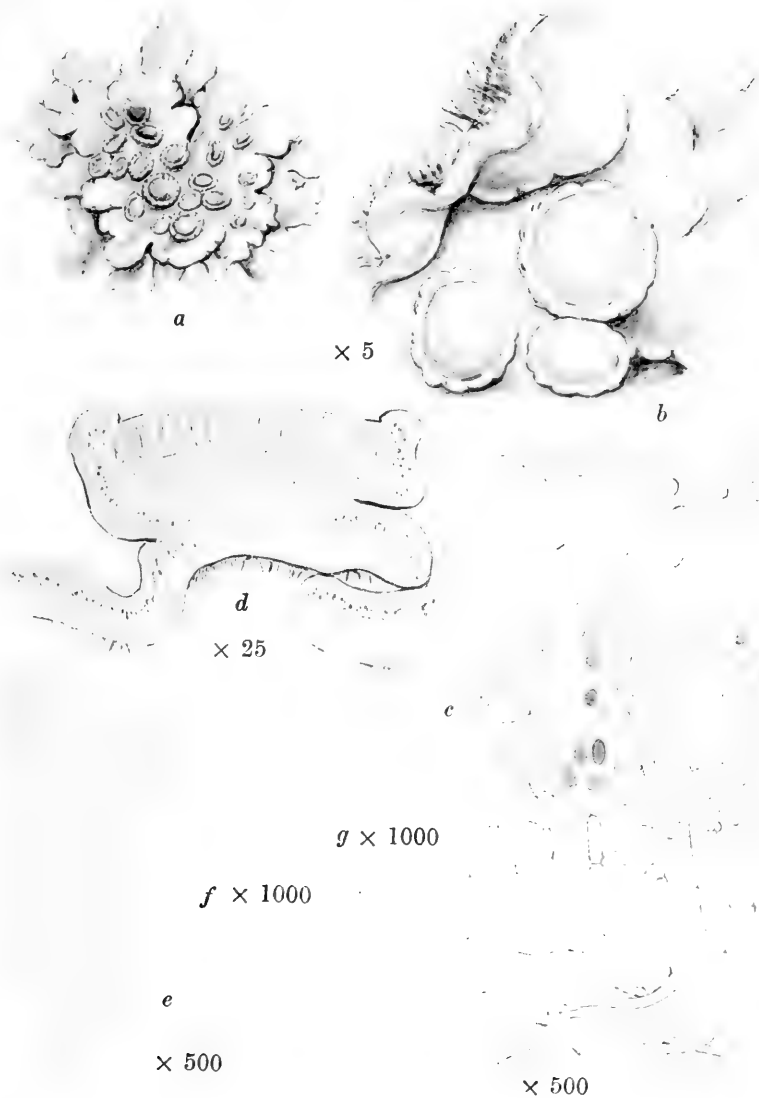




PARMELIELLA PLUMBEA Wain.

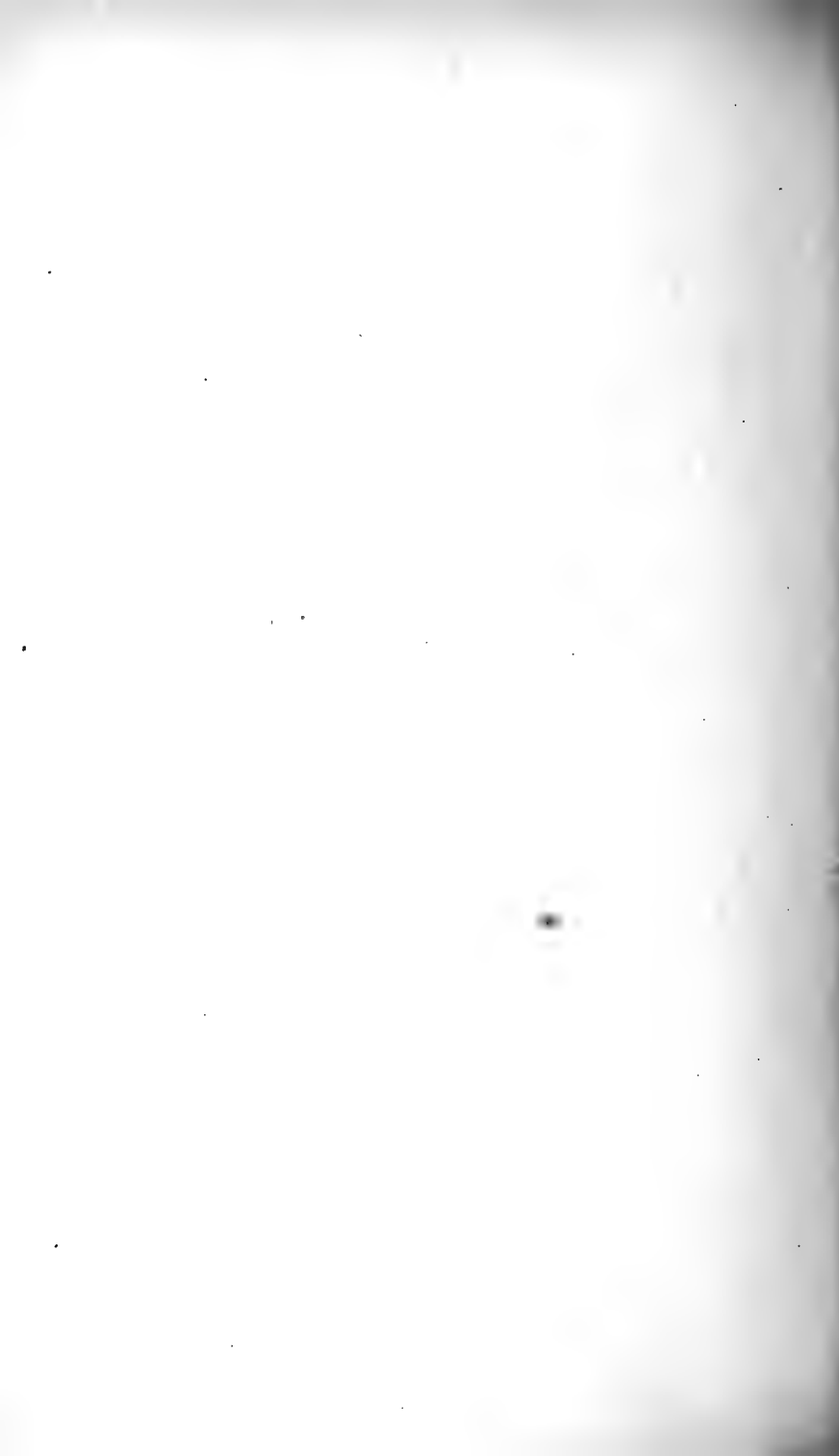
a. Plant. b. Portion of plant. c. Vertical section of thallus. d. Vertical section of apothecium. e. Ascus and paraphyses. f. Ascospores.

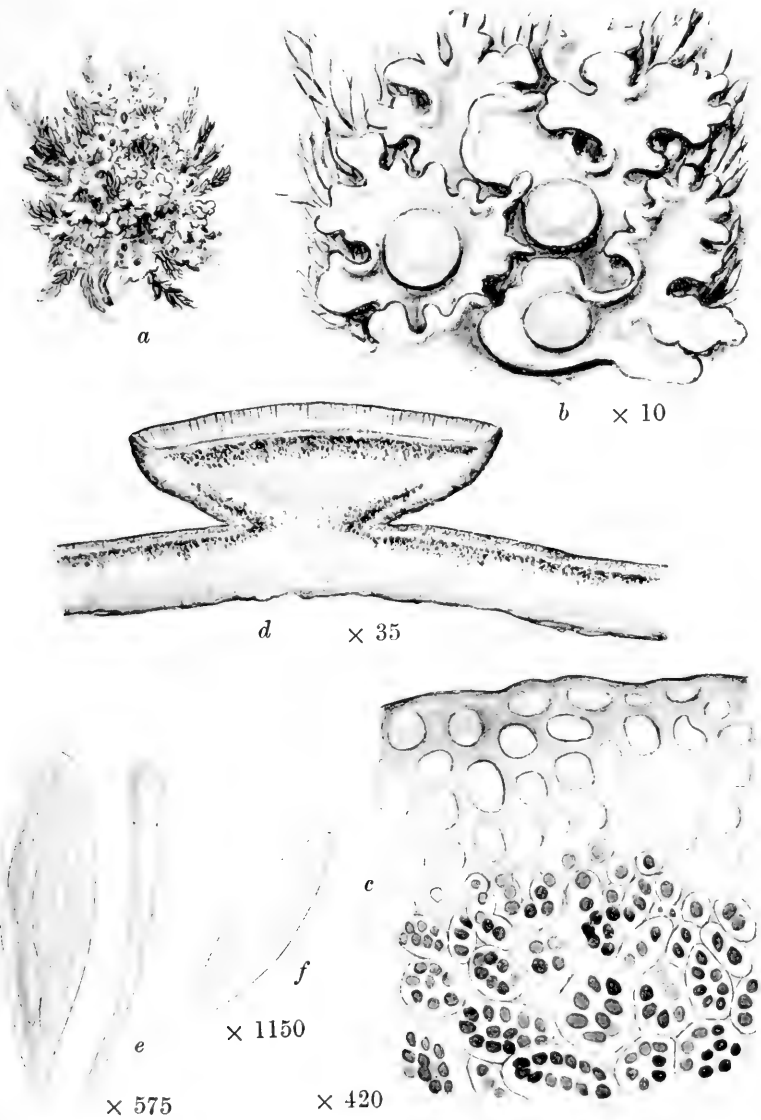




PANNARIA RUBIGINOSA Del.

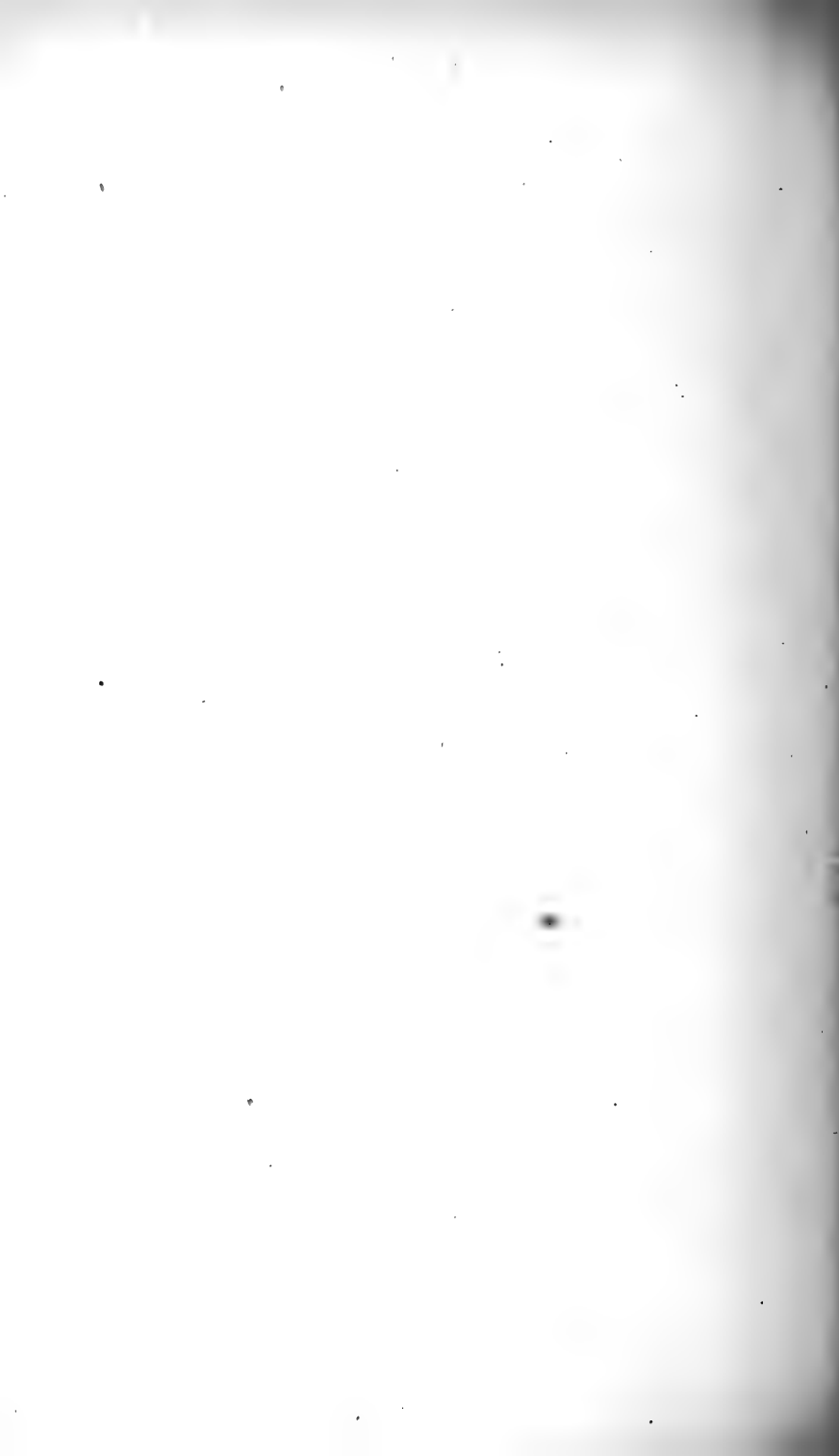
a. Plant. b. Portion of plant. c. Vertical section of thallus. d. Vertical section of apothecium. e. Ascus and paraphyses. f. Ascospores. g. Sterigma and spermatia.

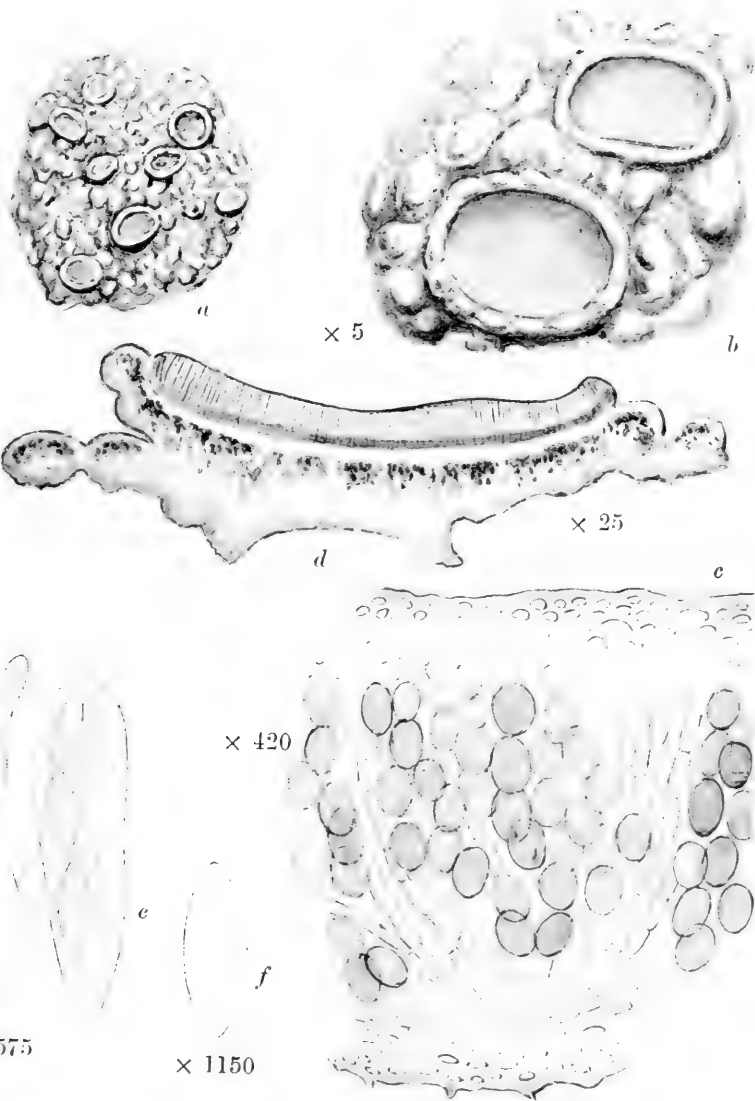




MASSALONGIA CARNOSA Koerb.

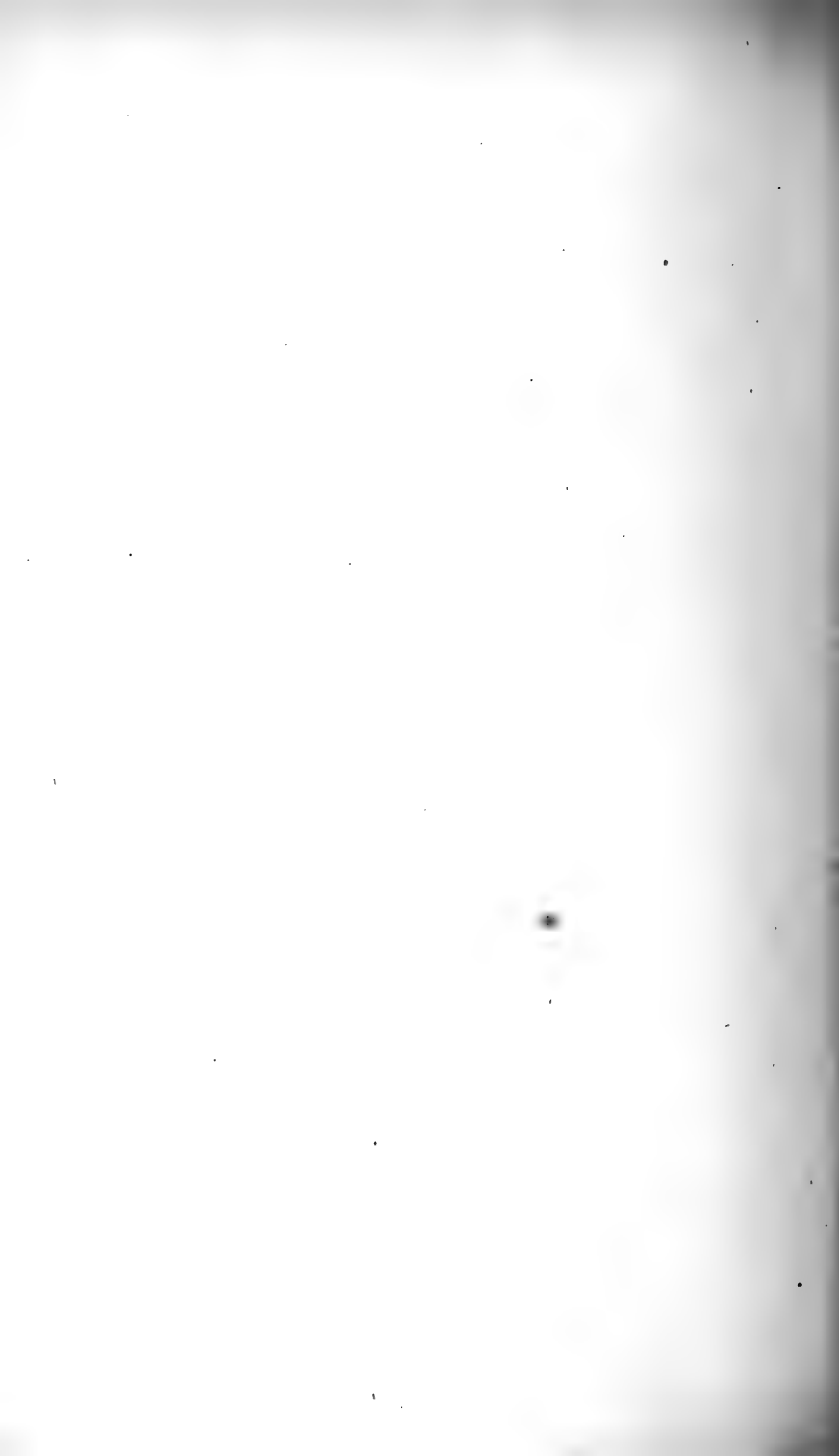
a Plant among moss. *b*. Portion of plant. *c*. Vertical section of thallus. *d*. Vertical section of apothecium. *e*. Ascus and paraphysis. *f*. Ascospore.

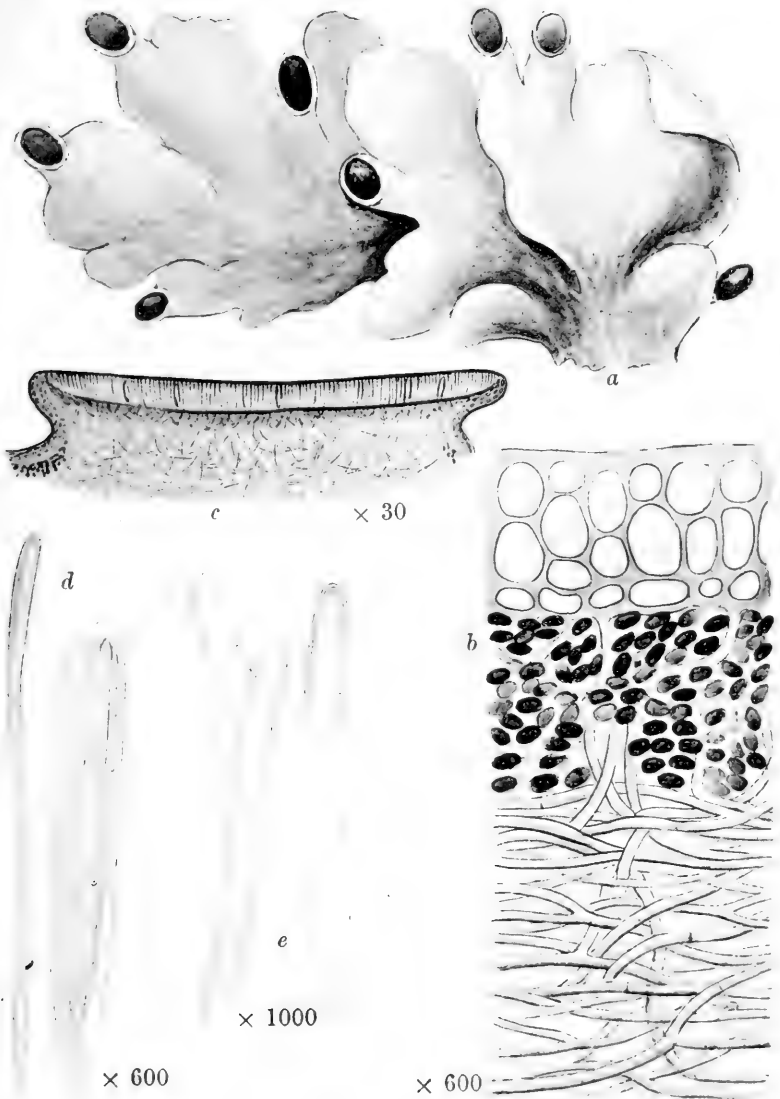




PSOROMA HYPNORUM S. F. Gray.

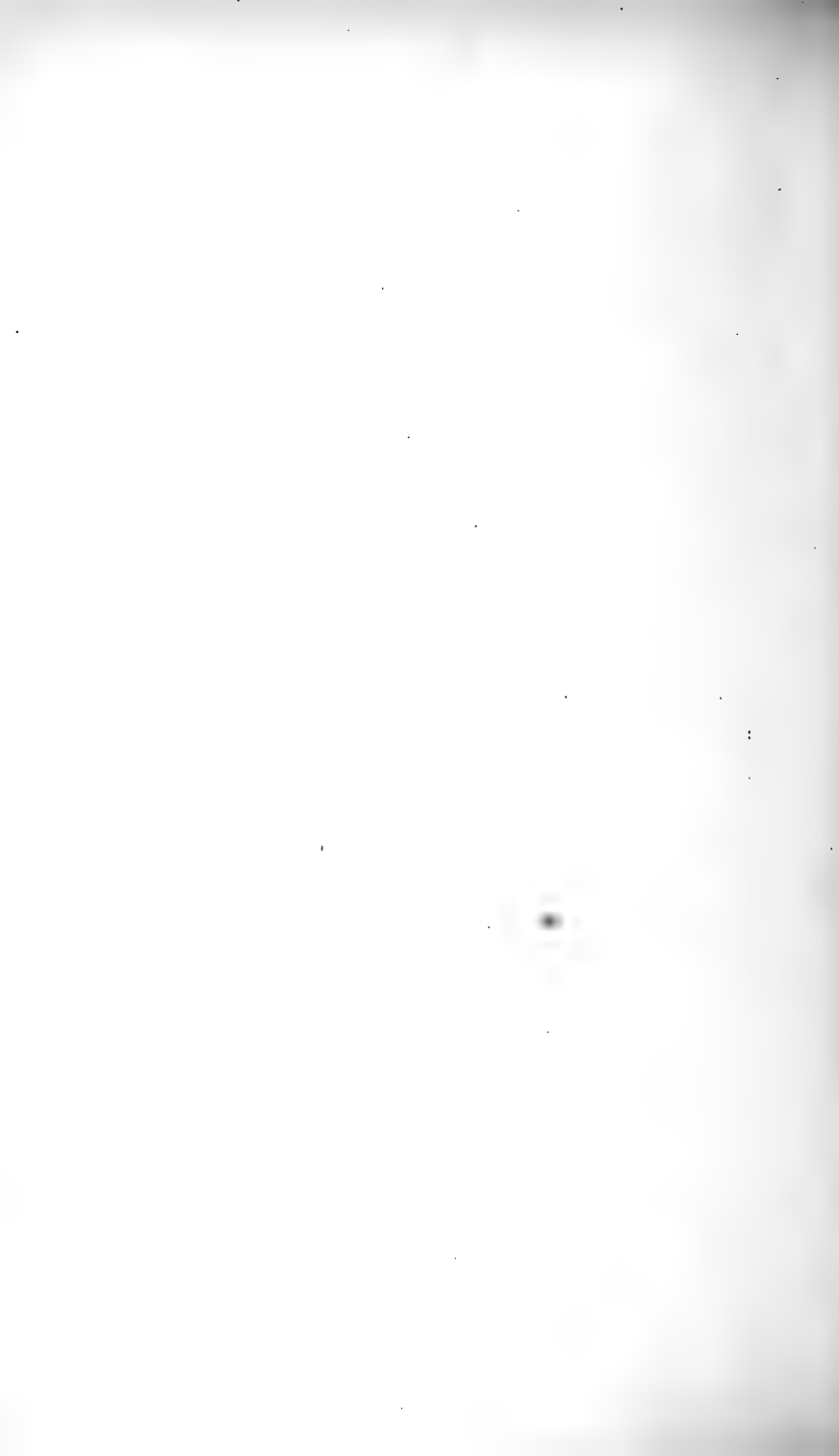
a. Plant. *b.* Portion of plant. *c.* Vertical section of thallus. *d.* Vertical section of apothecium. *e.* Ascus and paraphysis. *f.* Ascospore.





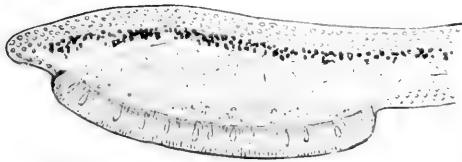
PELTIGERA CANINA Willd.

a. Portion of plant. *b.* Vertical section of thallus. *c.* Vertical section of apothecium. *d.* Ascus and paraphysis. *e.* Ascospores.





a



c

× 30



b



d

× 1000

× 700

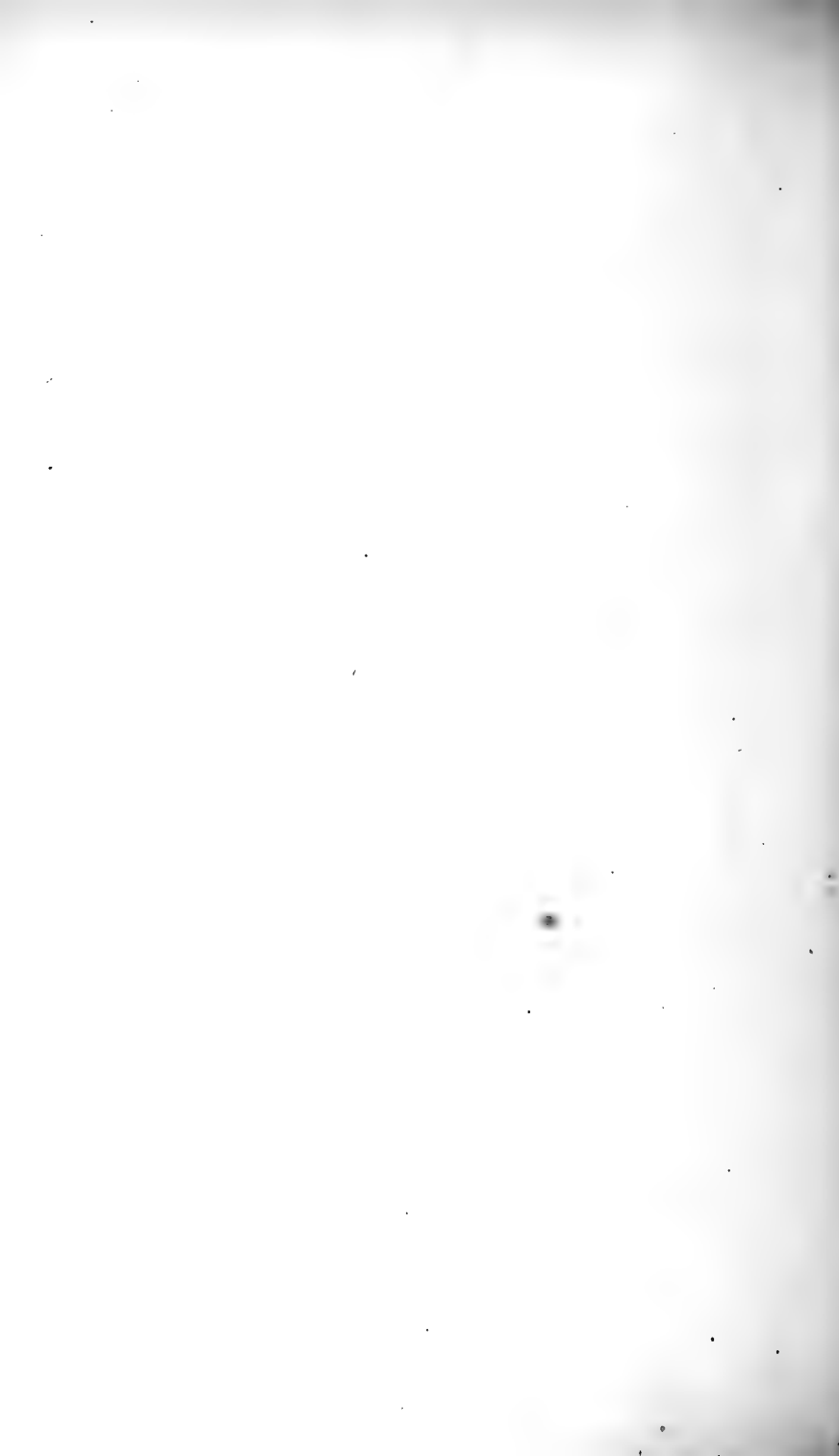


e

× 700

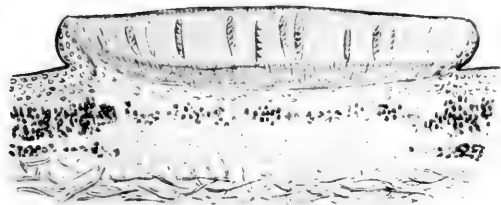
NEPHROMIUM LUSITANICUM Nyl.

a. Portion of plant. **b.** Vertical section of thallus. **c.** Vertical section of apothecium. **d.** Ascus and paraphysis. **e.** Ascospores.





a

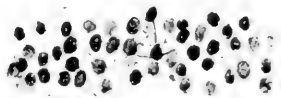


c

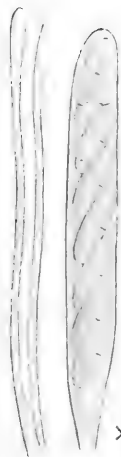
× 30



b

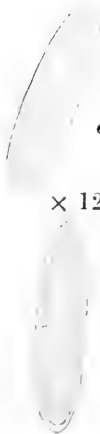


× 500



d

× 500

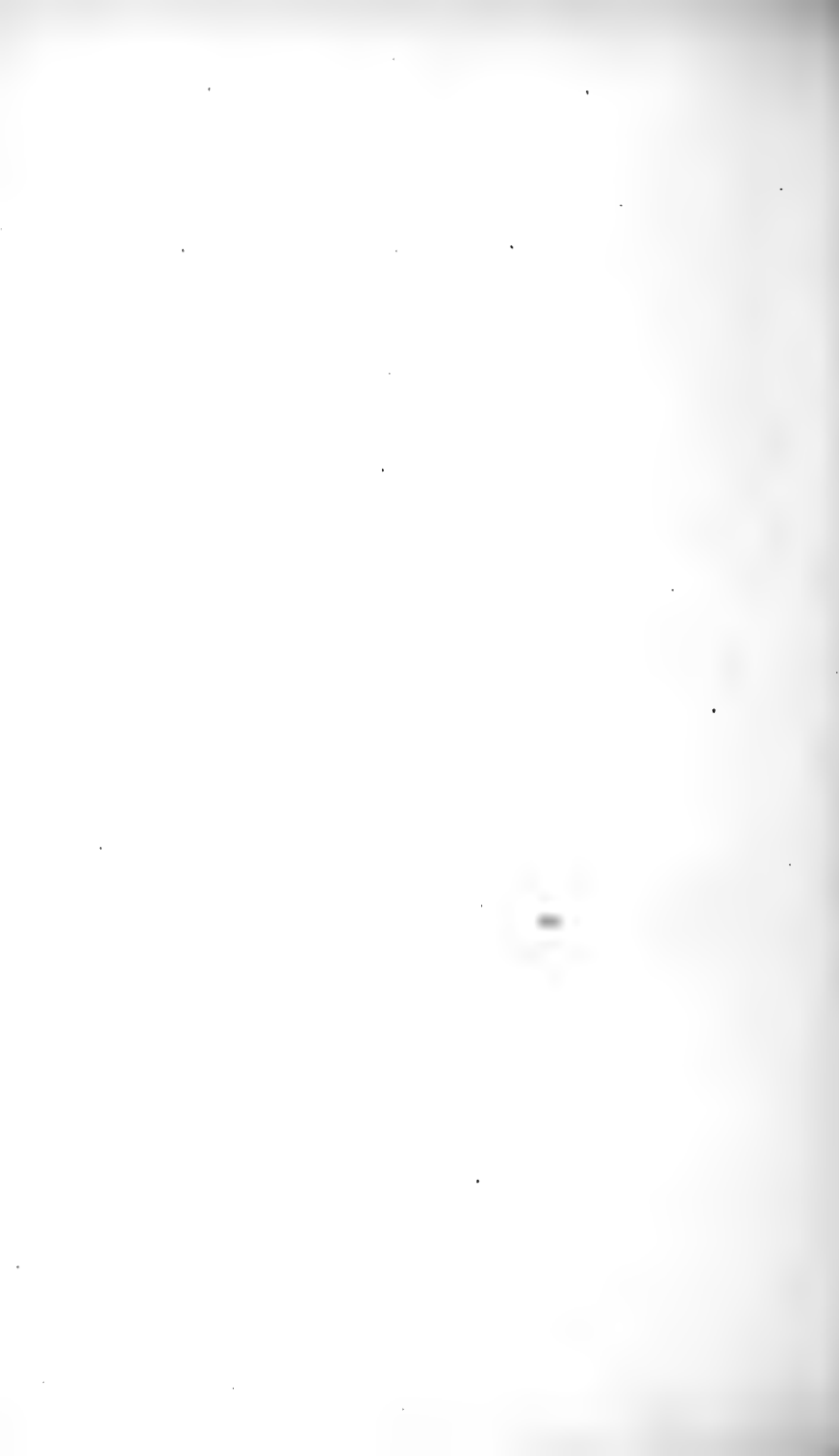


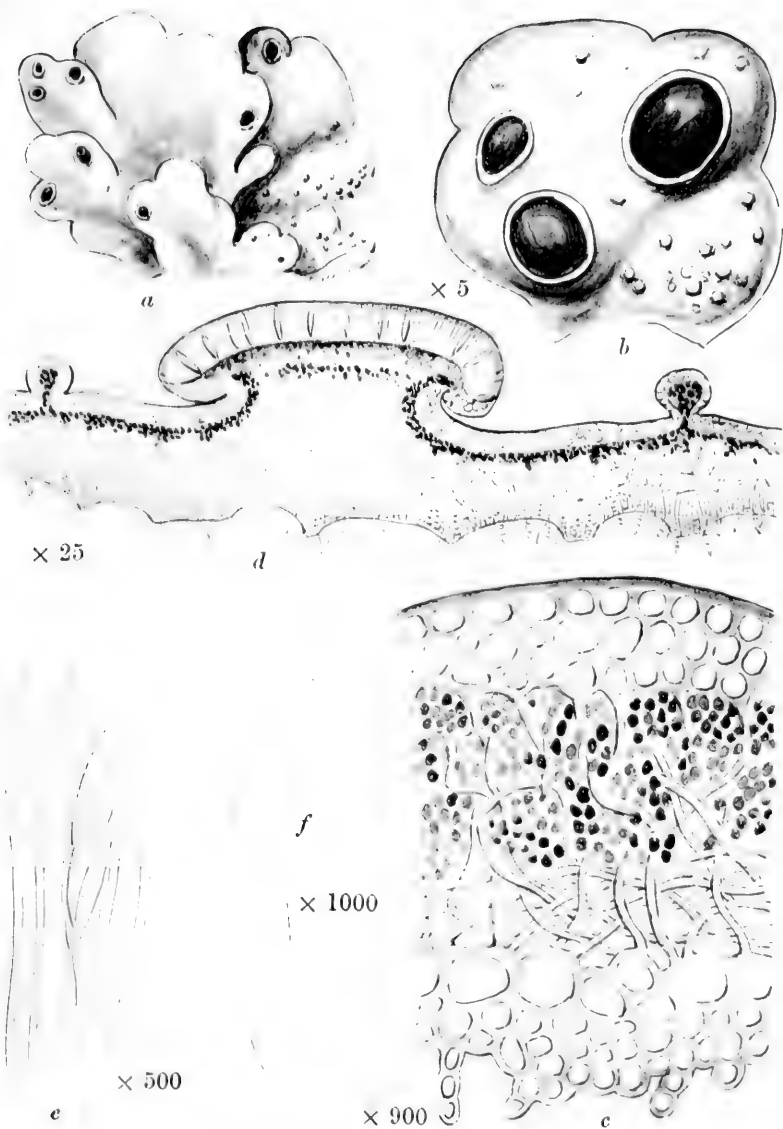
e

× 1200

SOLORINA CROCEA Ach.

a. Portion of plant. *b.* Vertical section of thallus. *c.* Vertical section of apothecium. *d.* Ascus and paraphyses. *e.* Ascospores.

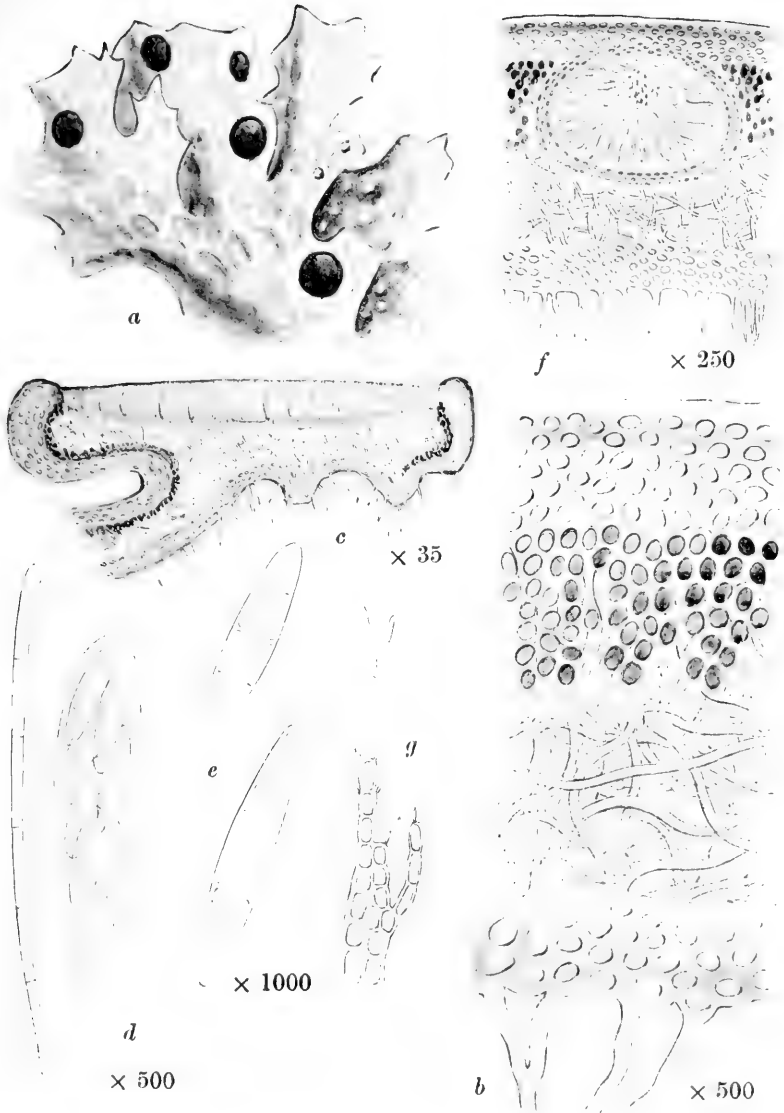




STICTA FULIGINOSA Ach.

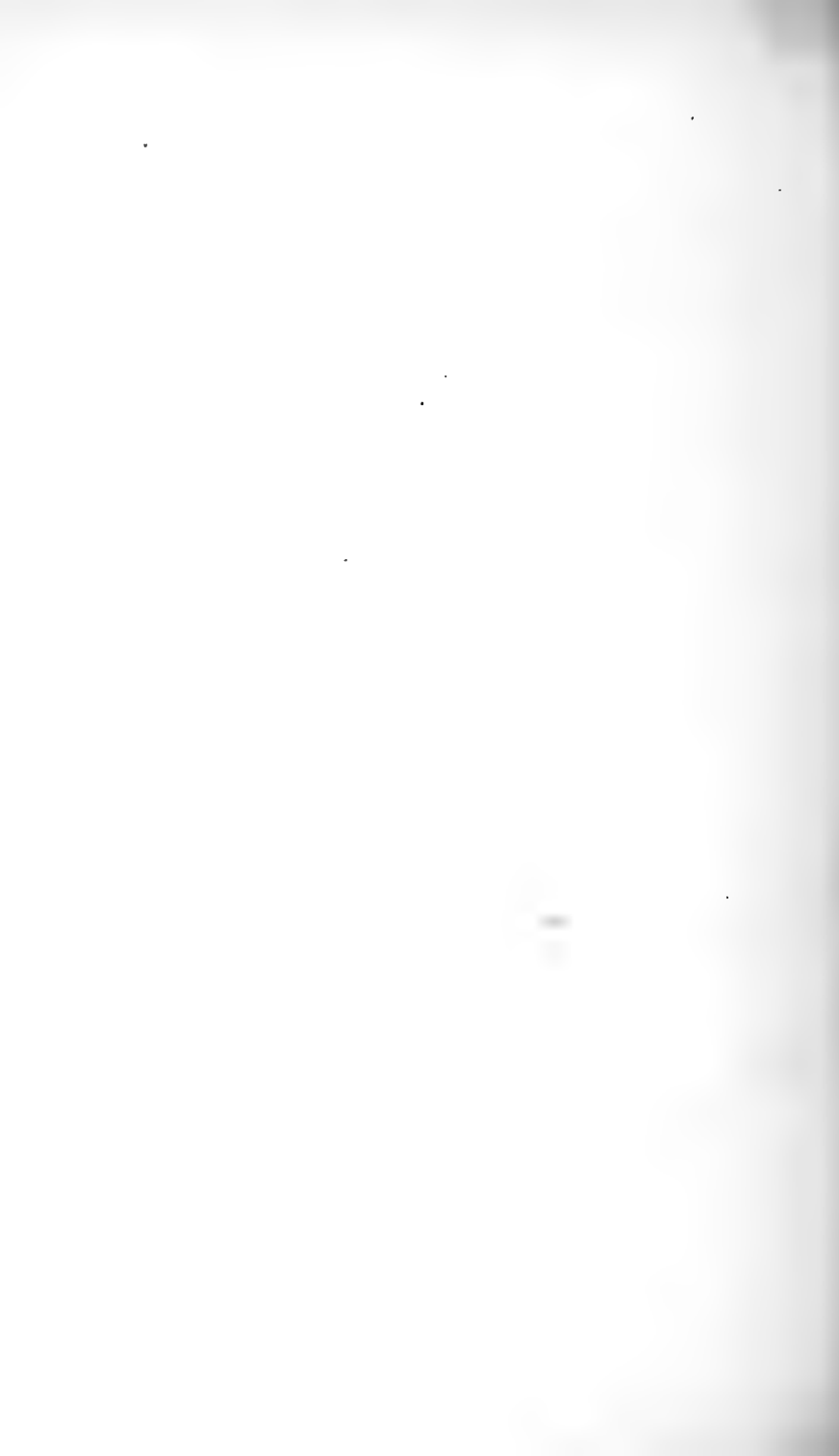
a. Plant. *b.* Portion of plant. *c.* Vertical section of thallus. *d.* Vertical section of apothecium and thallus. *e.* Ascus and paraphyses. *f.* Spores.

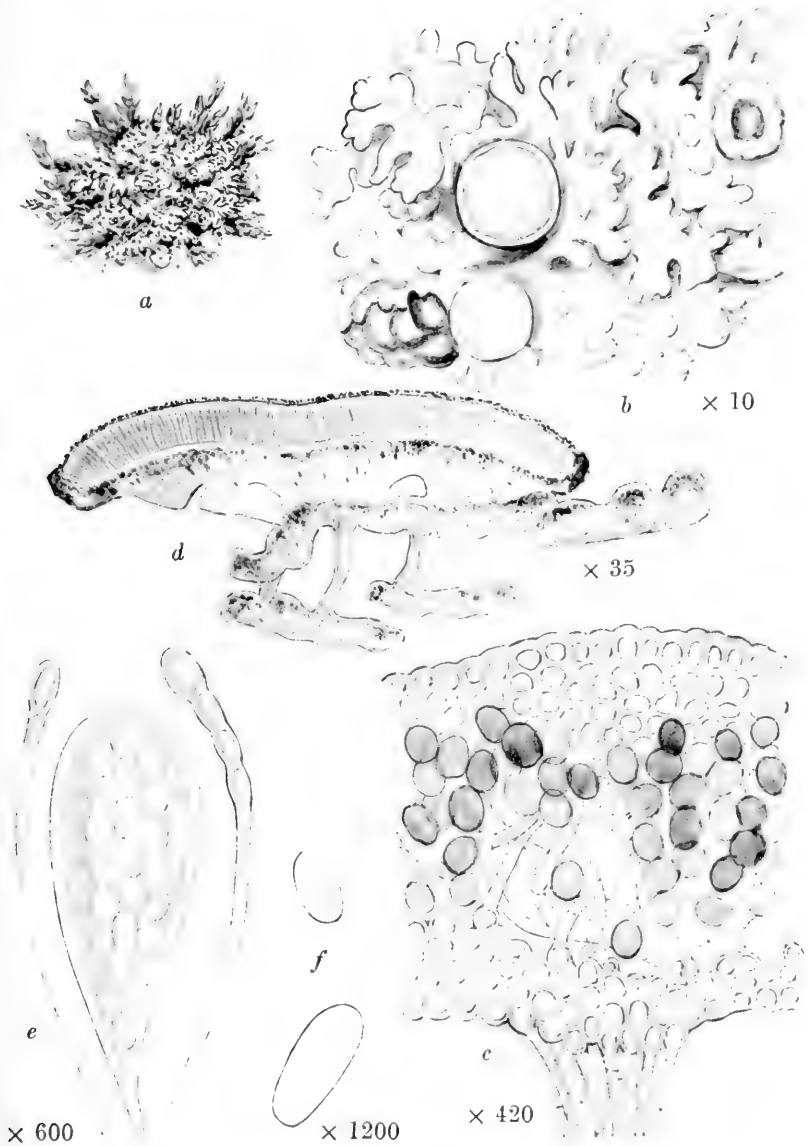




LOBARIA PULMONARIA Hoffm.

- a.** Part of plant. **b.** Vertical section of thallus. **c.** Vertical section of apothecium.
d. Ascus and paraphysis. **e.** Ascospores. **f.** Vertical section of spermogone. **g.** Sterigmata and spermatia.

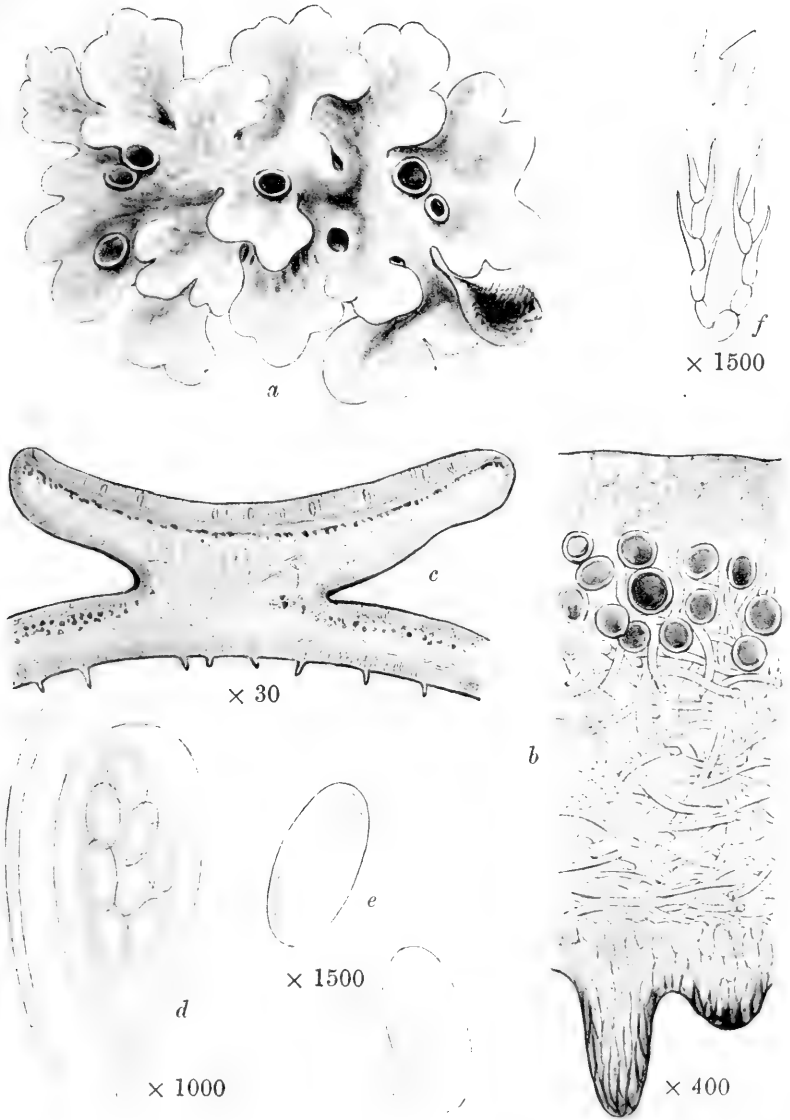




CANDELARIA CONCOLOR Wain.

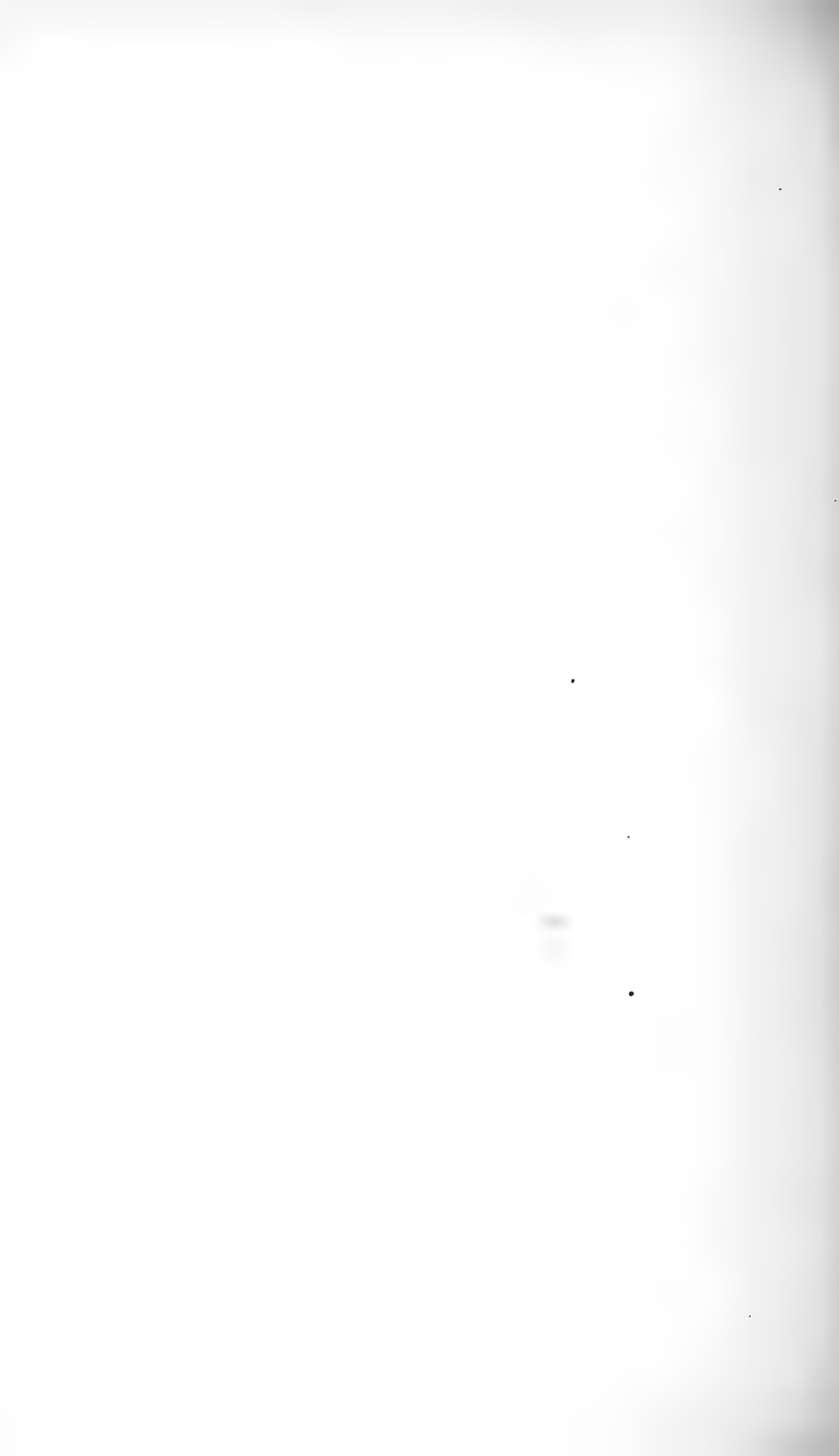
a. Plant. b. Portion of plant. c. Vertical section of thallus. d. Vertical section of apothecium and thallus. e. Ascus and paraphyses. f. Spores.

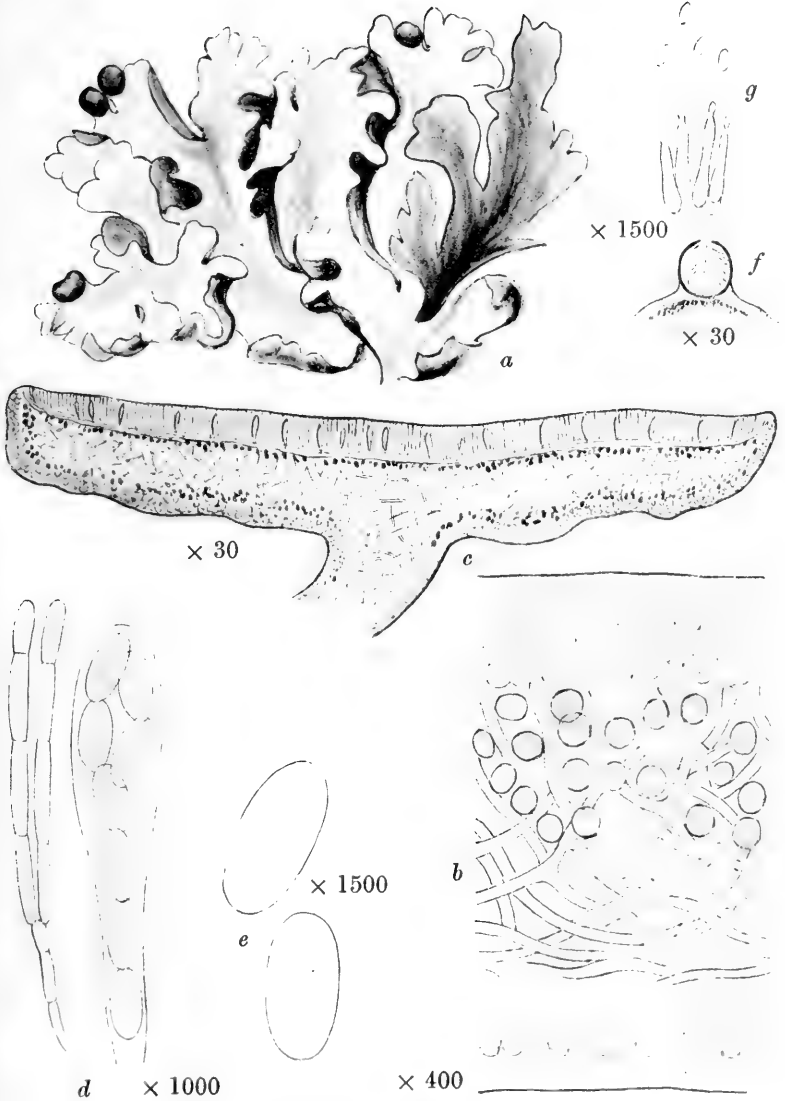




PARMELIA CAPERATA Ach.

a. Plant. b. Vertical section of thallus. c. Vertical section of apothecium and thallus. d. Ascus and paraphysis. e. Spores. f. Sterigmata and spermatia.

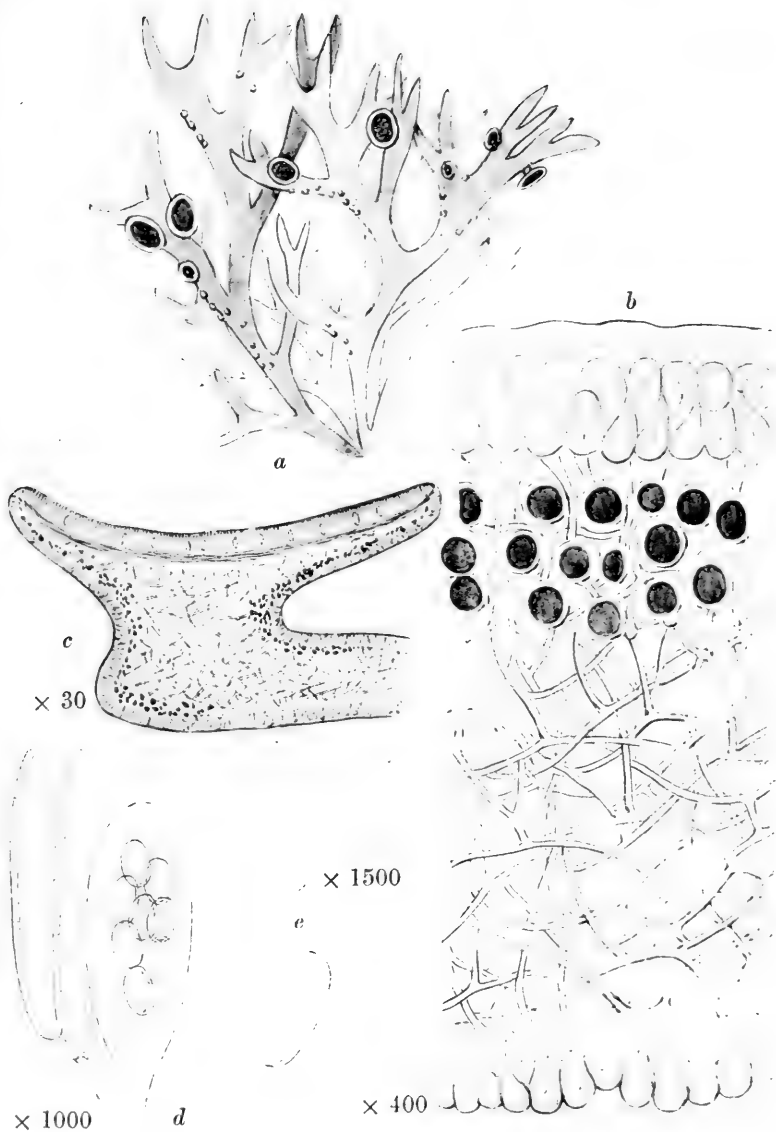




CETRARIA GLAUCA Ach.

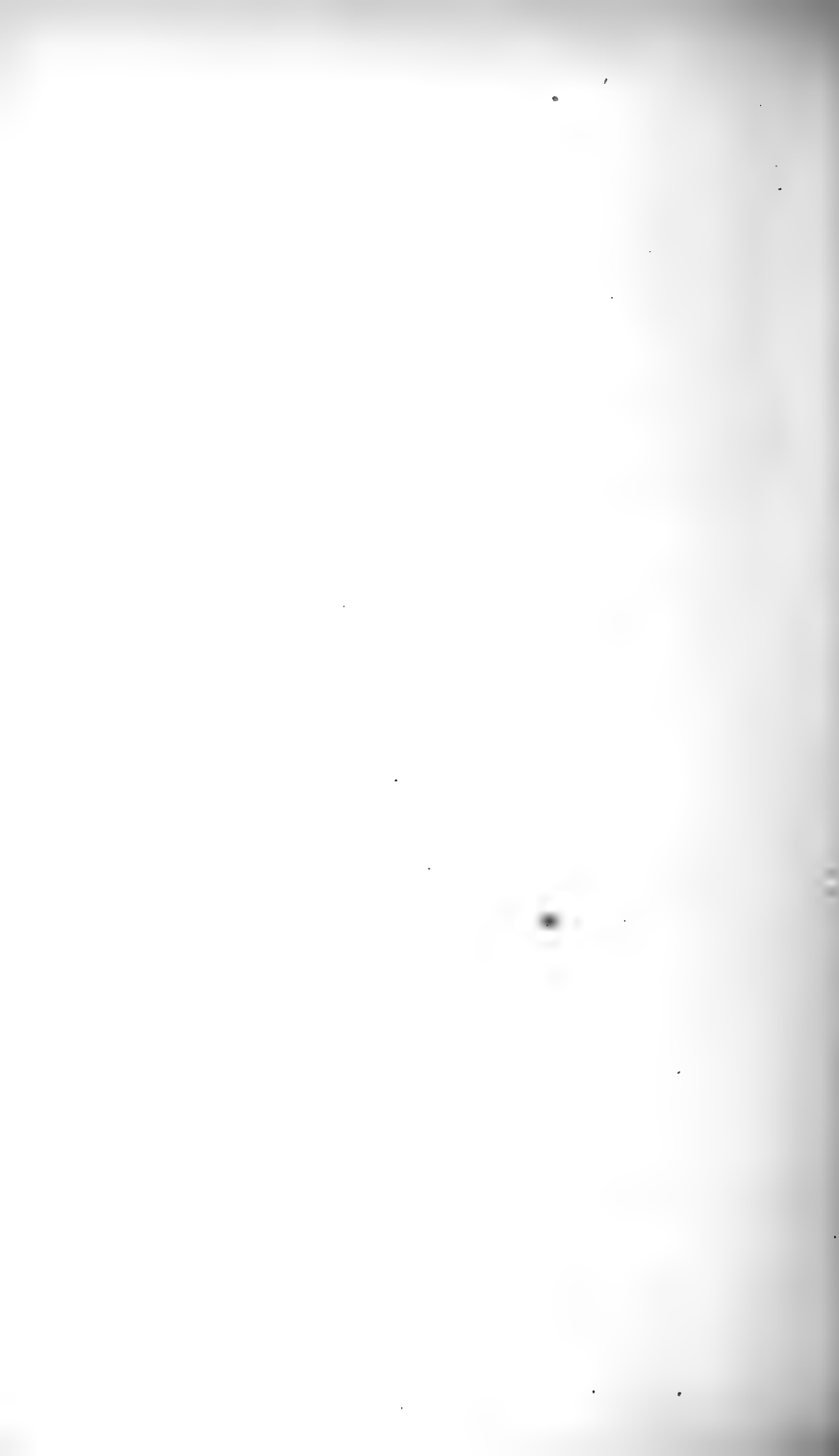
- a.* Plant. *b.* Vertical section of thallus. *c.* Vertical section of apothecium.
d. Ascus and paraphysis. *e.* Spores. *f.* Spermogone.
g. Sterigmata and spermatia.

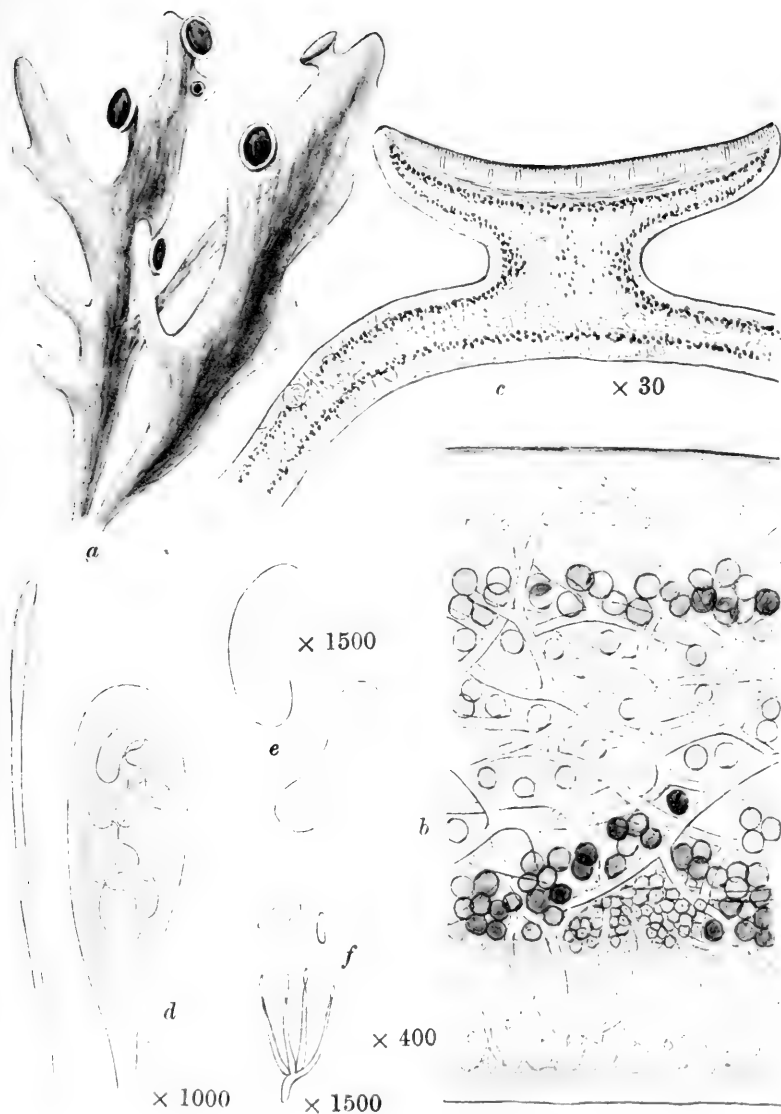




EVERNIA PRUNASTRI Ach.

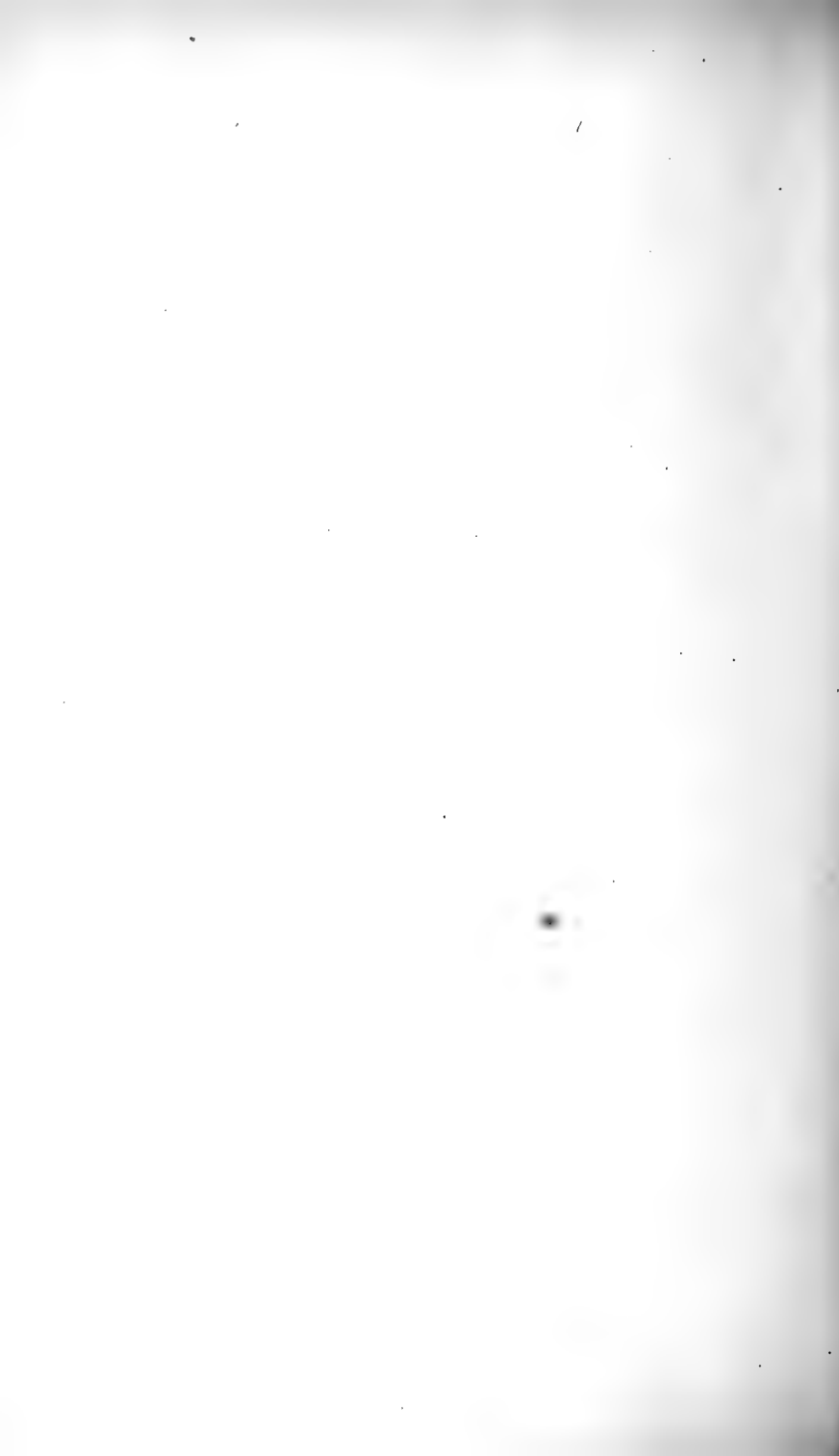
- a. Plant. b. Section of thallus. c. Vertical section of apothecium.
 d. Ascus and paraphyses. e. Spores.

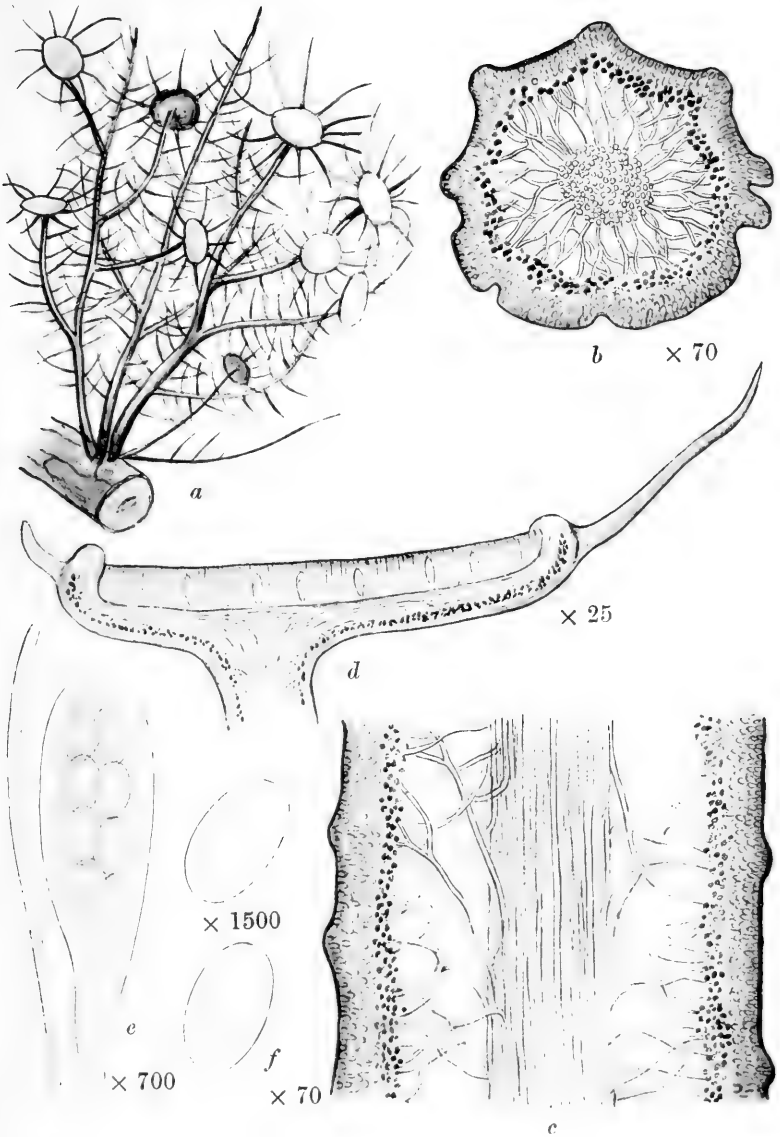




RAMALINA FRAXINEA Ach.

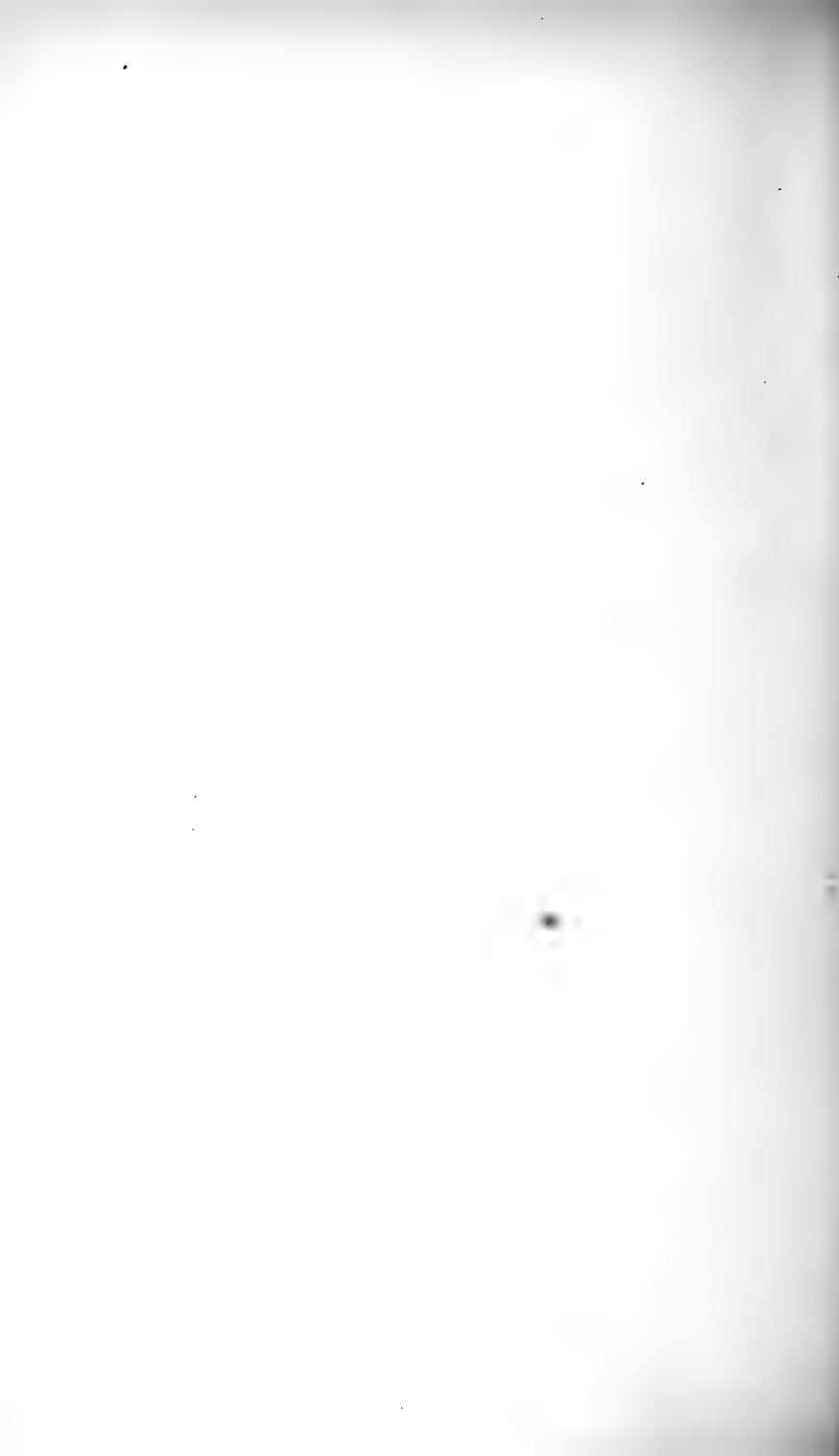
- a.* Portion of plant. *b.* Transverse section of thallus. *c.* Vertical section of apothecium and thallus. *d.* Ascus and paraphysis. *e.* Spores. *f.* Sterigmata and spermatia.

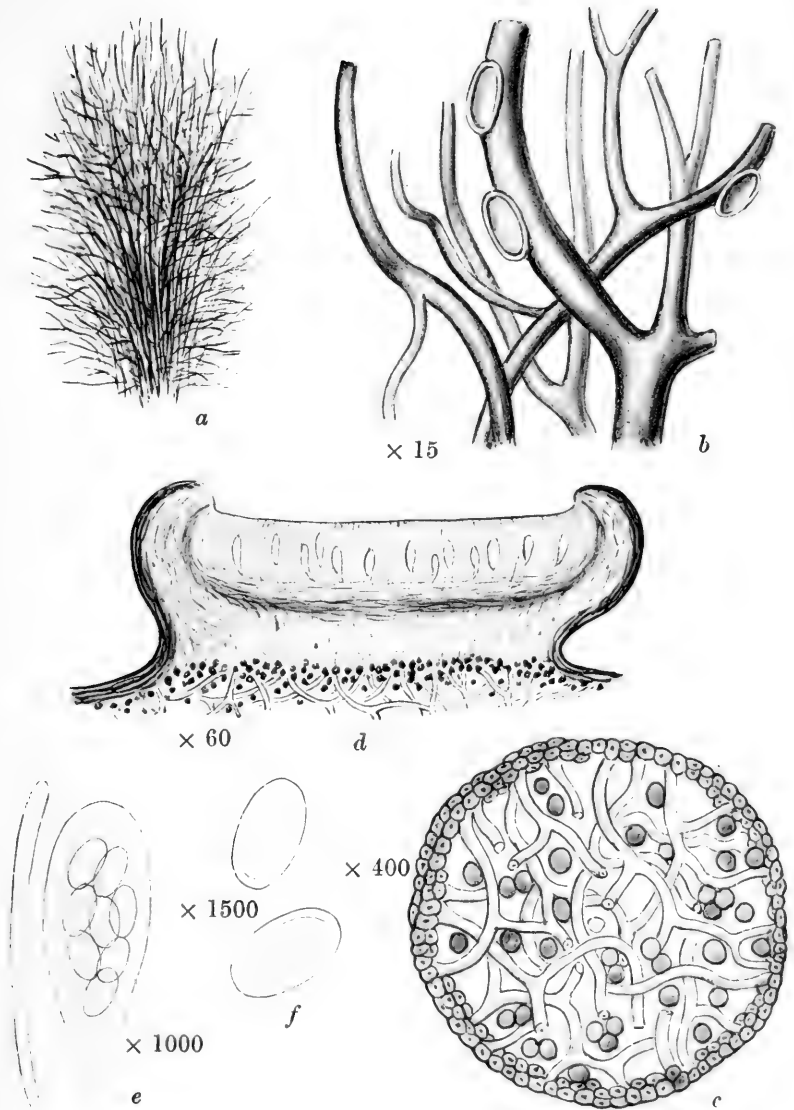




USNEA FLORIDA Web.

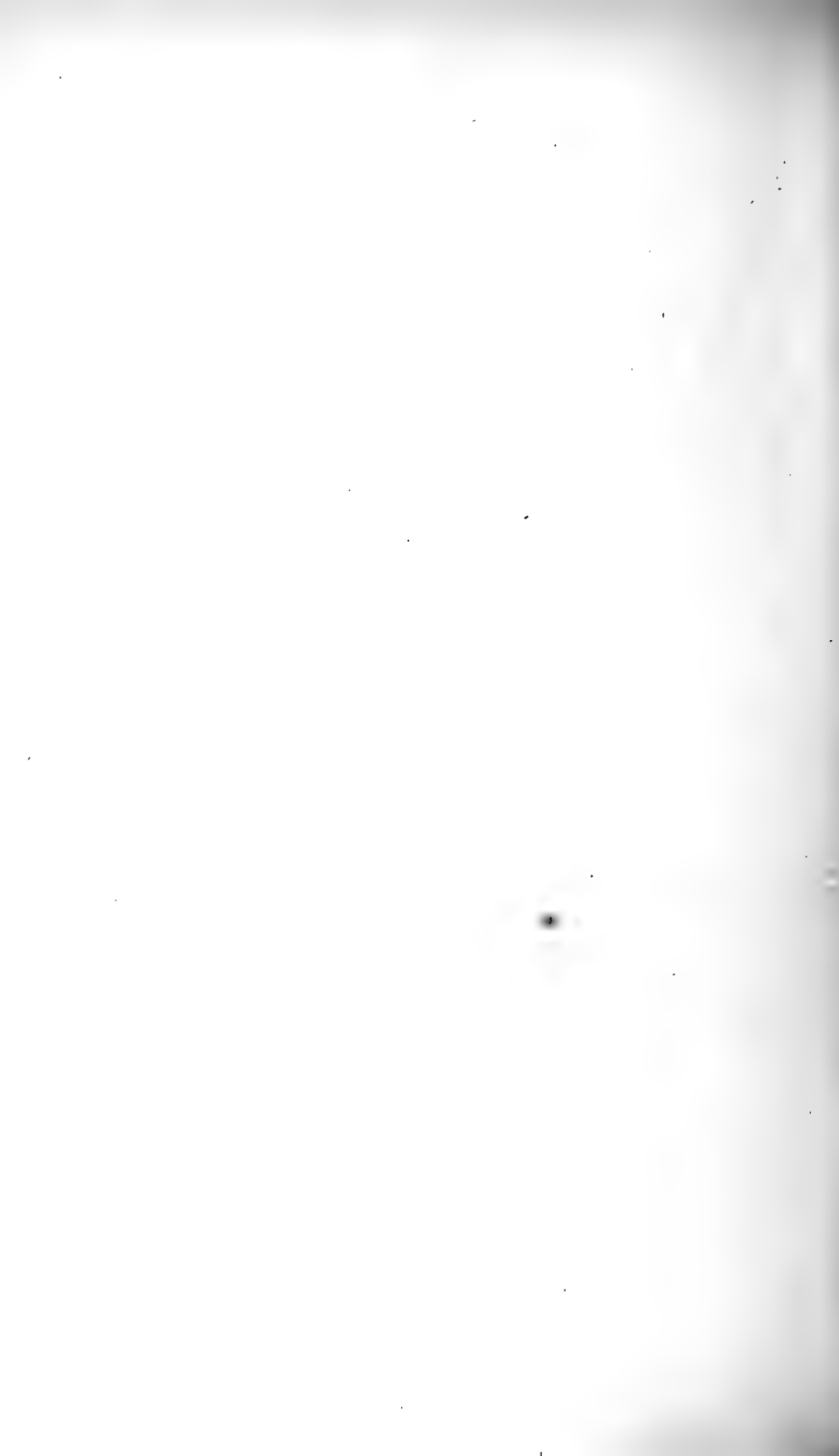
a. Plant on branch. *b.* Transverse section of thallus. *c.* Vertical section of thallus. *d.* Vertical section of apothecium. *e.* Ascus and paraphysis. *f.* Spores.

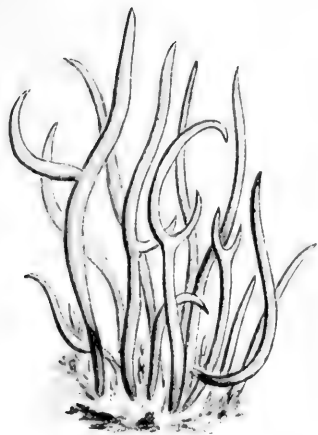




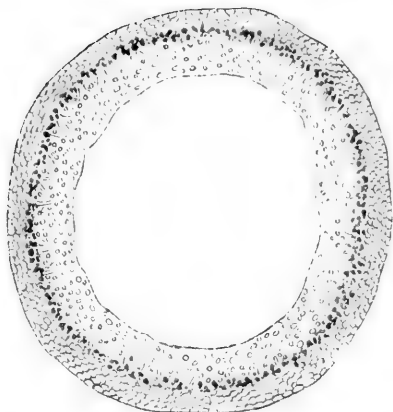
ALECTORIA JUBATA Ach.

a. Plant. *b.* Portion of plant. *c.* Transverse section of thallus. *d.* Vertical section of apothecium. *e.* Ascus and paraphysis. *f.* Spores.

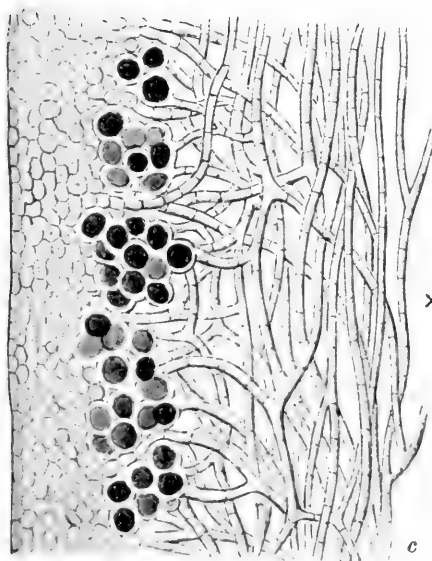




a

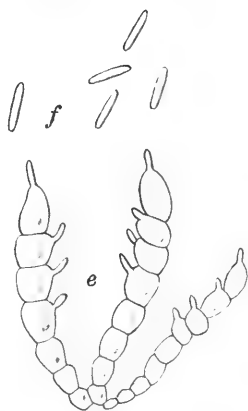


b $\times 40$

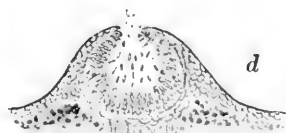


$\times 500$

c



$\times 1000$



$\times 30$

d

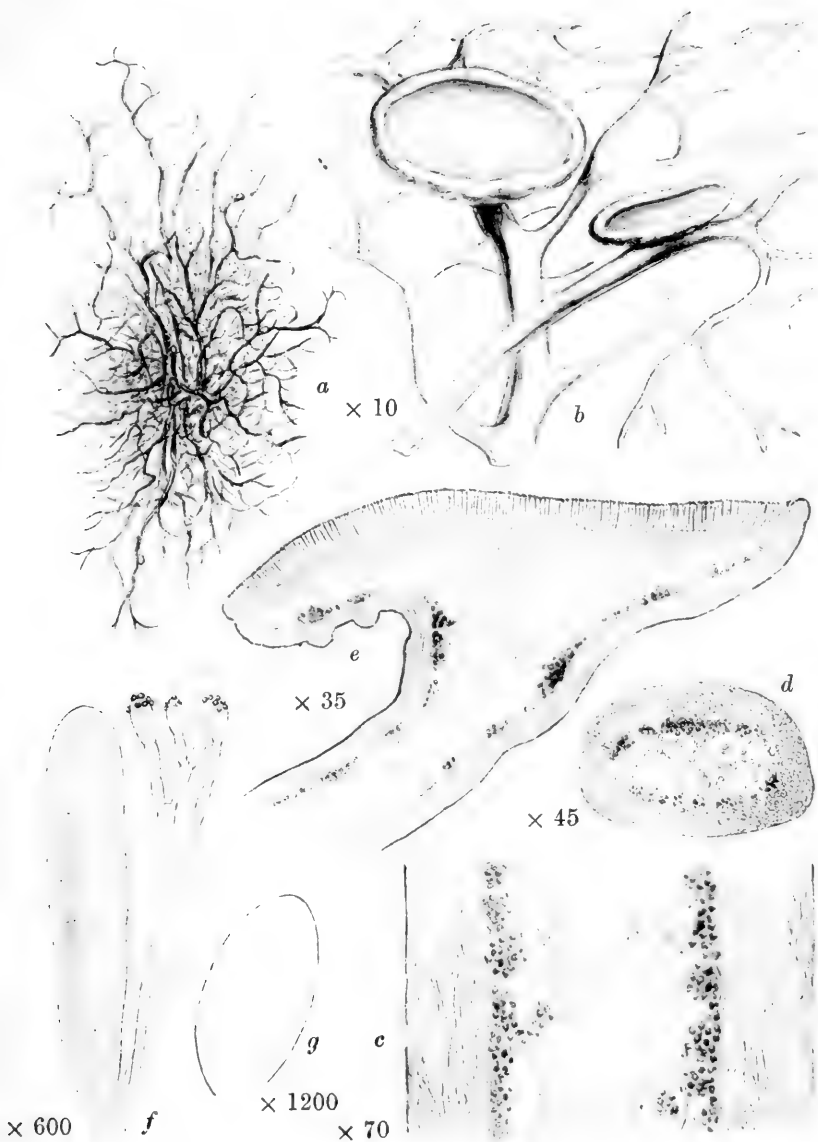


f

CERANIA VERMICULARIS S. F. Gray.

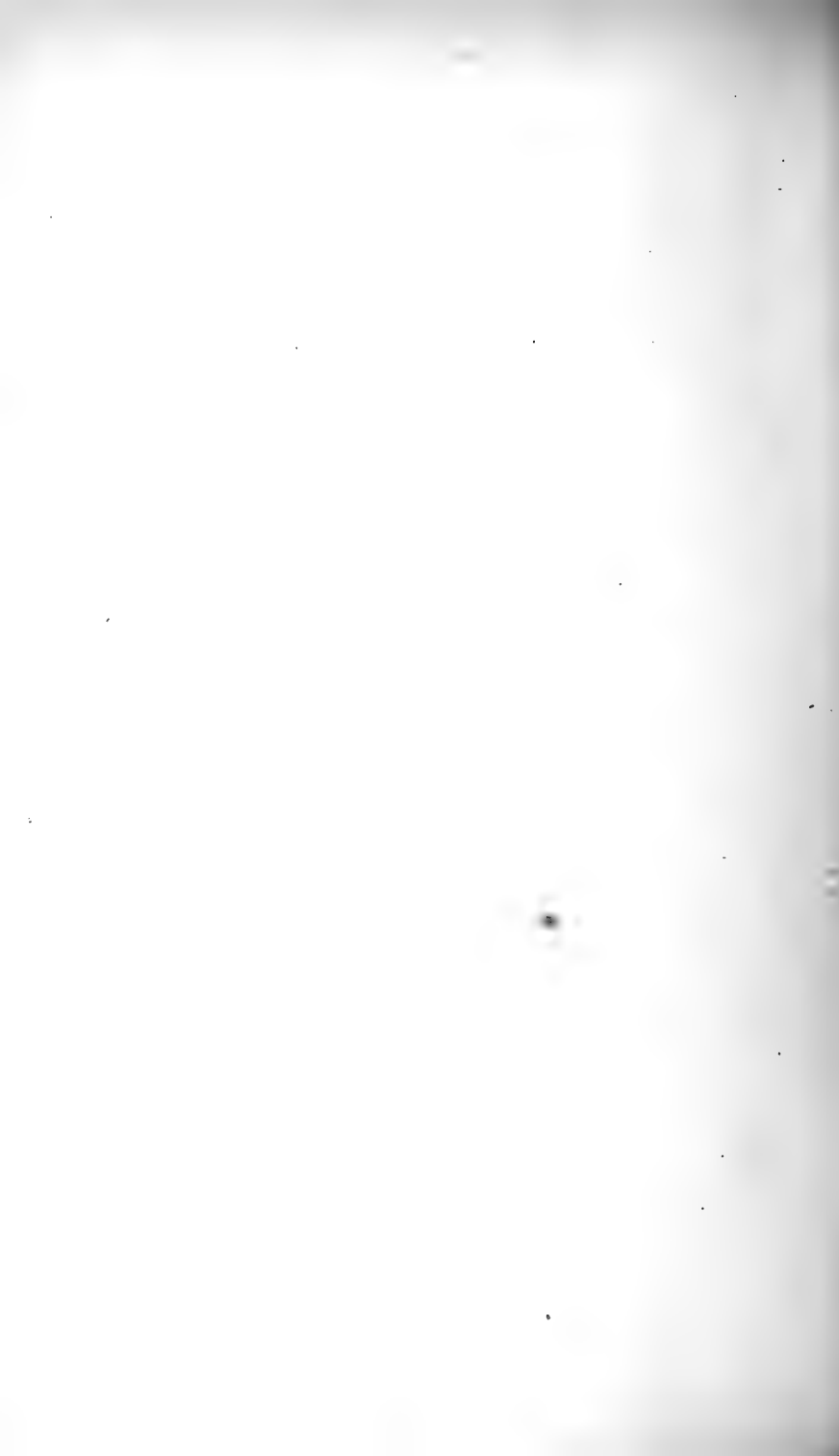
a. Plant on ground. b. Transverse section of thallus. c. Vertical section of thallus.
 d. Vertical section of spermatogone. e. Sterigmata. f. Spermata.

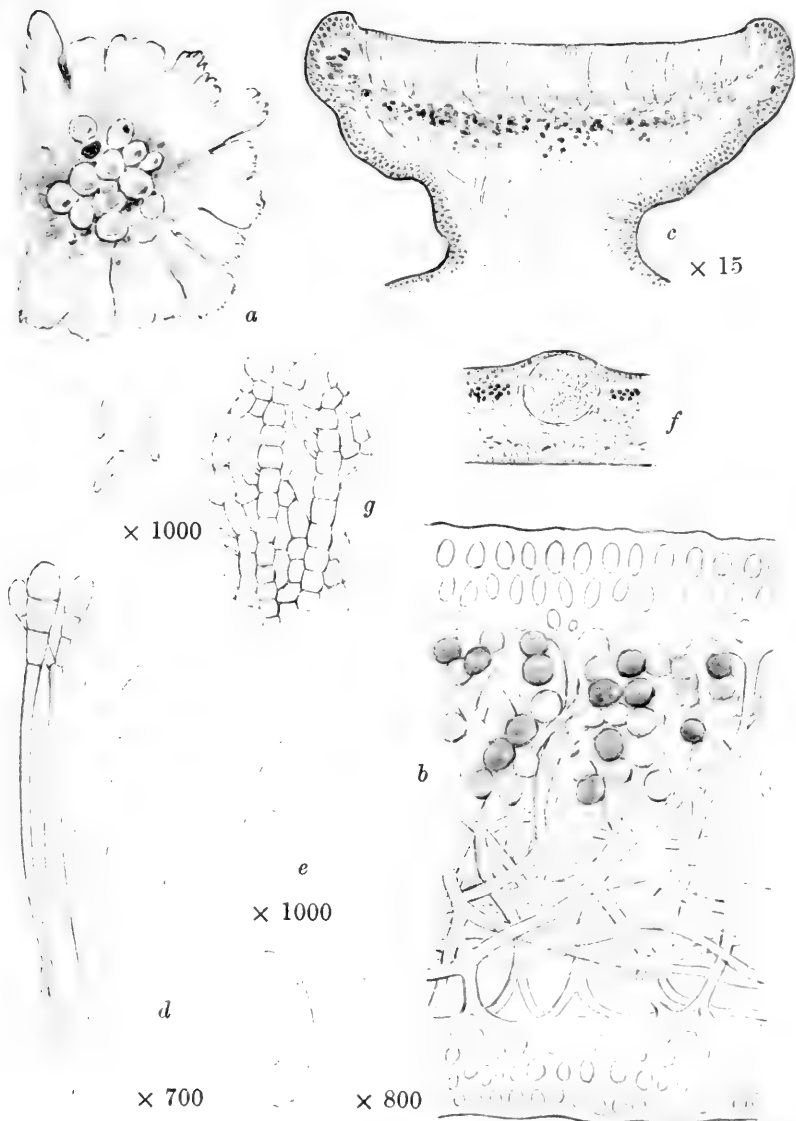




TELOSCHISTES FLAVICANS Norm.

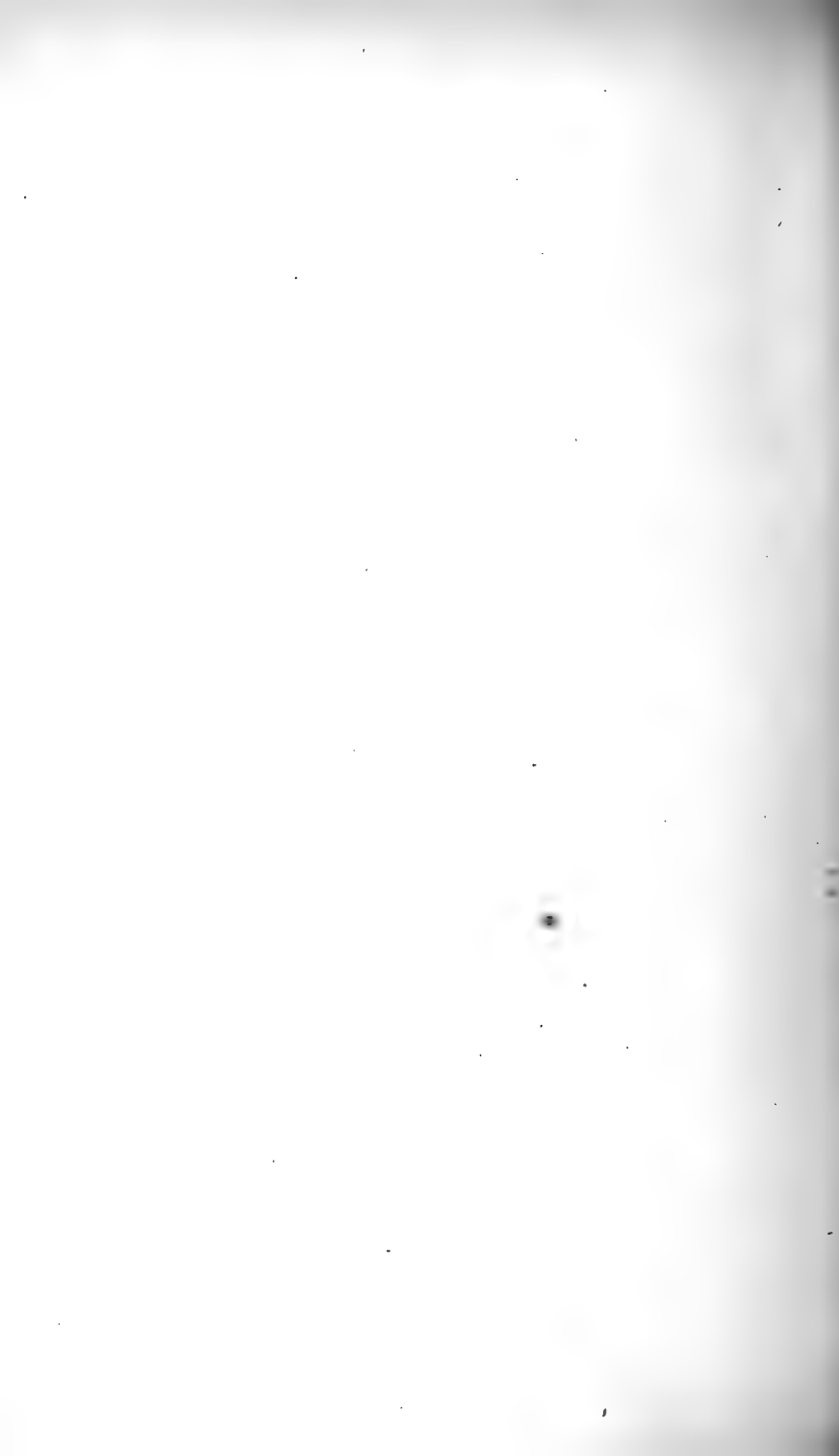
a. Plant. *b.* Portion of plant. *c.* Longitudinal section of frond. *d.* Transverse section of frond. *e.* Vertical section of apothecium. *f.* Ascus and paraphyses. *g.* Spore.

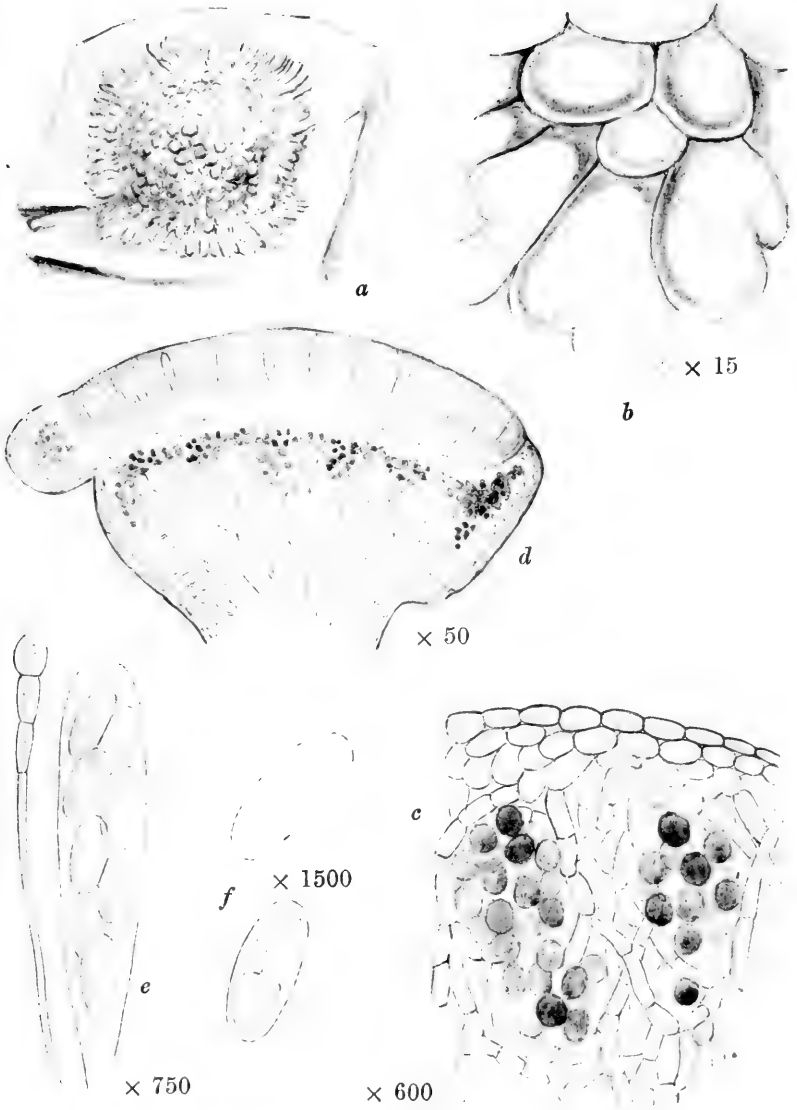




XANTHORIA PARIETINA Th. Fr.

- a.* Portion of plant. *b.* Vertical section of thallus. *c.* Vertical section of apothecium.
d. Ascus and paraphyses. *e.* Spores. *f.* Vertical section of spermatogone.
g. Sterigmata and spermatia.

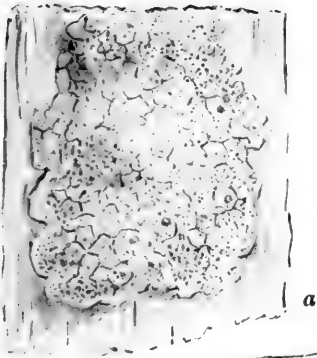




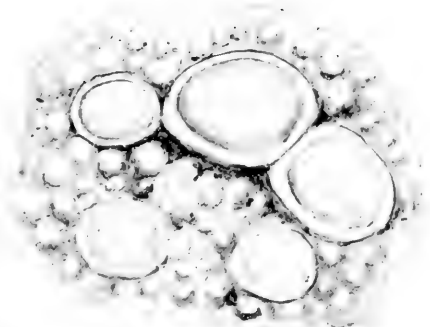
PLACODIUM MURORUM DC.

a. Plant on stone. **b.** Portion of plant. **c.** Vertical section of thallus. **d.** Vertical section of apothecium. **e.** Ascus and paraphysis. **f.** Spores.





a

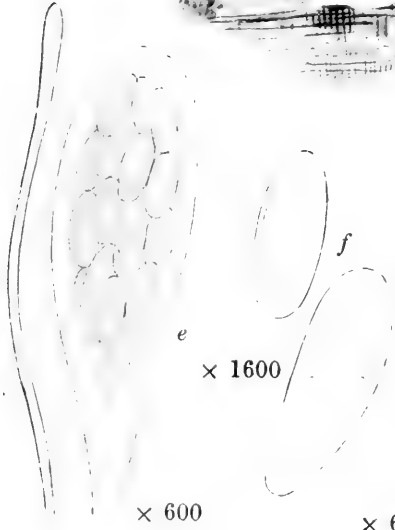


b × 10



d

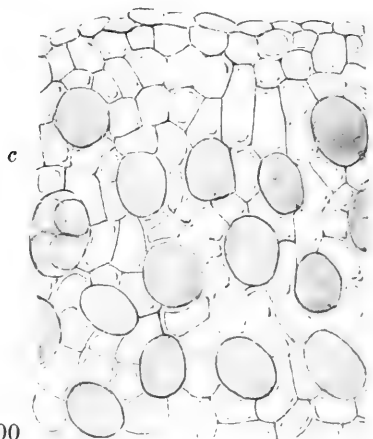
× 35



e

× 1600

× 600

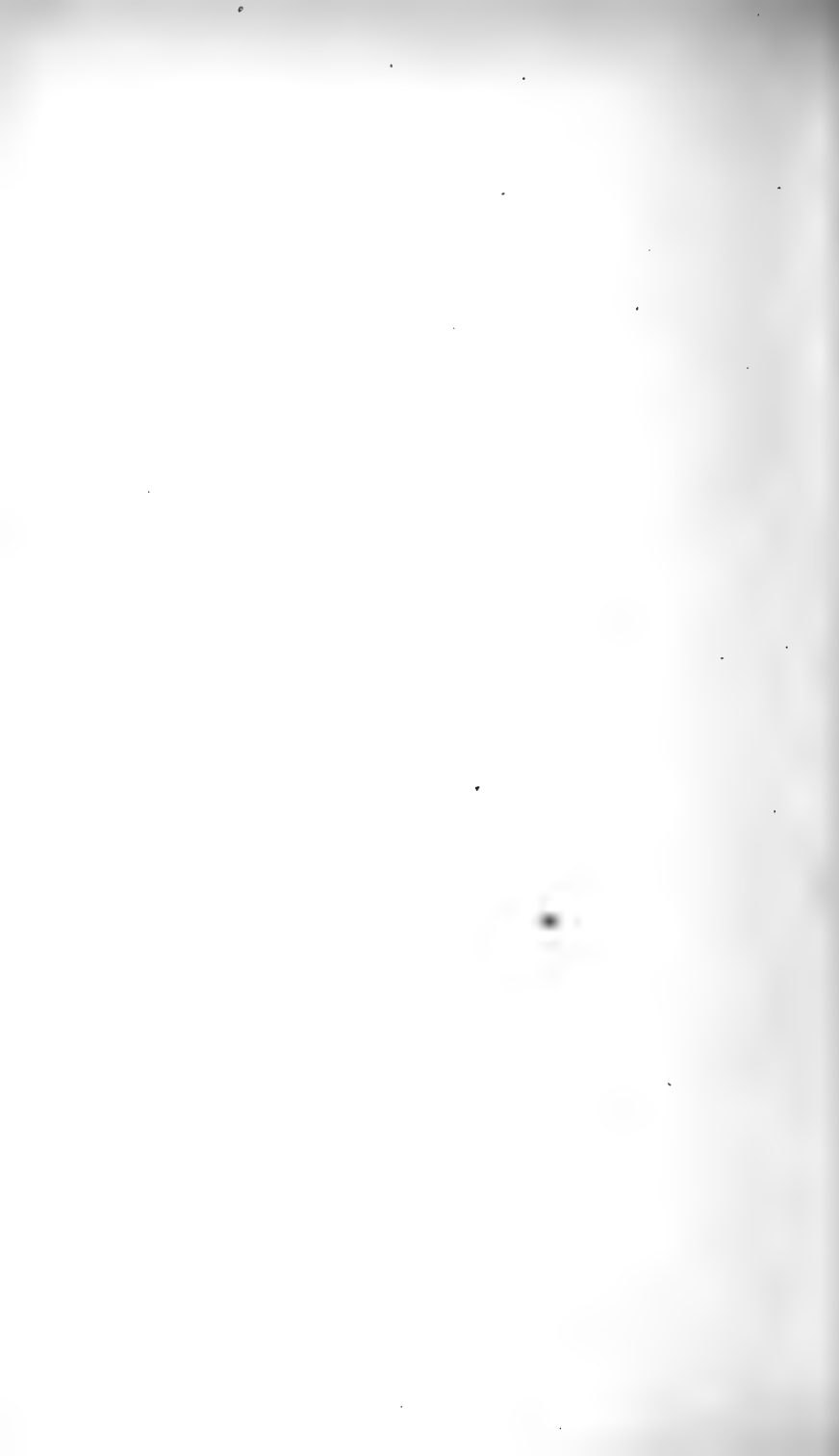


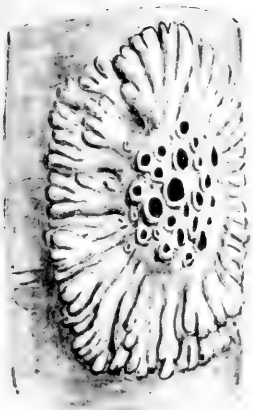
c

× 600

CANDELARIELLA VITELLINA Müll.—Arg.

a Plant on bark. b. Portion of plant. c. Vertical section of thallus. d. Vertical section of apothecium e. Ascus and paraphysis. f. Spores.

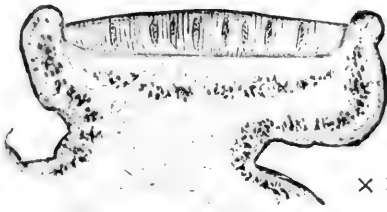




a

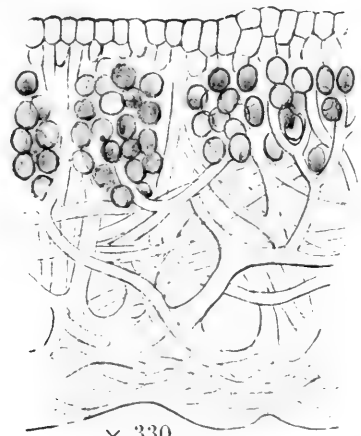


b × 5



d

× 25



c

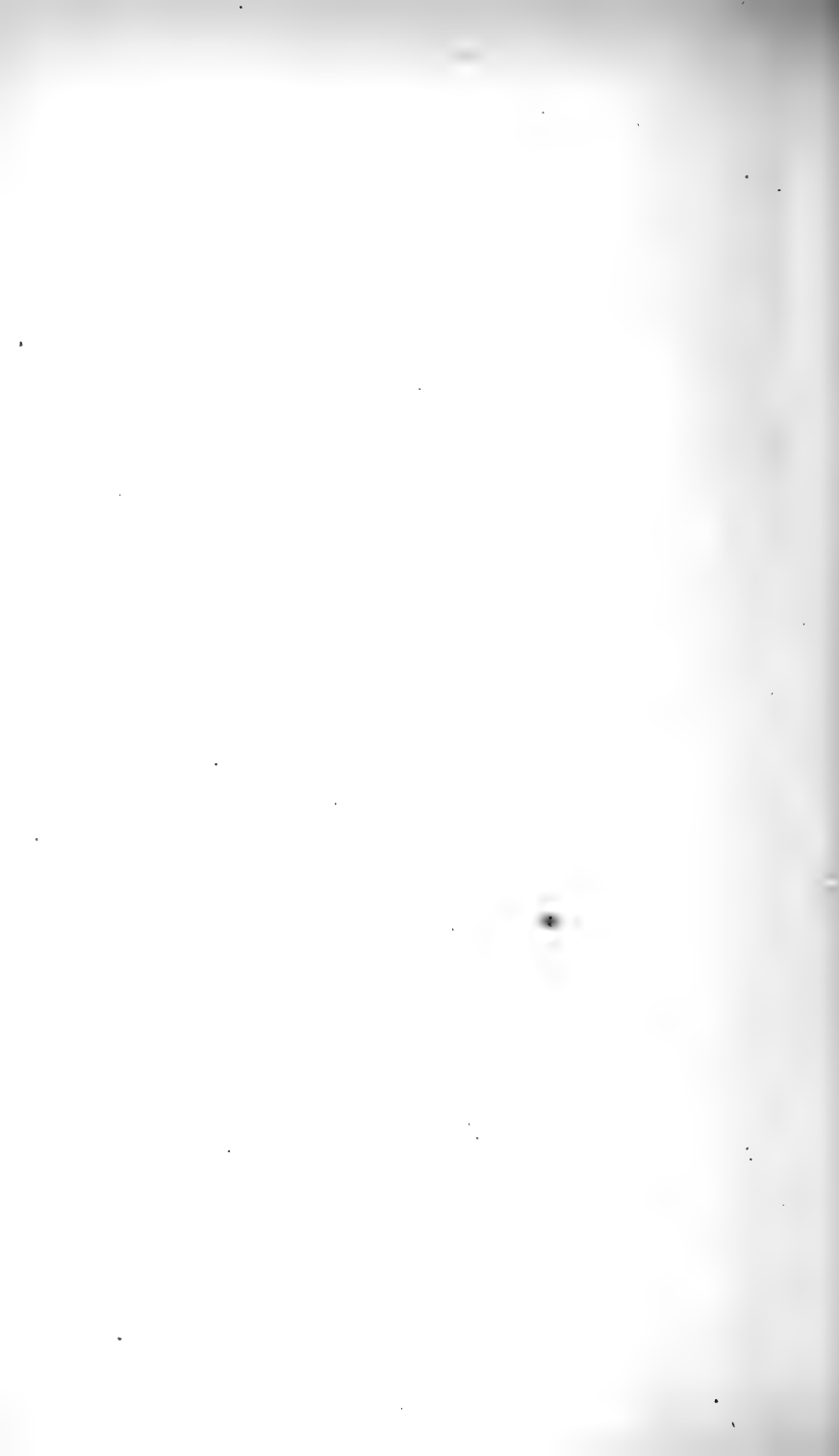
× 330

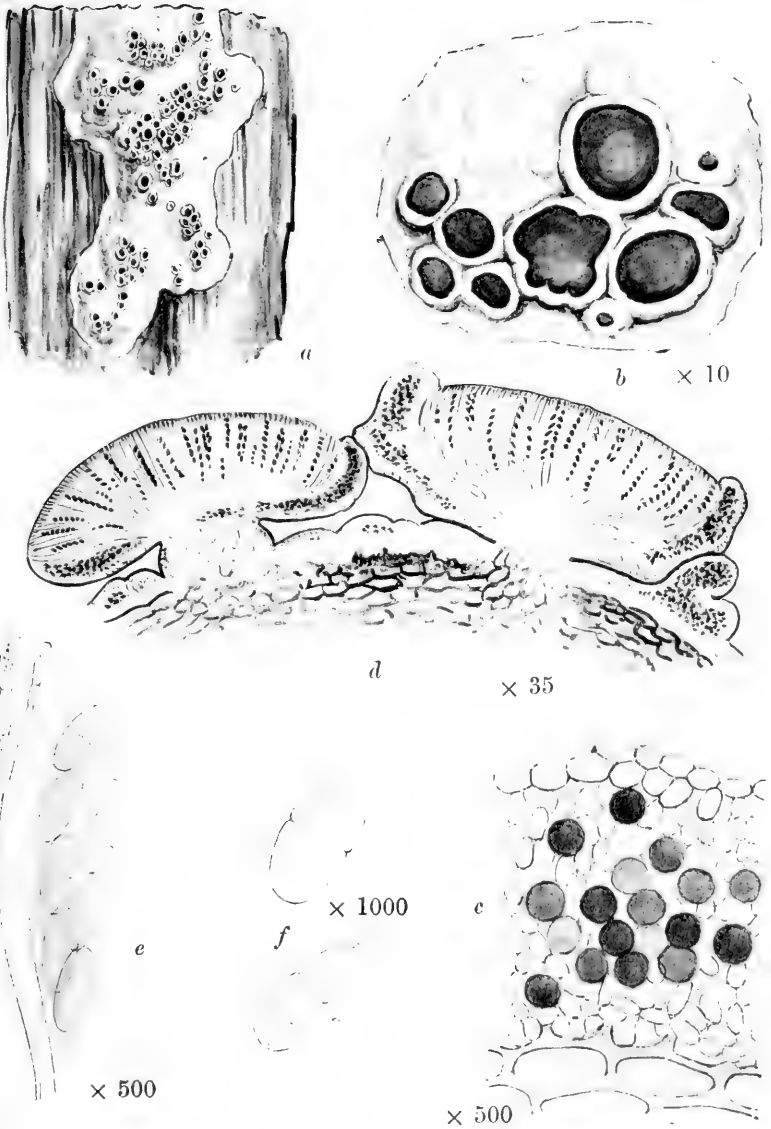
e × 1000

× 750

PHYSICIA STELLARIS Nyl. var. *AIPOLIA* Nyl.

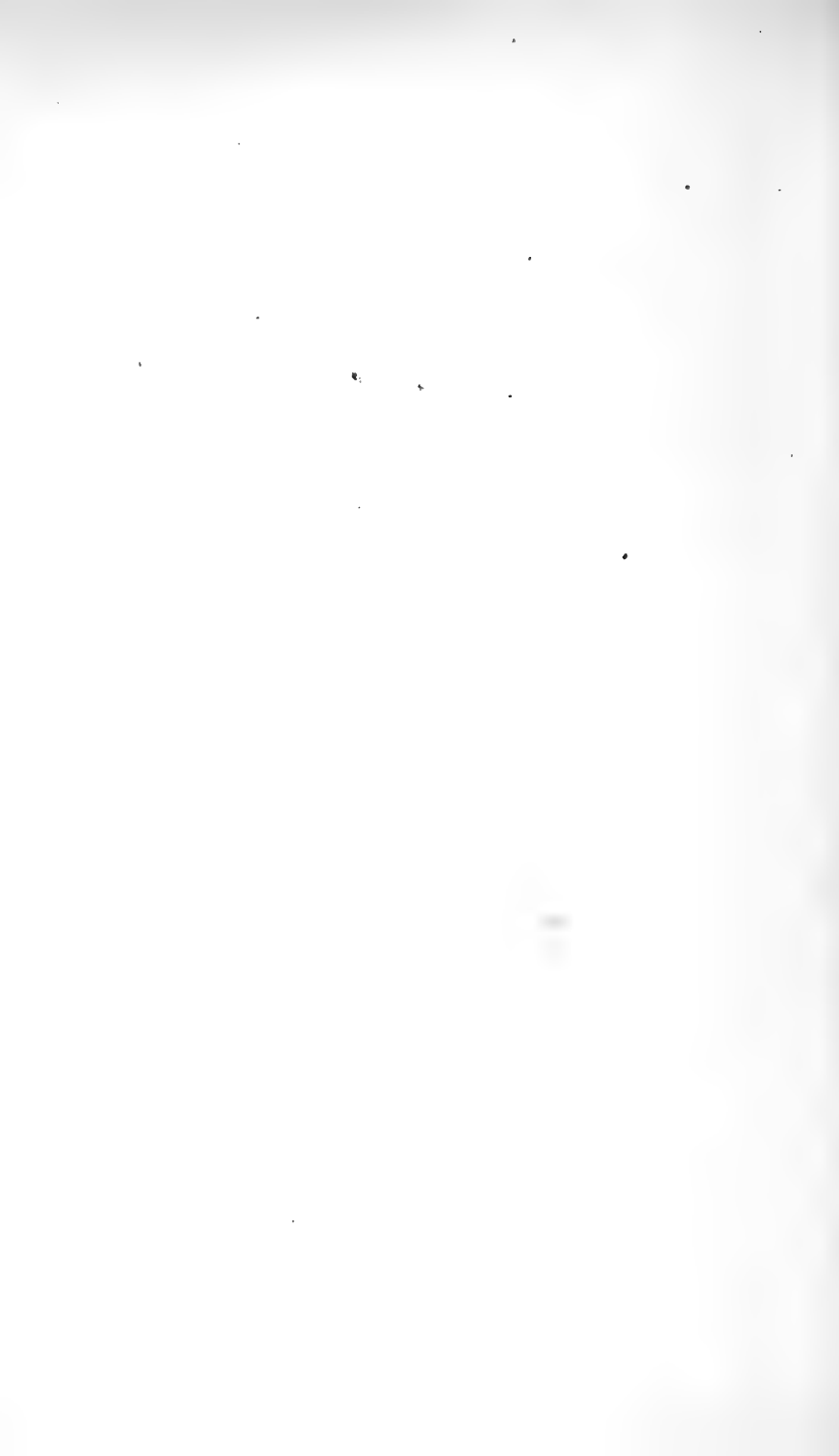
a. Plant on bark. b. Portion of plant. c. Vertical section of thallus. d. Vertical section of apothecium. e. Ascus and paraphysis. f. Spores.





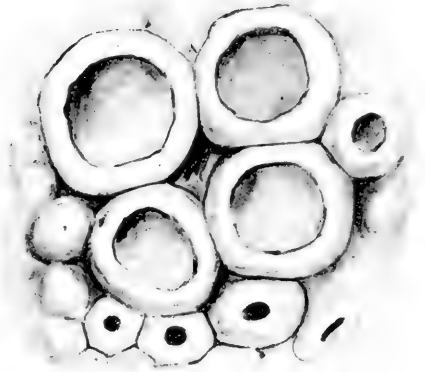
RINODINA ROBORIS Arn.

a. Plant on bark. b. Portion of plant. c. Vertical section of thallus. d. Vertical section of apothecium. e. Ascus and paraphysis. f. Spores.

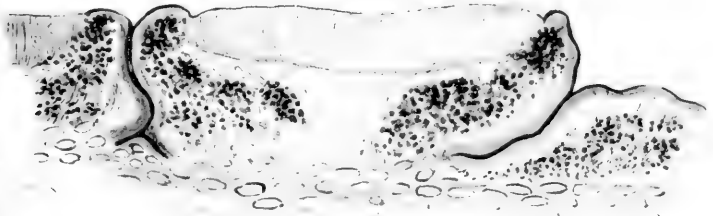




a



b × 10



d × 50

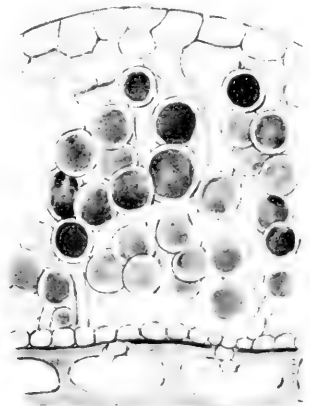


× 1000



× 1500

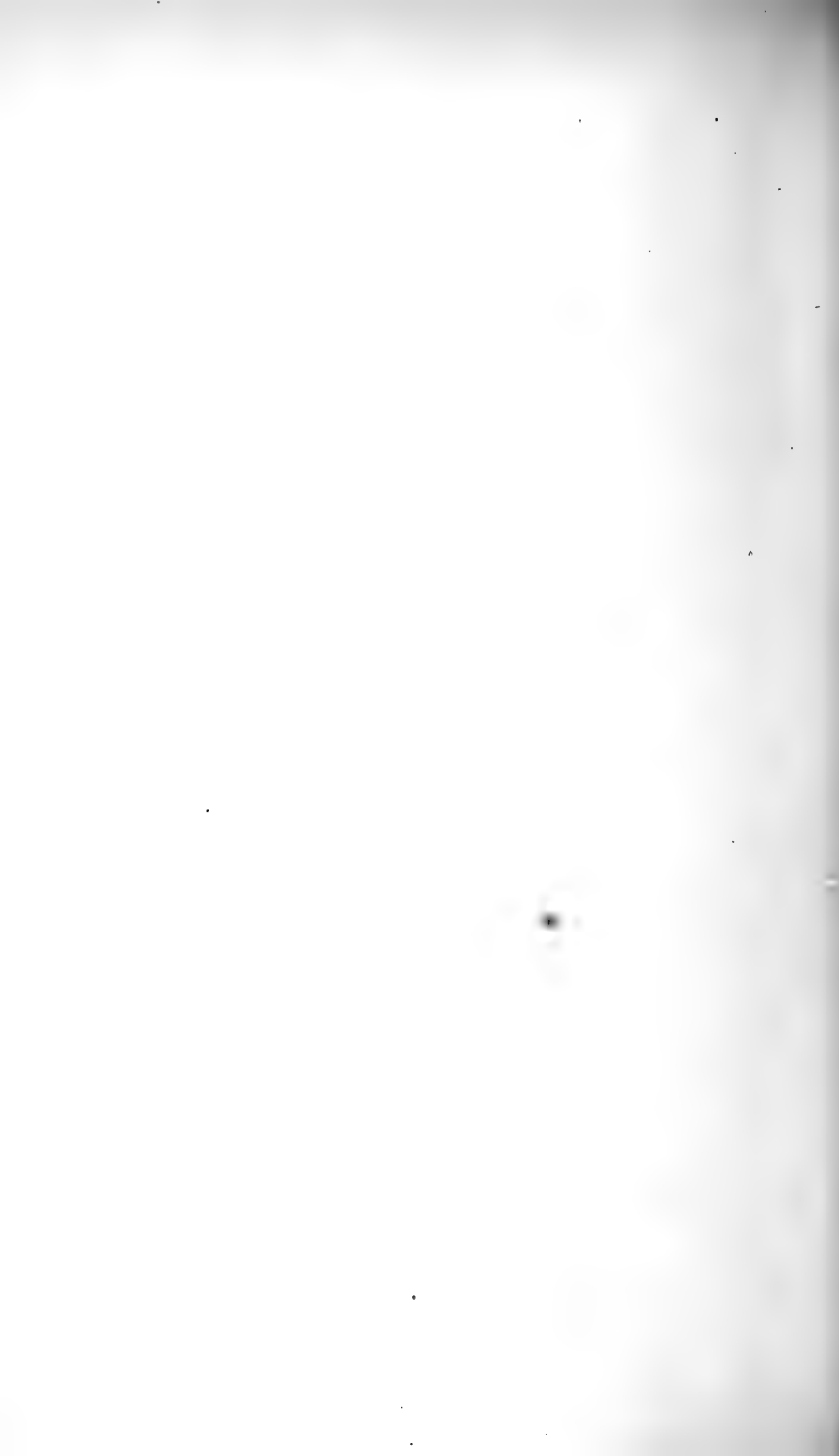
f

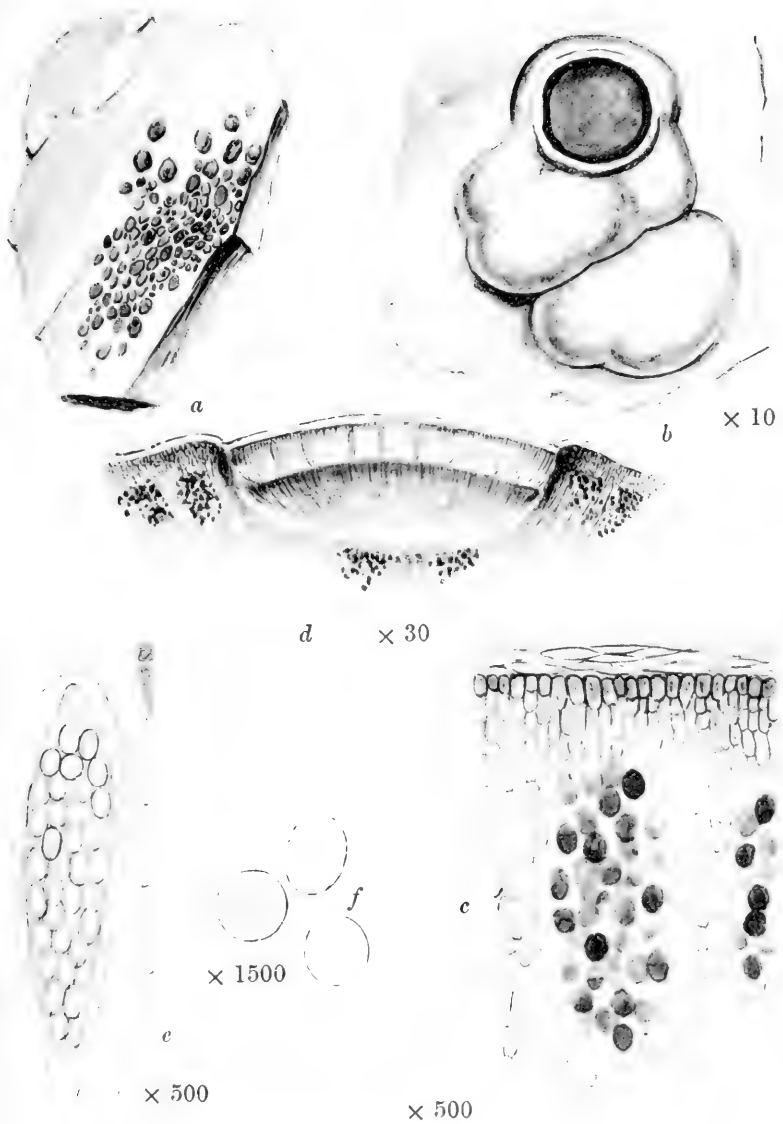


× 450

LECANORA VARIA Ach.

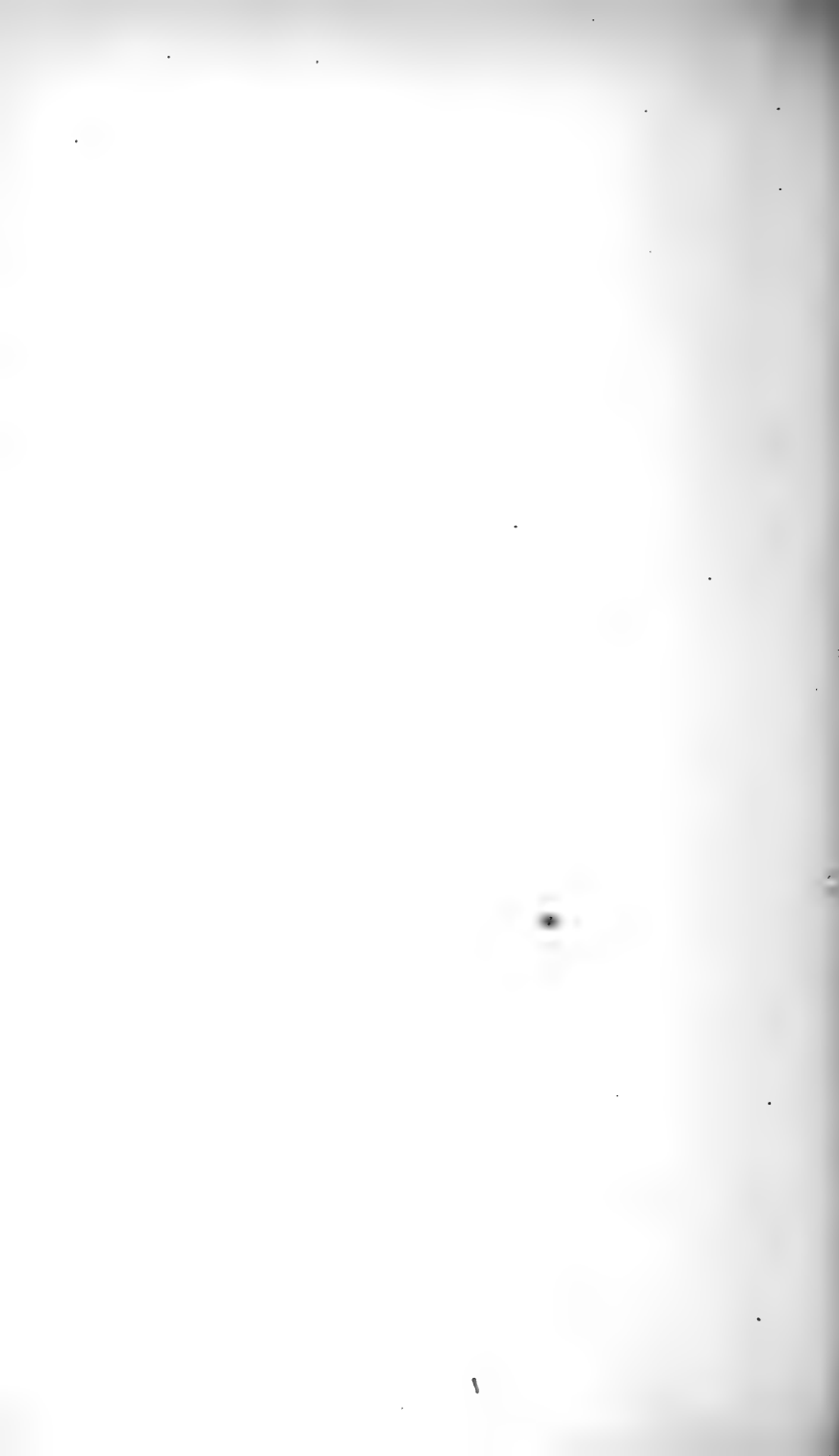
a. Plant on paling. b. Portion of plant. c. Vertical section of thallus. d. Vertical section of thallus and apothecium. e. Ascus and paraphysis. f. Spores.

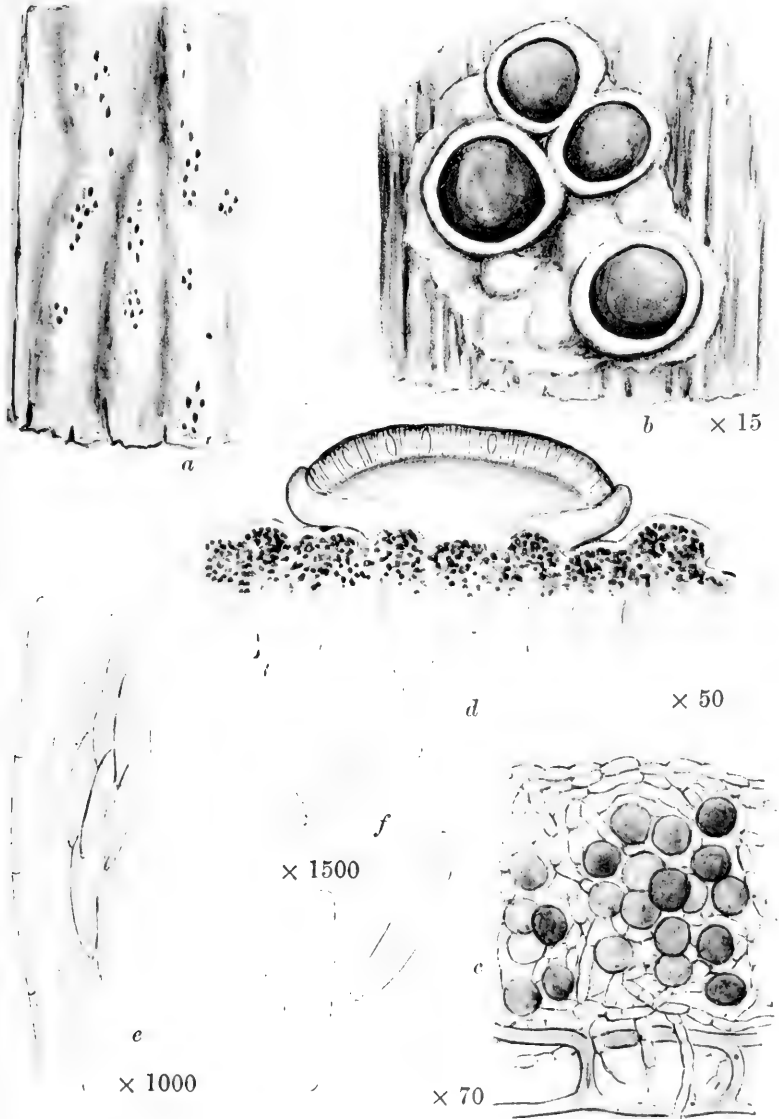




ACAROSPORA SQUAMULOSA Th. Fr.

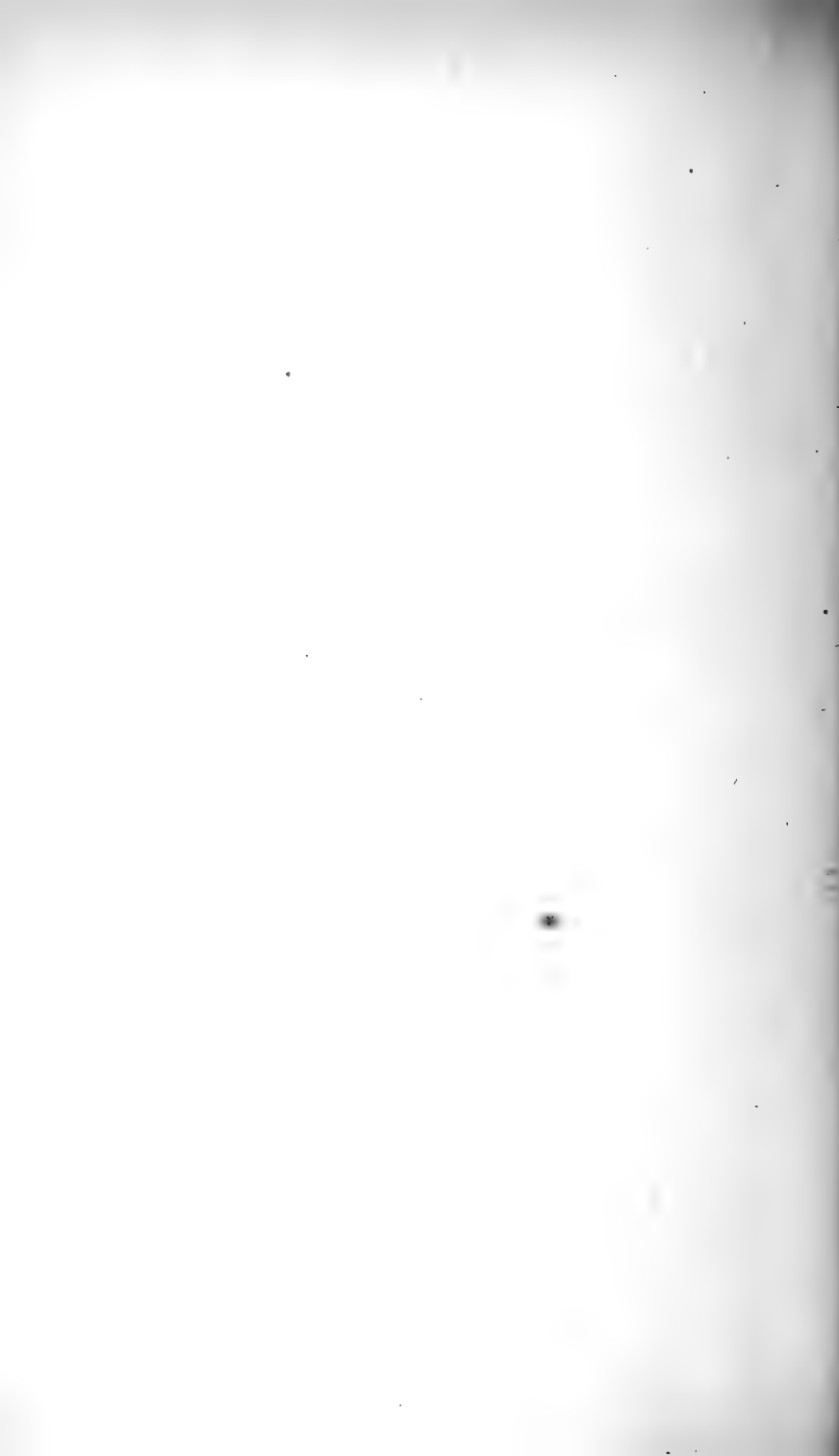
a. Plant on rock. *b.* Portion of plant. *c.* Vertical section of squamule. *d.* Vertical section of squamule and apothecium. *e.* Ascus and paraphysis. *f.* Spores.

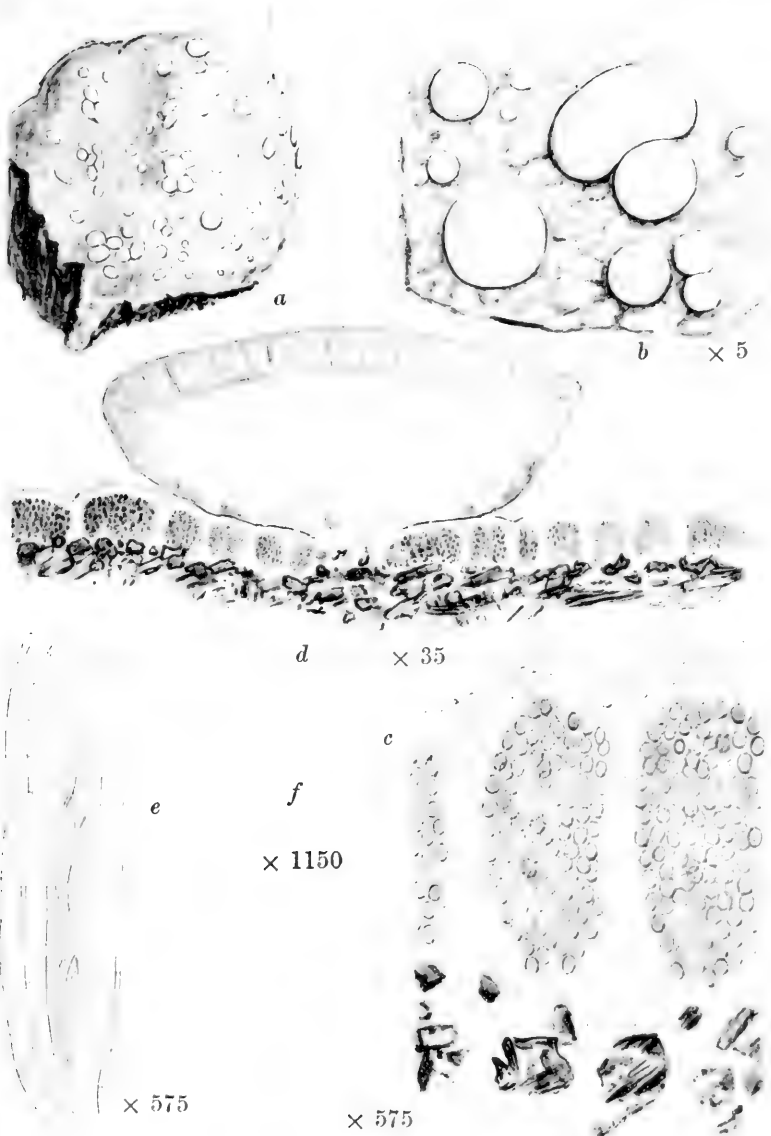




LECANIA SYRINGEA Th. Fr.

a. Plant on bark. b. Portion of plant. c. Vertical section of thallus. d. Vertical section of thallus and apothecium. e. Ascus and paraphysis. f. Spores.

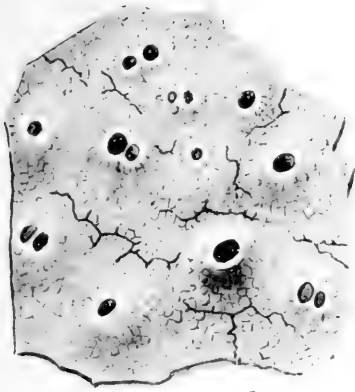




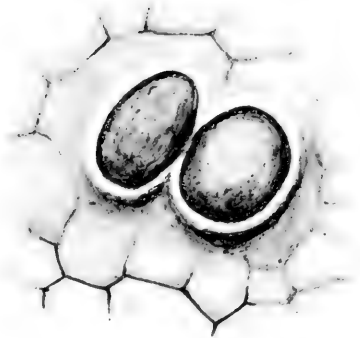
ICMADOPHILA ERICETORUM A. Zahlbr.

a. Plant on soil. *b.* Portion of plant. *c.* Vertical section of thallus. *d.* Vertical section of thallus and apothecium. *e.* Ascus and paraphyses. *f.* Spores.



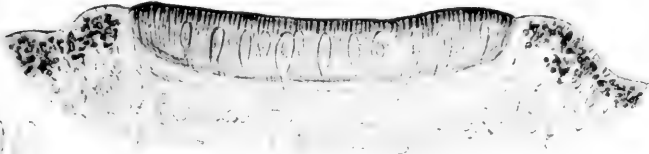


a



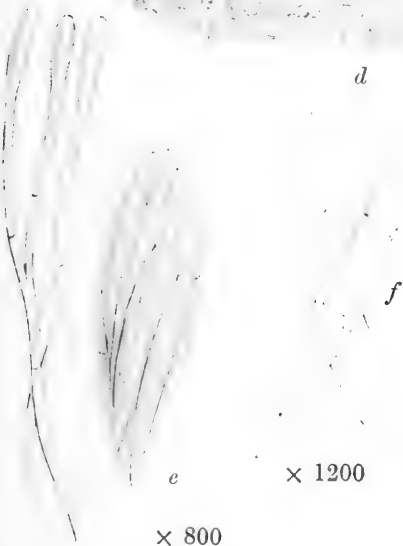
b

× 5



d

× 120



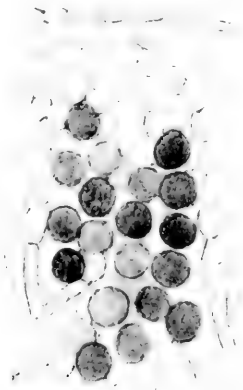
e

× 1200

× 800

× 500

c

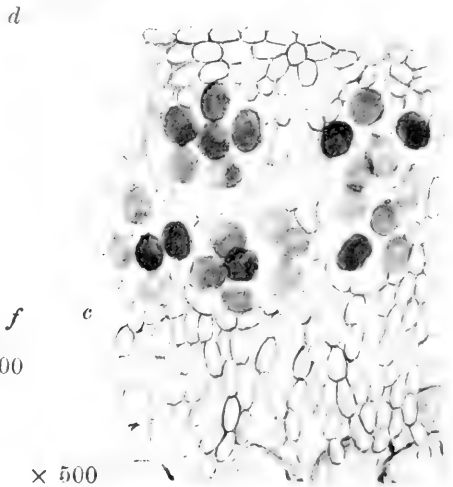
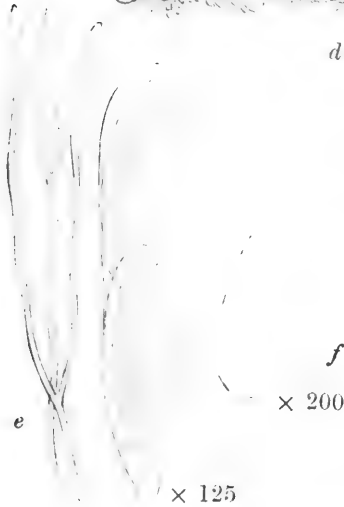
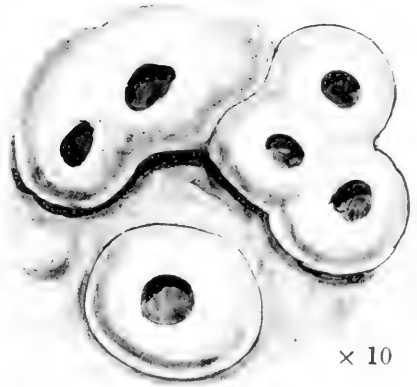
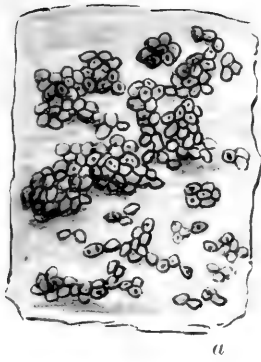


f

HÆMATOMMA COCCINEUM Koerb.

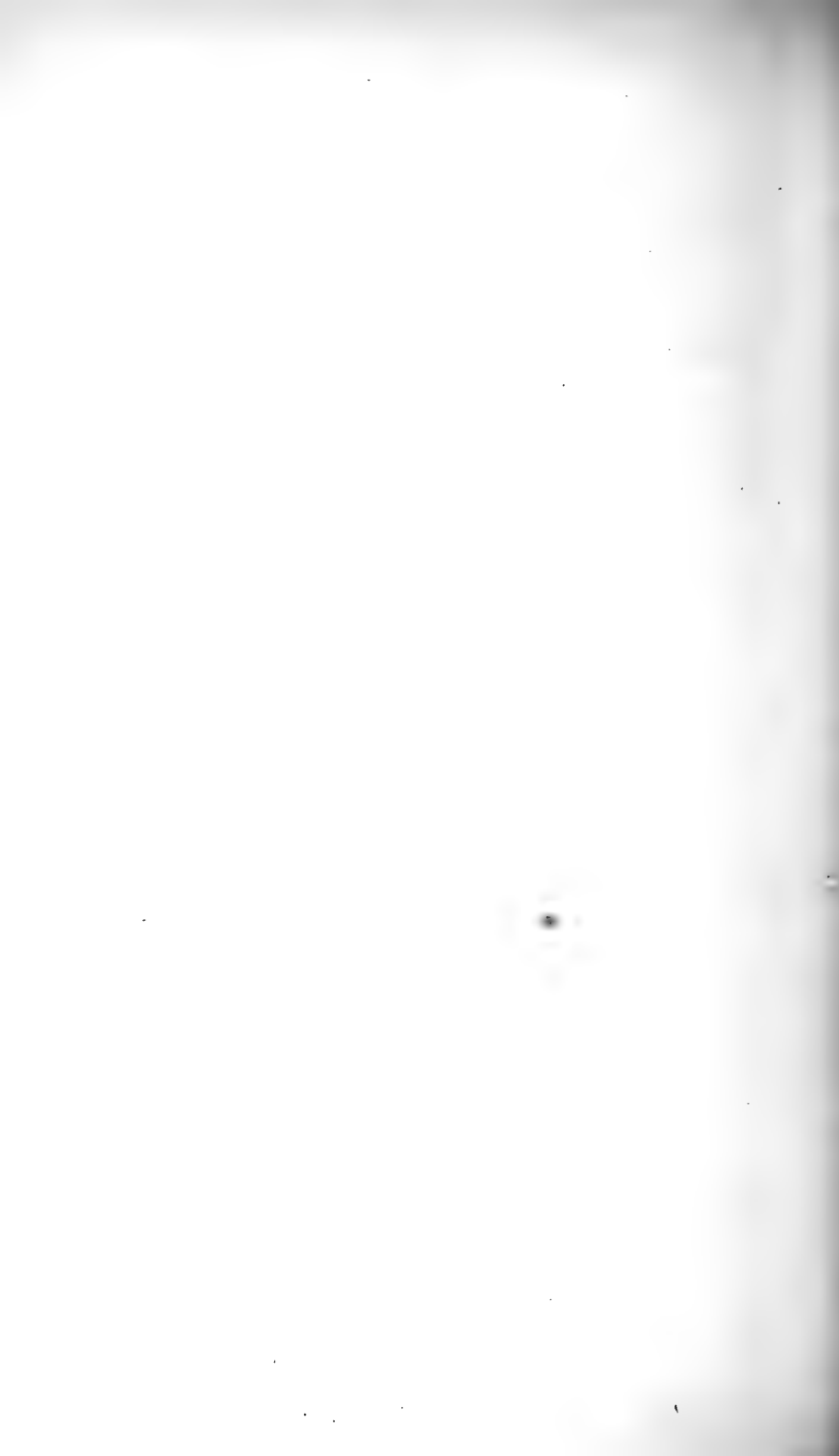
a. Plant on rock. b. Portion of plant. c. Vertical section of thallus. d. Vertical section of thallus and apothecium. e. Ascus and paraphyses. f. Spores.

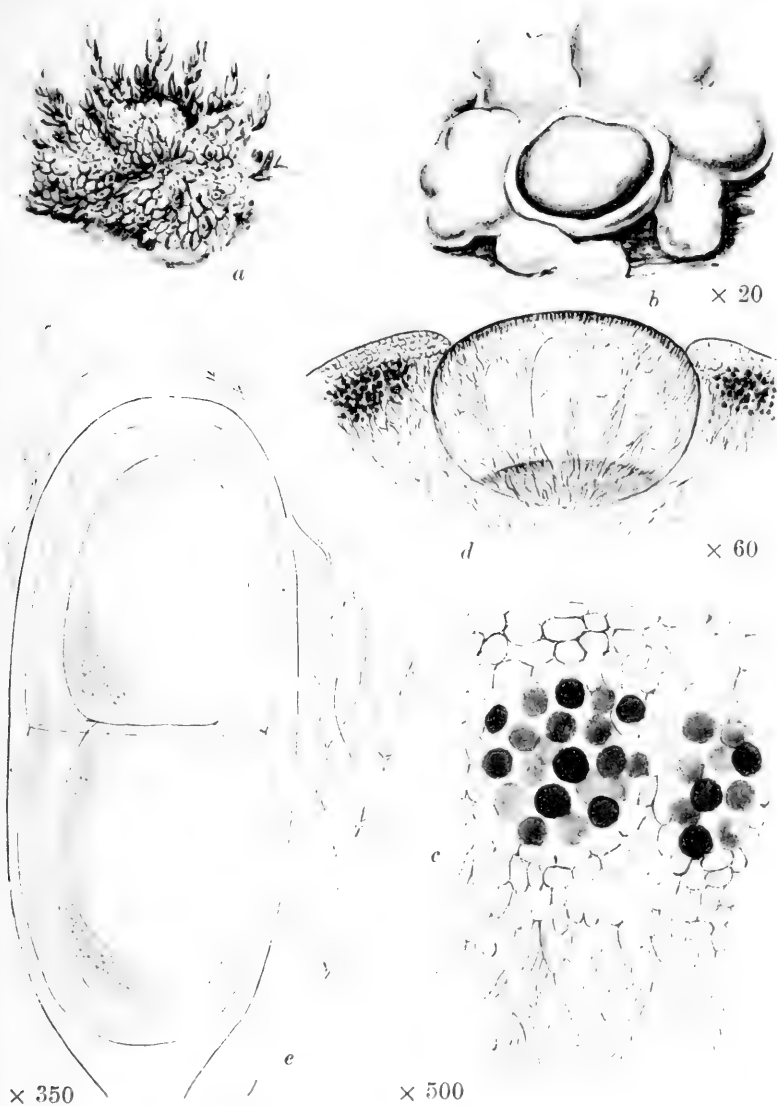




PERTUSARIA PERTUSA Dalla Torre and Sarnth.

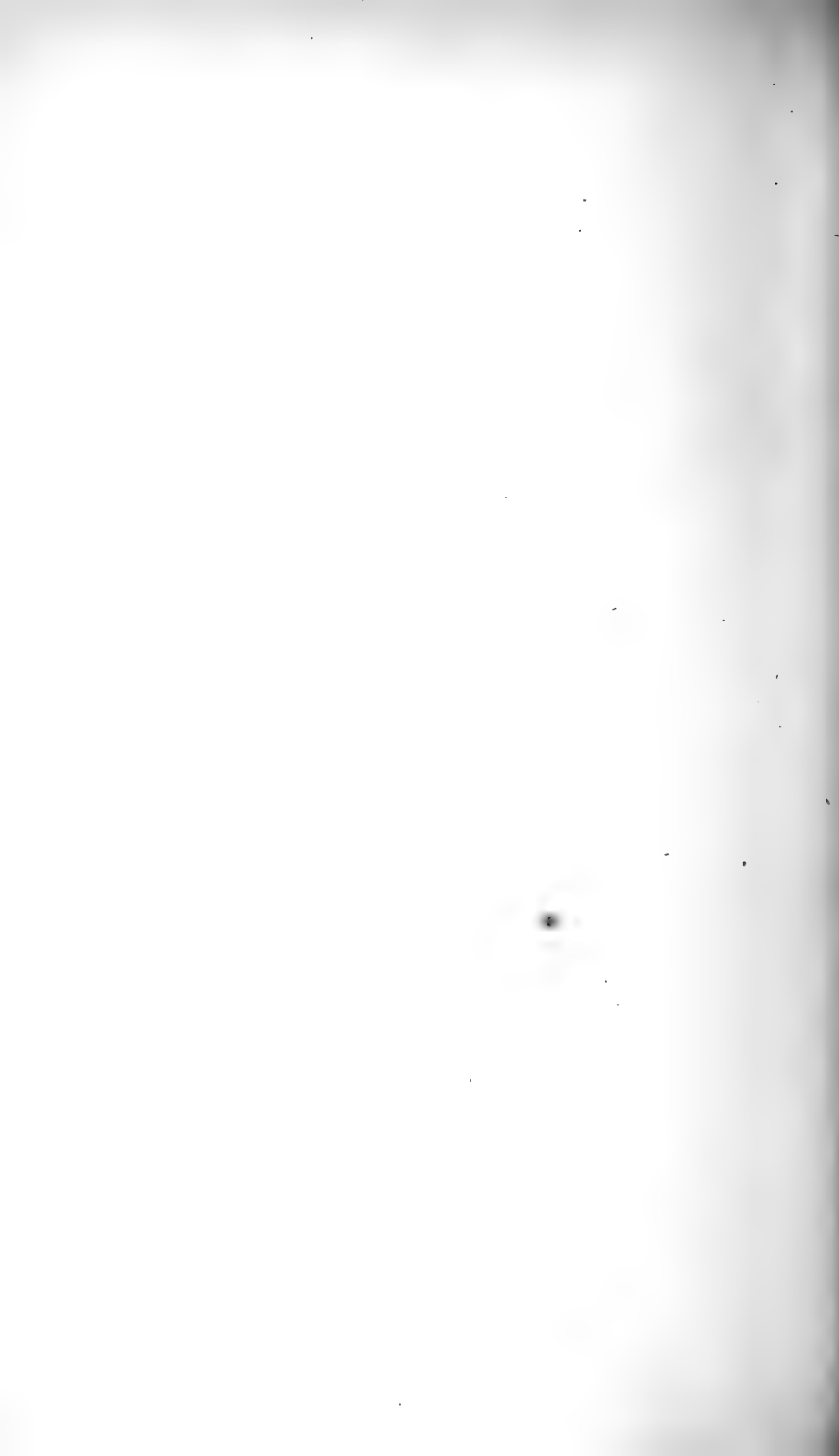
a. Plant on rock. *b.* Portion of plant. *c.* Vertical section of thallus. *d.* Vertical section of thallus and apothecium. *e.* Ascus and paraphyses. *f.* Spore.

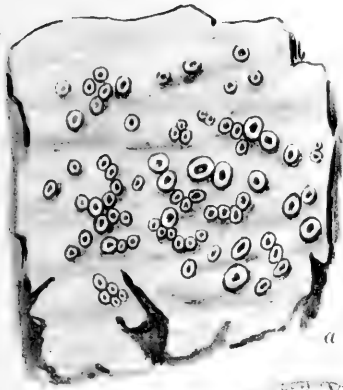




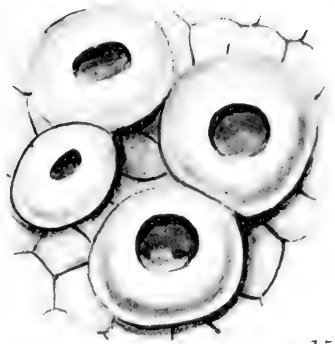
VARICELLARIA MICROSTICTA Nyl.

- a.* Plant on mossy soil. *b.* Portion of plant. *c.* Vertical section of thallus.
d. Vertical section of thallus and apothecium. *e.* Ascus with spore and paraphyses.

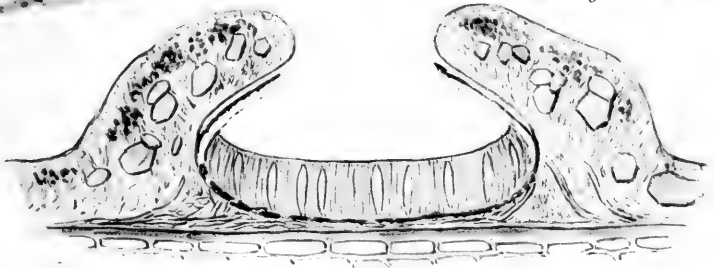




a



b × 15



d × 50



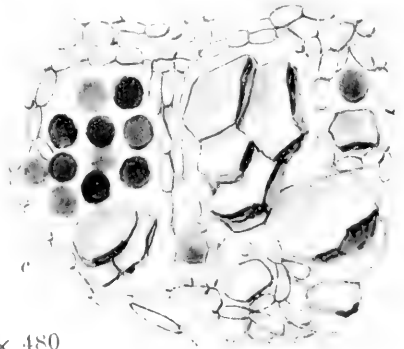
× 450

e



× 600

× 480



c

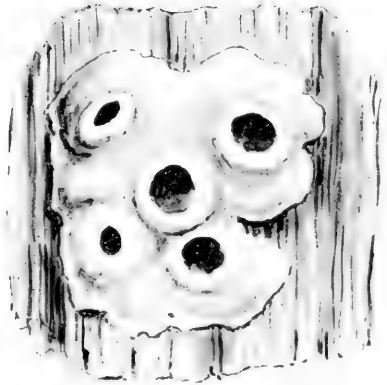
THELOTREMA LEPADINUM Ach.

a. Plant on bark. b. Portion of plant. c. Vertical section of thallus. d. Vertical section of thallus and apothecium. e. Ascus and paraphysis. f. Spore



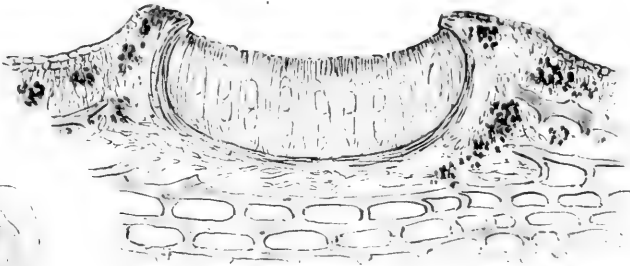


a



b

× 15



d

× 70

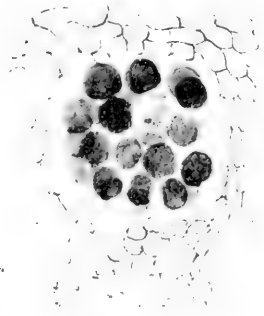


e

× 350



× 480

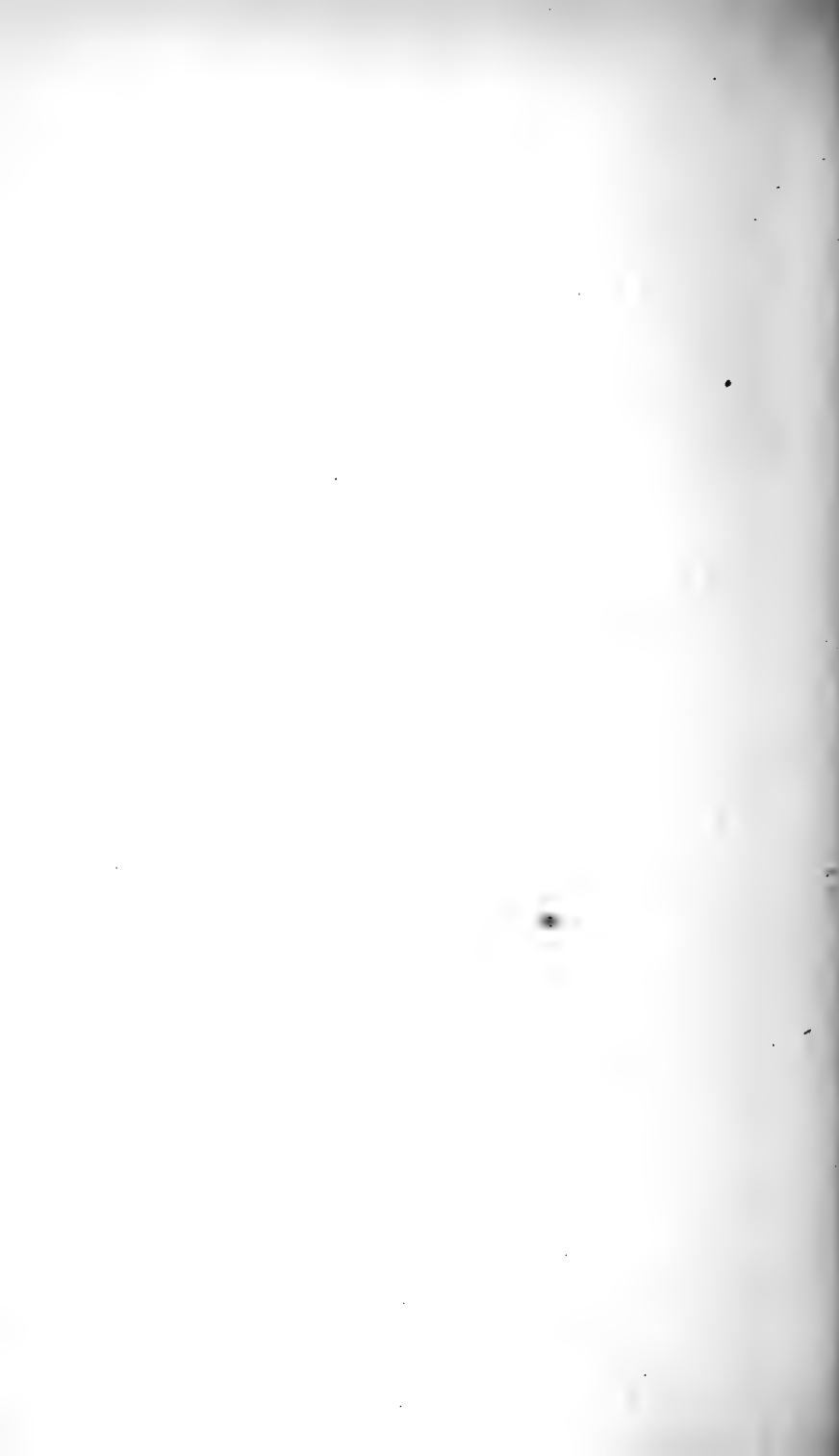


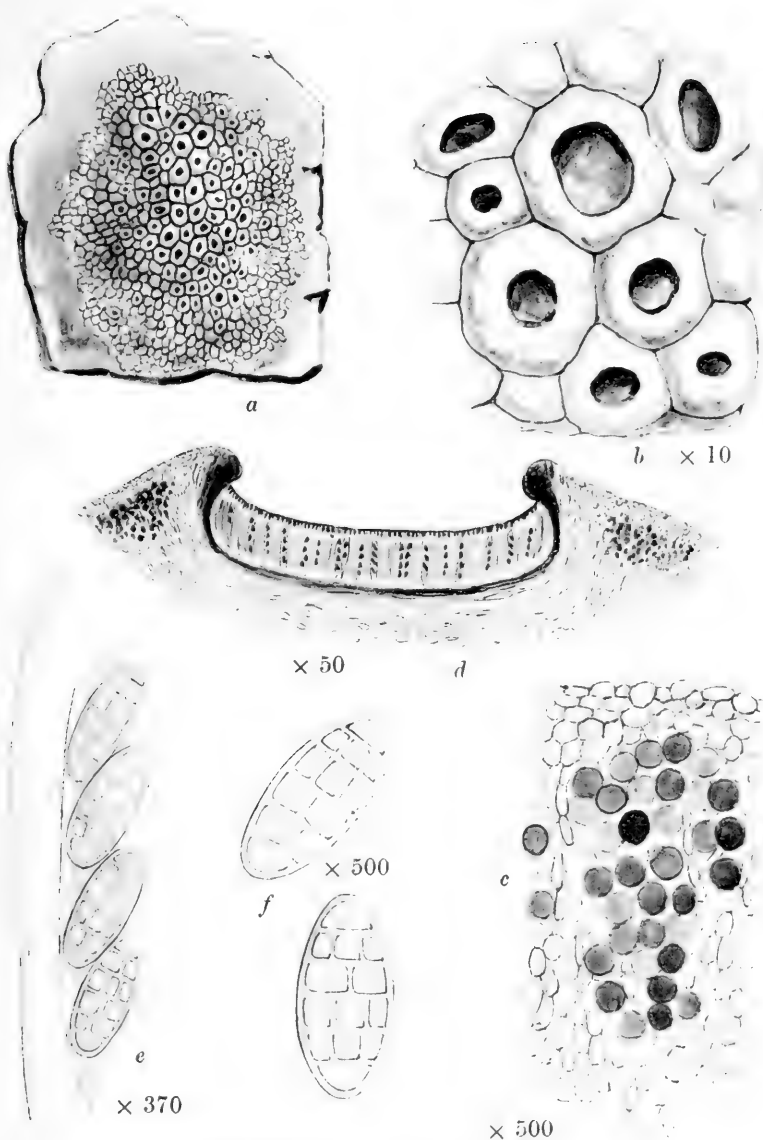
c

× 350

PHLYCTIS AGELÆA Koerb.

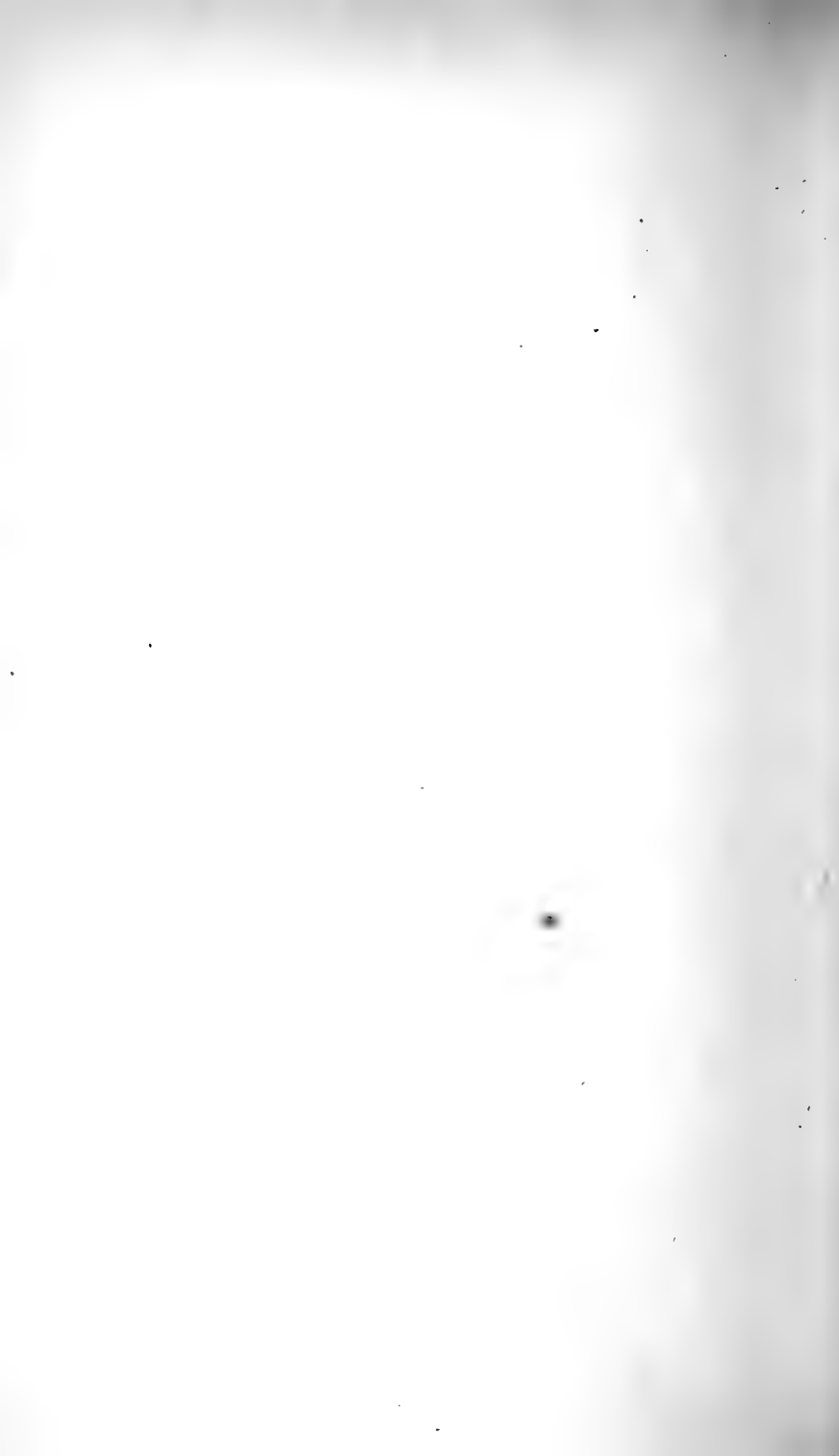
a. Plant on bark. *b.* Portion of plant. *c.* Vertical section of thallus. *d.* Vertical section of thallus and apothecium. *e.* Ascus and paraphysis. *f.* Spore.

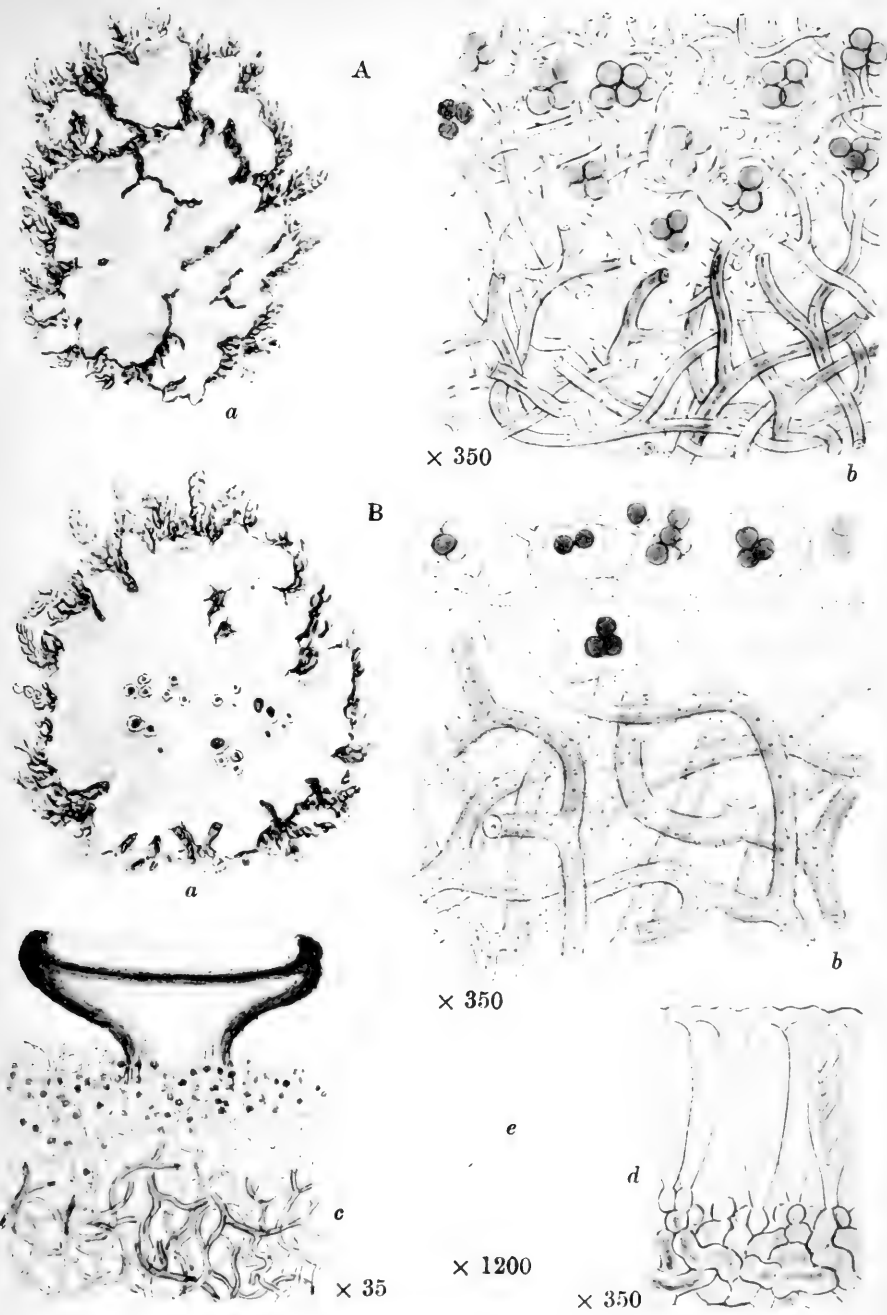




DIPLOSCHISTES SCRUPOSUS Norm.

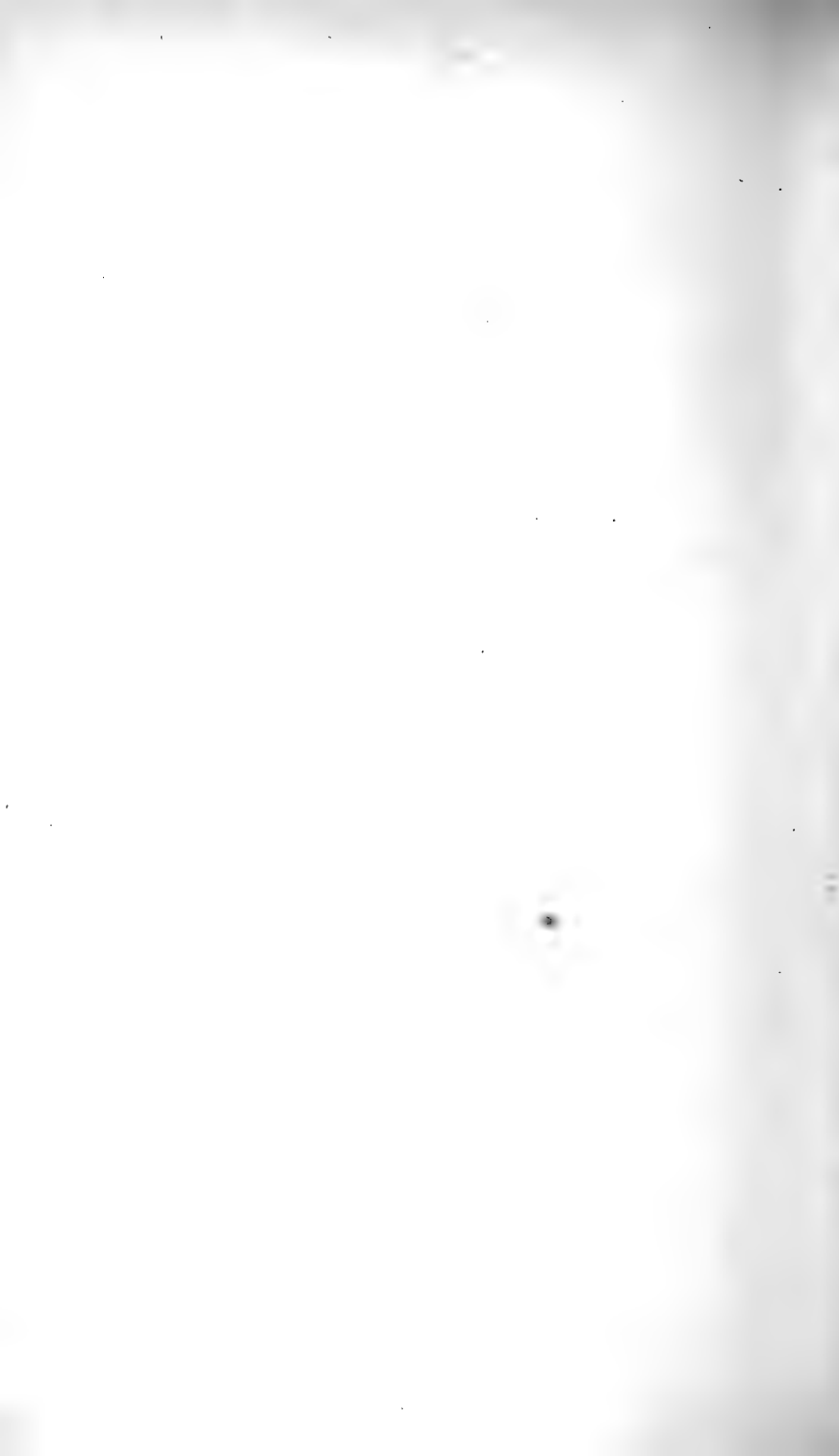
a. Plant on stone. b. Portion of plant. c. Vertical section of thallus. d. Vertical section of thallus and apothecium. e. Ascus and paraphysis. f. Spores.

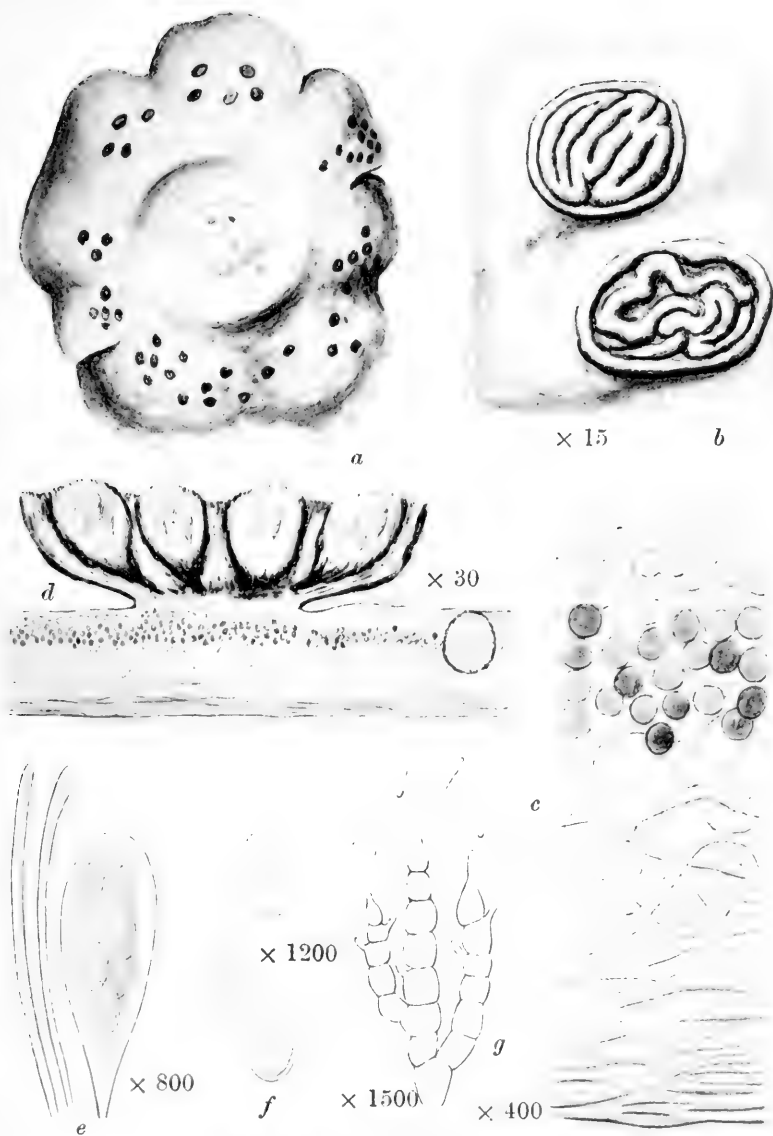




CROCYNIA Massal.

A—*C. lanuginosa* Hue. a. Plant on moss. b. Vertical section of sterile thallus.
 B—*C. gossypina* Nyl. (subtropical). a. Plant on moss. b. Vertical section of thallus.
 c. Vertical section of thallus and apothecium. d. Asci. e. Spores.

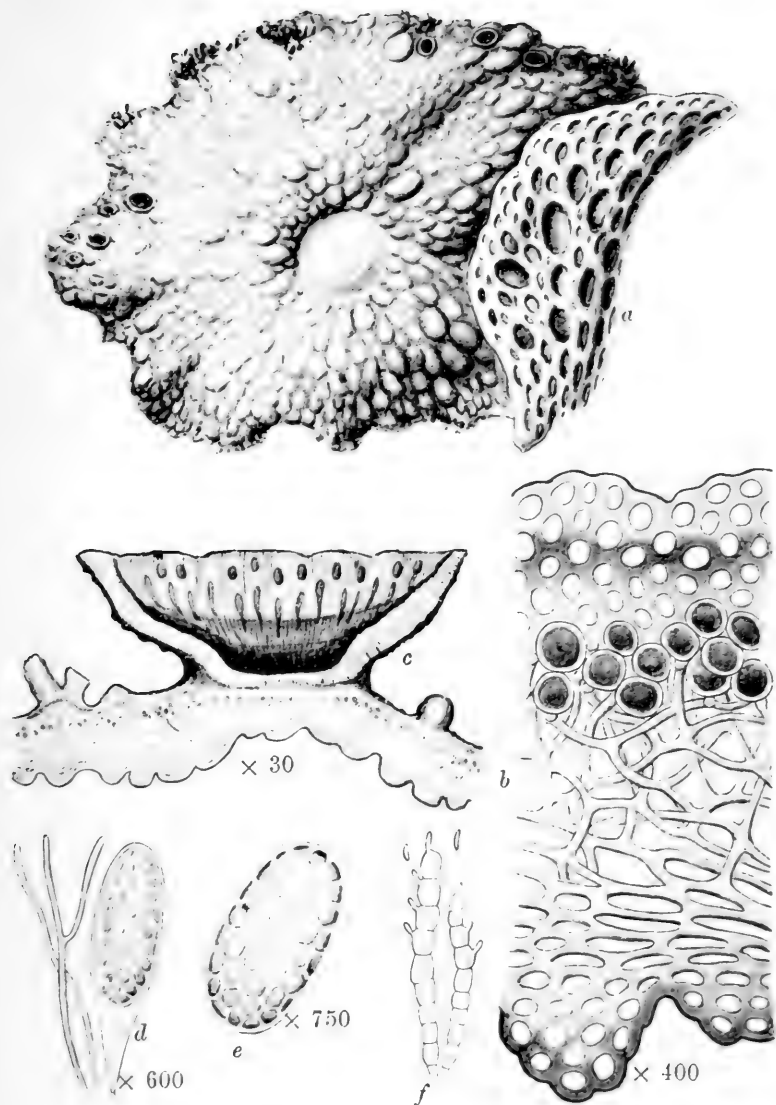




GYROPHORA PROBOSCIDEA Ach.

- a.* Plant from rock. *b.* Portion of plant and apothecia. *c.* Vertical section of thallus.
d. Vertical section of thallus, apothecium and spermatogone. *e.* Ascus and
 paraphyses. *f.* Spores. *g.* Sterigmata and spermatia.

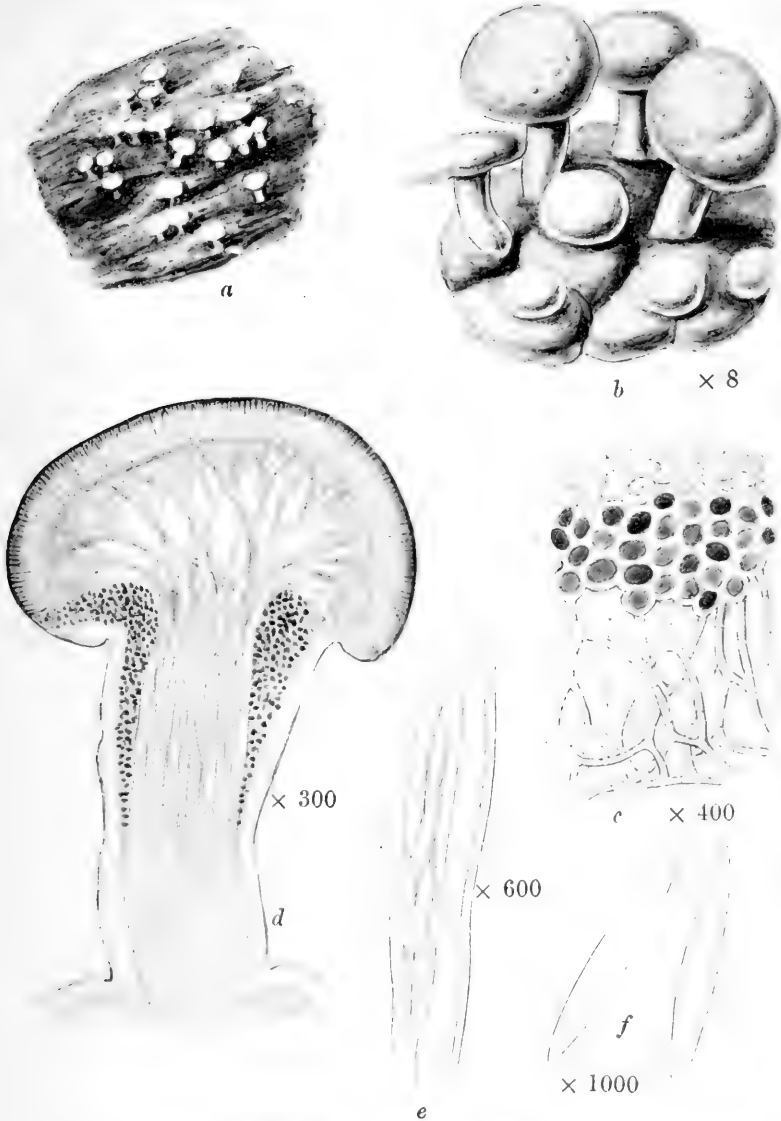




UMBILICARIA PUSTULATA Hoffm.

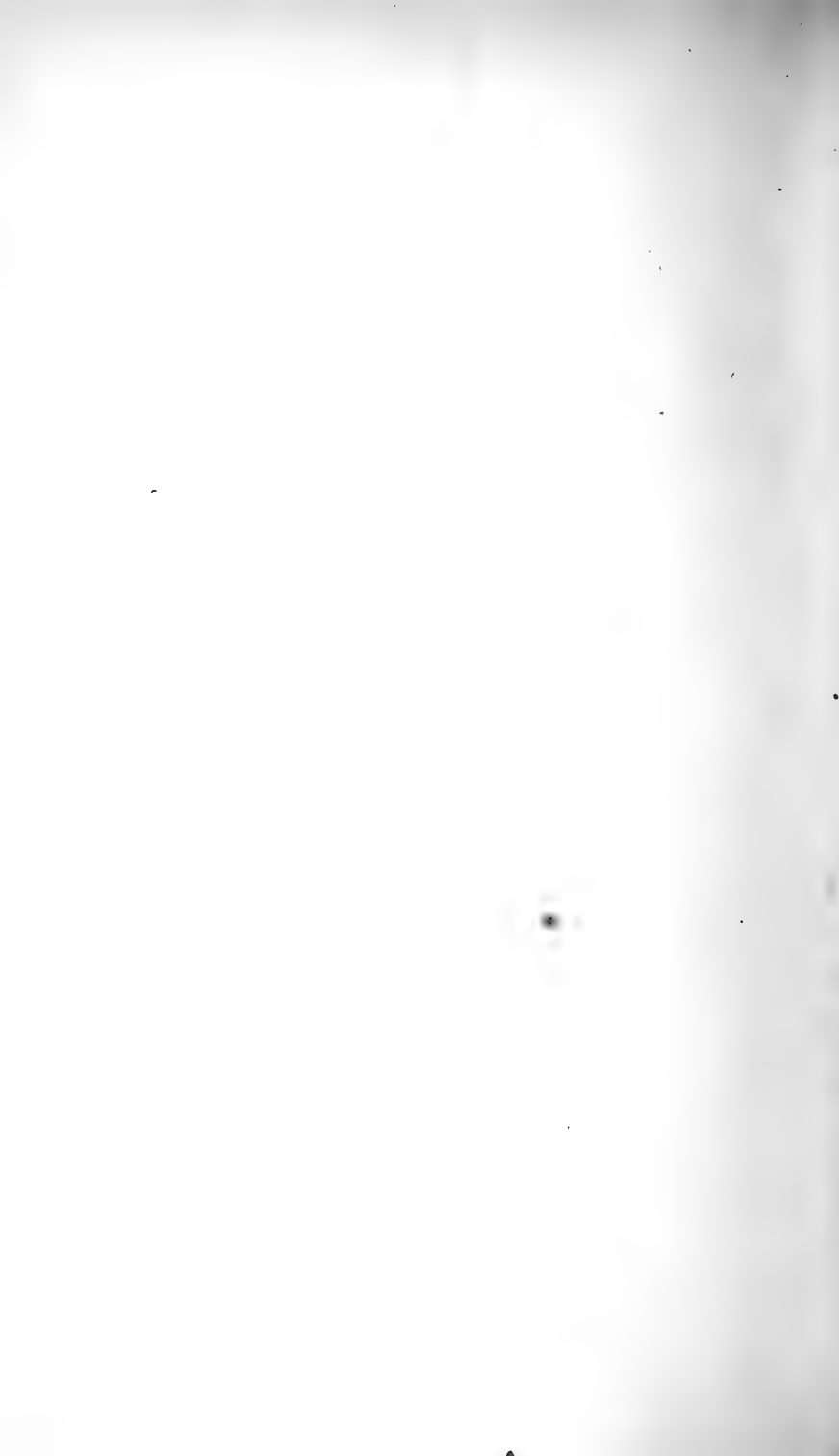
a. Plant from rock. b. Vertical section of thallus. c. Vertical section of thallus and apothecium. d. Ascus and paraphyses. e. Spore. f. Sterigmata and spermatia.

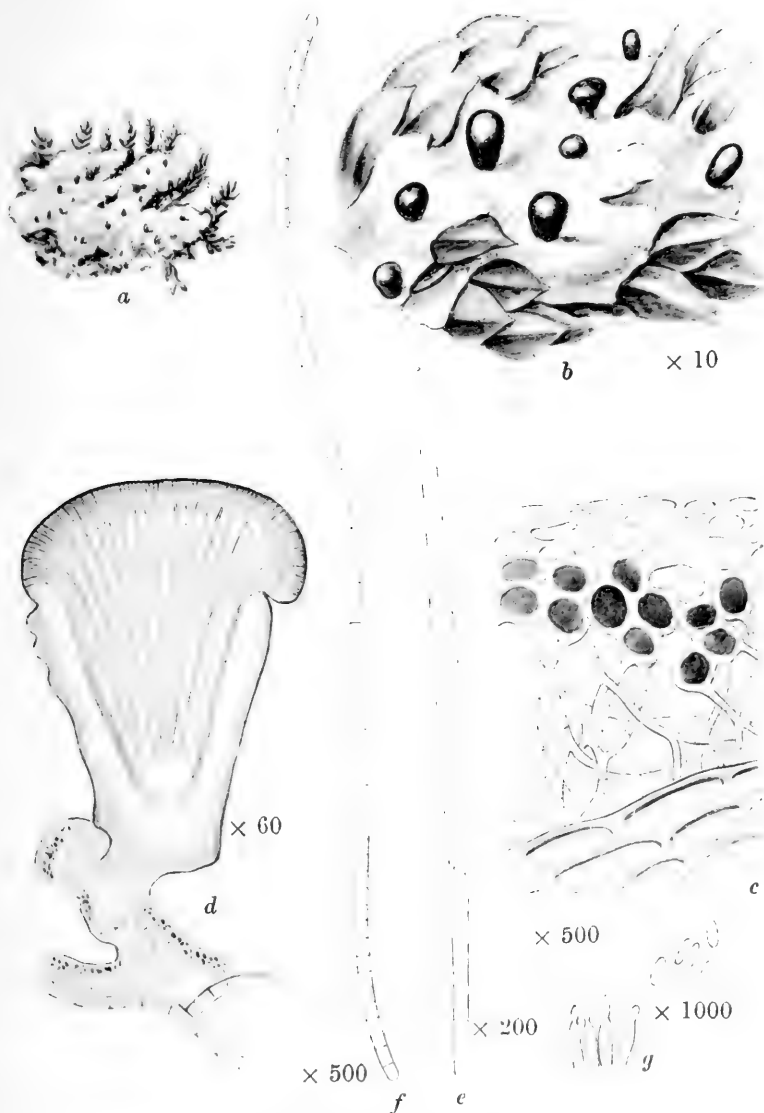




BÆOMYCES ROSEUS Pers.

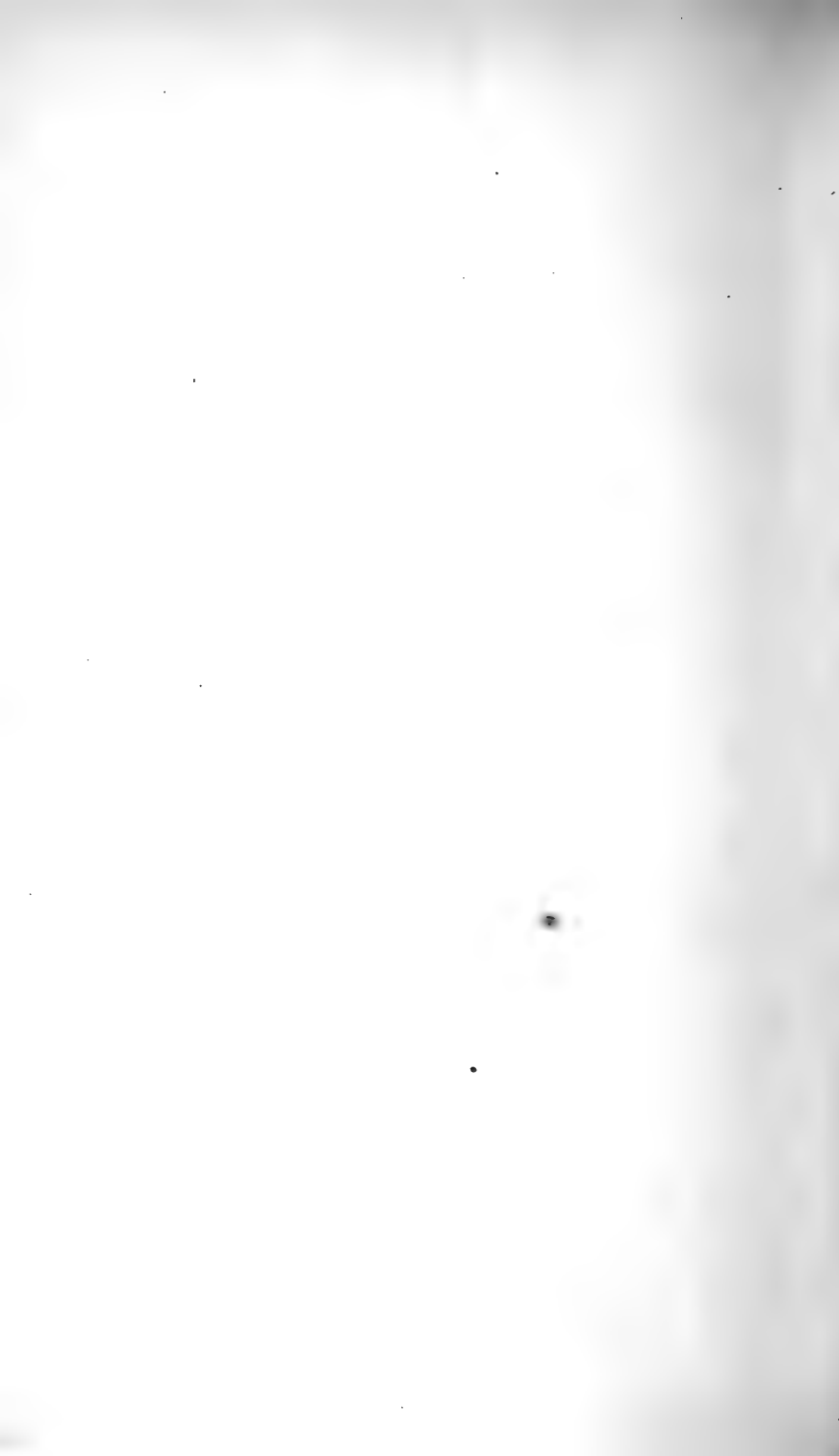
a. Plant on soil. b. Portion of plant. c. Section of thallus. d. Section of apothecium. e. Ascus and paraphysis. f. Spores.





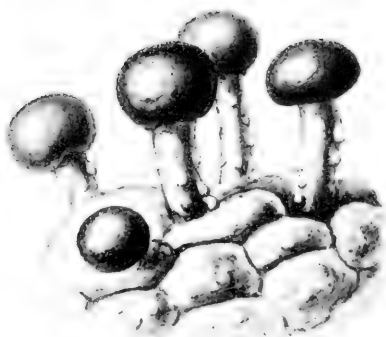
GOMPHILLUS CALYCIOIDES Nyl.

a. Plant on moss. b. Portion of plant. c. Vertical section of thallus. d. Vertical section of apothecium. e. Ascus and paraphyses. f. Spore. g. Sterigmata and spermatia.



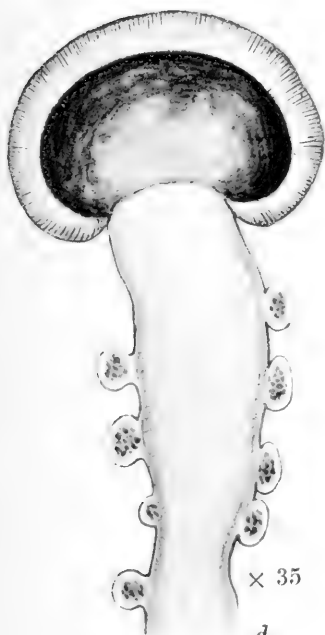


a



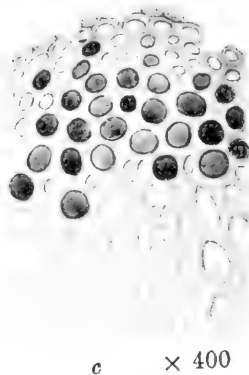
b

× 10



× 35

d



c

× 400



× 400

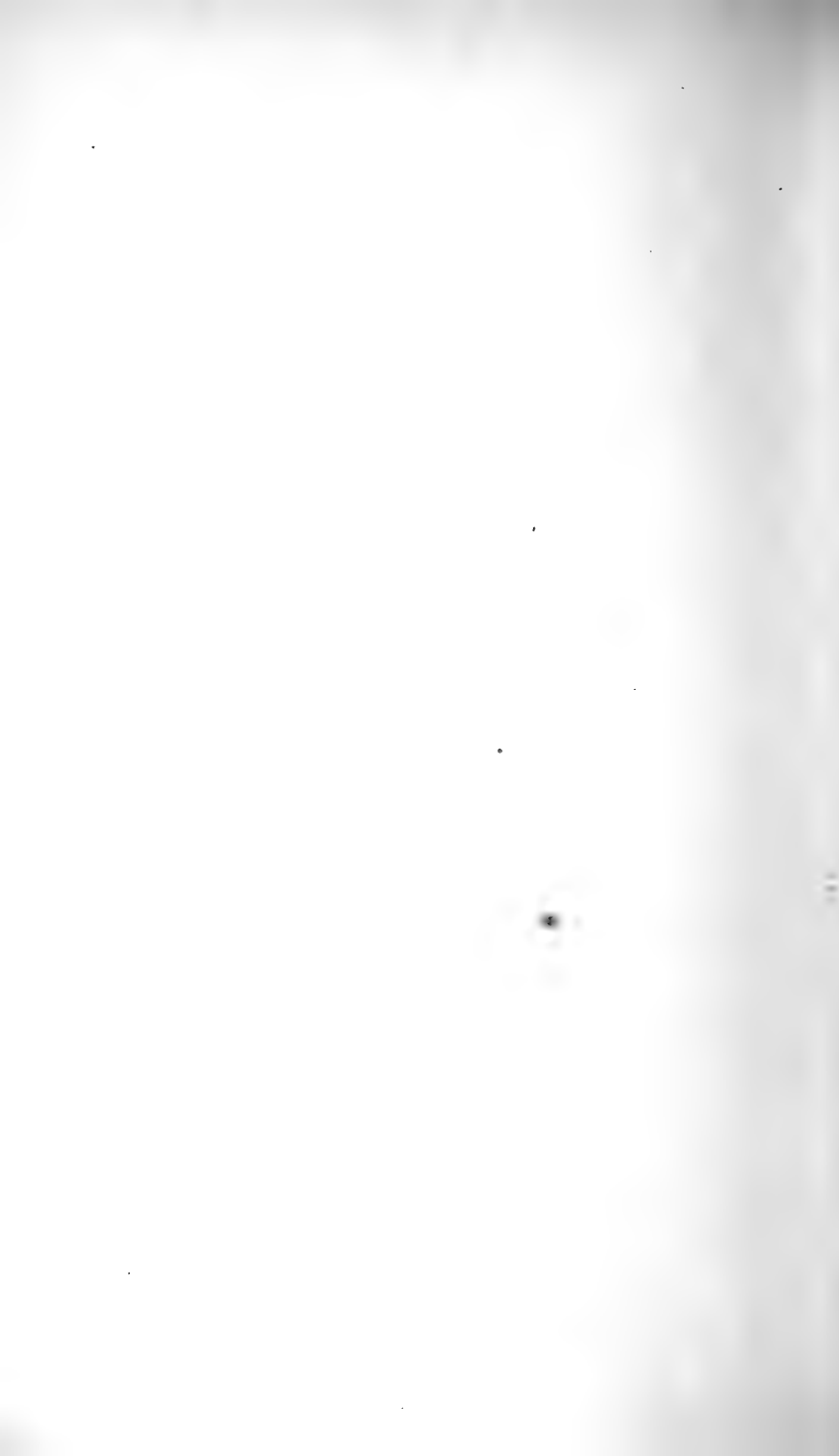
e

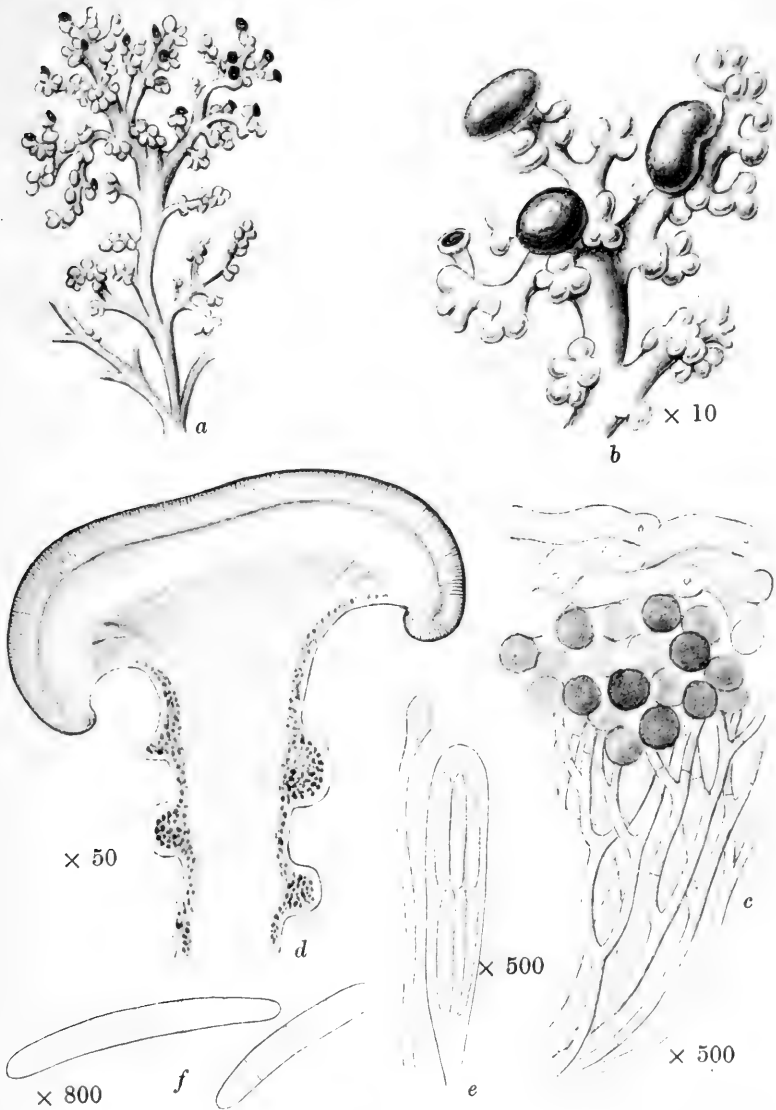
f

× 1000

PILOPHORUS CEREOLUS Stizenb.

a. Plant on rock. b. Portion of plant. c. Section of thallus. d. Vertical section of apothecium. e. Ascus and paraphysis. f. Spores.

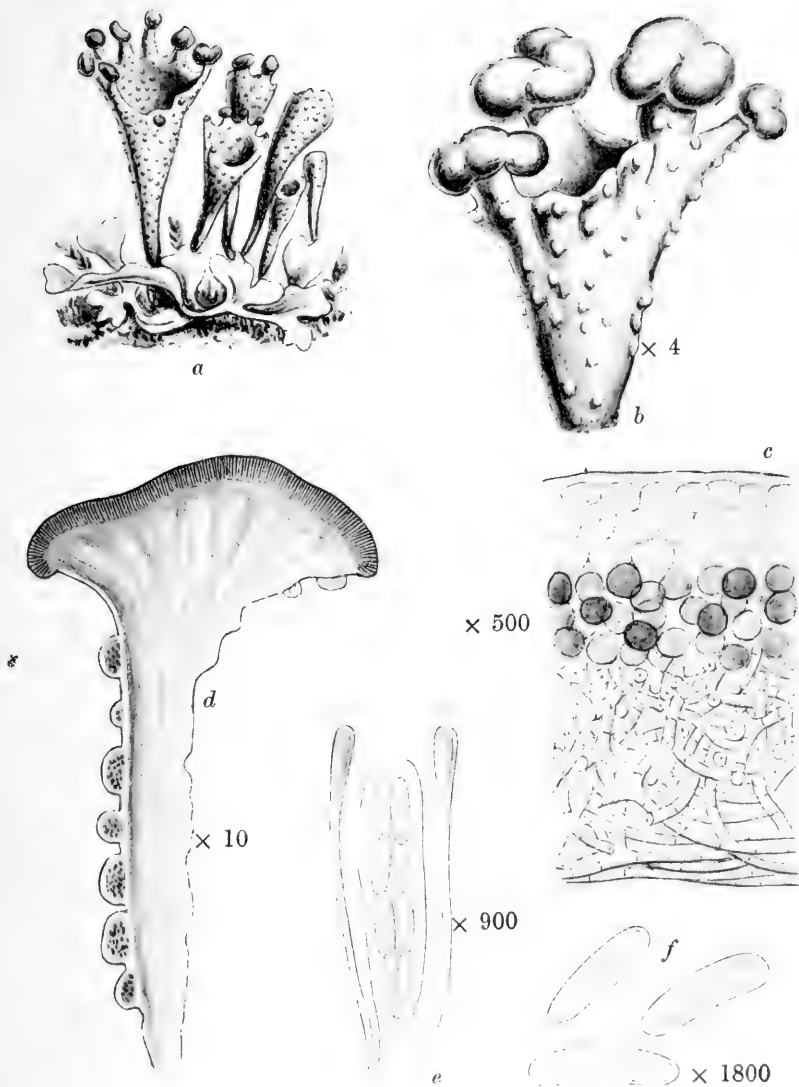




STEREOCAULON CORALLOIDES Fr.

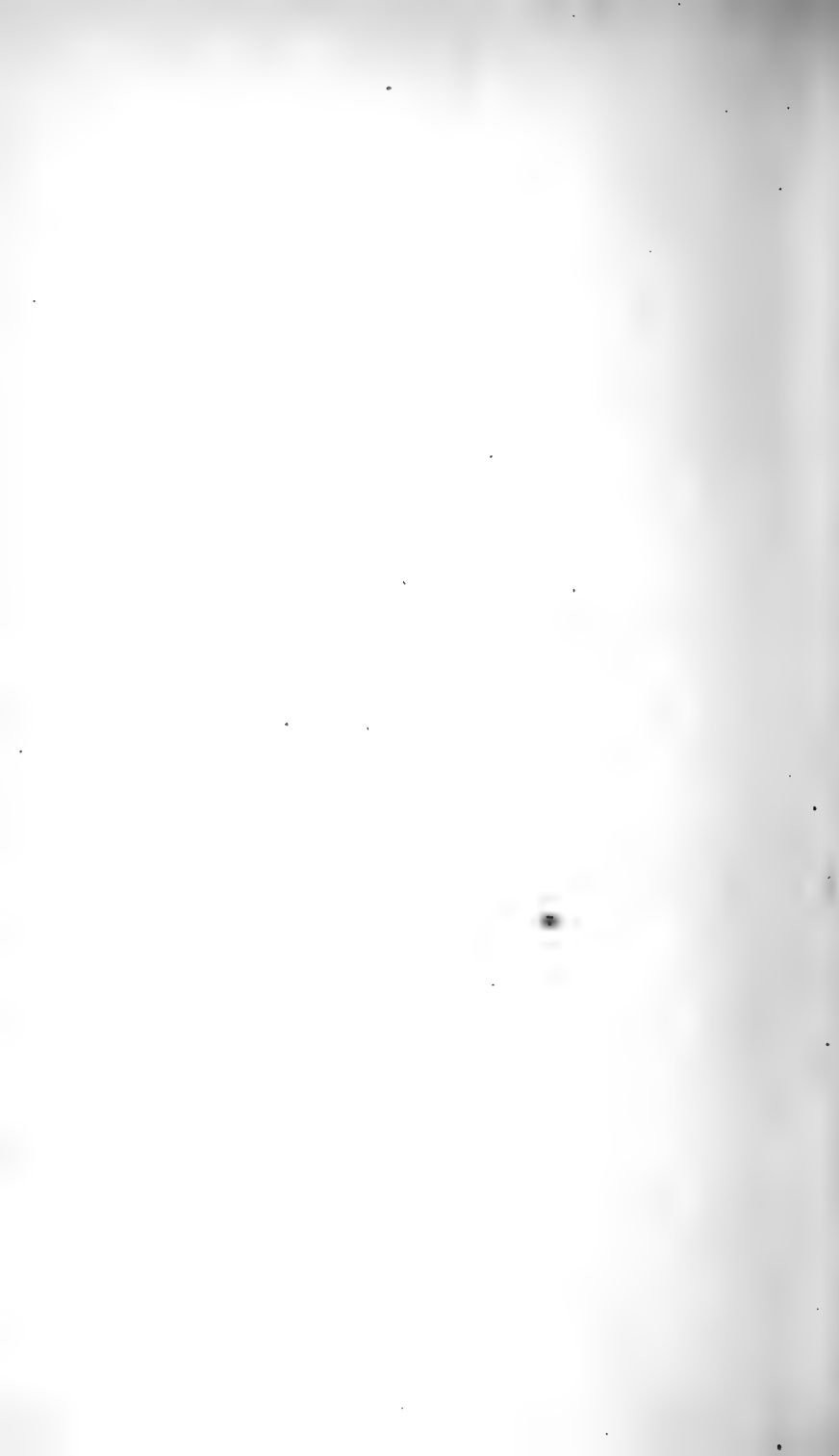
a. Frond of plant. b. Portion of plant. c. Section of outer portion of upright thallus. d. Vertical section of apothecium. e. Ascus and paraphysis. f. Spores.

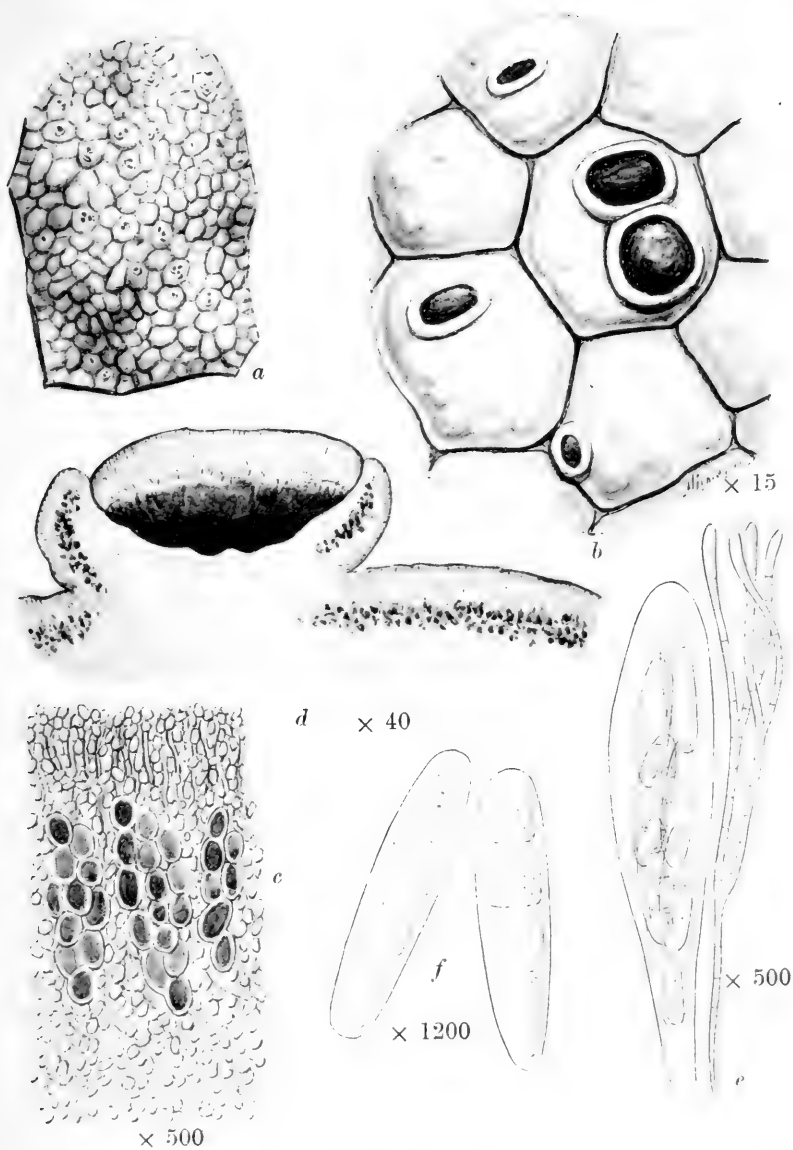




CLADONIA COCCIFERA Willd.

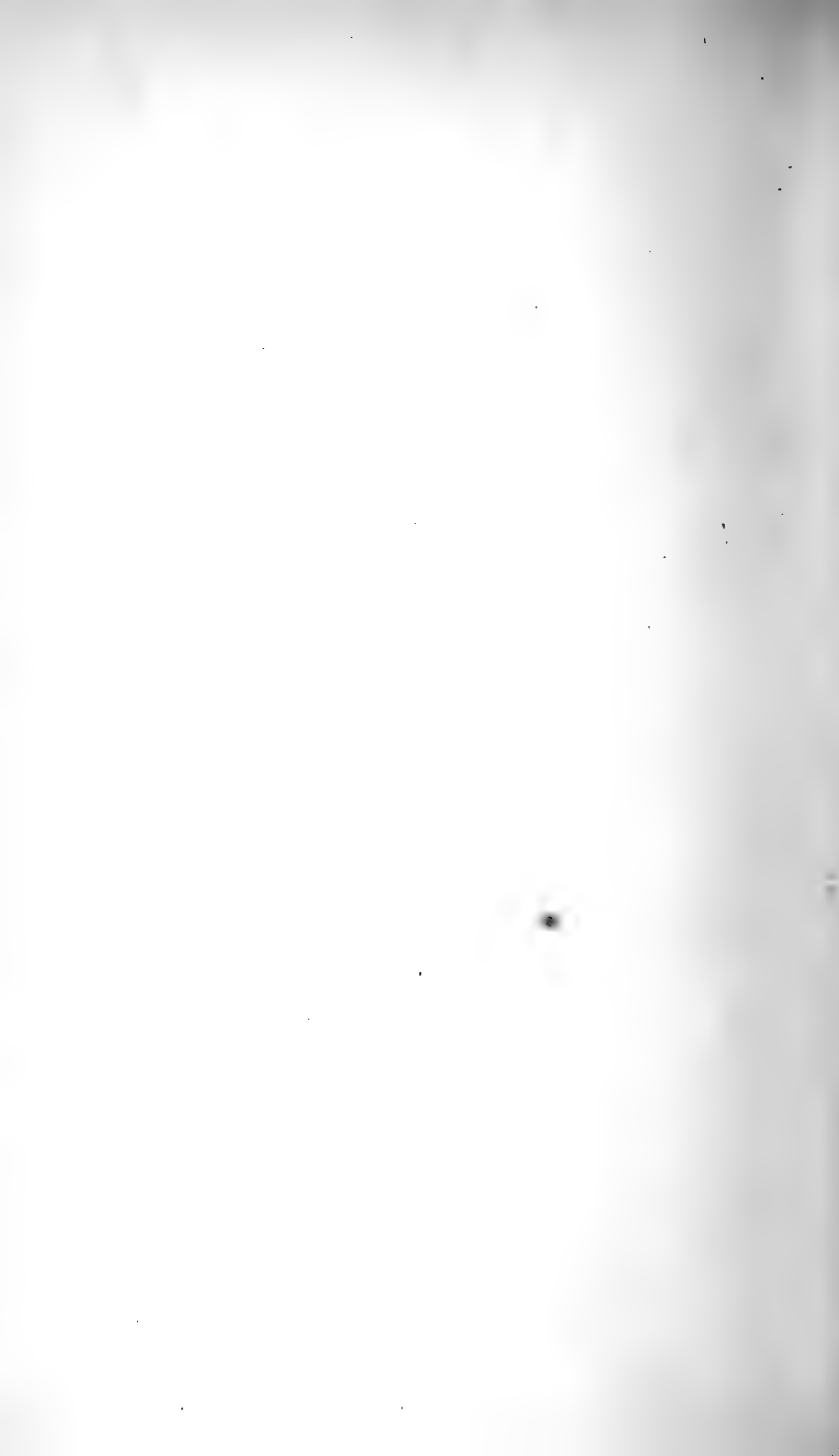
a. Plant with squamules and scyphi. b. Apex of scyphus. c. Vertical section of thallus. d. Vertical section of apothecium. e. Ascus and paraphyses. f. Spores.

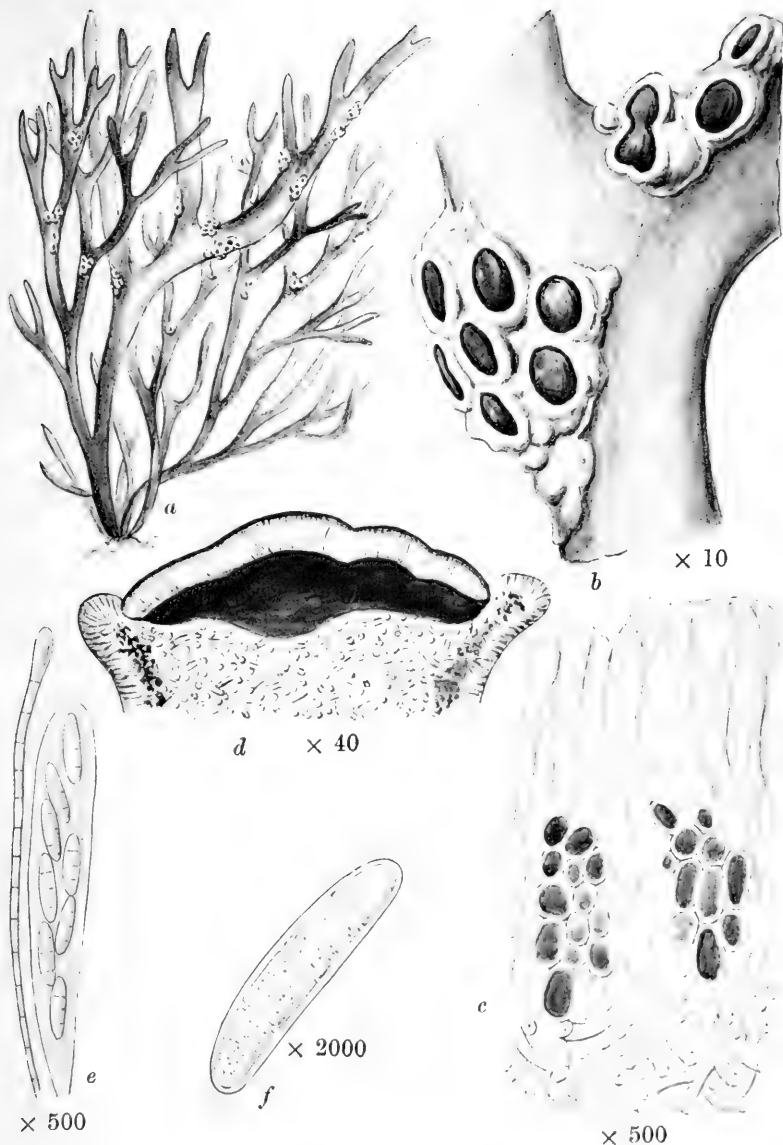




DIRINA REPANDA Nyl.

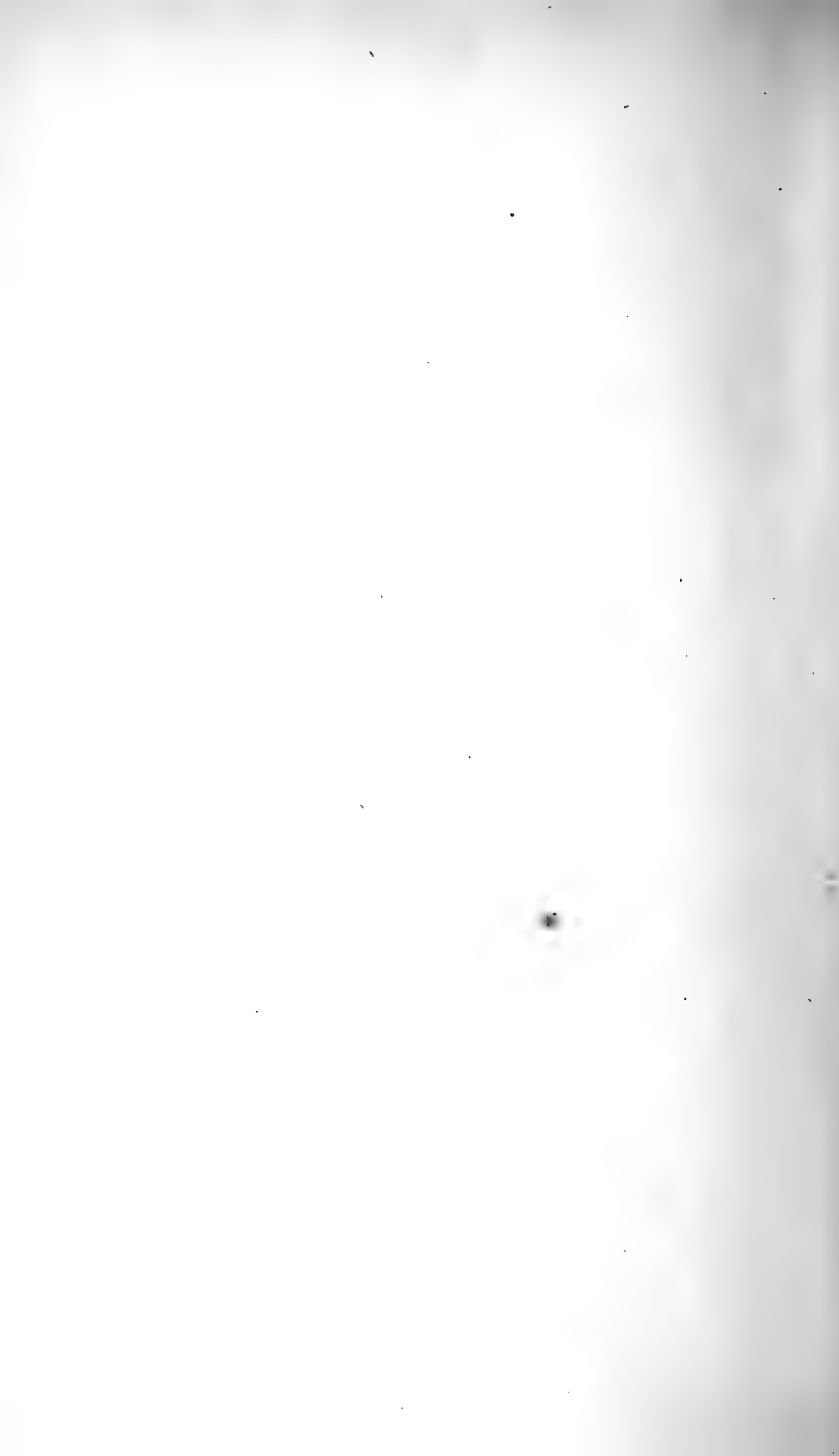
a. Plant on rock. *b.* Portion of plant. *c.* Vertical section of thallus. *d.* Vertical section of thallus and apothecium. *e.* Ascus and paraphysis. *f.* Spores.

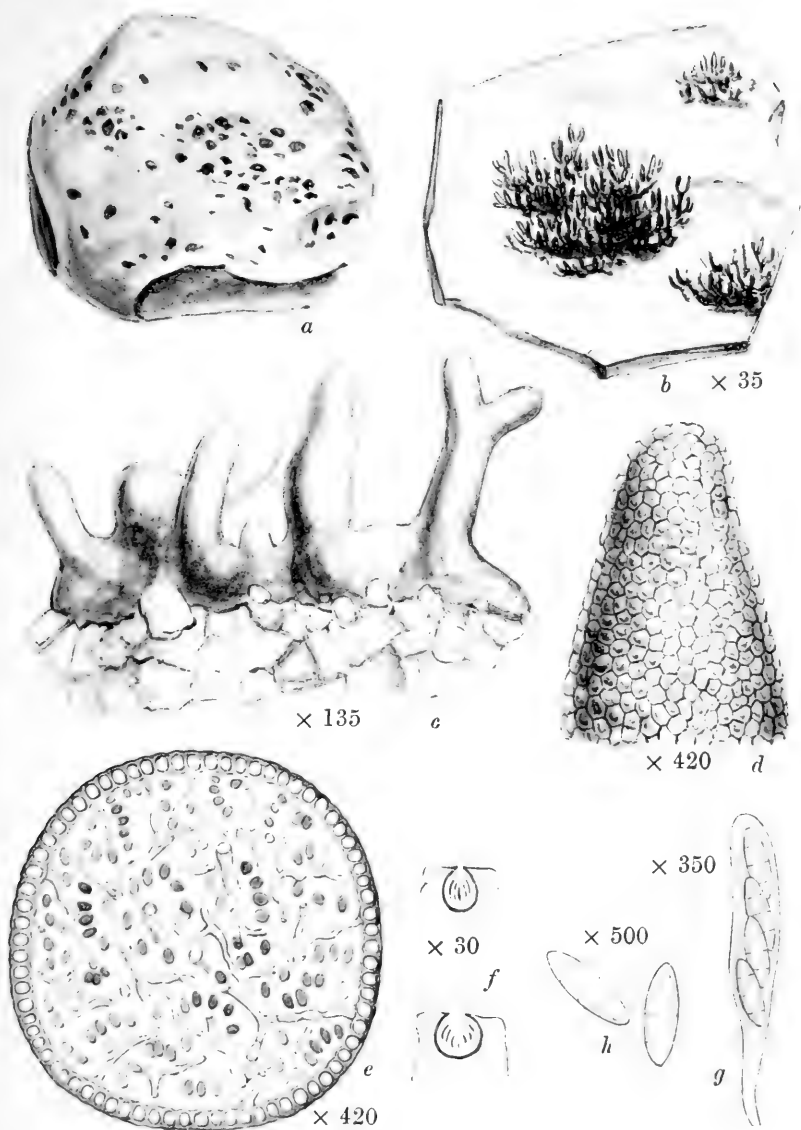




ROCELLA FUCIFORMIS DC.

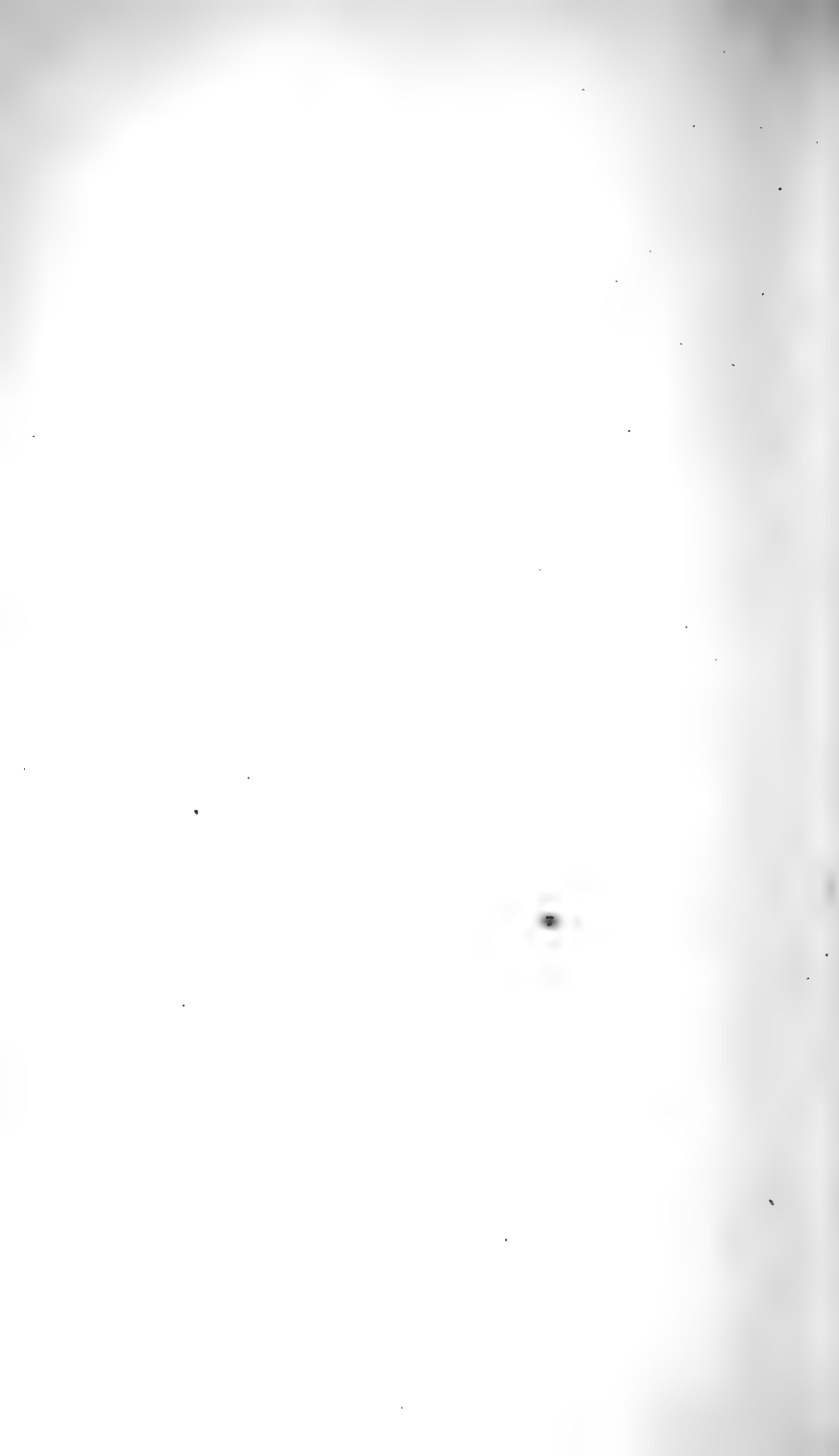
- a.* Plant from rock. *b.* Portion of plant with apothecia. *c.* Transverse section of frond. *d.* Vertical section of apothecium. *e.* Ascus and paraphysis. *f.* Spore.

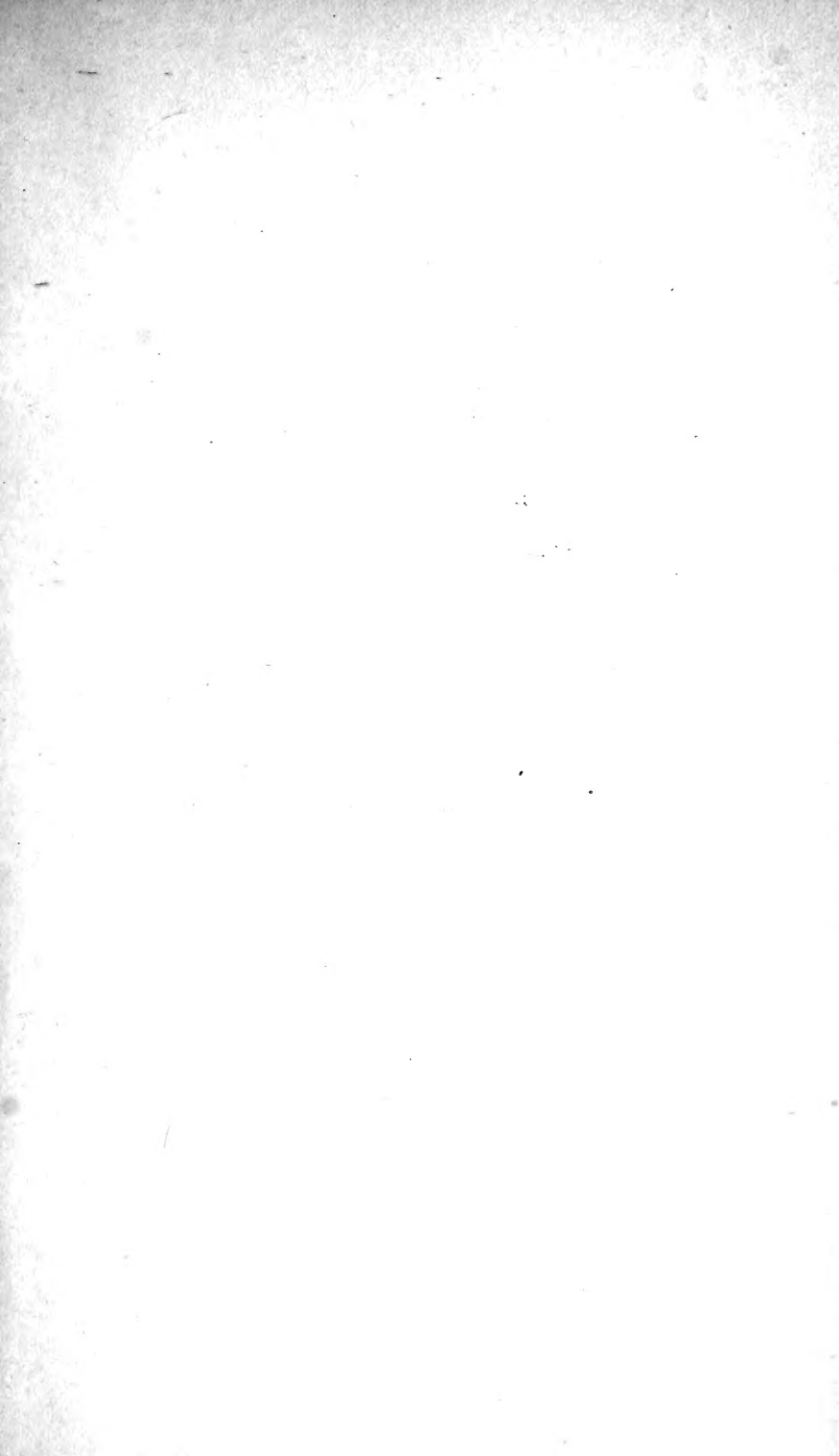


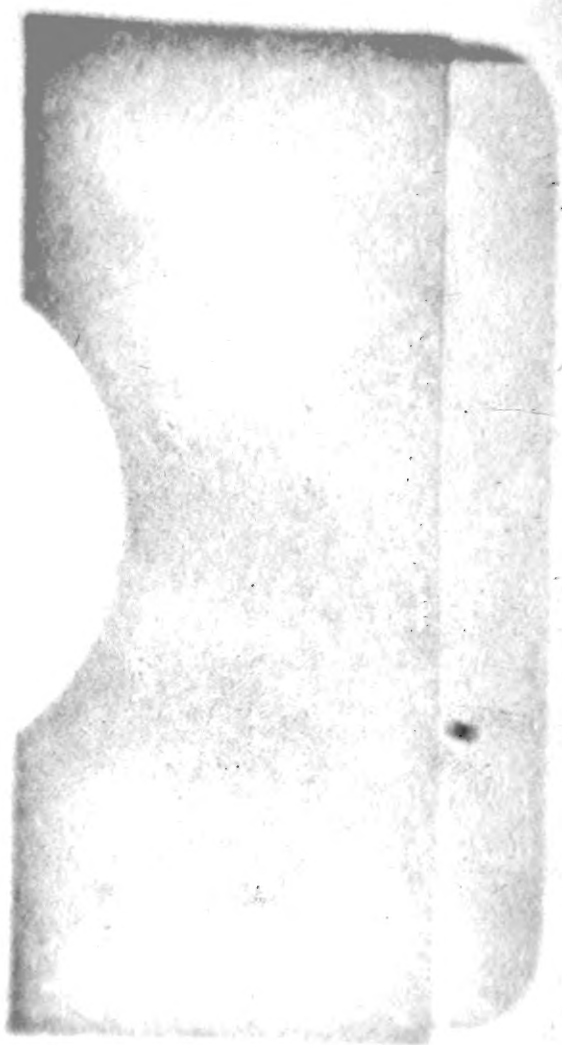


PYRENIDIUM ACTINELLUM Nyl.

- a. Plants on rock. b. Plant group. c. Portion of plant. d. Surface of frond.
 e. Transverse section of frond. f. Vertical section of perithecia.
 g. Ascus. h. Spores. (f. g. h. after Crombie.)







132.

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Title *A Monograph of the British Indians.*

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