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A

SYNOPSIS

OF THE

NORTH AMERICAN

LICHENS:

PART I.,

COMPRISING THE

PARMELIACEI, CLADONIEI, AND CŒNOGONIEI;

BY

EDWARD TUCKERMAN, M.A.,
AUTHOR OF GENERA LICHENUM.

BOSTON:
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1882.

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The arrangement of this book is that of the author's *Genera Lichenum*, 1872; and the few variations from this will, it is hoped, explain themselves. The plants described are, in great part, sufficiently well settled; and the new things appear to demand an at least provisional place: though the author would have preferred to keep the most of these last back, with Horace, *nonum in annum*. And this not merely from hesitation as to the novelty or the rank of the lichens referred to, but because he entertains strongly the opinion that the *science* of Lichens—whether as regards morphology or system—has by no means kept pace, since Fries's day, with the diagnostic enumeration of new forms called arbitrarily species; and he is sorry to have possibly added to the number of these constructions. Agreeably to the wishes of the friends who have urged an early publication, this part of the work, comprising the more conspicuous lichens, is printed first.

Amherst, Mass.,
1 Nov., 1881.

The lowest divisions of vegetable life may still be recognized as ALGÆ, LICHENES, and FUNGI; and conveniently associated together under the designation of THALLOPHYTES;—a thallus, that is to say a form or forms of vegetation in which there is no real distinction of stem and leaf being, in these plants, with whatever exception, taken for characteristical. And there is no doubt, notwithstanding the numerous and now startling discrepancies of these vast groups, that they stand in close natural relations to each other.

Lichenes are reckoned as intermediate between the other two Classes of Thallophytes; but all the limits are uncertain.

A lichen is (to speak only loosely) an aerial (*) Thallophyte, vegetating only under the influence of moisture, and thus of interrupted and slow (*) growth, but of indefinite duration (*) characterized by certain green cells (*gonidia*; *gonimia*); and the organ of vegetation of which (*thallus*) is distinct (*) from the organ of fructification (*apothecium*).

The thallus of lichens is composed, to speak generally, of 1, slender, more or less branched, loosely intertangled or closely compacted cell-threads (*filaments*; *hyphæ*; passing now into a parenchymatous modification) which constitute the bulk of the plant; being distinguishable into a central, or medullary layer, and an external, or cortical layer: and 2, of the just-named, rounded or elliptical, green, or bluish-green, cells, which form, for the most part, an irregular zone between the medullary and cortical layers, and make what is known as the gonimous layer. These green cells (*gonidia*, which take on now, in certain conditions of growth, a yellowish and even tawny coloration) owe their colour to a chlorophyll-like matter called thallochlor; as

(*) Exceptions, at least apparent, but now also real occur; the rule being however as stated.

the bluish-green ones (*gonimia*, Nyl.; glauco-gonidia, Itzigs.; collogonidia, Tuckerm.) which are more or less distinguished also by their gelatinous envelopes, are considered to agree in their colouring-matter with the phycochrom of certain groups of Algæ. The gonimous layer, in most lichens, consists of gonidia. The *Peltigerei* differ remarkably however by a two-fold gonimous system,—one series of otherwise generically related lichens of this Family offering gonidia, and the other gonimia;—but the inferior systematic value of this difference is perhaps sufficiently shewn by the fact that some of the species are scarcely otherwise distinguishable. The same discrepance recurs in the next following family—*Pannariei*. And finally, in the next—the *Collemei*, in which the development of gelatine reaches an extreme so marked that these plants have been called Jelly-lichens, we have only gonimia. The gonimous cells may make their way to the surface of the thallus, and appear there, enveloped in hyphæ, as powdery, often cushion-like heaps, which are capable of developing into new thalli, and are called *soredia*.

But we are not quite at liberty to stop here. The marked contrast of hypha and gonidium was open to a hypothetical explanation, based on the apparent relations of these organs to what seemed the same in the other Classes of Thallophytes, which suggested and had its exemplification in the memorable labour of Schwendener. This was met however by lichenologists in a manner and tone often ill enough corresponding with the simply objective position of the other side; and there was room for further investigation. Ideally, from the point of view of those who look at lichens as autonomous, the primordial cell should be referable either to hypha or gonidium; but, in fact, as well emphasized by Minks (*Microgonid.* p. 238), it is its dualism which, from the beginning of our knowledge, and through all its extent, characterizes the lichen-structure, and determines its history. Yet this is not all. The penetrating glance of the cited vegetable anatomist has demonstrated the

existence of a third element. Behind and before the manifestation of the hyphæ, which are to play so great a part in the lichen-world, is a dimly-seen, primordial tissue—a web or network of exceedingly delicate filaments (*Hyphema*, Minks) which gradually pass into the hyphæ proper (*Gono-hyphema*, Minks) as these accomplish their highest result in generating the gonimous cells (*Gonidema*, Minks *ubi supra*, p. 39).

As regards external form, lichens differ according as they ascend vertically from the substrate, or are spread out horizontally upon it. In the first case the development is, for the most part, into branched or shrub-like (*fruticulose*) types, becoming often finally pendulous; of which *Usnea barbata* offers familiar examples. But this is evidently an extreme of lichenous evolution; and we find, much more commonly, the horizontally expanded thallus, which is either *foliaceous* or *crustaceous*. Of the foliaceous thallus (exhibited in *Parmelia*) the *frondose* (of *Peltigera*, etc.) is a more entire expression; and the *squamulose* often (in *Pannaria*, etc.) a reduced one. *Cladonia* is remarkable as uniting in itself a horizontal and a vertical thallus, and has, on this account, been sometimes taken for the highest exhibition of lichenose vegetation. Foliaceous lichens are attached generally to the substrate by variously modified, and more or less conspicuous, fibrillose processes (*fibrils*; *hypothallus*). The crustaceous thallus ascends now into lobed, and even fruticulose expressions (as in the highest types of *Placodium* and *Lecanora*) not always readily reducible to their real rank; and in its squamulose types it approaches yet closer to the foliaceous; it is however, as respects the great majority of species, well characterized by its *uniform* (neither lobed nor branched) habit, and the peculiar intimacy of its relation to the substrate. In the lowest of all forms of the crustaceous thallus, we have only a web of hyphæ, with some few clusters of gonimous cells nestling *beneath* the outermost layers of cells of the bark upon which these humble plants grow.

The lichen-fruit is called *Apothecium*. Apothecia are vari-

ously shaped but for the most part rounded, organic bodies, which differ more or less in colour from the thallus over which they are besprinkled, or to which they are attached, or in which, more rarely, they continue normally immersed; and generate the *spores*. The essential parts of the apothecium are 1, the *proper exciple*, which contains all the other organs, but is itself reduced, in a very large proportion of the *Parmeliacei*, to a layer of cells (*hypothecium*) wholly concealed by the thalline receptacle characteristical in this tribe; and 2, the *hymenium*, consisting of *thekes* (thecæ; the spore bearing organs) intermingled with slender, erect filaments (*paraphyses*), which latter are sometimes undistinguishable or obsolete. The evolution of the paraphyses and thekes will be noticed when we consider the spermogones.

Spores are cells capable of germinating, and are developed in the thekes, which constitute, with the paraphyses, the hymenium. The spore-differences are numerous, and various; and their systematic value, in plants offering so many difficulties of arrangement as the Lichens, is unquestioned: but this value was at first overestimated, and too much made of certain particulars; as, on the other hand, in the reaction against the method of Massalongo, too little stress was sometimes laid on certain others. Less weight, in this view, should be given to spore-differences of a merely gradal character, or such as depend only on dimensions, or number; and more to such as seem to have claims to be regarded as typical. Analysis appears to indicate two well-defined kinds of lichen-spores, complemented (may we say?) in the highest tribe only, by a well-defined intermediate one. In one of these (typically colourless) the originally simple spore, passing through a series of modifications, always in one direction, and the spore tending constantly to elongation (as *e. g.* in the genus *Lecanora*), affords at length the needle-shaped (*acicular*) or now thread-shaped type. To this is opposed (most frequently but not exclusively in the lower tribes, and even possibly anticipated by the polar-bilocular sub-

type in *Parmeliacei*) a second (typically brown or brownish) in which the simple spore, completing another series of changes, tending rather to distention, and division in more than one direction, exhibits finally the stone-wall-like (*muriform*) type. (*) Differences such as these appear certainly to be significant; and to suggest a possible correlation with others, which shall leave no doubt that these types require marked expression in the System. Nor is such expression questioned in the best-developed, foliaceous groups. Nobody now hesitates to distinguish *Physcia* and *Pyxine* from *Parmelia*; or *Solorina* from *Peltigera*; and the argument from such foliaceous to the analogous crustaceous genera is impeded perhaps by nothing beside the thalline inferiority of the latter. But it is seen at once that the case is not the same with the successive steps in the process of differentiation of these types; and the value of such gradal (bilocular, quadrilocular, plurilocular) distinctions should be clearly inferior. Species which exhibit the ultimate condition of their spore-type, as here taken, exhibit also, ideally at least, or in a sufficiently extended view, the whole of the preceding process of evolution. This is still better observed in larger natural groups, as (*exc. excip.*) *Biatora vernalis*, Fr. *L. E.*, expressing, with general congruity of structure, the whole history of the colourless spore. And the step is not a long one from such groups to natural genera; to the assumption that gradal differences of the same type of spore, displayed by species, or clusters of species, within the circuit of what is otherwise a natural genus, shall be an insufficient ground for the breaking up of

(*) The distinction of the two principal types of spore speaks perhaps for itself; and the history of the acicular type seems tolerably clear. But the author indicated, at the place to be cited below, the difficulties in the spore-characters of *Sticta*, *Gyalecta*, and *Thelotrema*, as here understood; and, according to Minks (*Symb.* p. 41), the note of coloration was unduly stretched in including in the second or Coloured Series, the morphologically separate spores of *Arthonia*, and the *Caliciacei*.

such genus. Some consideration of the numerous, sometimes sufficiently significant instances, in which nature appears to point in this direction, may be found in the author's *Genera Lichenum*; from which work these observations on spore-values are taken. Suffice it here to say that *Parmelia* proper, Ach., will thus fall into *Theloschistes, Parmelia, and Physcia*; and *Lecanora* into *Placodium* (DC.), Naeg. & Hepp, *Lecanora*, and *Rinodina*. Excluding the sub-Biatorine forms of *Placodium* from the *Lecideei*, the latter family will have no examples of the polar-bilocular sub-type; but *Heterothecium*, corresponding to *Physcia* and *Rinodina*, will be distinguishable from *Biatora*, and *Buellia* similarly from *Lecidea*. And the whole Class may be conceived as in like manner passing into 1, a *Colourless Series*, especially prominent and characteristical in the higher tribes; and 2, a *Coloured Series*, having its chief development in the lower; series which, tabularized, will be found significant as well of the relations of the genera, as of the systematic value of the spores.

It is yet important to distinguish between spores typically colourless, and what are rather to be taken for decolorate conditions of spores typically coloured. There are sufficiently numerous instances of such decolorate spores; and we need perhaps scarcely hesitate to argue from them to some other cases in which the evidence is possibly less clear, and thus to keep certain natural genera entire. And, on the other hand, it is conceivable that a genus may rather be referable to the Colourless Series, notwithstanding that many of its species exhibit spores which, in respect at least of colour, look often the other way. Difficulties of this sort are however to be expected in every stage, from the first step, of our endeavours to study the life in nature. What responds to our intelligence there is indeed of kin to that intelligence, is the ideal; but the ideal imprisoned in, and subjected to all the inordinate fortuitousness of, the natural. (*Gen. Lich.* pp. vi–viii.)

There occur also, beside the apothecia, and very generally,

in Lichens, certain conceptacles, which, though they had not wholly escaped the attention of earlier writers, were first really discovered, and their structure exhibited by Tulasne (*Mém. sur les Lich.* pp. 129–235), who gave them the name of Spermogonia. These organs, for the most part very minute (but to this there are exceptions) are more or less rounded, and often more or less blackish, but now of the colour of the thallus; and occur immersed in, or protuberant like little warts above, its surface; and open (like the Verrucariaceous apothecium, as also like the young Parmeliaceous, with which, in some lichens they may be confounded) by a pore at the summit. The interior of the conceptacle is thickly clothed with converging filaments (*sterigmas*) which were considered as giving rise to, and as supporting little, more or less spore-like bodies found within the spermogonium, and called spermatia. The sterigmas are either elongated-cylindrical developing most commonly into branched, series of cells, or similar branched series of cells scarcely longer than broad (arthrosterigmas). The spermatia are either ellipsoid, or oblong, becoming staff-shaped (the most common form) or needle-shaped, the last often bowed. Nylander has made much systematic use of the differences in the sterigmas and spermatia, even in the limitation of genera; but the latest observations appear to confirm earlier ones that the latter organs may vary considerably in the same species; while it will be seen that the sterigmas are not always satisfactory as criteria. Beside Tulasne, Nylander has treated the spermogones and their contents in great detail (*l. c.* p. 40) and they are the object of a very extended investigation by Lindsay (Trans. Edinb. 22, pp. 101–304). Their function has always been obscure. According to Tulasne (as cited by De Bary *Morph. & Phys. d. Pilz.*, etc., p. 168, but there is scarcely anything in favour of the view in the French author's above-cited memoir) and the earlier opinion of Nylander (*l. c.* p. 40) the presumption that the spermatia are sexual organs, corresponding to the spermatozoids of higher cryptogams, as the spermogones to the autheridia of

the latter, is supported by several considerations, of which the chief is that it did not appear that the spermatia had ever been found to germinate; and, in this case, it would be the apothecium that should represent the other action. But nothing is in fact known either of the organs, the process, or the place of the supposed fecundation; and the seemingly significant designations of the new structures chosen by their eminent illustrator were perhaps only in anticipation of a possible result which he was not, as no other has been, able to reach. The resemblance already noted between the young apothecium and the spermogone, in some lichens,—so great indeed as to have led to a common confusion of the two—might however be well expected to come again into consideration, when these forms of structure were better distinguished. But Bayerhoffer (1860) was the first, as Minks indicates, to give expression to the view that their relations are most intimate; and to conceive the spermogone as distinguishable from, only as an early stage of, the apothecium. This is not the place to more than mention the latter author's development and illustration of what was perhaps little more than a happy guess. Suffice it to say that, according to him, the sterigmas, which indicate the beginnings of, and characterize the growing spermogone, have for function the development (not of the so-called spermatia, the difficulty of accounting for the enormous amount of which as compared with the filaments supposed to produce them, is noted by Nylander *l. c.*, but) of the fruit-hyphæ, which constitute, whether as sterile paraphyses or fertile thekes, the disk of the apothecium! But the cortical layer of the thallus, out of which the spermogone springs, is beset with the delicate threads of the hyphema, and it were inconceivable that these should not make their way among the growing sterigmas; abundantly as they are found to occur in the youngest apothecia. And they do so; and supply the other content of the spermogone—the so-called spermatia; which are of the nature of branches of the hyphema, and take the fitting name of *Hyphidia*. Their office is to develop the tissue out of

which they spring. (Minks *Microgonid.* p. 148, etc.) The hypha-nature of the spermatia was indeed long since indicated by Itzigsohn (*Bot. Zeit.*, 1854, cited by Minks) who described the evolution, from little heaps of gonidia overrun with spermatia, of a 'perfect thallus, the filamentous layer of which formed itself of the spermatia, as the gonimous of the gonidia.'(*)

But it is not by the fructification (apothecium) alone that the propagation of lichens is effected; nor is the soredium the only ancillary structure to the same end. We cannot indeed look here for the remarkable luxuriance in this respect pointed out by Tulasne in Fungi (developing thus Fries's dictum that the whole fungus is a fructification), but the resemblance between more than one of the organs of reproduction of the latter Class and certain lichen-structures is so close that, in the best-known of these, scarcely a doubt seems to have been entertained that the two do not differ. Minks, whose labours have already been marked in revising the very uncertain difference between the two Classes has as yet only touched the question of the morphology of the Pycnis of Tulasne as a lichen-structure; but enough appears to make it safer to follow him in distinguishing the latter from the structure of the same name in Fungi. The *Clinosporangium* (Minks; Pycnis, Tul. *pro p.*) is then a mostly very minute, Verrucariæform conceptacle, similar generally to spermogones externally, which is clothed within with short, thickish, always simple, converging filaments (*Clinidia*, Minks) generating at their summits spore-like bodies (*Clinospores*, Minks). Clinosporangia occur by no means very rarely, but are chiefly to be looked for in the lower *Graphidacei* and *Verrucariacei*; and especially such the thallus of which is hypophlœous, or innate in the matrix. The observations of our author upon the development of clinosporangia in the hypophlœous thallus

(*) This part of the book being prepared last, exhibits a later view of some points of structure than appears in the earlier portion; as especially in regard to Spermogone, and Spermatium.

(*Microgonid.* p. 135) are so important that a continuance of his investigation is to be hoped for; and the more so that the proper function of the organ is as yet unknown. (Minks *Microgonid.* pp. 133–139. *Symb. Lich.-Myc., passim.*)

The first step in man's apprehension of the ORDER in nature—that part of nature which is pre-eminently less natural than ideal, and responds to the ideal in himself—is his apprehension of *Habit.* This brings him to an indefinite conception of *Groups*—that individual animals or vegetables are associable, first, as of the same sort; and secondly that these sorts are associable as of the same kind—to some imperfect conception then of *Species*, and *Genus.* And systematic scientific study begins with the attempt to give definiteness to these vague notions, and elevate them to knowledge. In its progress higher groups are caught sight of; and species come to be arranged not only in genera, but the genera in *Families* and *Tribes.* It is the NATURAL METHOD which is unfolding itself; rich in an unlimited variety of processes, and a detail that we cannot grasp. But life is short; and all the delights of study prove unsatisfactory to some larger minds unless they reach forward to an universal view, and a *System* of nature; not at all to be got at, as Eschweiler well said, in nature. Art must supervene; and the natural become artificial, in the regulative intelligence of Man. And it being to be taken for granted that all systematists intend, whatever the determining principle of their arrangements, to exhibit fairly the whole of the structure of which their principle makes but a part, it is evident that the question what the principle be—whether, in the Class before us, 1, the thallus, or 2, the thallus and all other organs taken together, or 3, the apothecium, or highest of organs—is of less practical importance, than how the work be carried through, and serve us in use.

Of the three principles of arrangement just reckoned, the first in the order of thought,—the abstract lichen (so to say) not known as yet in the particulars that compose it—is naturally first also in the order of time,—the thallus. This first attracts

attention, and plays the principal part in the earlier arrangement of our plants: as in the three genera (Usnea, Coralloides, Lichenoides) in which they are brought together in the disposition of Dillenius; and the single genus (Lichen) under which they are arranged, in sections limited by thalline differences, by Linnæus. And the thallus has continued to commend itself to systematists even after the explication of the whole lichen-organism: as to Fée, in 1824; and as exhibited in the well-known *Systema* of Koerber. (*)

Study in any sufficient sense, begins however, in the order of time, with the next succeeding stage of inquiry, wherein the thallus is accepted only as the ground of a further development—as existing for the behoof of other essential organs, and we have before us all that constitutes the organism—the whole plant. The systematic disposition of Nylander reckons thus all organs, or, more particularly, thallus, spermogones, and apothecia, as of equal value in the system; and his arrangement proceeds eclectically, as now one and now another conspicuous character is assumed as determinative (*Syn. Lich.* 1, chap. x). But great as is the advantage which this disposition enjoys as the means of communication of the author who has described and is describing more lichens than any other, it is easily seen that it differs from other systematic works not at all, as the author would imply, in the exclusion of selection (that is, of the 'artificial and arbitrary'), but only in the use made of it. Not to dwell here on the treatment of near and remote affinity, or of affinity and analogy, in this arrangement—evidenced by the

(*) We cannot well refer, in this connection, to Dr. Th. Fries's elaborate Scandinavian Lichen-Flora (1871–1874), the principle of construction of which is the gonimous system, as but little as respects the evolution of the method has yet been published. But however greatly the significance of the gonimous cells may be advanced by more recent research, their anatomy and morphology are still but imperfectly known; and it is difficult to conceive that much can be gained from what must necessarily be arbitrary views of only a part of the phenomena.

wide separation of *Bæomyces* and *Cladonia* from *Biatora*, between all of which there are direct transitions—the difficulties of the multiplicity, and unequal, now very uncertain values of the points of view—'the salient characters of all parts of lichens' —are, for us, insuperable. The resulting complex of series and tribes belongs indeed to, and illustrates brilliantly, with the author's unequalled knowledge of particulars, the Natural Method; but the complex is, in very consequence of the extreme extent of this particularism, perplexing to the student (*), who finds himself entangled anew in the meshes of nature, from which meshes nature, with whatever devotion he seek her help, is powerless to release him. What wonder then, if escaping at length, by his own deliberate act, from the inordinate multifariousness and accidentality of the natural affinities, and unable to accept the thallus as a sufficient guide, he turn now to his only remaining choice,—the apothecium—the flower and fruit, and highest that we know of our plants: the principle of construction of Persoon, Acharius, Wahlenberg, and Fries. We are here considering only system, and it may be permitted to me to add, that much, and invaluable, and not yet to be fully estimated, as are the acquisitions of the improved methods of study of the last thirty years, the whole movement took its start from the

(*) And in view of the importance of this consideration, it is proper to be more explicit. The genus *Lecidea*, as understood by Nylander, while constituted of a now no little strained association of not less than six, (by some prominent writers broken into many more) generic types accepted by the great majority of modern lichenologists, two of these types indicating groups of vast extent, Fries's distinction of which has proved an invaluable boon to study, is yet further and to the last degree embarrassed, in the two great and difficult groups named, by crowds, ever increasing, of lichens called new, but neither sufficiently characterized, nor, for the most part, illustrated by any sufficient explanation; and has thus, in the great bulk of the genus, become, what we have no better word for than a wilderness of obscure forms, into the intricacies of which only the author can presumably possess any trustworthy clew.

results gained by the unsurpassed penetration of Elias Fries; and has never lost the impress of his genius. So great is the value of Habit in minds fully qualified to apprehend and appreciate its subtleties, that such minds may not only anticipate what the microscope is to reveal, but help us to understand its revelations.

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KEY TO THE ARRANGEMENT.

Ser. I.—GYMNOCARPI (Schrad.) Fr.

Apothecia normally open; either shield-like (*scutellæform*) or dish-like (*patellæform*) or difform, becoming elongated (*lirellæform*) or goblet-shaped and the disk compacted of naked spores (*crateriform*).

Trib. 1. PARMELIACEI. Apothecia rounded, margined by a thalline exciple (scutellæform), which includes also now, more or less distinctly, a proper exciple, when the fruit is called *zeorine*.

Fam. 1. USNEEI. Thallus sub-vertical and fruticulose, or pendulous; more rarely depressed, and dilated (foliaceous).

1. ROCCELLA. Disk of apothecium black, with a white bloom. Spores fusiform-oblong, 4-locular, colourless. Thallus fruticulose, or pendulous; somewhat leathery.

2. RAMALINA. Disk and thallus pale. Spores ellipsoid and oblong, 2-locular, colourless. Thallus fruticulose, or pendulous; compressed or subfoliaceous, cartilagineous.

3. CETRARIA. Disk coloured differently from the thallus, to the tips or margins of which the apothecia are attached. Spores sub-ellipsoid, simple, colourless. Thallus either fruticulose, or depressed and dilated (parmeliæform) more or less cartilagineous.

4. EVERNIA. Disk concave, coloured differently from the thallus; the apothecia at length often cyathiform. Spores sub-ellipsoid, simple, colourless. Thallus fru-

ticulose, or pendulous; softish; with a cottony medulla.

5. USNEA. Disk and thallus pale. Spores sub-ellipsoid, simple, colourless. Thallus fruticulose, or pendulous; mostly rounded; alike on all sides; with a double medulla, the innermost woody.

6. ALECTORIA. Disk coloured differently from the thallus. Spores ellipsoid, simple, or now muriform-multilocular, brown, or, more often, decolorate. Thallus fruticulose, or pendulous; mostly rounded; alike on all sides; cottony within.

7. SCHIZOPELTE. Disk black, dilated and lobed. Spores oblong, 4-locular, blackish-brown. Thallus fruticulose, terete.

Fam. 2. PARMELIEI. Thallus horizontal, foliaceous, differently coloured and normally fibrillose beneath, where it is without veins or cyphels. [See *Peltigerei.*] Rarely ascendant, everniæform; more rarely alectoriæform.

8. SPEERSCHNEIDERA. Apothecia scutellæform. Spores oblong, 2-4-locular, colourless. Thallus terete-compressed, dichotomously very much branched, and intertangled, forming rounded, appressed patches; fibrils obsolete.

9. THELOSCHISTES. Apothecia scutellæform; the disk yellowish-orange. Spores polar-bilocular [in an exotic species quadri-locular] colourless. Thallus foliaceous, or now ascendant and everniæform; mostly yellowish.

10. PARMELIA. Apothecia scutellæform; the disk mostly thin. Spores ellipsoid, and oblong, simple, colourless. Thallus foliaceous; or now everniæform; or even alectoriæform; rather membranaceous.

11. PHYSCIA. Apothecia scutellæform; the disk thickish.

Spores ellipsoid, bilocular, more rarely quadri-plurilocular, brown. Thallus foliaceous, or now everniæform; cartilagineous.

12. PYXINE. Apothecia from scutellæform becoming black all over, and lecideoid. Spores oblong-ellipsoid, bilocular (elsewhere also 4-locular) brown. Thallus crustaceous-foliaceous, sub-cartilagineous.

Fam. 3. UMBILICARIEI. Thallus horizontal, foliaceous, coriaceous-cartilagineous, sub-monophyllous, attached to the substrate at a single point.

13. UMBILICARIA. Apothecia sub-scutellæform, blackened, gyrose-plicate. Spores sub-ellipsoid, simple, or now muriform-multilocular, brown, or decolorate. Thallus as above.

Fam. 4. PELTIGEREI. Thallus plano-ascendant, frondose-foliaceous; beneath villous, and variegated with veins, or cyphels. [See *Sticta*.] Gonimia take very largely the place of gonidia.

14. STICTA. Apothecia scutellæform, sub-marginal, elevated. Spores from fusiform at length acicular, bi-quadri-plurilocular, fuscescent or colourless. Thallus frondose-foliaceous, coriaceous-cartilagineous, the under side variegated with little cups or rounded heaps of unknown import (*cyphels*) or spots. Gonimous layer constituted, in one group of species, of gonidia; in the other of gonimia.

15. NEPHROMA. Apothecia reniform, innate in the under side of extended lobes, the margin disappearing. Spores sub-fusiform, 4-locular; fuscescent. Thallus frondose, not veined below. Gonimous layer, in one group of species, of gonidia; in the other of gonimia.

16. PELTIGERA. Apothecia peltæform, adnate to the upper

side of extended lobes, the margin torn-crenate. Spores from fusiform at length acicular, 4-plurilocular, at length colourless. Thallus frondose, villous and veiny beneath. Gonimous layer, in several species, composed of gonidia; in the larger number, of gonimia.

17. ERIODERMA. Apothecia scutellæform, marginal. Spores ovoid-ellipsoid, simple, at length colourless. Thallus frondose, villous beneath, where it is clothed, more or less, with a pannose hypothallus. Gonimous layer constituted of gonimia.

18. SOLORINA. Apothecia orbicular, innate in the upper side of the thallus, the margin disappearing. Spores from ellipsoid fusiform-oblong, bilocular, brown. Thallus frondose, villous beneath. Gonimous layer constituted of gonidia and gonimia.

Fam. 5. PANNARIEI. Thallus horizontal, frondose-foliaceous, or, most commonly, squamulose; mostly more or less lead-coloured; imposed upon a conspicuous hypothallus (now obsolete). Gonimous layer almost universally (in our species) of gonimia.

19. ENDOCARPISCUM. Apothecia indicated only, for the most part, by an ostiole, but finally emerging and scutellæform. Spores very minute, simple, colourless, numerous in the thekes. Thallus foliaceous, peltate, the hypothallus deficient. Gonimous layer of gonimia.

20. HEPPIA. Apothecia orbicular, immarginate, more or less sunken in the minute, frondose-squamulose thallus. Hypothallus obsolete. Spores ovoid-oblong, simple, without colour. Gonimous layer of gonimia.

21. PHYSMA. Apothecia scutellæform. Spores ellipsoid, simple, colourless. Thallus foliaceous, clothed beneath with a nap-like hypothallus. Gonimous layer of gonimia, characterized much as in *Collema*.

22. PANNARIA. Apothecia either simply scutellæform, or the disk also bordered by a proper margin (*zeorine*) or the thalline margin obsolete, and the proper margin alone exhibited (*biatorine*). Spores ovoid or oblong, simple, or more rarely bi-quadrilocular, or very rarely muriform-plurilocular, fuscescent, or decolorate. Thallus monophyllous, or multifid, or, most often, squamulose, becoming crustaceous.

Fam. 6. COLLEMEI. Thallus frondose-foliaceous, more or less gelatinous when moist; becoming squamulose, or even crustaceous; lead-coloured, or blackish-green; the hypothallus almost always obsolete. Gonimia, without exception characteristical of the family, and conditioning its whole structure.

Sub-Fam. 1. LICHINEI. Thallus fruticulose or alectoriæform; the gonimia constituting an axis, which finally breaks up; or crowded together into a more regular layer, between the cortical, and the at length parenchymatous medullary. Apothecia globose, or variously irregular.

23. EPHEBE. Apothecia globose. Spores oblong-ellipsoid, simple, uncoloured. Thallus filiform, much branched, blackish-green; the never concatenate gonimia finally somewhat stratified.

24. LICHINA. Apothecia terminal, globose. Spores ellipsoid, simple, uncoloured. Thallus fruticulose, brownish-black; the concatenate gonimia distinctly stratified.

Sub-Fam. 2. EUCOLLEMEI. Thallus foliaceous or squamulose, or even crustaceous; very rarely fruticulose; the gonimia disposed most often in necklace-like chains, which are dispersed, more or less, in a gelatinous

pulp, amidst branched medullary filaments. Apothecia normally scutellæform; sometimes, in the lower groups, persistently globose.

25. PYRENOPSIS. Apothecia depressed-globose, urceolate, or now at length open. Spores ovoid-ellipsoid, simple or bilocular, decolorate. Thallus granulose. Gonimia in clusters; or now in chains.

26. OMPHALARIA. Apothecia sub-globose, immersed more or less in the thallus, or finally superficial, and explicate. Spores ellipsoid, simple, decolorate. Thallus fruticulose, or more commonly foliaceous, attached to the substrate, at only one point. Gonimia in clusters; or rarely in chains.

27. COLLEMA. Apothecia scutellæform. Spores ovoid-ellipsoid, either simple, or becoming fusiform, and bi-plurilocular, or most commonly muriform-plurilocular, scarcely coloured. Thallus foliaceous, very rarely fruticulose; mostly dark-green; cortical layer mostly indistinct; gonimia almost always concatenate; medullary filaments conspicuous.

28. LEPTOGIUM. Apothecia scutellæform, or zeorine; or biatorine. Spores ovoid-ellipsoid, either simple, or becoming fusiform and bi-plurilocular, or, most often, muriform-plurilocular, scarcely coloured. Thallus foliaceous, or rarely fruticulose, mostly lead-coloured; cortical layer distinctly parenchymatous; gonimia and medullary filaments as in *Collema*.

29. HYDROTHYRIA. Apothecia biatorine. Spores fusiform, quadrilocular, uncoloured. Thallus foliaceous, lead-coloured; cortical layer distinct, as in *Leptogium*; gonimia disposed, in very short chains, between the compact medullary layer, and the cortical.

Fam. 7. LECANOREI. Thallus crustaceous; now lobulate, or even branched; but, for the most part, uniform; adnate to the substrate; hypothallus inconspicuous.

Sub-Fam. 1. EULECANOREI. Apothecia scutellæform.

30. PLACODIUM. Apothecia now zeorine; or biatorine. Spores either (most rarely) simple, or of the usual bilocular type, or, commonly and typically polar-bilocular, colourless. Thallus now lobulate, or very rarely fruticulose; mostly uniform, and oftener yellowish.

31. LECANORA. Apothecia now zeorine. Spores ellipsoid and oblong, simple, or rarely bi-quadrilocular, or now long-fusiform and plurilocular, colourless. Thallus now lobulate, or rarely fruticulose; mostly uniform.

32. RINODINA. Apothecia now zeorine; or biatorine. Spores ellipsoid, bilocular, rarely 4-plurilocular, brown. Thallus now lobulate; mostly uniform.

Sub-Fam. 2. PERTUSARIEI. Apothecia (reverting indeed to the scutellæform type, but) typically compound, and difform.

33. PERTUSARIA. Apothecia globular-difform, opening by pores, and including (1-00) nucleiform hymenia; or now explanate, and lecanorine. Spores mostly very large, ellipsoid, simple, or bilocular, colourless.

Sub-Fam. 3. URCEOLARIEI. Apothecia more or less urceolate.

34. CONOTREMA. Apothecia urceolate, truncate-conoidal; a black proper exciple, veiled, more or less, by an evanescent thalline one. Spores cylindraceous, very long, plurilocular, colourless. Thallus uniform.

35. GYALECTA. Apothecia urceolate-biatorine, with a

somewhat crenulate margin; a coloured (rarely black) connivent proper exciple, which is now explanate, received in, or veiled by an often evanescent, thalline one. Spores ellipsoid, fusiform, or acicular, bi-quadri-plurilocular, or the cells rarely also irregularly, or even murally divided; uncoloured. Thallus uniform.

36. URCEOLARIA. Apothecia urceolate-scutellæform; a black, connivent, proper exciple becoming oftener explanate, and bordering the black disk with its more or less whitened margin, which is finally discrete from the lecanorine, thalline one (now obsolete). Spores ovoid-ellipsoid, muriform-plurilocular, brown. Thallus uniform.

37. THELOTREMA. Apothecia urceolate, now verrucæform, or endocarpeine, but at length largely scutellate, the disk veiled by an inner exciple (often obsolete); proper exciple variously coloured, somewhat torn-margined, concrete with the thalline. Spores ellipsoid and oblong, bi-plurilocular, or finally muriform-multilocular, brown, or decolorate. Thallus crustaceous, uniform.

38. GYROSTOMUM. Apothecia from urceolate finally explanate, orbicular or often elongated-difform; a black proper exciple, with entire margin, clothed at first by an evanescent thalline one. Spores ellipsoid, muriform-plurilocular, brown. Thallus uniform.

* MYRIANGIUM. Apothecia lecanoroid, multilocular, each loculament developing a single theke, unaccompanied by paraphyses. Spores oblong-ovoid submuriform-multilocular, colourless. Thallus rounded, more or less plaited or lobulate at the circumference, blackish-brown; without gonidia.

Trib. 2. LECIDEACEI. Apothecia rounded, margined (normally) only by the proper exciple (patellæform).

Fam. 1. CLADONIEI. Thallus two-fold, a vertical one (*podetium*) ascending from a horizontal, squamulose, or granulose one; the latter now obsolete.

39. Stereocaulon. Apothecia patellæform, brown, at length convex and the margin excluded (*cephaloid*) solid. Spores fusiform or acicular, 4-plurilocular, colourless. Thallus fruticulose, erect, solid (podetia), clothed more or less with granules, passing now into fibrils; horizontal thallus granulose, or obsolete.

40. Pilophorus. Apothecia cephaloid, solid, black. Spores ellipsoid, simple, colourless. Podetia simple, or but little branched, originally solid, granulate; horizontal thallus granulose.

41. Cladonia. Apothecia mostly cephaloid, variously coloured (not black). Spores ovoid-oblong, simple, colourless. Podetia fistulous, either simple, and cup-shaped or funnel-shaped, or at length very much branched; rarely club-shaped; the horizontal thallus squamulose, or rarely granulose, or obsolete.

Fam. 2. CŒNOGONIEI. Thallus horizontal, conferva-like.

42. Cœnogonium. Apothecia patellæform. Spores fusiform-ellipsoid, simple or bilocular, colourless. Thallus composed of jointed filaments densely intertangled, making a more or less determinate web.

Fam. 3. LECIDEEI. Thallus crustaceous; now lobulate, or even, very rarely, caulescent; but, for the most part, uniform; adnate to the substrate.

Sub-Fam. 1. Bæomycei. Apothecia prolonged downwards into a stipe (*stipitate*).

43. Bæomyces. Apothecia patellæform, or cephaloid; the stipe now reduced, or disappearing. Spores ellipsoid, or sub-fusiform, simple, or now bi-quadrilocular, colourless. Thallus horizontal; lobulate, or uniform.

Sub-Fam. 2. BIATOREI. Apothecia sessile; the exciple paler than the disk.

44. BIATORA. Apothecia patellæform, or oftener cephaloid. Spores either ellipsoid and simple, or oblong and bi-quadrilocular, or fusiform passing into acicular and finally plurilocular, colourless. Thallus now lobulate; mostly uniform.

45. HETEROTHECIUM. Apothecia patellæform; the exciple often thickened and lecanoroid. Spores for the most part large, from ellipsoid becoming oblong, and either simple, or bi-plurilocular, or muriform-multilocular; brown, or decolorate. Thallus uniform.

Sub-Fam. 3. EULECIDEEI. Apothecia sessile; exciple coal-black.

46. LECIDEA. Apothecia patellæform, now cephaloid. Spores from ellipsoid becoming fusiform, and finally acicular; either simple, or more rarely bi-quadri-plurilocular, colourless. Thallus now lobulate, or very rarely caulescent; but, for the most part, uniform.

47. BUELLIA. Apothecia patellæform. Spores ellipsoid and oblong; from simple becoming bi-quadrilocular, or finally muriform-multilocular; brown, or decolorate. Thallus now lobulate; mostly uniform.

Trib. 3. GRAPHIDACEI. Apothecia difform, oftener elongated (lirellæform), margined (normally) only by the proper exciple; now itself indistinct.

Fam. 1. LECANACTIDEI. Apothecia rounded more or less, or also, less commonly, elongated; margined.

48. LECANACTIS. Apothecia rounded, or more rarely oblong, black. Spores from dactyloid becoming at length fusiform-oblong, quadri-plurilocular, colourless. Thallus uniform.

49. PLATYGRAPHA. Apothecia rounded, or oblong; the proper exciple more or less obscure, bordered by an accessory thalline or thalloid one. Spores fusiform, quadri-plurilocular, colourless. Thallus uniform.

50. MELASPILEA. Apothecia rounded, or oblong, black. Spores ovoid-ellipsoid, bilocular, brown, or decolorate. Thallus uniform, or obsolete.

Fam. 2. OPEGRAPHEI. Apothecia normally lirellæform.

51. OPEGRAPHA. Apothecia lirellæform (very rarely rounded-difform), oftener simple, for the most part superficial, the exciple almost always black throughout. Spores smallish, from ellipsoid becoming finger-shaped (*dactyloid*) or oftener fusiform, bi-quadri-plurilocular, brown, or, much oftener, decolorate. Thallus uniform, or almost obsolete.

52. XYLOGRAPHA. Apothecia now angulate-patellæform, but oftener lirellæform; the exciple softish, and originally pale, but at length black. Spores ellipsoid, simple [or, at length, in a foreign species, somewhat muriform-plurilocular] decolorate.

53. GRAPHIS. Apothecia lirellæform, oftener branched, or very rarely rounded-difform, for the most part innate; the exciple either coloured, or black, but more often colourless below, and bordered almost always by an accessory thalline or thalloid one. Spores ellipsoid, or oblong, quadri-plurilocular, or finally muriform-multilocular, brown, or decolorate. Thallus uniform, or now almost obsolete.

Fam. 3. GLYPHIDEI. Many apothecia collected in a common, cushion-like thalloid receptacle (*stroma*).

54. CHIODECTON. Apothecia rounded-difform, or oblong, plano-convex, immarginate, immersed in a white

stroma. Spores fusiform, or now oblong-ovoid, quadri-plurilocular, very rarely muriform-multilocular, almost always uncoloured. Thallus uniform.

55. GLYPHIS. Apothecia rounded, or oblong, concave, black, associated together in a white stroma. Spores ellipsoid, and oblong, quadri-plurilocular, brown, or decolorate. Thallus uniform.

Fam. 4. ARTHONIEI. Apothecia difform, without proper margin, commonly confluent, and now evidently compound.

56. ARTHONIA. Apothecia rounded, or oblong; now bordered by an accessory thalloid margin; clustered commonly, or finally confluent in a difform, rounded or stellate pseudo-stroma. Spores (commonly in pyriform thekes) oblong-ovoid, or oblong, or rarely fusiform, 2-4-plurilocular, or, at length muriform-multilocular; brown, or decolorate. Thallus uniform or almost obsolete.

57. MYCOPORUM. Apothecia rounded or oblong, black, finally compound; a difform pseudo-stroma including (1-6) hymenia. Spores (in sub-pyriform thekes) oblong-ovoid or oblong [bi-quadrilocular, or finally] muriform-multilocular; brown, or decolorate. Thallus uniform, or almost obsolete.

* AGYRIUM. Apothecia rounded or oblong, softish (reddish) immarginate. Spores ellipsoid, simple, uncoloured, or reddish. Thallus scarcely or not visible, represented mainly by a few gonidia, nestling amidst the fibres of the woody substrate.

Trib. 4. CALICIACEI. Apothecia turbinate-lentiform (crateriform) or globose; a proper exciple, which is either naked, and oftener stipitate, or bordered by an accessory

thalline one, margining or supporting a hymenium the disk of which consists of naked spores.

Fam. 1. SPHÆROPHOREI. Thallus vertical, fruticulose.

* SIPHULA. Apothecia unknown. Spermatia linear. Thallus erect, sparingly branched or almost simple, passing below into root-like branchlets by which the lichen is attached to the substrate, densely cottony within.

58. SPHÆROPHORUS. Apothecia globose; the proper exciple reduced to a hypothecium, which is included in a thalline receptacle, formed by the swollen tips of the branches. Spores spherical, simple, violet-black. Thallus fruticulose, erect, densely cottony within.

59. ACROSCYPHUS. Apothecia crateriform; a black proper exciple included in a clavate thalline receptacle, formed by the swollen tips of the branches. Spores ellipsoid, bilocular, brown. Thallus fruticulose, erect, solid, the medullary layer at length more or less compacted into cartilagineous cords.

Fam. 2. CALICIEI. Thallus crustaceous, lobulate, or, mostly, uniform.

60. ACOLIUM. Apothecia crateriform, or now urn-shaped, sessile; a black proper exciple, which is either naked, or margined by an accessory thalline one. Spores spherical and simple, or more often ellipsoid and bilocular, rarely also quadrilocular, or even muriform-plurilocular; brown. Thallus crustaceous, rarely lobulate, for the most part uniform.

61. CALICIUM. Apothecia crateriform, stipitate; a naked, black proper exciple. Spores spherical, ellipsoid, or oblong, simple, or bilocular, rarely quadrilocular, brownish. Thallus crustaceous, or now almost obsolete, or (in parasitical species) none.

62. CONIOCYBE. Apothecia globose, stipitate, the margin of the coloured proper exciple obscure. Spores spherical, simple, almost uncoloured. Thallus crustaceous, or now almost obsolete.

Ser. II.—ANGIOCARPI. (Schrad.) Fr.

Apothecia globular, opening only by a pore at the summit.

Trib. 5. VERRUCARIACEI. Apothecia globular; a proper exciple (perithecium) covering a similarly shaped hymenium (*nucleus*) which is itself included in a more or less distinguishable inner envelope (*amphithecium*).

Fam. 1. ENDOCARPEI. Thallus foliaceous, becoming squamulose.

63. ENDOCARPON. Apothecia immersed in the thallus; perithecium much reduced; amphithecium pale, or at length now blackening; paraphyses obsolete. Spores ovoid, ellipsoid, or oblong, mostly simple, now biquadrilocular, or rarely muriform-multilocular, brown, or decolorate. Thallus foliaceous, monophyllous, or squamulose, passing also into sub-crustaceous states.

64. NORMANDINA. Apothecia immersed in thalline warts; perithecium indistinct; amphithecium black; paraphyses obsolete. Spores oblong, 8-locular, uncoloured. Thallus squamæform, monophyllous.

Fam. 2. VERRUCARIEI. Thallus crustaceous.

Sub-Fam. 1. SEGESTRIEI. Apothecia solitary; perithecium coloured.

65. SEGESTRIA. Apothecia immersed in thalline warts; perithecium coloured; amphithecium pale, or finally blackening; paraphyses distinct. Spores ellipsoid,

oblong, or fusiform, simple, or bi-quadri-plurilocular, or at length, muriform-multilocular, uncoloured. Thallus now lobulate, mostly uniform.

66. STAUROTHELE. Apothecia immersed in thalline warts; perithecium blackening; amphithecium pale; paraphyses obsolete. Spores ellipsoid, muriform-multilocular, brown, or decolorate. Thallus somewhat lobulate, or uniform.

Sub-Fam. 2. TRYPETHELIEI. Many apothecia collected in a verrucæform stroma.

67. TRYPETHELIUM. Apothecia (1-00) immersed in a stroma; perithecium reduced, blackening; amphithecium black; paraphyses distinct. Spores ellipsoid, and oblong, 4-plurilocular [or, in exotic species, muriform-multilocular] brown, or decolorate. Thallus uniform, mostly obscure, or disappearing.

Sub-Fam. 3. PYRENULEI. Apothecia solitary, or now confluent; perithecium black.

68. SAGEDIA. Apothecia innate-superficial; perithecium black; amphithecium pale, or at length blackening; paraphyses distinct, or now obsolete. Spores from cymbiform fusiform, at length acicular quadri-plurilocular, colourless. Thallus uniform, or disappearing.

69. VERRUCARIA. Apothecia innate; perithecium black; amphithecium pale, or finally blackening; paraphyses slender and for the most part indistinct or obsolete. Spores ovoid-ellipsoid, simple, or bi-quadrilocular, or finally muriform-multilocular, decolorate. Thallus uniform, somewhat tartareous, rarely areolate-squamaceous.

70. PYRENULA. Apothecia somewhat prominent; perithecium black; amphithecium pale, or blackening;

paraphyses distinct, or now obsolete. Spores from ellipsoid oblong, bi-quadri-plurilocular, or at length muriform-multilocular, brown, or decolorate. Thallus mostly obscure.

71. PYRENASTRUM. Apothecia rather prominent, turbinate, several oftener confluent above into a common mouth (*ostiole*); perithecium conical, oblique, black; amphithecium blackening; paraphyses distinct. Spores ellipsoid and oblong, muriform-multilocular, brown. Thallus obscure.

72. STRIGULA. Apothecia prominent, depressed-globose; perithecium black; amphithecium pale, or blackening; paraphyses distinct. Spores oblong-ovoid, or oblong, from simple bi-quadrilocular, without colour. Thallus epiphyllous, passing finally into a lobulate crust.

Trib. I.—PARMELIACEI.

Apothecia rounded and open, or more rarely subglobose and persistently more or less closed; a thalline exciple margining a normally discoid hymenium which rests on a mostly imperfect proper exciple (hypothecium).

In this vast tribe, perhaps the first to attract the attention of lovers of nature, and to be studied, it is the thallus which plays the chief part; and this, by its endless variations, lends interest to our latest studies. The predominance of the thallus is seen equally in the fruit. Except in the lowest groups, the proper exciple is for the most part reduced here to a layer of cells supporting the hymenium; while, on the other hand, a thalline receptacle, of but subordinate value when found in other tribes, is here characteristical. And it is, once more, the thallus, which fitly determines the families, or largest groups, into which the tribe breaks up.

It requires little consideration to discern that *Usnea* is an extreme, as well of *Parmeliacei* as of Lichenes; and the group of genera which associate themselves with it, will constitute our first family—USNEEI. But the variations of *Usneei* bring it into closest relations with *Parmelia* and its allies; and we find thus our second family—PARMELIEI. Close to *Parmelia*, and yet differenced remarkably by their texture, manner of attachment, and abnormal fruit, follow the UMBILICARIEI. And close to the last succeeds tropical *Sticta*, represented at the north by only a few species; and its associates—PELTIGEREI. With this family begins a modification (already spoken of) of the structure of the thallus; a change, that is to say, in the constitution of the gonimous or green layer; this being constituted, in one group of species of *Sticta*, *Nephroma*, *Peltigera*, and *Solorina*, of the ordinary gonidia, and, in another, not otherwise separable, of the very distinct, and gelatinous gonimia. This structural modification, which, owing to the darker colour of the gonimia, affects more or less the external coloration of the lichens conditioned by it, and becomes thus, to a considerable degree, discoverable by the naked eye, recurs again in our next succeeding family of mostly humble forms, the humblest indeed we have yet reached—PANNARIEI. And it reaches its height, and the gela-

tinous development an inordinate expression, in our next; the last group of foliaceous *Parmeliacei*—COLLEMEI. Like the *Pannariei*, with which it is most intimately associable, this family descends to very humble, and even crustaceous forms; and thus anticipates, though in another line of direct affinity, the normally crustaceous LECANOREI. These, while ascending, now conspicuously, into conditions recalling the higher, foliaceous *Parmeliacei*, run yet into others wherein at last the thallus becomes wholly subordinate, and the fructification, as in the lowest lichens, plays the principal part;—exhibiting an extraordinary variety of modification, and anticipating, not seldom, types only fully exemplified in other tribes. And yet there is no doubt that *Parmelia* and *Lecanora* may be looked at as members of a continuous series; and some of the most extreme of Lecanoreine deviations from the tribal type (as *Pertusaria* and *Thelotrema*) revert yet, in certain instances, to conditions which we cannot well compare with anything remote from *Lecanora*.

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Fam. 1.—USNEEI.

Thallus erectish, typically fruticulose, and passing then, not seldom, into much elongated, pendulous forms; variously also now dilated, and at length also depressed, or subfoliaceous.

Though well distinguished, as a whole, from the next succeeding family, which is typically horizontal and foliaceous, the latter also ascends, in all its most important divisions, into fruticulose states, to be discriminated carefully from the typically vertical *Usneei*. It is easy however to discern what is really the preponderant affinity of most of these ascendant Parmelieine lichens: as of *Theloschistes chrysophthalmus* to *T. parietinus*; of *Parmelia Camtschadalis* to *P. lævigata*; or of *Physcia ciliaris*, and, especially *P. leucomela*, etc., to *P. speciosa*. But, on the other hand, the family now before us is represented at its centre by a genus (*Cetraria*) in which a certain degree of dilatation of the frond is all but everywhere discernible; and, in this genus, we find finally (in some of our most familiar rail-lichens) so near an approach, in habit, and even in character, to *Parmelia*, that one may well hesitate to which group a lichen shall be referred: and the difficulty will only yield to a fuller knowledge of the whole differentiation of the two series of forms.

As respects spore-features, the great bulk of *Usneei* (in obvious analogy with *Parmelia* of the next family) offers simple spores, always referable to the Colourless Series except in *Alectoria*, in which moreover in all the species but two the spores are decolorate. From this centre departs, in the same series, *Ramalina* with its bilocular spores; to which the Coloured or Brown Series affords no analogue. But *Roccella*, the next and extremest type of the Colourless Series, stands in curious analogy with *Schizopelte* of the Coloured; whereof also *Alectoria* (the analogue of *Umbilicaria*, further on) though ambiguous in most species, displays finally the ultimate type.

I.—ROCCELLA, DC.

Apothecia scutellæform, lateral, more or less adnate; the disk blackening; the hymenium imposed upon a black hypothecium. Spores dactyloid-fusiform; quadrilocular; colourless. Spermatia needle-shaped, bowed; upon sub-simple sterigmas. Thallus fruticulose, or finally pendulous, alike on both sides, cartilagineous-coriaceous, glaucous or now fuscescent; the medullary layer rather loosely cottony.——Anatomy of the thallus given in Schwendener, *Untersuch. l. c.* 2, *p.* 165, *t.* 6, *f.* 2–17.——The few species, which are very closely akin, and belong especially to the warmer, maritime regions of the earth, constitute the famous Orchella-weed of dyers.

1. *R. tinctoria*, DC.; thallus coriaceous, terete (but often more or less flattened) glaucous and pale, dull; sparingly branched but much elongated, and intertangled; apothecia middling to ample, sessile, disk flattish, black, equalling or excluding the margin. Spores fusiform-oblong, $\frac{20\text{-}26}{5\text{-}8}$ mic.——*Ach. L. U. p.* 439. *Fr. L. E. p.* 33. *Schær. Enum. p.* 7. *Nyl. Syn. p.* 258.

Rocks, Mexico, *Krempelhuber*, 1868. San Diego, California, *Dr. Palmer* in *herb.* Willey.

2. *R. leucophæa*, Tuckerm.; thallus smooth, varying from pale to darker brown; the irregular, flexuous branches compressed and now foraminous below, but attenuated and finally terete and filiform above; apothecia middling-sized, sessile, plano-convex, disk black, white-pruinose, margin thin, white.

Spores dactyloid, $\frac{18-28}{5-7}$ mic.——*Suppl.* 1 (*Amer. Journ. Sci.* 25) *p.* 423. *Nyl. Syn.* 1, *p.* 260.

Shrubs (*Obione*) on the coast of California (*Dr. C. C. Parry*), Tuckerman *l. c.* 1858.

3. *R. phycopsis*, Ach.; thallus coriaceous, terete-compressed, dwarfish, dichotomously at length much branched, whitish ash-coloured, often sorediiferous; ["apothecia lecideine, small, black, naked or lightly pruinose. Spores fusiform-oblong, $\frac{12-16}{3-4}$ mic."]—— *Ach. L. U. p.* 440. *Schær. Enum. p.* 7. *Nyl. Syn. p.* 259.

San Diego, California, now on bushes, etc., in company with the last, *Dr. Hill* (Hassler exp.) the same with a Peruvian (*Herb. Berol.*) and Cape of Good Hope (*Zeyher; Wright*) form referable here, and flatter than the Madeira lichen (Nyl. *in* Mandon *Lich. Mader.* n. 36) with which one from Cuba (*Wright*) perfectly agrees. The very dubious plant offers now the aspect of *R. tinctoria* and now of *R. fuciformis*, and is not easily referred to either.

4. *R. fuciformis* (L.) Ach.; thallus cartilagineous-coriaceous, compressed, flat, dichotomously divided into linear-lanceolate, attenuate segments; greenish-glaucous and pale; apothecia marginal, sessile, disk flattish, grey-pruinose, the margin somewhat persistent. Spores fusiform, $\frac{20-28}{4-6}$ mic.——*Ach. L. U. p.* 440. *Fr. L. E. p.* 33. *Schær. Enum. p.* 7. *Nyl. Syn. p.* 260.

Rocks, La Paz, Lower California, *Dr. H. N. Bolander.*

II.—RAMALINA, Ach., De Not.

Apothecia scutellæform, mostly marginal, sub-pedicellate; the disk pale. Spores ellipsoid, or oblong, now becoming fusiform; bilocular; colourless. Spermatia oblong, or staff-shaped; upon sparingly branched sterigmas. Thallus fruticulose, or finally pendulous, mostly compressed, or at length sub-foliaceous, alike on both sides, cartilagineous, pale greenish-glaucescent; the cottony medullary filaments in part coalescing into solid cords.——Anatomy of the thallus (of the group represented by *R. calicaris*) given in Schwendener, *Untersuch. l. c.* 2, *p.* 155, *t.* 5, *f.* 7–11.—— The rigidity, or at least tenacity of the thallus is largely

due to the finally distinct and solid cords into which the medullary filaments more or less pass: these cords becoming either (as in the majority of species) mostly united with the cortical layer; or (in *R. homalea*) dispersed rather through the cottony medullary; or finally (in the species last-named, and especially in *R. ceruchis*) now collected into something like an axial column, within the cottony portion. The analogy of *Ramalina* with *Usnea* is seen thus to be not confined to external features.

* *Medullary cords free of the cortical layer, and at length axial; or indistinct. Spermogones black.*

1. *R. ceruchis* (Ach.) De Not.; thallus tufted, terete, or compressed-terete, smooth, but soon and at length deeply pitted and wrinkled; somewhat simple or sparingly branched, the tips of the branches often attenuate; apothecia middling to ample, lateral. Spores oblong, $\frac{12-16}{3\frac{1}{2}-4\frac{1}{2}}$ mic.——*Borrera*, *Ach. Lich. p.* 504. *Ramalina*, *De Not. Framm. Nyl. Syn.* 1, *p.* 289; *Recogn. p.* 8.

Trees and rocks, coast of California (*C. Wright*) Tuckerman *Gen.* 1872.——An infertile form upon dead wood, Sta. Cruz, *D. Anderson*, is distinguished by large, lateral and capitate, grey soredia (*f. cephalota*).——*R. Combeoides*, Nyl. (*Recogn. Ramal. p.* 9) with quite simple, podetiiform thallus, and commonly terminal, now clustered apothecia, grows with the next species in California (*Bolander*) but, though certainly marked, is inseparable from South American forms (Terra del Fuego, Wilkes exp.) which appear fully referable to *R. ceruchis*. Specimens of the present species commonly, and at length densely floccose; the medullary filaments escaping largely through the rents of the easily broken cortical layer.

2. *R. homalea*, Ach.; thallus tufted, compressed and two-edged, smooth, but finally wrinkled; sparingly and irregularly branched, the branches attenuate and at length spreading and the tips teretish; apothecia middling to ample, marginal, now dilated and flexuous. Spores oblong, $\frac{11-16}{3-4}$ mic.——*Ach. Lichenogr. p.* 598. *Nyl. Syn. p.* 289; *Recogn. p.* 9.

Rocks; coast of California (*Menzies*). Ach. *L. U.* 1810.—— *R. testudinaria*, Nyl. (*Recogn. p.* 10) from California, is not distinguishable.

* * *Medullary cords uniting mostly with the cortical layer. Spermogones commonly pale.*

3. *R. reticulata* (Noehd.) Krempelh.; thallus much compressed, linear, elongated and pendulous, very much branched; either narrow and somewhat channelled, with teretish tips, or dilated; the longitudinally striate branches often united here and there into a coarse network, and giving forth frequent, lateral, oblong expansions which become foraminous, and at length extended, and densely reticulate-perforate; apothecia mostly marginal, smallish to middling-sized, sub-sessile. Spores ellipsoid, and oblong, $\frac{11\text{-}19}{4\text{-}5\frac{1}{2}}$ mic.——*Lichen, Noehden in Schrad. Journ.* 1, *cit. Krempelh. Geschicht. d. Lich.* 1, *p.* 86, 2, *p.* 617. *Nyl. Recogn. p.* 25. *R. Menziesii, Tayl. in Lond. Journ. Bot.* 6, 189. *R. retiformis, Menz. herb., Tuckerm. Syn. N. Eng. p.* 12.

Trees; California (*Menzies.*), Noehden *l. c.* 1800. Northward to Vancouver's Island, *J. Macoun.* The longest specimens seen (a little exceeding a foot) altogether narrow-lobed; from 0 mm., 1, at the extremities, to about 1 mm. wide. Other specimens run from 1 mm. to 15 mm. in width, and the widest, perforated expansions exceed 20 mm.. Apothecia from 2 mm. finally 3-4 mm. wide.

4. *R. Usneoides* (Ach.) Fr.; thallus compressed and more or less longitudinally striate, much branched and elongated, pendulous, often at length spirally contorted, greenish-glaucous; apothecia smallish to middling, marginal, somewhat pedicellate. Spores fusiform, $\frac{18\text{-}26}{3\text{-}5}$ mic.——*Nyl. Syn.* 1, *p.* 291, *f.* 8, *f.* 27; *Recogn. p.* 23.

Trees in intertropical countries; common in Mexico, and reaching Southern Florida, *C. F. Austin.*

5. *R. rigida* (Pers.); thallus tufted, slender, terete, or terete-compressed, smooth, or at length longitudinally striate, or besprinkled often with white warts; irregularly- and finally long-branched, the branches attenuate, and the tips filiform; apothecia lateral, smallish to middling-sized. Spores ellipsoid and oblong, $\frac{10\text{-}18}{4\text{-}7}$ mic.——*Lichen, Pers., e Nyl. in Prodr. N. Gran. p.* 15, *not. R. gracilenta, Fr. L. E. p.* 29, *e Nyl., ibid. R. tenuis, Tuckerm. Suppl.* 1, *l. c. p.* 423, *part. R. rigida, R. gracilis, & R. gracilenta, Nyl. Recogn. pp.* 14, 17, 19.

Trees; Florida (*A. W. Chapman*), Tuckerman *l. c.* 1858. Louisiana, *J. Hale.* Texas, *Wright*; and Mexico. Rarely also

northward, as in the Pines of New Jersey, *Austin;* and even on the south shore of Massachusetts, *H. Willey.*——Small forms occur, from half an inch to an inch in height, with larger (rarely 6 mm. wide) white-pruinose apothecia, and the aspect of *Usnea.* The elongated, flexuously-branched, exclusively southern form reaches three inches in length, and is readily distinguished from our other species. The slenderest of these forms scarcely differ at all from the South American *R. angulosa*, Laur., as determined by Meissner, which should be *R. gracilis* (Pers.) Nyl. *Recogn. p.* 17, except in rather larger spores (the chemical differences being excluded) and both *R. gracilis*, and *R. angulosa*, so far as the specimens (Brazil, *Herb. Meissn.* Cape of Good Hope, *Herb. Sonder*) and the characters go, should be referable here. Spores at length somewhat fusiform, when the lichen is inseparable from

b. Montagnæi, which is wholly undistinguishable but by the distinctly fusiform (rarely 3-locular) spores, $\frac{16\text{-}30}{3\text{-}7}$ mic. *R. rigida part, Mont. in Ann.* 2, 12, *fide De Not. R. Montagnæi, De Not. Framm. Lich. p.* 45. *Nyl. Recogn. Ramal. p.* 30.

Trees; South Carolina, *H. W. Ravenel.* Florida, *Chapman.* Louisiana, *Hale.* Texas, *Wright.*——Branches of this, as of *a*, not rarely here and there united, forming meshes.

6. *R. linearis* (L. f.; Sw.) thallus tufted, compressed, slender, for the most part channelled, somewhat elongated but sparingly divided, long-acuminate above, pale greenish-glaucescent; apothecia smallish to middling-sized, marginal. Spores ellipsoid becoming sub-fusiform, $\frac{9\text{-}20}{5\text{-}7}$ mic.——*R. linearis, Mont.! herb. R. canaliculata, Tayl.! in Hook. Lond. Journ. Bot.* 1847, *p.* 188. *Nyl. Recogn. p.* 30.

b. alludens; spores narrow-fusiform, straight or oblique, $\frac{20\text{-}30}{3\text{-}5}$ mic.——*R. alludens, Nyl. Recogn. p.* 30.

Trees and shrubs; Lower California, *J. Xantus. Herb. Taylor. Nylander.*

7. *R. stenospora*, Müll.; thallus tufted, compressed, coarsely longitudinally white-striate, and more or less tuberculate; sparingly divided, the divisions lanceolate-linear, now irregularly minutely laciniate; greenish-glaucous; apothecia middling-sized, pedicellate. Spores fusiform, straight, or a little curved, $\frac{16\text{-}28}{3\text{-}4}$ mic. *Lich. Beitr. in Flora*, 1877, *n.* 30.

Trees, etc., Louisiana, *Müller Arg. l. c.* Texas, *Wright; Ravenel.* A short, broad form, with the aspect of *R. calicaris, v. fraxinea*, is found on dead wood in South Carolina, *Ravenel.*—— The narrowest forms are scarcely to be separated from *R. rigida, b, Montagnæi*, to which I had also (*in herb.*) referred the wider one, in part; but the latter is in fact better comparable with *R. lævigata.*

8. *R. lævigata*, Fr.; thallus tufted, at length rather elongated, complanate, smooth or longitudinally striate; dividing at the stalked base into a few, sub-simple, lanceolate lobes; apothecia small to middling-sized, flat, scattered on the upper side of the lobes. Spores ellipsoid, and oblong-ellipsoid, $\frac{10\text{-}17}{4\frac{1}{2}\text{-}7}$ mic.——*S. O. V. p.* 283. *Tuckerm. in Bot. Wilkes exped. p.* 129. *R. calicaris, f. Eckloni, Nyl. Syn.* 1, *p.* 295. *R. Yemensis, Nyl. Recogn. Ramal. p.* 46.

Trees; Texas, and New Mexico (*Wright*), Tuckerman *Calif.* 1866.——An easily recognizable lichen, widely diffused throughout the warmer regions of the earth. Thallus with us scarcely exceeding 3 in. in length. Apothecia 1 mm. to scarcely 3 mm. wide.

9. *R. Menziesii*, Tuckerm.; thallus much compressed and rather membranaceous, or now at length more rigid, linear, originally channelled, and puberulent, but soon smooth; sparingly branched, the elongated, sub-simple, flexuous branches becoming lacunose and here and there finally foraminous; apothecia marginal, middling to ample, sub-pedicellate, the margin incurved. Spores oblong, a little curved, $\frac{11\text{-}19}{4\text{-}7}$ mic.——*Tuckerm. Syn. N. Eng. p.* 12, *not of Taylor. R. leptocarpha, Ejusd. Suppl. p.* 423.

Trees; California (*Menzies*), Tuckerman *l. c.* 1848.——The full history of this very distinct lichen is not yet ascertained. The longest specimens seen are 4-5 inches in length, and from 2 to 5 mm. wide. Apothecia 3-8 mm. in width.

10. *R. complanata* (Sw.) Ach.; thallus tufted, flattened, smooth or now striate, besprinkled with minute papillæform tubercles; either shorter and wider, dividing below into a few, sub-simple, linear lobes, or narrower, and at length densely branched, the channelled branches constricted more or less above into teretish and longitudinally pitted, or finally filiform tips; apothecia marginal, middling-sized. Spores ellipsoid, and oblong-ellipsoid, often a little curved, $\frac{10\text{-}18}{4\text{-}7}$ mic.——*Lichen, Sw., ex. Ach.*

L. U. p. 599; *Syn. p.* 294, *fide Nyl. Recogn. Ramal. p.* 29. *Parmelia denticulata, Eschw. in Mart. Fl. Bras. p.* 221. *Ramalina rigida, Mont.! Pl. Cell. Cub. p.* 234, *in part. R. rigida De Not. Framm. Lich. p.* 44. *R. calicaris, f. rigida, Nyl. Syn.* 1, *p.* 295, *fide auct. in Prodr. N. Gran. R. complanata & R. denticulata, Nyl. Recogn.*

Trees; Key West, Florida *(Herb. Torrey.)*, Tuckerman *Gen.* 1872. Texas, *Wright.* Mexico, *Nylander.* Thallus, in our specimens, from half an inch to an inch and a half in length. Apothecia 2-4 mm. wide, but now exceeding 10 mm., in Mexico. The present species, which is closely akin to *R. calicaris*, exhibits now a wider form, suggesting the *v. fraxinea* of the latter, and now a much-narrowed and branched one, comparable with the *v. farinacea;* but also with *R. rigida* (Pers.). The great majority of our plants fail to shew the red reaction with potash.

11. *R. calicaris* (L.) Fr.; thallus tufted, rather rigid, soon more or less reticularly-lacunose, variously divided; apothecia flattish, middling-sized to ample. Spores ellipsoid, and oblong-ellipsoid, mostly straight, except now in *a.* $\frac{8\text{-}19}{3\frac{1}{2}\text{-}7\frac{1}{2}}$ mic.——*L. E. p.* 30.

a. fraxinea, Fr.; wide- and at length long-lobed; the lobes sub-simple; apothecia lateral.

b. fastigiata, Fr.; lobes shorter and crowded, dividing dichotomously above; apothecia sub-terminal.

c. canaliculata, Fr.; narrowed; the channelled lobes dichotomously- and at length much-branched and elongated; apothecia attached just below the deflexed, or geniculate tips.

d. farinacea, Schær.; flattened, smoothish; now wider, and sparingly branched, and now teretish and much branched; finally filiform-attenuate and pendulous; besprinkled with white powdery soredia; apothecia lateral, rare.

Trees; and *d.* also upon rocks; very common in the Northern States, and Canada, *Muhlenberg Catal.* 1818; and also southward. California (only *d.*) and Mexico.——A different view of this species may be found in the recent monograph of Nylander (*Recogn.*) but the distinctions relied upon are far enough from satisfactory, and admitted to be so, to some extent, by the author himself.

12. *R. pusilla* (Prev.); thallus tufted, inflated and hollow, foraminous; [either short- and few-lobed, turgid, wrinkled, and rather membranaceous, as in the original, Southern-European lichen, or] more rigid, soon narrowed, and branched; apothecia oftener sub-terminal, finally sub-pedicellate. Spores ellipsoid, and oblong-ellipsoid, mostly straight, $\frac{11\text{-}17}{4\text{-}7}$ mic.——*Fr. L. E. p.* 29. *Schær. Enum. p.* 8. *Nyl. Syn.* 1, *p.* 295.

β. geniculata; terete-compressed, smooth, dichotomously- at length much-branched, the tips somewhat digitately divided, and now sorediiferous; apothecia small to middling-sized, attached just below the deflexed tips.——*R. geniculata, Hook. f. & Tayl. in Lond. Journ. Bot.* 3, *p.* 655, *& R. inflata, of the same, Fl. Antarct.* 1, *p.* 194, *t.* 79, *f.* 1. *Nyl. Recogn. Ramal. p.* 63–5. *R. minuscula, Nyl. Lich. Lapp. Or. p.* 114; *Recogn. p.* 66.

Trees, White Mountains, and in Maine; *Tuckerman Gen.* 1872. Canada, *A. T. Drummond.* Arctic America, *Herb. Hook.* Oregon, *E. Hall.*——The cortical layer varies in thickness; but only as it is found to vary in *R. pollinaria*, and other species, in which the inner, distinctly filamentous portion is now deficient: and this variation appears quite insufficient to separate the original *R. pusilla* (Portugal, *Welwitsch!* Italy, *Massalongo!*) from the otherwise similar Australian lichen (Van Diemen's land, *Herb Sonder!* perhaps *R. Tasmanica, Nyl. Recogn. p.* 64) here associated with it. The plants we have noticed are easily comparable with *R. calicaris, v. fraxinea;* and, like *R. calicaris, R. pusilla* passes readily into a narrower, much-branched state (Java, *Junghuhn!* shores and islands of the China Sea; Japan; and Cape of Good Hope; *Wright!* Venezuela, *Herb. V. d. Bosch!*) which is our *β.* From this last, the North American lichen, and the only form as yet published from the north of Europe (Lapland, *Fellman!*) are quite inseparable. Thallus at length more or less constricted immediately under the apothecia, even in the Portuguese specimens; which thus differ little in this respect from the others, with their distinctly sub-pedicellate, or subsessile fruit. The spores of the original *R. pusilla* are taken by *Nylander l. c.*, for smaller than those of his *R. Tasmanica;* but this difference also disappears in the Italian lichen (*Mass. Ital. n.* 175).

13. *R. pollinaria* (Ach.); thallus tufted, rather membranaceous, flaccid, lacunose, irregularly or as if torn-branched, burst-

ing, especially at the tips, into conspicuous, dilated soredia; apothecia small to middling-sized, sub-terminal. "Spores oblong, $\frac{10\text{-}15}{4\text{-}6}$ mic."——*L. U. p.* 608. *Fr. L. E. p.* 31. *Nyl. Recogn. Ramal. p.* 52.

Trees, rarely; and rocks; New England, *Tuckerman Gen.* 1872. New Mexico, *Fendler.*——Our plants, which are all sterile, belong to the northern form (*Rabenh. Lich. Eur. n.* 102, 766), which is especially near to *R. calicaris, v. farinacea;* and the much-dilated, flattish, dichotomously laciniate state of other European regions is quite unknown here, though it occurs well-marked in Peru (*Winterfeld!*). Of the specimens before me, a minute, pulvinate form, found on stone walls in Massachusetts, and in Rhode Island, is the most distinct.

14. *R. polymorpha* (Ach.); thallus tufted, compressed, rigid, longitudinally costate, sub-simple or at length irregularly much divided, the branches besprinkled or terminated by granulate, often capitate soredia; apothecia smallish to middling-sized, sub-terminal. "Spores oblong, $\frac{11\text{-}16}{4\text{-}5}$ mic."——*L. U. p.* 600. *Fr. L. E. p.* 32. *Nyl. Recogn. Ramal. p.* 50.

Rocks, North America; *Muhlenberg Catal.* 1818. Newfoundland, *Despreaux.* Arctic America, *Wright.*——Soredia not mealy, as in the last species, and *R. calicaris, v. farinacea;* and the lichen much more rigid. Delise referred here a Newfoundland lichen (*Despreaux, in herb. Spreng.!*), which has since occurred, in a better-developed state, in islands of Behring's Straits (*Wright*), but this differs, in several respects, from the European plant; and the latter is, at present, scarcely known as North American.

15. *R. scopulorum* (*Dicks.*) Ach.; thallus tufted, thickish, terete or much-compressed, coriaceous-cartilagineous, rigid, mostly polished; sub-simple or divaricately much-branched, finally often elongated, and pendulous; apothecia smallish to middling-sized, pedicellate, the margin soon reflexed. "Spores oblong, straight, $\frac{12\text{-}19}{4\frac{1}{2}\text{-}6\frac{1}{2}}$ mic."——*Lichen. Dicks. Pl. Crypt.* 3, *p.* 18. *Ach. L. U. p.* 604; *Syn. p.* 297. *Fr. L. E. p.* 32. *Nyl. Syn.* 1, *p.* 292.

Maritime rocks. North America, *Nylander l. c.* 1860. I have seen no American specimens; but the lichen inhabits Lapland, and Iceland; and Mr. Wright found it in Japan.

III.—CETRARIA (Ach.) Fr., Müll.

Apothecia scutellæform, then often dilated, or peltæform, affixed obliquely to the tips or margins of the thallus, from which the disk differs in colour. Spores sub-ellipsoid, simple, colourless. Spermatia oblong, either thickened at one, or both ends, or cylindrical; or staff-shaped; upon sparingly branched sterigmas. Thallus typically ascendant; either fruticulose, with now terete-compressed, now turgid, or now channelled branches; or expanded and foliaceous; cartilagineous or now membranaceous; glaucescent, or much more often brown, or yellowish; the medullary layer cottony.——Anatomy of the thallus of the first sub-section, and of the second and third sections, given in Schwendener, *Untersuch. l. c.* 2, *p.* 149, *t.* 3, *f.* 30–33, *t.* 4, *f.* 1–12; and of the second sub-section in Nyl. *Syn.* 1, *p.* 286.——The type of *Cetraria* is to be looked for in its alpine species; and especially in those of the second section, which are at once fruticulose and yet sub-foliaceous. From this centre diverge, on the one hand the two well-marked clusters with teretish thallus; and, on the other, we find receeding the finally quite foliaceous and *Parmeliiform* third section.

* *Thallus fruticulose, terete-compressed.*

† *Thallus slender, brownish, rigid.*

1. *C. tristis* (Web.) Fr.; thallus tufted, fruticulose, erectish, very rigid and tenacious, compressed-terete, divided sparingly below, but the tips often passing into fastigiate branchlets; brownish-black; apothecia middling-sized to ample, subterminal, appendiculate by the deflexed tips, plano-convex, the disk dark-chestnut, the margin entire or toothed, or now radiate. Spores ellipsoid, $\frac{7\text{-}10}{5\text{-}6}$ mic. Spermogones and spermatia much as in the next.——*Fr. L. E. p.* 34. *Schær. Spicil. p.* 258. *Platysma, Nyl. Syn.* 1, *p.* 307.

Alpine rocks. Arctic America (*Richardson*), Hooker in Frankl. Narr. 1823. Alpine region of Mt. Hood, Oregon, *Hall.*——The quality and amount of anatomical difference in the thallus (Schwend. *l. c.* p. 149) is scarcely sufficient to obscure the manifestly close relation of this lichen to *Cetraria.*

2. *C. Californica*, Tuckerm.; thallus tufted, fruticulose, erect, cartilagineous, sub-fistulous, compressed-terete, at length deeply- and canaliculate-lacunose; dichotomously much- and spread-branched; greenish-olivaceous, and fuscescent, dull; apothecia sub-terminal, middling-sized, appendiculate, the disk dark-green, becoming convex and black, and excluding the toothed margin. Spores ellipsoid, $\frac{6-9}{3-4}$ mic.——Spermogones immersed-papillæform; spermatia oblong, thickened at each end, $\frac{4-5}{1-1\frac{1}{2}}$ mic. ——*Suppl.* 2, *l. c. p.* 203.

Trees, coast of California (*Menzies*), Tuckerman *l. c.* 1859. Fences, Oregon, *Hall.* British Columbia, *Macoun.*——Most naturally associable with the genus which shall include *C. aculeata*; but agreeing in the spermogones and their contents with *C. tristis.*

3. *C. aculeata* (Schreb.) Fr.; thallus densely tufted, fruticulose, erect, rigid, sub-fistulous, more or less compressed or angled below but teretish above; divaricately much branched and the branches beset more or less with black spinules; dark-chestnut-brown, polished; apothecia sub-terminal, middling-sized, the disk chestnut, the margin toothed. Spores ellipsoid, $\frac{6-9}{3-4}$ mic. Spermogones in spinules; spermatia oblong, cylindrical.——*Fr. L. E. p.* 35. *Schær. Spicil. p.* 254. *Nyl. Syn.* 1, *p.* 300.

On the earth, and growing over mosses on rocks, in alpine districts. White Mountains, *Tuckerman*, Syn. N. E. 1848. Newfoundland, *Despreaux.* Rocky Mountains, *Macoun.* British Columbia, *Macoun.* Arctic America, *Herb. Hook.*

4. *C. odontella*, Ach.; thallus densely tufted, fruticulose, expanded, chestnut-brown; the flat, linear, palmately-divided, spinulose branches emitting here and there fibrils beneath, but more or less ascendant; "apothecia terminal, flat, the disk brown."——*Syn. p.* 230. *Fr. L. E. p.* 35. *Th. Fr. Lich. Scand. p.* 99.

Growing over mosses on rocks in Arctic America? The authorities (Syn. Lich. N. Eng. p. 14) are all uncertain. *C. nigricans*, Nyl., especially differing in being still more depressed and expanded, with somewhat channelled lobes, and rather distincter fibrils beneath, but known only in a sterile state; is, however, a native of Greenland; *Th. Fr. l. c.*

†† *Thallus turgid, straw-coloured, or now fuscescent, softish.*

5. *C. ramulosa* (Hook.); thallus tufted, fruticulose, erect, compressed-terete, fistulous, from much-inflated and rather simple or finger-shaped becoming dichotomously branched, and somewhat muricate, especially towards the obtuse tips, with papillæform branchlets; from straw-coloured at length fuscescent, smooth; apothecia mostly terminal, smallish to middling-sized, dark chestnut, at length flat, and the crenulate margin erect. Spores sub-spherical, $\frac{5\text{–}6\frac{1}{2}}{4\text{-}6}$ mic.—— *Append. to Parry's 2d Voy. p.* 424. *Dactylina, Tuckerm. Obs. Lich.* 2, *l. c. p.* 397.

Growing over mosses on alpine rocks. Arctic America, *Hooker l. c.* 1823. Rocky Mountains, *Herb. Hook.* Islands of Behring's Straits, *Wright.*——The branched condition is well comparable, in habit, with *C. aculeata, v. obtusata*, Schær. (*Anzi Lang. n.* 22; *& Rabenh. n.* 743.)

6. *C. madreporiformis* (Ach.) Müll.; thallus tufted, fruticulose, erect, turgid, sub-fistulous, dichotomously short-branched, the branches nodulose, with obtuse tips; straw-coloured, smooth; apothecia lateral, smallish to middling-sized, disk chestnut, margin erect, crenulate. "Spores ellipsoid, $\frac{7\text{–}8}{3\frac{1}{2}}$ mic." Spermatia staff-shaped.——*Müll. in Flora*, 1870, *p.* 321. *Dufourea, Ach.; Nyl. Syn.* 1, *p.* 287. *Evernia, Fr. L. E. p.* 25. *Dactylina, Tuckerm. Obs. Lich. l. c.*

On the earth in alpine districts. Rocky Mountains, now fertile (*Dr. C. C. Parry*) Tuckerman Calif., 1866.

7. *C. arctica* (Hook.); thallus somewhat tufted, turgid, finger-shaped, erect, hollow within, simple or sparingly divided, with tapering, obtuse tips; straw-coloured or now in part fuscescent, smooth; apothecia terminal, smallish to middling-sized, disk chestnut, the crenulate margin at length obscure. Spores sub-spherical, diam. 5–6 mic. Spermatia staff-shaped.——*Append. to Frankl. Narr. p.* 762. *Dactylina, Nyl. Syn.* 1, *p.* 286. *Tuckerm. Obs. Lich. l. c.*

On the earth; Arctic America (*Richardson*), Hooker *l. c.* 1823. ——The finger-shaped thallus, which developes, in *C. ramulosa*, into a branched one not unlike that of *C. aculeata*, is persistent here; and the plant being also larger, is sufficiently remarkable. There can yet be no doubt of the very near affinity of the two lichens; or that *C. madreporiformis* is congenerical.

* * *Thallus fruticulose, canaliculate, cartilagineous.*

8. *C. Islandica* (L.) Ach.; thallus tufted, erect, sub-foliaceous, irregularly laciniate, mostly canaliculate, or the margins now connivent and here and there often uniting, ciliate-spinulose, and beset for the most part, especially below, with white soredia; olivaceous-chestnut, stained more or less sanguineous at the base; apothecia ample to large, adnate, disk dark-chestnut. Spores ellipsoid, $\frac{6\text{-}11}{3\frac{1}{2}\text{-}4\frac{1}{2}}$ mic. Spermogones in spinules; spermatia oblong, cylindrical.——*Ach. L. U. p.* 512. *Fr. L. E. p.* 36. *Nyl. Syn.* 1, *p.* 298.

b. Delisæi (Bor.); paler throughout, and brown at the base, with much divided summits.——*Nyl. Scand. p.* 79. *C. hiascens, Th. Fr. Scand. p.* 98.

On the earth, in alpine districts, abundant. *Muhlenberg Catal.* 1818. Arctic America, *Richardson*, etc. White Mountains, *Tuckerman*. Carolina Mountains, *Michaux*. Rocky Mountains, *Hall*. Oregon, *Hall*. Also in barren fields on the coast, sterile, New England, *Tuckerman*. Delaware Water Gap, *Austin*.——*b.* Arctic America, *Herb. Hook.*, etc. Newfoundland, *Despreaux*. North shore of Lake Superior, *Agassiz*. White Mountains. Sometimes suggesting the next.

9. *C. Richardsonii* (Hook.); thallus prostrate, sub-foliaceous, divaricately divided, and the somewhat channelled extremities multifid; fulvous- at length chestnut-brown. "Apothecia ample, marginal, disk yellowish-brown, margin irregular." "Spores $\frac{6\text{-}8}{4\text{-}6}$ mic. Spermogones papillæform; spermatia oblong, a little constricted at the middle."——*Hook. in Richards. Append. to Frankl. Narr. p.* 761. *Platysma, Nyl. Syn.* 1, *p.* 306.

Arctic America (barren grounds, north of Great Slave Lake, *Richardson*), Hooker *l. c.* 1823.

10. *C. cucullata* (Bell.) Ach.; thallus tufted, erect, rather sparingly sinuate-laciniate, the margins undulate and connivent; straw-coloured, stained more or less purple at the base, smooth; apothecia ample to large, adnate to the under side of the dilated and hooded fertile lobes, disk chestnut, margin thin, entire. Spores ellipsoid, $\frac{7\text{-}8}{3\text{-}3\frac{1}{2}}$ mic. Spermogones papillæform; spermatia oblong, thicker at each end.——*Ach. L. U. p.* 511. *Fr. L. E. p.* 87. *Nyl. Syn.* 1, *p.* 302.

On the earth in alpine districts. Arctic America (*Richardson*), Hooker *l. c.* 1823. White Mountains, *Tuckerman*. Rocky Mountains, *Hall*.

11. *C. nivalis* (L.) Ach.; thallus tufted, erect, or erectish, reticulately lacunose, much- and sinuately-laciniate, the lobes, which are at length many-cleft above, widely more or less canaliculate; straw-coloured, stained commonly yellowish at the base, smooth; apothecia ample to large, adnate to the upper side of the lobes, disk yellowish-flesh-coloured, margin crenulate. Spores ellipsoid, $\frac{7-8}{3-4}$ mic. Spermogones and spermatia as in the last.——*Ach. L. U. p.* 510. *Fr. L. E. p.* 38. *Nyl. Syn. p.* 1, 302.

On the earth in alpine districts. Arctic America (*Richardson*), Hooker *l. c.* 1823. White Mountains, *Tuckerman.* Rocky Mountains, *Hall.*

* * * *Thallus depressed, expanded, submembranaceous.*

a. Stock of C. sæpincola.

12. *C. aleurites* (Ach.) Th. Fr.; thallus membranaceous, foliaceous, many-cleft, besprinkled with isidioid granules, and crowded finally, at the centre, into a plicate, densely granulate crust; whitish- or at length cinereous-glaucescent; beneath pale, wrinkled, beset with scattered, brown fibrils; lobes sinuate-laciniate, with rounded and crenate, or more deeply divided tips; apothecia marginal, ample, from pale at length chestnut-brown, externally, and the thin margin as well, granulate like the thallus. Spores rounded and ellipsoid, $\frac{4\frac{1}{2}-9}{4\frac{1}{2}-6}$ mic. Spermatia oblong, thickened at the ends.——*Th. Fr. Lich. Scand.* 1, *p* 109. *Parmelia, Ach. L. U. p.* 484. *Fr. L. E. p.* 62. *P. placorodia, Nyl. Scand. p.* 106.

b. placorodia; smooth; apothecia crenulate, at length much dilated.——*Cetraria, Tuckerm. Syn. N. Eng. p.* 16. *Parmelia, Ach. Syn. p.* 196.

Trees, and dead wood. *a.* on pines, and common on rails, in the northern States, *Halsey* View, 1823. Maryland, *Tuckerman.* Mountains of South Carolina, *Ravenel.*——*b.* also upon pines, and rails, in the Northern and Middle States, *Muhlenberg Catal.* 1818; and southward to Maryland.——Associable in general habit, and in the peculiar features of the under side, at once with the species next following, as especially with *C. aurescens.* The spermogones, and spermatia, agree with those of the present cluster, as first pointed out by Dr. Fries; and the former are sufficiently obvious in *b*, though exceedingly rare in *a.* The description of his *Parmelia aleurites* by Acharius (*l. c.*) appears to point to our *a*, much rather than to *Parmelia hyperopta;* and

the published specimen of Dickson! which is cited by the former, is certainly the same plant: as are those of Floerke (*herb.*) Fries, Schærer, and Mougeot & Nestler (739). But it is scarcely to be questioned that *b*, known only as American, is the true type of the species.

13. *C. Fendleri* (Tuckerm.); thallus dwarfish, membranaceous, foliaceous, many-cleft, smooth; from pale- at length brownish-olivaceous; beneath whitish, reticulately wrinkled, and beset with scattered, coarse, pale fibrils; lobes-substellate, linear, flat, denticulate, now at length crowded and complicate; apothecia (frequent, and now crowded) smallish to middling, marginal; chestnut; shining; with a crenulate margin. Spores rounded and ellipsoid, $\frac{4\frac{1}{2}\text{-}11}{4\text{-}5}$ mic. Spermatia as in the last, but longer; as in the two next.——*Cetraria, Tuckerm. Gen. p.* 280. *Parmelia, Ejusd. in Nyl. Enum. Gén. p.* 105, *& Lich. Calif. p.* 14. *Platysma, Nyl. Syn. p.* 309.

Trees, and dead wood. On pines, New Mexico (*Fendler*), Tuckerman in Nyl. *l.c.* 1858. Colorado, *Brandegee*, comm. Sprague. Pines, South Carolina, *Ravenel.* Alabama, *Peters.* Pines, and rails, Maryland, *Tuckerman;* New Jersey, *E. Michener.* Rails, Rhode Island, *J. L. Bennett.*——The rail specimens more compact and complicated, exactly as in the preceding species, *C. ciliaris*, etc. Spermogones marginal in the tree-form; and not in fact varying from this more than we find to occur in some other *Cetrariæ.* The under side of the thallus agrees closely with that of *C. aurescens.*

14. *C. Fahlunensis* (L.) Schær.; thallus sub-cartilagineous, foliaceous, many-cleft, smooth; from olivaceous-brown soon blackening; beneath blackening, wrinkled, with scattered fibrils of the same colour; lobes sinuately lobulate, more or less channelled; apothecia marginal, middling-sized to ample, externally granulated, at length dilated; disk chestnut; margin rugose-crenulate. Spores short-ellipsoid, $\frac{5\text{-}11}{3\frac{1}{2}\text{-}6}$ mic.——*Schær. Spicil. p.* 255. *Parmelia, Ach. L. U. p.* 470. *Fr. L. E. p.* 66. *Platysma, Nyl. Syn.* 1, *p.* 309.

Alpine rocks; and descending, in mountainous districts. Arctic America (*Richardson*), Hooker *l. c.* 1823; *Vahl.* Newfoundland, *Despreaux.* Hastings county, Canada, *Macoun.* Higher mountains of New England, *Tuckerman.*——A state with

wider lobes, the margins of which are flecked with white soredia in the manner of some *Ramalinæ*, has occurred in the alpine region of the White Mountains, and in Mt. Desert, Me.; and a narrower, but similarly sorediate, sterile plant, near Brattleborough, Vt., *J. L. Russell & C. C. Frost;* and even at the Delaware Water Gap, N. J., *Austin*. Imperfect spermogones in these sterile plants relate them to the present species; but I have found no spermatia. The species is in some respects not incomparable with narrow-lobed forms of the next.——*C. commixta* (Nyl.) Th. Fr., especially differing in its oblong-ellipsoid spermatia, is unknown as North American.

15. *C. ciliaris* (Ach.); thallus cartilagineous-membranaceous, foliaceous, sinuate-laciniate; greenish-glaucous becoming brownish; beneath brownish and more or less fibrillose; lobes crowded, ascendant, often narrowed and many-cleft, lacunose-uneven, the crenate margins fringed here and there with fibrils; apothecia marginal, middling-sized to ample; disk dark-chestnut; margin crenulate. Spores sub-spherical, 4½–7 mic. in diam. Spermatia oblong, thicker at the ends.——*Ach. L. U. p.* 508. *Tuckerm. Syn. N. Eng. p.* 16; *Exs. n.* 5. *Platysma, Nyl. Syn.* 1, *p.* 308.

Old rails, very common; and also on trees; throughout the Northern, Middle, and Southern States, *Muhlenberg* in Ach. *L. U.* 1810, *Ravenel*, etc. Newfoundland (a blackened state, referred to *C. sæpincola* by Delise), *Despreaux*. Arctic America (a dwarf form growing on twigs, also referred to *C. sæpincola* in), *Herb. Hook.* California, *Menzies*.

15(*a*). *C. platyphylla;* thallus cartilagineous, rigid, foliaceous, sub-monophyllous; olivaceous-brown; paler beneath, the fibrils obsolete; lobes rounded, strongly reticulate-lacunose, and rugged, tuberculate; apothecia middling-sized, marginal; disk dark-chestnut, shining; margin tuberculate. Spores sub-spherical, 4-7 mic. in diam.

Trees, British Columbia, *Macoun*. Yosemite Valley, California, *Bolander*. Thallus pale sulphur-coloured within, but perhaps not always. The lichen has something of the habit of *Sticta fuliginosa*, but is near to *Cetraria ciliaris*, from which it does not at all differ in the spores.——*C. ciliaris* of the Pacific coast, if perhaps smaller, differs in no respect from the originally described plant of the Eastern States; in which last the fibrils are not always present, as they are not always absent in the

other; so that *Platysma orbatum*, Nyl., *Flora*, 1869, p. 442, rests wholly on the uncertain chemical character.

16. *C. sæpincola* (Ehrh.) Ach.; thallus sub-membranaceous, foliaceous, few- and short-lobed; olivaceous-brown; beneath paler, and without fibrils; lobes crowded, flattish, undulate and crenate, more or less ascendant, much hidden by the abundant fruit; apothecia marginal, smallish; chestnut. Spores ellipsoid, $\frac{7\text{-}9}{4\text{-}5}$ mic. Spermatia as in *C. ciliaris.*——*Ach. L. U. p.* 507. *Fr. L. E. p.* 39. *Platysma, Nyl. Syn.* 1, *p.* 308.

b. chlorophylla, Wahl.; larger, and paler; the irregularly laciniate lobes with white-sorediate edges; scarcely fertile.

On twigs, Arctic America (*Richardson*), Hooker *l. c.* 1823. Branches of dwarf firs in the sub-alpine region of the White Mountains, *Tuckerman.* Cold swamp, Hawley, Hampshire, Mass., *Porter.*——*b*, Oregon, *Dr. Lyall.* Coast of California, *Bolander.*

b. Stock of C. glauca.

17. *C. lacunosa*, Ach.; thallus cartilagineous-coriaceous, foliaceous, the crowded lobes more or less dilated and rounded, and deeply reticulate-lacunose, with ascendant, lacero-crenate, smooth margins; glaucous above; whitish, or here and there now blackening below; apothecia (abundant) sub-terminal, ample, at length a little elevated; disk chestnut (often perforated at the centre); margin entire. Spores rounded-ellipsoid, $\frac{4\text{-}8}{4\text{-}4\frac{1}{2}}$ mic. Spermatia oblong, thickening gradually towards one end.—— *Ach. L. U. p.* 508. *Tuckerm. Syn. N. E. p.* 16; *Exs. n.* 6, 61. *Platysma, Nyl. Syn.* 1, *p.* 314.

b. stenophylla; lobes more lax, narrow-linear, elongated, channelled; white beneath; apothecia terminal.

Trees, North-west coast (*Menzies*), Ach. *Meth.* 1803. Very common on trees and rails through the Northern and Middle States, and, along the mountains, southward; *Halsey; Ravenel*, etc.——*b*, simulating now the habit of large states of *Ramalina calicaris* and now of *Evernia furfuracea*, California; *Bolander.* The var. *laciniatum*, Nyl. *Flora*, 1869, p. 442, from California, cannot be cited, as it has no character.

18. *C. glauca* (L.) Ach.; thallus membranaceous, foliaceous, sinuate-lobate or irregularly lacerate-laciniate; glaucous, black-

ening below; the jagged edges of the lobes often sorediate, and prolonged finally more or less into conspicuous, coralloid branchlets; apothecia (rare) sub-terminal, ample; disk dark-chestnut; margin irregular and disappearing. Spores rounded-ellipsoid, $\frac{4\frac{1}{2}-7}{3\frac{1}{2}-5}$ mic. Spermatia as in the last.——*Ach. L. U. p.* 509. *Fr. L. E. p.* 38. *Platysma, Nyl. Syn.* 1, *p.* 313.

b. stenophylla; lobes loose, narrow-linear, channelled; black, or now whitening beneath.

Trees, and rocks, in mountain forests, New England, *Tuckerman* Enum. 1845. Newfoundland (strongly lacunose; a state occurring also in Scotland, Borrer! but not well referable to *C. lacunosa*), *Despreaux.* Oregon, and Washington Territories, and Vancouver's Island; *Dr. Lyall*, etc.——*b*, Oregon, *Wilkes exped.* California, *Bolander.*——The variety is analogous to *C. lacunosa*, *b*, but has the characters of the present species; and is explained by European states, especially of the *v. fallax*, Ach. The colour of the thallus of *C. glauca*, *a*, finally darkens; becoming now olivaceous-brown, *v. fusca* (Flot.), on rocks, in the White Mountains.

19. *C. chrysantha*, Tuckerm.; thallus cartilagineous-coriaceous, foliaceous, round-lobed, rugulose; straw-coloured; beneath black and shining; lobes crowded, ascendant at the crenate, smooth margins; apothecia adnate to the upper side of the fertile lobes, ample; disk blood-red, and blackening; margin crenulate. Spores ellipsoid, $\frac{8-12}{5\frac{1}{2}-7}$ mic. Spermatia oblong, thickening gradually towards one end.——*Tuckerm. Suppl.* 1, *l. c. p.* 423. *Platysma septentrionale, Nyl. Syn.* 1, *p.* 315.

Rocks, Kotzebue's Sound (*Herb. Church. Babington*), Tuckerman *l. c.* 1858. Islands of Behring's Straits, *Wright.* Fertile, in Japan, *Wright.*——The specific name (criticised by Nylander, *Syn.* p. 315, where a name, published without character by himself, is substituted for it) is quite as good as *chloantha*, Ach.; and, like this, in entire accord with the usage of the language from which the names are taken, as with that of other languages.

20. *C. Oakesiana*, Tuckerm.; thallus cartilagineous-membranaceous, foliaceous, for the most part rather loosely linear- and long-lobed, but now more compact; from greenish at length straw-coloured; beneath brownish, and fibrillose; lobes sinuately cut, flattish, but the margins soon elevated, and whitish-soredi-

ate; apothecia marginal, middling-sized to ample; disk chestnut; margin entire or irregular. Spores rounded-ellipsoid, $\frac{5-9}{4\frac{1}{2}-6}$ mic. ——*Tuckerm. Syn. N. Eng. p.* 17; *Exs. n.* 7. *Platysma*, *Nyl. Syn.* 1, *p.* 304. *Cetraria Bavarica*, *Krempelh. in Flora*, 1851, *p.* 273.

Trees and rocks; New England, and New York, and southward to Maryland, fertile only in mountain forests; *Tuckerman* Lich. N. E. 1841. Lake Superior, *Agassiz.* Black Mountains, South Carolina, fertile, *M. A. Curtis.*——I have failed to find spermatia, either in this or the species next following; but the two are associable (better perhaps than *C. Oakesiana* with *C. Laureri*) and *C. aurescens* certainly suggests *C. juniperina.*

21. *C. aurescens*, Tuckerm.; thallus sub-membranaceous, foliaceous, sinuate-laciniate; straw-coloured; beneath whitish, with frequent fibrils of the same colour; lobes narrowed, many-cleft above, the ascendant margins crisped; apothecia marginal, middling-sized to ample, at length rather elevated; disk chestnut; margin crenulate. Spores rounded, and sub-ellipsoid, $\frac{3-5\frac{1}{2}}{3-5}$ mic.——*Tuckerm. Syn. N. Eng. p.* 16. *Platysma*, *Nyl. Syn.* 1, *p.* 313.

Coniferous trees; and (infertile) on old rails, New England; *Tuckerman Syn.* 1848. New Jersey, *Austin.* Alabama, *T. M. Peters.*

22. *C. juniperina* (L.) Ach.; thallus membranaceous, foliaceous, lacero-laciniate; from greenish-glaucescent at length straw-coloured above and pale-yellow below, or finally bright-yellow on both sides; the crowded, more or less lacunose, erose-crenate and crisped lobes ascendant; apothecia sub-marginal, middling-sized to ample, at length rather elevated; disk chestnut; margin crenulate. Spores ellipsoid, $\frac{4\frac{1}{2}-8}{3\frac{1}{2}-5}$ mic. Spermatia as in *C. chrysantha.*—— *Ach. L. U. p.* 506. *Tuck. Exs.* 8. *Th. Fr. Lich. Scand. p.* 104. *Platysma*, *Nyl. Syn.* 1, *p.* 312.

b. terrestris, Schær.; lobes narrowed and sub-linear with scarcely crisped edges, finally erectish, angulous-teretish, and dichotomously branched; sterile.——*Schær. Spicil. p.* 10 (1823). *Varr. terrestris & tubulosa*, *Schær. Enum. C. Tilesii*, *Ach. Syn. p.* 228.

c. Pinastri, Ach.; lobes depressed, flat, the ascendant margins bright-yellow-sorediate; scarcely fertile.——*Ach. L. U. p.* 506.

a, upon trees throughout the eastern United States. *Muhlenberg Catal.* 1818. West Coast, *Menzies.*——*b*, on the earth, in alpine districts. Arctic America, *Herb. Hook.* Rocky Mountains, *Hall.*——*c*, shrubs and rocks in sub-alpine districts, and descending. Arctic America, *Richardson.* New England mountains, *Tuckerman.* Rocky Mountains, *Hall.* British Columbia, *Macoun.*

IV.—EVERNIA, Ach., Mann.

Apothecia scutellæform, concave, then often dilated and cyathiform; the disk coloured differently from the thallus. Spores sub-ellipsoid, simple, colourless. Spermatia oblong, or staff-shaped, thickened either at one, or both ends, or cylindrical; upon sparingly branched sterigmas. Thallus fruticulose, at length often pendulous; angulose-teretish or foliaceous-compressed; softish; glaucous, straw-coloured, or lemon coloured; the medullary layer cottony; or, the filaments now coalescing, and finally solid.——Anatomy of the thallus in Schwend. *Untersuch, l. c.* 2, *p.* 157, *t.* 4, *fig.* 13–15, *t.* 5, *f.* 1–6.

* *Medullary layer solid.*

1. *E. Trulla* (Ach.) Mont.; thallus tufted, membranaceous, prostrate and assurgent, dichotomously linear-laciniate, channelled, naked on both sides; greenish-glancescent above; pale-brownish and violaceous-black beneath; 'apothecia marginal, ample, cyathiform, wrinkled and plaited; the concave disk brown. Spores ellipsoid, $\frac{11\text{-}16}{7\text{-}9}$ mic.'——*Mont. Chil. p.* 74. *Parmelia, Ach. Meth. p.* 256, *t.* 4, *f.* 6; *L. U. p.* 496. *Parmelia (Evernia) denudata, Hampe in Linnæa*, 1843, *p.* 122. *Everniopsis Trulla, Nyl. Syn. p.* 374.

On the earth? Central and South America. Mexico, *Nylander.*——Perhaps best comparable with *E. furfuracea*, the structural thalline difference of which may possibly be regarded as mediated by the next species.

** *Medullary layer cottony; but coalescent, more or less, into solid cords.*

2. *E. vulpina* (L.) Ach.; thallus tufted, erect, angulous-teretish or here and there compressed, lacunose, dichotomously

much- and at length long- and divaricately branched, and subpendulous, with attenuate tips; lemon-coloured; the base at length dilated and rigid; apothecia sub-terminal, ample, appendiculate, at length much dilated; disk chestnut; margin entire, or most commonly radiate. Spores short-ellipsoid, $\frac{5-8\frac{1}{2}}{4\frac{1}{2}-5\frac{1}{2}}$ mic. Spermatia oblong, scarcely thickened a little, towards one end. ——*Ach. L. U. p.* 443. *Fr. L. E. p.* 23. *Tuck. Exs.* 53. *Chlorea, Nyl. Syn.* 1, *p.* 274.

Trees, and also on fences. Pacific coast (*Menzies*), Tuckerm. Syn. 1848. Rocky Mountains, reaching 10,000 feet of altitude; and observed (infertile) in the Black Hills, Nebraska, *Dr. Hayden.*

* * *Medullary layer entirely cottony.*

3. *E. furfuracea* (L.) Mann; thallus tufted, erectish, or prostrate and pendulous, compressed, sub-foliaceous, dichotomously very much- and somewhat pinnately- and finally long-lobed; glaucous above and beset mostly with isidioid tubercles passing into branchlets; below channelled and lacunose, pale, or here and there black-spotted, or now mostly black; apothecia marginal, ample to large, sub-pedicellate; chestnut. Spores short-ellipsoid, $\frac{5\frac{1}{2}-8}{3\frac{1}{2}-5}$ mic. Spermatia a little thickened toward both of the acutish ends.——*Fr. L. E. p.* 26. *Tuck. Exs. n.* 55. *Nyl. Syn.* 1, *p.* 284.

b. Cladonia, Tuckerm.; smooth, very slender, the branches compressed-terete above, but becoming channelled below, more or less thyrsoid-entangled.——*Syn. N. Eng. p.* 12; *Exs. n.* 56.

Trees, Northern States; *Halsey* View, 1823. Southward, in the mountains, *Curtis; Ravenel.* Texas, *Dr. Parry.* New Mexico, *Fendler.* Mexico, *Nylander.* Our lichen scarcely ever as wide-lobed as it occurs not uncommonly in Europe; and it is possibly also less blackened beneath.——*b*, on high mountains. White Mountains, *Tuckerman.* Mt. Whiteface, N. Y., *C. H. Peck.* The fruticulose type is sufficiently marked in this mountain form, which offers now scarcely a trace of difference in the two surfaces of the thallus; but finally agrees with *a* in everything but size, and the isidioid prolifications.

4. *E. prunastri* (L.) Ach.; thallus tufted, erectish, or pendulous, angulous-teretish, or flattened, and finally channelled below, lacunose, dichotomously very much- or at length divaricately-long-branched, more or less sorediate; pale-greenish, or straw-

coloured, the wide-lobed states paler beneath; apothecia lateral, middling-sized, sub-pedicellate; disk chestnut. Spores ellipsoid, $\frac{5-7}{3\frac{1}{2}-4\frac{1}{2}}$ mic.——*Ach. L. U. p.* 442. *Fr. L. E. p.* 25. *Tuck. Exs. n.* 54. *Nyl. Syn.* 1, *p.* 285.

Trees, fertile; and on dead wood, sterile; Northern States, *Muhlenberg Catal.* 1818. Arctic America, *Richardson.* Pacific Coast, *Menzies.* Black Hills, Nebraska, *Dr. Hayden.*——Spermatia of the present and next following species similar to those of the last. *Nyl.*

5. *E. divaricata* (L.) Ach.; thallus prostrate, or pendulous, teretish or more often somewhat compressed and angulate, lacunose-rugose, flaccid; pale-straw-coloured; the much elongated, dichotomously more or less divided branches passing into filiform, acute tips; apothecia lateral, middling-sized; disk chestnut. Spores ellipsoid, much as in the last.——*Ach. L. U. p.* 441. *Fr. L. E. p.* 25. *Nyl. Syn.* 1, *p.* 285.

Trees (branches of pines and firs), infertile, Rocky Mountains (*Hall*), Tuckerman Calif. 1866. Mountains of Colorado, *G. Vasey.* The thin cortical layer often breaking, and displaying the soft but yet string-like medullary, in the manner of *Usnea.*

V.—USNEA (Dill.) Ach.

Apothecia orbicular, peltate, sub-terminal; disk pale, or very rarely blackening; margin radiately fibrillose. Spores sub-ellipsoid, simple, colourless. Spermatia oblong, and staff-shaped, a little thickened towards the base; on sub-simple sterigmas. Thallus fruticulose, or more commonly pendulous, more or less terete, or now angulate, alike on all sides; glaucescent, or rarely straw-coloured; the medullary layer two-fold; an exterior, cottony portion enclosing an interior, indurated cord.——Anatomy of the thallus (of the second section) in Schwend. *Untersuch. l. c.* 2, *pp.* 110–144, *t.* 1, 2.

* *Medullary cord at length discontinuous and cottony at the centre; especially below. Disk of apothecium black.*

1. *U. sulphurea* (Müll.) Th. Fr.; thallus tufted, erect, terete, dichotomously branched, papillate-scabrous, deeply pitted with

age; pale yellow and becoming darker, the more or less attenuate tips blackening, or black-vittate; apothecia, in South American specimens, sub-terminal, appendiculate; disk black; fibres of the margin commonly obsolete. Spores rounded-ellipsoid, $\frac{7-13}{5-8}$ mic.——*Th. Fr. Lich. Spitsb. p.* 9. *U. melaxantha, Ach. L. U. p.* 618. *Neuropogon, Nyl. Syn.* 1, *p.* 272. *Usnea sphacelata, R. Br.*

Rocks, Arctic America; dwarfed, and sterile. Melville Island (Parry's 2d Voy.), *R. Brown*, 1824; *Babington*. Greenland, *J. Vahl.* The modification of the medullary cord is now marked in the luxuriant austral lichen; but scarcely to be detected in the Arctic specimens, whether American or European.

* * *Medullary cord continuous. Disk of apothecium pale.*

2. *U. barbata* (L.) Fr.; thallus terete, papillate-scabrous glaucescent. Spores rounded-ellipsoid, $\frac{5-9}{4-6}$ mic.——*Fr. L. E. p.* 18. *Schær. Spicil. p.* 504. *Nyl. Syn.* 1, *p.* 267.

a. florida, Fr.; thallus tufted, erect, stout and rigid, divaricately branched, more or less strigose-fibrillose; apothecia (abundant) middling to large, pale-flesh-coloured, with now a white bloom.

* *hirta*, Fr.; very minutely more or less fibrillose, and besprinkled thickly with soredia.

* * *rubiginea*, Michx.; similar to the last, but rusty-red.

b. ceratina, Schær.; thallus as in *a*, but pendulous and finally much elongated; the apothecia middling to large, rarer in extreme (mountain) forms, which pass into *c*.

c. dasypoga, Fr.; thallus pendulous, slender and rather lax, much-elongated; rather sparingly divided, the branches beset with spreading fibrils; apothecia smaller, and less frequent.

d. plicata, Fr.; thallus pendulous and much elongated, slender and lax, sub-dichotomously divided, pale, the branches without spreading fibrils; apothecia smaller and less frequent.

e. articulata, Ach.; thallus pendulous, broken more or less into joints, and the joints inflated; apothecia not seen.

Very common on trees, and (mostly degenerate) on dead wood, and stones, throughout the United States and Canada (*Muhlenberg Catal.* 1818), and far northward (*Richardson*); *a*,

and its subordinate conditions, and *b*, being low-country forms, extending through the whole north and south, including Mexico; and *c*, and *d*, especially northern, or at least mountain ones; *e* is ill-exhibited in North America; but is not wholly wanting on the Pacific Coast; *Scouler; Macoun.*

3. *U. angulata*, Ach.; thallus pendulous, greatly elongated, rather rigid, angulate, sparingly divided, thickly clothed with horizontal, terete, attenuate fibrils; glaucescent; apothecia, of ours smallish, but of Brazilian specimens ample; pale-flesh-coloured, with a white bloom. Spores rounded-ellipsoid, $\frac{5-8}{4\frac{1}{2}-5\frac{1}{2}}$ mic.——*Ach. Syn. p.* 307. *Hals. Syn. View. p.* 21. *Tuck. Exs.* 51. *Nyl. Syn.* 1, *p.* 272.

Trees, northern States (*Muhlenberg*) Ach. *Syn.* 1814; southern States, *Ravenel; Wright;* and found in the greatest luxuriance in Mexico, the West Indies, and South America. Thallus sharply- often four-angled; but occurring also in part papillate-scabrous, and the angles less distinct, when the lichen comes very close to *U. barbata.*

4. *U. trichodea*, Ach.; thallus pendulous, elongated, slender, or very slender, and lax, terete, smooth; glaucescent, the mostly few, main branches giving out many shorter, spreading ones, and with the scattered and irregular flexuous fibrils becoming more or less contorted; apothecia (frequent) small, or very small; disk pale-flesh-coloured; margin sparingly, or scarcely radiate. Spores much as in *U. barbata*, or a little smaller, $\frac{4-8}{3\frac{1}{2}-5\frac{1}{2}}$ mic.; and the most slender southern forms agreeing in this with the northern. A rather coarser, very abundant southern form offers larger spores, $\frac{5-11\frac{1}{2}}{4\frac{1}{2}-7}$ mic.——*Ach. Meth. p.* 312. *Tuckerm. Syn. N. Eng. p.* 8.

Trees, Nova Scotia (*Menzies*) Ach. *Meth.* 1803. White Mountains, *Tuckerman.* New Jersey, *Austin.* Throughout the Southern States, *Schweinitz; Hale; Wright.* The very slender northern lichen of Menzies! which Acharius originally described, is also an inhabitant of the Southern States (Texas, *Wright*), but passes into a coarser one with the flexuous fibrils much more numerous and marked (*U. discoidea, Fr. herb! U. trichodea, v. ciliata*, Müll. *Lich. Beitr.* in *Flora*, 1875), and the aspect of *U. longissima;* for which last it has often been taken, both here and in Europe. This larger form has also passed, in

Europe, for *U. barbata, v. dasypoga;* as the smaller has been saluted as *U. filaris*, Ach., and *U. Jamaicensis*, Ach.

5. *U. longissima*, Ach.; thallus pendulous, greatly elongated, terete, or compressed-terete, scurfy; glaucescent; sub-simple or sparingly divided, clothed thickly with horizontal, rather straight, more or less scabrous fibrils; [apothecia, in Bavarian specimens, of middling size, disk pale-flesh-coloured. Spores ellipsoid, $\frac{7-10}{4\frac{1}{2}-6}$ mic.]——*Ach. L. U. p.* 626. *Tuck. Exs.* 1. *Nyl Syn.* 1, *p.* 270.

Trees on high mountains; New England, *Tuckerman Enum.* 1845. Newfoundland, *Herb. Hook.* North shore of Lake Superior, *Agassiz.* Washington Territory, *Herb. Torr.* Russian America, *Dr. Kellogg.*

6. *U. cavernosa*, Tuckerm.; thallus pendulous, elongated, compressed-terete or angulate, lacunose, glaucescent; below remotely branched, attenuated above into long, dichotomously much-divided, densely intertangled, finally capillary extremities, scarcely fibrillose; apothecia small to middling sized; disk pale-flesh-coloured, with a white bloom. Spores rounded-ellipsoid, $\frac{5-10}{4\frac{1}{2}-7}$ mic.——*Tuckerm. in Agass. L. Super. Append.* 1850. *U. lacunosa (Willd. msc.) Nyl. Syn.* 1, *p.* 271.

Trees; Shores of Lake Superior (*Castelnau* in *Mus. Par.*), Tuckerman l. c. 1850. Rocky Mountains, *Hayden.* British Columbia, *Dr. Lyall.* White Mountains.——Well distinguished in habit from our other species; and resembling *Alectoria ochroleuca, v. sarmentosa.*

VI.—ALECTORIA (Ach.) Nyl.

Apothecia scutellæform, lateral, innate-sessile; the disk coloured differently from the thallus. Spores ellipsoid, for the most part simple or, in one instance, muriform-multilocular, brown, or more often decolorate. Spermatia staff-shaped, a little thickened towards each end; upon sparingly branched sterigmas. Thallus fruticulose, or pendulous; terete or compressed-terete; alike on all sides; brown or straw-coloured; the cottony medullary layer loose, and the thallus now hollow.——Anatomy of the thallus in Schwend. *Undersuch. l. c.* 2, *p.* 144, *t.* 3, *f.* 1–29.

1. *A. divergens* (Ach.) Nyl.; thallus tufted, erect, or pros-

trate, robust, rigid, fragile, compressed-terete; chestnut, and blackening, and mostly shining; dichotomously much-branched, the branches divergent and at length flexuous, and the tips forked; "apothecia of middling size; chestnut; the margin at length crenulate-uneven. Spores ellipsoid, without colour, $\frac{8-10}{4\frac{1}{2}-5\frac{1}{2}}$ mic."——*Nyl. Syn.* 1, *p.* 278 (*char. fruct. excl.*) *& in Prodr. Fl. Nov. Gran. p.* 14, *not. Cornicularia*, *Ach. Syn. p.* 300.

On the earth in alpine, and arctic regions; known fertile only from Northeastern Asia (*Nyl.*), Arctic America (*Richardson*) Hooker *l. c.* 1823. Greenland, *Vahl.* Islands of Behring's Straits, *Wright.* Kotzebue's Sound, *Herb. Church. Babington.*

2. *A. jubata* (L.); thallus tufted, or pendulous, slender and soon filiform, terete, smooth; blackish-brown, or now paler; dichotomously very-much-branched; apothecia (small, and rare) very entire. Spores rounded-ellipsoid, without colour, $\frac{5-9}{4-7}$ mic. ——*Evernia*, *Fr. L. E. p.* 20.

a. bicolor, Fr.; thallus erect, or prostrate, and now pendulous, rather rigid, densely-branched, the branches divergent and more or less fibrillose-ramulose; black below, and paler at the ends.

b. chalybeiformis, Ach.; thallus prostrate and sarmentose, or now sub-pendulous, rather rigid, remotely divergent-branched, flexuous; brown; the branches somewhat fibrillose-ramulose, of one colour.

c. implexa, Fr.; thallus pendulous, elongated, softish, filiform becoming capillary, very much branched and densely intertangled; brown, the branches of one colour.

Throughout North America; at least in mountainous regions. ——*a*, on the earth in alpine districts; and, more developed, becoming pendulous, and fertile, on firs in the higher forest of the White Mountains, *Tuckerman* Lich. N. E. 1841; *Lich. Exs. n.* 2. Greenland, *J. Vahl.*——*b*, on the earth in alpine districts; Greenland, *J. Vahl;* and White Mountains, fertile, *Lesquereux;* as also on branches of firs in cold swamps, where equally fertile; and very common in a sterile state, on dead wood, throughout the Northern States, and along the mountains southward and westward, *Muhlenberg Catal.* 1818 (this low-country lichen being ill-distinguishable from *Alectoria nidulifera*, Norrl. *Lich. Fenn. n.* 15).——*c*, on trees, Northern States and Canada, fertile on mountains, *Michaux* (*Setaria trichodes*), *Flora Bor. Amer.* 1803. Rocky-Mountains, *Hall.* Arctic America, *Richardson.*

3. *A. Fremontii*, Tuckerm.; thallus pendulous, elongated, compressed-terete, smooth; brown; irregularly and remotely much-branched, the flexuous branches more or less dilated and lacunose below, and passing above into long-attenuated, capillary, finally densely intertangled summits; apothecia smallish to middling sized; disk yellow-pruinose, soon convex, and the thin, entire margin disappearing. Spores rounded-ellipsoid, without colour, $\frac{4\frac{1}{2}-8}{4-5}$ mic.——*Tuckerm. Suppl.* 1, *l. c. p.* 422; *Exs. n.* 52. *Nyl. Syn.* 1, *p.* 280.

On the branches of coniferous trees, in California (*Fremont*) Tuckerman l. c. 1858. Oregon, *Prof. Newberry.*——The lichen was first found (in 'British North America') by *Drummond Herb. Tayl.*).

4. *A. ochroleuca* (Ehrh.) Nyl.; thallus compressed-terete, divaricately branched; straw-coloured. Spores in twos and fours, ellipsoid, brown, $\frac{18-43}{13-24}$ mic.——*Nyl. Syn.* 1, *p.* 281. *Evernia, Fr. L. E. p.* 22.

a. rigida, Fr.; thallus tufted, erect, rigid, finally much-branched, the attenuate, much-divided, reflexed summits blackening; apothecia sub-terminal, middling-sized.

* *osteina*, Nyl., thallus (prostrate) smaller and paler; apothecia lateral.

** *nigricans*, Ach.; the whole thallus more or less at length livid, and blackening.——*A. nigricans*, *Nyl. Lich. Scand. p.* 71. *Th. Fr. Lich. Scand. p.* 22.

b. cincinnata, Fr.; thallus prostrate, sarmentose, rigid; the here and there irregularly dilated and flattened branches lacunose, and the long-attenuated summits mostly of the same colour; apothecia as in *a*.

c. sarmentosa, Nyl.; thallus sarmentose-pendulous, much-elongated, softish; below remotely branched, attenuated above into long, much-divided, densely intertangled, finally capillary extremities of the same colour; apothecia smallish to middling.

Arctic and alpine, mostly, except *c*, which inhabits high mountain forests.——*a*, on the earth, Arctic America, fertile *Richardson*), Hooker *l. c.* 1823. Newfoundland, *Despreaux.* Vancouver's Island, fertile, *Herb. Hook.* Peak of Orizaba, Mexico, *Nylander Syn.*——* On the earth, high mountains of Mexico,

Herb. Hook.——**On the earth, fertile, Labrador, *Th. Fries Scand.* 1871. Newfoundland, fertile (the spores exactly as in *a*), *Despreaux.*——*b*, on the earth, fertile, Newfoundland; *Despreaux.* White Mountains, *Tuckerman.*——*c*, on Coniferous trees, White Mountains, sparingly fertile, *Tuckerman* Syn. 1848. Newfoundland, *Despreaux.* Oregon, Washington Territory, and northward, fertile, *Prof. Newberry*, etc.

5. *A. Loxensis* (Fée) Nyl.; thallus erect or prostrate, terete, slender, very much branched and intertangled, the branches and branchlets divergent, here and there foraminous; pale- to chestnut-brown (or now whitened or blackened); apothecia lateral, middling-sized; disk dark-chestnut, flat. Spores solitary, muriform-multilocular, brown, '$\frac{80\text{-}105}{28\text{-}45}$ mic.'——*Nyl. Syn. p.* 278.

On the earth, and on trunks, in the high mountains of equinoctial America. Peak of Orizaba, Mexico, *C. Mohr.*

VII.—SCHIZOPELTE, Th. Fr.

Apothecia terminal, flabelliform; the disk coloured differently from the thallus; the hypothecium black. Spores plurilocular, brown. Thallus fruticulose, terete, solid; the medullary layer loosely cottony.——The thin cortical layer contrasts with the very marked one of *Roccella;* as does the brittleness of the lichen with the leathery toughness of the latter.

S. Californica, Th. Fr.; thallus tufted, stout but brittle, sparingly and irregularly branched, or sub-simple, from smooth becoming rugulose; ashy-white, dull; apothecia from middling-sized, soon large, fan-shaped; crenate and lobed; disk black, thinly white-pruinose. Spores in eights, oblong and finger-shaped, from 4- more commonly 5-7-locular, blackish-brown, $\frac{18\text{-}24}{5\text{-}8}$ mic.——*Flora*, 1875, *p.* 143.

On the earth, coast of California, *Dr. T. H. Fries*, *l. c.*

Fam. 2.—PARMELIEI.

Thallus horizontal, foliaceous, expanded (rarely ascendant and Everniæform, very rarely Alectoriæform) cartilagineous-membranaceous; beneath, normally, fibrillose.

Instead of the normally vertical, passing then into elongated and pendulous forms, of the first family, we have here normally horizontal, and leaf-like lichens. But we found the former becoming dilated and sub-foliaceous, especially in the more central groups, and finally depressed; and these central groups of *Usnei* may be said to expand now into the new family before us. Its near neighbourhood to the preceding is evinced still further by ascendant forms already alluded to, which, taken without regard to their whole history, might well pass for members of the *Usneei*.——*Speerschneidera*, though sufficiently recedent in its in fact fruticulose thallus, the under surface of which differs only in colour from the upper, has yet clearly the horizontal vegetation, and habit.——*Theloschistes* may be said to combine, in one most natural group, the habit, now of *Ramalina*, and now of *Evernia*, with that of *Parmelia*.——The genus last-named is the centre and type of the *Parmeliei;* but it displays also, as does *Physcia*, in occasional but striking forms, the same tendency to revert to ascendant and Evernioid conditions. ——*Pyxine* is a small cluster of strictly foliaceous lichens, differenced from *Physcia* by the fruit-character.

From the point of view of the spores, the centre of the *Parmeliei* is seen to be *Parmelia*, of the Colourless Series; filling here the place which is occupied by four genera in the *Usneei*, and offering analogues, we had almost said, to each. From *Parmelia* deviates *Theloschistes*, of the same series, the analogue of *Ramalina;* while a still greater divergence in the same direction is exemplified in *Speerschneidera*, which it seems possible to consider as in like relation to *Roccella*. In the Brown Series, on the other hand, the place corresponding to *Theloschistes* is taken by *Physcia*, the analogue here of *Alectoria* in the *Usneei;* and finally by *Pyxine*, an extreme and aberrant type, anticipating, as respects the fruit, the similarly exceptional, next succeeding family. *Genera p.* 17.

VIII.—SPEERSCHNEIDERA, Trev.

Apothecia scutellæform. Spores from ellipsoid becoming oblong and dactyloid; 2-4-locular; colourless. Spermatia oblong; on sparingly articulate sterigmas. Thallus orbicular, depressed-fruticulose, terete, dichotomously many-cleft, cartilagineous-coriaceous; fibrils deficient on the under side.

S. euploca (Tuckerm.) Trev.; thallus smooth but dull, fuscescent, or now whitening above; beneath white; the regularly very much divided, filiform branches scarcely a little compressed, intricately interlacing; apothecia small, scattered, sessile; the flat, rufous-fuscous disk finally convex, and excluding the mostly entire margin. Spores, $\frac{9\text{-}15}{3\text{-}5}$ mic.——*Physcia, Tuckerm. Suppl.* 1, *l. c. p.* 424. *Obs. Lich. l. c.* 4, *p.* 388. *Nyl. Syn.* 1, *p.* 413.

Shaded rocks on the banks of streams, in Western Texas (*Wright*) Tuckerman *l. c.* 1858. On calcareous rocks in Kansas, *Hall.*——More appressed, and much more regularly limited than *Parmelia lanata* (L.) Wallr.; and it is perhaps easier, on most accounts, to refer the Texan plant to *Physcia*, than the other to *Parmelia*. But we cannot overlook the fact that the spores of our Texan lichen are irreconcilable with those of *Physcia;* as the whole plant is with *Theloschistes.*

IX.—THELOSCHISTES, Norm., Emend.

Apothecia scutellæform, the disk yellow. Spores ellipsoid, polar-bilocular (the spore-cells occupying the tips of the spore and conjoined more or less by a tube) or (n. 3) simply bilocular; or simple; colourless. Spermatia ellipsoid, and oblong; on multi-articulate sterigmas. Thallus foliaceous; or now reduced and squamulose; appressed; or now ascendant and Everniæform; cartilagineous-membranaceous, mostly yellowish.——A well-defined group, offering difficulties only in its relation to *Placodium* in *Lecanorei;* from which it is yet distinguished exactly as *Lecanora* from *Parmelia.* The anatomy of the thallus is explained in Schwend. *Untersuch. l. c.* 2, *p.* 157, 161, *t.* 4, *f.* 16–17; 3, *p.* 154, 160, *t.* 8, *f.* 10–12. It is observable that the considerable anatomical differences between the Everniæform and the foliaceous types of *Theloschistes* (differences soon to recur again in *Physcia*) are insufficient to obscure the naturalness of their association as members of the same genus.

* *Thallus ascendant; the cortical layer not parenchymatous; the medullary in part now coalescing into solid cords.*

1. *T. chrysophthalmus* (L.) Norm.; thallus tufted, erectish or spreading, or at length pendulous, sub-cartilagineous, more or

less yellow; the narrow-linear, dichotomously divided branches smooth, or now puberulent, and terminating, for the most part, in fibrillose-ramulose tips; apothecia scattered; disk orange; margin often radiately fibrillose. Spores ellipsoid, $\frac{11\text{-}18}{5\text{-}8}$ mic.——*Parmelia, Eschw. in Mart. Fl. Bras. p.* 223. *Physcia, Tuckerm. Obs. Lich. l. c.* 4, *p.* 384.

—*a.* erectish, much compressed, rather sparingly divided, the many-cleft tips ciliate-fibrillose; from glaucescent-whitish with yellow fibrils becoming yellow throughout above, when the under side continues often whitish; smooth; apothecia sub-terminal, middling-sized to largish, commonly radiate.——*Parmelia chrysophthalma, Ach. Meth. p.* 267. *Tuck. Lich. exs. n.* 80. *Physcia, Nyl. Syn.* 1, *p.* 410 *(v. pubera & Capensi excl.).*

b. flavicans, Wallr.; spreading, and becoming elongated and pendulous; teretish, or compressed-terete, and now somewhat channelled; divaricately much-branched; yellow, or now whitening; smooth, or often puberulent; apothecia smallish, scattered, the marginal fibres mostly deficient.——*Evernia flavicans, Fr. L. E. p.* 28. *Physcia. Nyl. Syn.* 1, *p.* 406. *Borrera flavicans, Capensis, & pubera, Ach. L. U. p.* 502.

Trees.——*a.* Northern and middle States (*Muhlenberg*), Jacq. *Coll.* 1786. Minnesota, *I. A. Lapham.* Louisiana, *Hale.* Texas, *Wright.* Rocky Mountains, *Hall.* California, *Bolander.* ——*b.* Southern States, fertile. South Carolina (*Bosc*), Michaux *Fl.* 1803, to Texas, *Wright.* California, *Herb. Gray.* Mexico, *Nylander.* Occurring also, sterile and sorediiferous, northward, along the coast. Nantucket, *Tuckerman.* And even Newfoundland (*Nyl.*). This extended form (*b*) offers no satisfactory differences to separate it from the other. Nor are its puberulent conditions otherwise distinguishable from the smooth ones.

** *Thallus foliaceous, appressed (rarely ascendant and at length teretish), the cortical layer parenchymatous throughout.*

2. *T. parietinus* (L.) Norm.; thallus foliaceous, membranaceous, orbicular, from pale- at length bright-yellow, and orange; the appressed, radiant, crenate, often plaited lobes for the most part dilated and rounded above; apothecia middling-sized, mostly orange, with an entire, at length flexuous border. Spores ellipsoid, $\frac{14\text{-}18}{7\text{-}10}$ mic.——*Parmelia, Fr. L. E. p.* 72, *a. Tuck. Lich.*

exs. n. 79. *Physcia, Nyl. Syn.* 1, *p.* 410, *a. Xanthoria, Th. Fr. Scand. p.* 145.

On trunks and stones near large bodies of water. Newfoundland, *Pylaie*, 1826. New England, and New York, common. Shores of Lake Superior, *Agassiz.* San Diego, California, *Dr. J. G. Cooper.*

2(*a*). *T. polycarpus* (Ehrh.); thallus reduced, sub-orbicular, now sub-stellate, but typically conglomerate, and complicate; the much narrowed divisions many-cleft, concealed for the most part by the very numerous smallish, sub-crenulate apothecia. Spores as in the last.——*Parmelia parietina, f., Fr. L. E. p.* 73. *Physcia, Tuck. Obs. Lich.* 1, *l. c. p.* 385. *Physcia parietina, var.* 3, *Nyl. Syn.* 1, *p.* 410. *Xanthoria lychnea, β, Th. Fr. Scand. p.* 146.

On trees and dead wood, in the northern and western States, very common, *Halsey* (*Parm. rutilans*) View, 1823. British America, *Richardson.* Alabama, *T. M. Peters.* Rocky Mountains, *Dr. Hayden.* Santa Fe, *Fendler.* California, *Wright.*—— The North American lichen commonly larger than the European, and on the under side rather conspicuously, and now even marginally fibrillose; but not otherwise really differing, even in the widest lobed, sub-stellate Californian state.——Nylander (*Scand.* p. 108) remarks that a Scandinavian form of *T. lychneus* on dead wood, seems sometimes to pass into the present; and Dr. Th. Fries (*Scand.* p. 147) indicates Stenh. *Lich. exs.* n. 127, B, as an instance of such transition. But I am unable to see anything in the specimen just-cited, or in others exactly similar from California (*Bolander*) but the present sub-species; which, however nearly approaching the narrower states of *T. parietinus*, it is perhaps more natural to keep apart from it.

2(*b*). *T. lychneus* (Nyl.); thallus reduced, sub-orbicular, sub-stellate, or effuse, varying in colour as the preceding; the linear, many-cleft divisions at length more or less ascendant and granulose or powdery at the margins; apothecia rather infrequent, smallish, margin entire or granulate. Spores as in *T. parietinus.* ——*Physcia parietina, v. lychnea, Schær., Tuckerm. Obs. Lich.* 1, *l. c. p.* 386. *Physcia lychnea, Nyl. Scand. p.* 107. *P. controversa, Mass., Koerb. Parerg. p.* 38. *Xanthoria lychnea, a, in part, Th. Fr. Scand. p.* 146.

On trees, and stones; occurring in a wider, regularly laciniate form fully represented by German and Italian specimens (as *Massal.* n. 36) but, like the American *T. polycarpus*, yet better developed, and found from the coast of New England, *Tuckerman l. c.* 1860, to Wisconsin, *Lapham;* and, still more commonly, in a narrow, and much dissected state (f. *laciniosa*, Schær. *Helv.* n. 381) which occurs throughout the United States, from New England, *J. L. Russell*, to South Carolina, *Ravenel*, Texas, *Wright*, and California, *Bolander*. This last form assumes the characters of the present, but in most respects it is now fully associable with stellate conditions of *T. polycarpus*, and may be said to connect the two.

b. pygmæus, Fr.; sub-orbicular and pulvinate, or effuse; fulvous or orange; the minute, irregularly cleft divisions thickened and becoming erect and more or less terete-branched above, the tips and margins at length granulose; apothecia smallish, orange, with an entire or granulate margin. Spores as in *T. parietinus.*——*Parmelia parietina*, *v.* pygmæa, Fr., *L. E.* p. 73. Physcia pariet. v. Finmarkica (Ach.), Tuckerm. l. c.

On rocks, Islands of Behring's Straits (*Wright*), Tuckerman *l. c.* 1860. Alaska, *Dr. Kellogg*. Coast of California, *Bolander*.

2(*c*). *T. ramulosus*, Tuckerm.; thallus effuse, pale-yellow; made up of minute, scattered, sparingly divided, semi-terete lobules, which are decumbent, and at length sub-imbricate; apothecia minute, entire, of the same colour. Spores as in *T. parietinus.*——Physcia parietina, v. ramulosa, *Obs. Lich.* 1, *l. c. p.* 385.

On bushes, coast of California (*Wright*), Tuckerman *l. c.* 1860: Best comparable in habit, and the colours, with *T. concolor;* but diverse in the spores. Too little as yet known.

3. *T. concolor* (Dicks.); thallus foliaceous, orbicular, greenish-yellow, or now ash-coloured; the very narrow divisions lacero-laciniate and now much dissected; pale, and becoming densely fibrillose on the under side; apothecia small, wax-yellow, becoming fulvous and rufous, with a mostly entire margin, more or less fibrillose beneath. Spores numerous (20-60) in the thekes, simple or imperfectly bilocular, $\frac{4\frac{1}{2}\text{-}12}{3\text{-}5\frac{1}{2}}$mic.——*Physcia candelaria*, *Nyl. Prodr. Gall. p.* 60; *Syn.* 1, *p.* 412; *and in Lindig Herb. N. Gran. n.* 2600. *Tuckerm. Obs. Lich. l. c.* 4, *p.* 387. *Parmelia fibrosa*, *Fr. S. O. V. p.* 284. *Tuck. Lich. exs. n.* 88.

b. effuse, squamulose; the crowded squamules granulose at the margin, and passing now into a powdery crust.——*Lichen concolor, Dicks. Pl. Crypt. Brit.* 2, *p.* 18, *t.* 9, *f.* 8. *Xanthoria, Th. Fr. Lich. Scand. p.* 147. *Lecanora candelaria, a, Ach. Syn. p.* 192. *Candelaria vulgaris, Mass.; Koerb. Syst. p.* 120.

On trees; and now also on rocks; common throughout the northern States (*Muhlenberg*, in Hoffm. *D. Fl.*, 1796; where the plant finds a place under the well-described *Lichen candelaris;* as it does also under his *Lecanora candelaria, a, in herb.* Ach., *fide* Th. Fr.) and found equally through the southern (*Dr. Curtis*, etc.) to Texas (*Wright*) and as well in South America (*Lindig l. c.*)——*b*, has the same range; extending southward to Louisiana (*Hale*) and found also in the island of Cuba (*Wright Lich. Cub. n.* 79). This reduced form is certainly undistinguishable in species from our *a;* and it does not appear to differ at all from the commonly published states of the European lichen: which compares with ours then much as the European *T. polycarpus* and *T. lychneus* with the more luxuriant American. The exuberant development of fibrils is at length marked in *a;* and suggests readily a comparison with some, in other respects often well comparable forms, of our *Physcia obscura*. Though perhaps less to be expected in *b*, it is probable that the fibrils of the receptacle are not always wholly deficient even in this; and something like indications of them may be made out in Anz. *Lich. Ital. Sup. n.* 131, if not also in *Moug. & Nestl. n.* 743, *a*.

X.—PARMELIA (Ach.) De Not.

Apothecia scutellæform, sub-pedicellate; the disk mostly thin; the hypothecium colourless. Spores ovoid, ellipsoid, or oblong, simple, colourless. Spermatia oblong, constricted at the middle and with mostly acute tips, or, rarely (n. 18), needle-shaped and bowed; upon sparingly branched, or now sub-simple sterigmas. Thallus imbricate-foliaceous, lobate-laciniate, appressed (rarely ascendant and Everniæform, very rarely filiform and Alectorioid) sub-membranaceous; more or less densely, or now sparingly fibrillose, or rarely naked, beneath.——Anatomy of the thallus given in Schwendener *l. c.* 3, *p.* 157.

* *Thallus glaucescent* (*varying also, rarely, to brown, or even yellowish*).

a. Stock of P. perlata.

1. *P. perlata* (L.) Ach.; thallus at length much dilated, membranaceous, smooth, greenish-glaucescent; beneath black with brown margins, rather obsoletely black-fibrillose, or largely naked and very smooth; lobes ample, a little ascending, rounded, the undulate margins not ciliate, but often white-sorediate; apothecia (infrequent) ample to large; disk chestnut; margin entire. Spores ellipsoid, $\frac{10\text{-}17}{6\text{-}9}$ mic.——*Ach. L. U. p.* 459. *Fr. L. E. p.* 59. *Tuck. Lich. exs. n.* 15. *Nyl. Syn.* 1, *p.* 379.

Rocks, especially in the mountains of the northern States; and also on trunks; *Halsey* View, 1823. Lake Superior, *Agassiz.*

1(*b*). *P. flavicans*, Tuckerm. herb.; thallus ample, with the texture of the last, pale-yellow, mostly naked beneath; lobes sinuately lobulate, more or less sorediiferous, with naked edges; apothecia ample, much as in the last. Spores also similar, but $\frac{16\text{-}23}{9\text{-}12}$ mic.——*P. perlata, v. flavicans, Lich. Calif. p.* 13.

Rocks, coast of California, *Bolander.* No reactions with chloride of lime or potash, observed.

1(*c*). *P. latissima*, Fée; very much dilated, smooth, whitish-glaucescent, for the most part wholly glabrous and shining beneath; lobes rounded, the wavy margins naked, or now sorediiferous; apothecia, in West Indian and South American specimens, much as in *P. perlata*, but the spores much larger, reaching $\frac{23\text{-}34}{14\text{-}20}$ mic.——*Fée Suppl. p.* 119. *P. perlata, v. latissima, Mont. Cuba, p.* 231. *Nyl. Syn.* 1, *p.* 379. *P. glaberrima, Krempelh. in Flora*, 1869, *p.* 223.

Trees; tropical America; but found also, though only as yet infertile, in Texas, *Lindheimer;* Florida, *Chapman;* and South Carolina, *Ravenel.*

2. *P. perforata* (Jacq.) Ach.; thallus at length much dilated, coriaceous-membranaceous, smooth, glaucescent; beneath brownish-black, strongly but interruptedly black-fibrillose; the rounded lobes soon crenate, and cut, ciliate; apothecia (abundant) ample to very large, commonly perforate, cyathiform; disk chestnut; margin entire. Spores ellipsoid, $\frac{11\text{-}17}{5\text{-}9}$ mic.——*Ach. L. U. p.* 459. *Fr. L. E. p.* 58. *Tuck. Lich. exs. n.* 69. *Nyl. Syn.* 1, *p.* 377. *Lobaria sub-marginalis, Michx. Fl., fide* Müll.

* *hypotropa*, Nyl.; more or less largely pale or even white beneath; the lobes finally divided as in *b*, often sorediiferous.—— *Syn.!* 1, *p.* 378.

Trees, and also (in mostly sterile states) on stones, common; very luxuriant and fertile on the eastern Coast, the apothecia exceeding at length an inch in diameter, and the lichen observed early. Virginia (*J. Mitchell*), Dillenius *Hist. Musc.* 1741. Pennsylvania, *J. Bartram.* Canada and Carolina, *Michaux.* Mexico, *Nylander.* Pacific Coast, *Menzies.*——* Texas (*Trecul*) and Mexico, Nylander, 1860. Louisiana, *Hale.* South Carolina, *Ravenel.* Ohio, *Lesquereux.* Wisconsin, *Lapham.*——Both Acharius, and Fries, laid stress on the lobes of this species being ciliate, and denied the character to *P. perlata;* a view which the evidence of the North American lichens appears certainly to confirm. And the sterile European lichens, of late years referred to a *P. perlata, v. ciliata* (*Herb.* Borr.; Zwackh *Exs.* n. 56; *Herb,* Koerb.; Anz. *Lich. Ital.*, n. 100, and even 101; Welwitsch *Cr. Lusit.* n. 77; as also *P. proboscidea*, Tayl., and *P. reticulata.* Tayl.) are, in fact, whether we regard the ultimate division of the summits of the lobes, or their hispid under side, quite as much at home in the present species.

2(*b*). *P. cetrata*, Ach.; thallus dilated, of the colour of the last, but rather thinner, smooth above; black and hispid beneath; the sinuate-laciniate lobes (now conspicuously sorediiferous at the margins) soon narrowed, and passing into more or less finger-shaped, at length prolonged and everniæform, scarcely ciliate lobules; apothecia and spores as in the last.——*Ach. Syn. p.* 198. *P. perforata, b, Fr. L. E. p.* 58. *Nyl. l. c.*

Trees, and also on stones, throughout our territory, *Acharius, Syn.* 1814; but reaching its perfection at the west (Illinois, *Hall;* Ohio, *Lesquereux*, etc.) and south (Carolina, *Schweinitz; Ravenel;* Louisiana, *Hale;* Texas, *Wright*).——*P. perforata* differs from *P. perlata* as well in its strongly fibrillose under side, as in the tendency of its normally ciliate lobes, to pass, at the margins, into smaller ones. This tendency becomes very marked in the present; and fragmentary specimens have been referred, in European herbaria, to *Evernia.*

2(*c*). P. *subrugata*, Krempelh.; thallus of the colour and texture of the last; 'black,' or now pale, and for the most part naked beneath; the lobes passing, as in the last, into smaller, convolute marginal ones, which are ciliate with strong fibrils; apothecia ample, cyathiform, strongly scrobiculate on the outside, the margin torn-crenuate, becoming lobulate. Spores, $\frac{30\text{-}40}{18\text{-}23}$ mic.——*Exot. Flecht. p.* 18.

Mexico, *C. Mohr.* Agreeing so well with the description of the Brazilian lichen in everything but the colour of the under side (which exactly resembles and suggests that of *P. perforata* * *hypotropa*) that I cannot but consider it the same. Its place appears however to be much less with *P. perlata* than with *P. perforata.*

2(*d*). *P. crinita*, Ach.; thallus dilated, of the colour of the last, coriaceous-membranaceous, beset densely with minute granules and branchlets (isidiophorous) beneath black and black-fibrillose; the rounded lobes ciliate; apothecia ample, cyathiform, commonly imperforate. Spores of the Northern lichen ellipsoid, $\frac{23-32}{10-18}$ mic.; of the Southern, $\frac{15-25}{8-11}$ mic.——*Syn. p.* 196. *Tuckerm. Syn. N. E. p.* 25. *P. perforata*, *var.*, *Fr. L. E. p.* 58.

Trees, and also rocks. New England and the northern States, *Muhlenberg* in Ach. *Syn.* 1814. South Carolina, *Ravenel.* Texas, *Wright.*——The southern plant (Wright *Lich. Cub. n.* 69) is perhaps more readily comparable with *P. perlata* than the northern lichen, but is differenced as well by the distinct fibrillose character of the under side, and the ciliate margin, as by the isidiophorous upper side.——*P. proboscidea*, Tayl.! (P. perlata, v. ciliata, Koerb.! as of Nylander *Syn.*) was referred (*e char.*) to *P. perforata* by Fries; and, I can entertain no doubt, correctly. It is sometimes well comparable with the present.

2(*e*). *P. sulphurata*, Nees & Flot.; like the southern *P. crinita*, as respects both upper and under sides, but from glaucescent passing soon into greenish-yellow above;

* white within; the apothecia not observed.——*P. chrysantha Tuck. herb.*

* * sulphur-coloured within; apothecia commonly imperforate. Spores ellipsoid, $\frac{18-25}{7-12}$ mic.——*P. sulphurata*, *Nees & Flot. Linnæa*, 1834, *p.* 501. *Tuckerm. in Wright Lich. Cub. n.* 72. *Nyl. Syn.* 1, *p.* 377.

Trunks; *, Blue Ridge in Virginia, *Tuckerman.* Mountains of Tennessee, *Prof. Shepard.* Louisiana, *Hale.*——* * South Carolina, *Dr. Mellichamp.* Louisiana, *Hale.* Texas, *Hall.*—— The specimens leave it scarcely doubtful that * is undistinguishable in species from * *; as it is also exceedingly near to *P. crinita.*

3. *P. lævigata* (Sm.) Nyl.; thallus more narrowed, membranaceous, smooth, glaucescent; beneath black, and more or less densely black-fibrillose; lobes sinuate-pinnatifid; the tips now sorediiferous; apothecia middling-sized; disk chestnut, with an entire, or at length toothed margin. Spores ellipsoid, $\frac{12\text{-}20}{7\text{-}9}$ mic. ——*Nyl. Syn. p.* 384. *P. sinuosa*, *Fr. L. E. p.* 63.

b. sinuosa, Nyl.; thallus pale-yellowish.——*P. sinuosa* (*Sm.*) *Ach.*, *teste Borr. P. relicina*, *β*, *Fr. L. E. p.* 70.

Trees, and rocks. *a*, Louisiana, *Hale.*——*b*, Nova Scotia, (*Menzies*) Ach. *Syn.* 1814. Mexico, *Nylander.*

The species is ill-represented here. The first form (Louisiana, *Hale*) referred also by Nylander (*Syn.*) to *P. lævigata*, and closely resembling the European *f. revoluta*, Nyl., under which he arranges it, stands yet in difficult relation to *P. cetrata.*—— *b*, is at present quite unknown here as a North American lichen. ——*P. tiliacea* approaches the present more closely here, and in tropical America, than in Europe; and barren specimens of the former scarcely now differ at all from the latter (as exhibited in Nyl. *Lich. Par. n.* 112) but in smaller size: the fertile ones are separable by the spores.

3(*b*). *P. aurulenta*, Tuckerm.; lobes rugose, less divided and more compacted than in the last preceding, at length thickly besprinkled with now confluent soredia; the medullary layer sulphur-yellow; apothecia middling-sized; disk chestnut. Spores ellipsoid, $\frac{10\text{-}16}{4\text{-}7}$ mic.——*Suppl.* 1, *l. c. p.* 424. *Nyl. Syn.* 1, *p.* 382.

Trunks in the White Mountains, and rocks of the Blue Ridge, Virginia, fertile, *Tuckerman l. c.* 1858. Rocks and trunks, Illinois, fertile, *Hall.* Trees, South Carolina, fertile, *Ravenel.* Alabama, *J. F. Beaumont.* Louisiana, *Hale.*——The lichen of the White Mountains was the *P. lævigata* of the author's Syn. N. Eng., and would perhaps make the best representative that we have of the European species, were it not for the coloration (more or less distinct) of the medullary layer.

4. P. *Camtschadalis* (Ach.) Eschw.; thallus ascendant, dichotomously branch-lobed; smoothish or now isidiophorous; whitish or now cinereous-glaucescent; beneath channelled, soon blackening and becoming wrinkled and very black, and beset, at least at the margins, with black fibrils, which are now deficient; the narrow lobes finally elongated, attenuate, and densely inter-

tangled; apothecia middling-sized, elevated; disk chestnut, with a somewhat entire margin.. Spores ellipsoid, $\frac{15-23}{7-10}$ mic.—— *Eschw. Bras. p.* 202. *Mont. & V. d. Bosch. Jav. p.* 20. *Nyl. Syn.* 1, *p.* 387. *P. Americana, Mont. Chil.*

Trees. Orizaba, Mexico (*Galeotti*), Nylander *Syn.* 1860. Well comparable with *Evernia furfuracea.* The South American lichen proves to be undistinguishable from the Asiatic; though the spores are perhaps a little smaller.

5. *P. tiliacea* (Hoffm.) Floerk.; thallus closely adnate to the substrate, soon and much narrowed; coriaceous-membranaceous, smoothish, glaucescent; beneath black, and densely black-fibrillose; the contiguous, sinuate-laciniate, more or less wrinkled lobes rounded, and crenate, or more deeply divided; apothecia (frequent) middling-sized; disk chestnut, with a crenulate margin. Spores rounded-ellipsoid, small, $\frac{5-11}{5-7}$ mic.——*Floerk. in Sommerf. Lapp. p.* 113. *Fr. L. E. p.* 59. *Tuck. Lich. exs. n.* 70. *Nyl. Syn. p.* 382.

b. sublævigata, Nyl.; lobes sub-linear, more or less pinnately many-cleft and discrete, often stellate; apothecia and spores as in *a.*——*Nyl. l. c. P. tiliacea, v. minor, Müll. Flora.* 1877, *n.* 5, *e descr.*

c. relicina; thallus pale-yellowish; apothecia and spores as in *a.*——*P. relicina, Fr. S. O. V. p.* 283, *teste Mont. M. & V. d. Bosch Lich. Jav. p.* 19. *Nyl. Syn.* 1, *p.* 386. *P. tiliacea, v. flavicans, Tuckerm. in Wright Lich. Cub. n.* 74.

d. sulphurosa; medullary layer sulphur-yellow; apothecia, and spores as in *a.*

Trees, and stones, very common. Canada, and northern and western States; *Muhlenberg Catal.* 1818, etc. Also throughout the southern States; *M. A. Curtis, Hale,* etc.——*b*, southern States; *Ravenel, Hale, Wright;* but similar forms occurring also northward.——*c*, a lichen of Cuba, to be expected in the extreme south.——*d*, Illinois, *Hall.*

The North American *P. tiliacea* is a smaller plant than the European; but our first form appears to be otherwise undistinguishable. And much the same remark may be made of the common, narrow-lobed American forms, which scarcely differ from such European ones as the var. *carporhizans*, Nyl. (*Herb. Church. Babingt. Anz. Ital. n.* 102) but in inferior dimensions,

and still narrower divisions. The effect of these slight modifications is yet at length so marked as to obscure the species; and our plant becomes thus better comparable in almost everything except size, especially of the spores, with *P. lævigata;* while, at the same time, the narrowed conditions are easily seen to pass imperceptibly into the wider and more typical; *b*, being thus to be taken for an American variety of *P. tiliacea*, determines the place of *c*, which differs from *b* only in being straw-coloured. *d* is also microphylline, or similar to *b*, in the only specimen as yet observed; but the internal coloration which distinguishes it may not prove to be confined to such narrow states. It appears impossible, in any large view, whether of *P. sulphurata*, *P. aurulenta*, or the present, to assign any other than a subordinate value to the modifications in these lichens, of the medullary colour.

6. *P. Texana*, Tuckerm.; thallus narrowed, coriaceous-membranaceous, reticulately rimose, cinereous-glaucescent; beneath black, papillate, the fibrils obsolete; lobes contiguous, plano-convex, rather dilated at the periphery and lacero-crenate or lobulate, besprinkled with rounded, at length confluent soredia; apothecia middling-sized; disk chestnut, with an entire margin. Spores ellipsoid, $\frac{11\text{-}15}{4\frac{1}{2}\ 5\frac{1}{2}}$ mic.——*Suppl.* 1, *l. c. p.* 424.

On dead wood; thickets of the Blanco; Texas (*Wright*), Tuckerman *l. c.* 1858.

Intermediate between the last species and the next: but, on the whole, best comparable with small forms of *P. Borreri*, *b*, from the same region.

7. *P. Borreri*, Turn.; thallus soon narrowed, coriaceous-membranaceous, more or less reticulately rugose, and beset with rounded soredia; cinereous-glaucescent; beneath pale-brown (becoming darker), with now dense, white (or blackening) fibrils; lobes of the periphery rather dilated and rounded, cut-crenate; apothecia middling to large, chestnut, with an entire margin. Spores rounded-ellipsoid, $\frac{8\text{-}18}{7\text{-}10}$ mic.——*Turn. in Linn. Trans.* 9, *p.* 148. *Ach. L. U. p.* 461. *Fr. L. E. p.* 60. *Nyl. Syn.* 1, *p.* 389. *P. Borreri*, * *hypoleucites*, *Nyl. Syn.* 1, *p.* 389, *e descr. P. Bolliana*, *Müll. Flora*, 1877, *n.* 5.

b. rudecta, Tuckerm.; thallus beset with isidioid granules and branchlets; the lobes now more divided.——*Syn. Lich. N. Eng. p.* 26. *P. rudecta*, *a*, *Ach.! Syn. p.* 197.

c. hypomela; blackening beneath.

Trees, and dead wood; common; and now (Illinois, *Hall;* Texas, *Wright;* Mexico) scarcely differing from the European lichen, but in smaller soredia. But our plant is mostly referable to *b*, which occurs from Canada southward (*Muhlenberg*) Ach. *Syn.* 1814, to Louisiana (*Hale*) and Mexico. Rarely (*c*) this blackens beneath (South Carolina, *Ravenel.* Texas, *Wright*) and it passes, finally, at the circumference, into narrower, sinuately lobulate conditions suggestive as well of the two species next preceding, as of the closely akin following one.——Though typically pale beneath, it is certainly the same plant which becomes finally, on this side, blackish-brown.

8. *P. saxatilis* (L.) Fr.; thallus narrowed, cartilagineous-membranaceous; soon more or less reticulately rimose, and lacunose, often isidiophorous, glaucous-cinerascent; beneath black, and (now densely) black fibrillose; lobes sinuately, often pinnately, many-cleft, retuse; apothecia middling to large; disk chestnut, with an irregular, sub-crenulate margin. Spores ellipsoid, $\frac{14\text{-}21}{9\text{-}14}$ mic.——*Fr. L. E. p.* 61. *Schær. Spicil. p.* 454. *Nyl. Syn.* 1, *p.* 388.

b. sulcata, Nyl.; lobes mostly wider and paler, besprinkled with conspicuous, rounded or oblong, now confluent and reticulate soredia.——*Nyl. Lich. Scand. p.* 99. *P. saxatilis, v. rosæformis, Ach., Tuckerm. Syn. Lich. N. Eng. p.* 27.

c. panniformis (Ach.) Schær.; lobes short, densely crowded, and imbricated.——*Ach. L. U. p.* 469. *Schær. Spicil. p.* 456.

d. omphalodes, Fr.; thallus brown, and blackening.——*Fr. l. c. Nyl. l. c.*

Trees, dead wood, and rocks; common in the northern States, and northward *(a, b) Muhlenberg Catal.* 1818. Arctic America, *Richardson; Vahl.* Wind River Mountains, *Hayden.* New Mexico, *Fendler.* West Coast, *Lyall*, etc.——*c*, Arctic America, *Herb. Hook.* Vermont, *J. L. Russell.* White Mountains.——*d*, rocks in mountainous and alpine districts; White Mountains, *Oakes.* British Columbia, *Macoun.* Arctic America.

b. Stock of P. physodes.

9. *P. physodes* (L.) Ach.; thallus rather loosely attached to the substrate, more or less inflated, coriaceous-membranaceous, glaucous-white; beneath brownish-black and black, smooth,

destitute of fibrils; lobes plano-convex, somewhat ascendant, sinuately many-cleft, now crowded, and at length complicate, terminating not seldom in white soredia; apothecia middling to large; disk chestnut, with a rather entire margin. Spores subellipsoid, $\frac{4\text{-}7\frac{1}{2}}{4\text{-}6}$ mic.——*Ach. Syn. p.* 218. *Tuckerm. Syn. N. Eng. p.* 28; *Lich. exs. n.* 72. *P. ceratophylla, Schær. Spicil. p.* 458.

b. obscurata, Ach.; thallus brown, and blackening.——*Ach. l. c.*

c. enteromorpha, Tuckerm.; lobes wider and less divided, ventricose-inflated, now shorter and complicated, and now elongated and evernioid, rarely black-margined; apothecia (abundant) ventricose-cyathiform, at length very large.——*Syn. N. Eng. l. c., in part. Parm. enteromorpha, Ach. l. c. p.* 219.

d. vittata, Ach.; lobes mostly lax, linear, elongated, more or less black-margined; apothecia (abundant) ventricose-cyathiform, and dilated.——*Ach. l. c.*

A common lichen. *a*, on rocks and dead wood, rather rarely fertile, and also on trunks (*Muhlenberg Catal.* 1818), very commonly fertile on spruce, in mountains, and passing into *d.*——*b*, alpine rocks, Arctic America, *Herb. Hook.* Islands of Behring's Straits, *Wright.*——*c*, trees, West Coast, from *California* (*Menzies*) Ach. *Meth.* 1803, to *Alaska; Dr. Kellogg.*——*d*, trees, West Coast (*Menzies*) Ach. *sub P. duplicata*, 1803. On spruces in the White Mountains, *Tuckerman.*

9(*b*). *P. encausta* (Sm.) Nyl.; thallus less, or scarcely inflated, glaucous-cinerascent; the crowded, narrowed, convex, wrinkled lobes at length complicate, and passing irregularly, more or less, into very narrow, teretish, and torulose ones; [apothecia middling to large; spores much as in the last preceding].——*Nyl. Syn.* 1, *p.* 401; *Scand. p.* 104. *P. physodes β, Fr. L. E. p.* 64.

b. alpicola, Nyl.; a blackened, alpine condition.——*P. alpicola, Th. Fr. Scand. p.* 125.

Alpine rocks. *a*, Greenland (*Vahl.*) Th. Fries *l. c.* 1860. White Mountains, infertile. St. Elmo, Colorado, *Brandegee in herb.* Sprague.——*b*, Greenland, *Vahl.* Mt. Hood, Oregon, fertile, *Hall.*——The lichen is well differenced by its almost total want of inflation, and very narrow and irregular, crowded lobes, and is confined here, to alpine districts. *P. alpicola*, Th. Fr., is

not a member of the brown series, but a blackened form of a member of the glaucescent series; and there is no question with which species of the latter it shall in that case be associable, as an extremely recedent, exclusively alpine condition.

10. *P. pertusa* (Schrank) Schær.; thallus closely attached to the substrate, inflated, membranaceous, glaucous-white; beneath black, smooth, destitute of fibrils; lobes sinuately-many-cleft, compaginate, here and there sparingly perforated with rounded holes, and beset with conspicuous, scattered, round, white soredia; apothecia (very rare, except in austral regions) 'smallish, chestnut, with an entire margin. Spores in twos and fours, ellipsoid, $\frac{45\text{-}60}{22\text{-}28}$ mic.'——*Schær. Spicil. p.* 457. *Nyl. Syn.* 1, *p.* 402. *P. terebrata*, *Mart. Tuck. Lich. exs. n.* 16. *P. diatrypa*, *Ach. L. U. p.* 493.

Trunks, and also rocks, frequent in mountain forests, but not seen fertile. White Mountains; and also in Hampshire, Mass., *Tuckerman* Lich. N. E. 1841.

11. *P. lophyrea*, Ach.; thallus cartilagineous, cinereous-glaucescent; beneath black, smooth, and, on this side only, cribrose-foraminous; lobes flattish, lacunulose, flexuous, sinuately many-cleft, the tips cut-crenate; apothecia middling-sized; disk chestnut, with a thin, sub-crenate margin. Spores spherical, diam, 3½-4½ mic.——*Ach.! L. U. p.* 481, *& e Nyl. Scand. p.* 104. *P. cribellata*, *Tayl.! New Lich. in Hook. Lond. Journ. Bot.*, 1847, *p.* 164. *Nyl. Syn.* 1, *p.* 403.

Trees on the West Coast (*Menzies*) Acharius *Meth.* 1803.

12. *P. colpodes* (Ach.) Nyl.; thallus coriaceous-membranaceous, glaucescent, clothed beneath with a dense, spongy, dark-brown, and blackening nap, and beset here and there with coarse fibrils; lobes sinuately-many-cleft, flattish, at least at the periphery, and there at length more or less cristate-lobulate; apothecia middling to large; disk chestnut, entire. Spores very numerous in the thekes, oblong, or club-shaped, and more or less bowed, $\frac{7\text{-}15}{2\text{-}3}$ mic.——*Tuck. Lich. exs. n.* 74. *Nyl. Syn.* 1, *p.* 404. *P. colpodes*, *& P. cristulata*, *Ach. Syn. pp.* 118–19. *Imbricaria convexiuscula*, *Michx. Fl.*, *fide Müll.*

Trunks, common throughout the larger part of the United States; but not known as yet from the Rocky Mountains, or the West Coast. New England (*Swartz*), Ach. *Prodr.* 1798.

Middle States, *Muhlenberg*. Southern States to Louisiana, *Curtis*, *Hale*, etc. It occurs also in tropical America (*P. parasitica*, Fée, *e* Nyl.).

** *Thallus olivaceous-brown.*

13. *P. olivacea* (L.) Ach.; thallus membranaceous, plicate-radious, becoming rugulose, and now isidiophorous, from pale- at length dark-olivaceous, and brown; beneath black, with more or less frequent blackening fibrils; lobes flattish, rounded, crenate; apothecia middling-sized; disk chestnut, with a wrinkled or crenulate margin. Spores short-ellipsoid, $\frac{11\text{-}20}{6\text{-}11}$ mic.——*Ach. L. U. p.* 462. *Fr. L. E. p.* 66. *Nyl. Syn.* 1, *p.* 395.

* *aspidota*, Ach.; thallus, and apothecia externally, thickly beset with minute warts of the same colour. Spores more rounded, and smaller.——*Ach. l. c. Th. Fr. Lich. Scand. p.* 122. *P.* (*sub-sp.*) *exasperata*, *Nyl. l. c.*

b. prolixa, Ach.; thallus narrowed, many-cleft. Spores smaller.——*Ach. l. c. Nyl. l. c.*

* *panniformis*, Nyl.; lobes (except those of the periphery) divided into short, irregularly cleft, densely crowded and imbricate ones, now passing into finger-shaped branchlets.——*Nyl. l. c. Exs. Anz. Lang. n.* 428.

c. sorediata (Ach.) Nyl.; thallus narrowed as in *b*, the more discrete, many-cleft, lacunulose lobes beset with pulvinate, white soredia.——*Nyl. Lich. Scand. p.* 102. *P. dendritica*, *Fr. L. E. p.* 68, *fide ipsius*. *P.* (*sub-sp.*) *sorediata*, *Th. Fr. Lich. Scand. p.* 123.

Trees and rocks. *a*, on trees; northern, and middle States, *Muhlenberg Catal.* 1818. Arctic America, *Richardson*. Mountains of North Carolina, *Ravenel*. New Mexico, *Wright*. California, *Bolander*. British Columbia, *Macoun*.——*b*, on rocks; Mountains of New England, *C. C. Frost*, etc. California, *Bolander*. ——*c*, on rocks; New England, *Tuckerman*. California, *Bolander*. British Columbia, *Macoun*. Spores (in the few specimens at hand) of *a* * clearly smaller; as they are found to be in Europe. But *a* occurs, in the otherwise well-characterized New Mexico specimens, with similarly reduced spores. Spores of *b*, in the New England lichen, $\frac{9\text{-}12}{4\text{-}7}$ mic.; but larger, and approaching at length very closely, in dimensions, to *a*, in the Californian.

14. *P. stygia* (L.) Ach.; thallus sub-cartilagineous, smooth and shining, from olivaceous-brown finally blackening; beneath at length black, obsoletely fibrillose; lobes linear, convex, palmately many-cleft, finally contorted, and passing now into terete branches, the tips more or less incurved; apothecia middling-sized; disk dark-chestnut, and blackening, with a subgranulate margin. Spores rounded and ellipsoid, $\frac{5-12}{5-7}$ mic.——*Ach. Meth. p.* 203. *Fr. L. E. p.* 67. *Tuck. exs. n.* 17. *Nyl. Syn. p.* 397.

Alpine and sub-alpine rocks. Arctic America (*Richardson*), Hooker *l. c.* 1823. Higher mountains of New Hampshire, and Vermont, *Tuckerman.* Mt. Monadnock, N. H., *J. L. Russell.* Adirondack mountains, New York, *C. H. Peck.*

14(*b*). *P. lanata* (L.) Wallr.; Alectorioid, blackening, lobes filiform, terete, dichotomously much-branched, intricately intertangled, decumbent; apothecia and spores of the last.——*Nyl. Scand. p.* 103. *Th. Fr. Scand. p.* 126. *P. stygia* β, *Fr. L. E. p.* 68.

Arctic America (*Richardson*), Hooker *l. c.* 1823. Yosemite valley, California, fertile, *Bolander.*

* * * *Thallus straw-coloured.*

15. *P. caperata* (L.) Ach.; thallus dilated, coriaceous-membranaceous, undulate-plicate, conspicuously rugulose, now sorediate, or coarsely isidiophorous, pale-greenish-yellow; beneath black, rather sparingly black-fibrillose; lobes sinuately-laciniate, with rounded, somewhat entire tips; apothecia middling to large; disk chestnut, with a sub-crenulate margin often at length sorediate, or isidioid-granulate. Spores ellipsoid, $\frac{16-25}{7-10}$ mic. ——*Ach. Syn. p.* 196. *Fr. L. E. p.* 69. *Tuck. exs. n.* 75. *Nyl. Syn.* 1, *p.* 376.

Trunks, dead wood, and stones; not very commonly fertile. Virginia, *Dillenius Musc.*, 1741. Northern, middle, and western States, *Muhlenberg*, etc. Southern States to New Mexico, *Curtis; Hale*, etc. Mexico, *Nylander.* California, *Bolander.* Arctic America, *Richardson.*

A narrower-lobed southern form (Texas, *Wright;* New Mexico, Fendler) characterized not seldom by white-sorediate margins, and shewing smaller spores ($\frac{12-17}{5-7}$ mic.), differs also from the common plant in giving a red reaction with chloride of lime;

but the same reaction is afforded by a similarly white-edged Californian lichen with spores of $\frac{14-20}{7-9}$ mic.; and as well by a specimen from Arctic America (*Herb. Hook.*) scarcely otherwise differing from the common northern *P. caperata*.

16. *P. conspersa* (Ehrh.) Ach.; thallus dilated, cartilagineous-membranaceous, laciniately much-divided, smooth and more or less polished, but the centre often isidiophorous, greenish-straw-coloured; beneath brown, or blackening, or at length black, with similarly varying fibrils, which are now mostly obsolete; lobes sinuately cut, passing often into narrowed, pinnatifid, at length densely complicate conditions; apothecia middling to large; disk chestnut; margin sub-crenulate. Spores ellipsoid, $\frac{7-12}{5-7}$ mic.——*Ach. L. U. p.* 486. *Fr. L. E. p.* 69. *Nyl. Syn.* 1, *p.* 391.

Rocks and stones (and, degenerate, on dead wood) very common at the north; and, in the mountains, southward. Northern and middle States, *Muhlenberg Catal.* 1818, and throughout the upper districts of the southern, *Ravenel*, etc.; as also in the mountains of Texas, *Wright;* New Mexico, *Fendler;* and Mexico, *Nylander.* Rocky Mountains, *Hall.* On the western Coast, *Douglas; Bolander.* Arctic America, *Richardson.*

16(*b*). *P. leucochlora*, Tuckerm.; lobes closely appressed and compaginate, sinuately more or less pinnatifid, rugulose, from glaucescent becoming pale-straw-coloured; apothecia smallish; disk chestnut. Spores roundish-ellipsoid, $\frac{7-9}{5-7}$ mic.——*Tuckerm. in Nyl. Syn.* 1, *p.* 392.

On Bald Cypress, Mississippi (*Dr. Veitch*), Tuckerman *l. c.* 1860. South Carolina, *Dr. J. H. Mellichamp.* Florida, *Ravenel.* Louisiana, *Hale.*——The apothecia of *P. conspersa* exceed at length 15$^{mm.}$ in width, and the spores 13$^{mmm.}$ in length; but the apothecia of the present average 2-3$^{mm.}$ and only rarely reach 4$^{mm.}$ in width, and the rounded spores appear to be also smaller. The chemical differences of *P. leucochlora*, treated with chloride of lime, and with potash, pointed out by the present writer (*Amer. Naturalist*, April, 1868) as by Nylander (*Flora*, 1869, p. 293) will not here be dwelt on; but the plant is otherwise not without interest.

16(*c*). *P. molliuscula*, Ach.; Everniæform, the narrowed lobes sub-stellate, or loosely intricate, dichotomously more or

less regularly divided, convex; beneath channelled, or the margins connivent, and densely, or now obsoletely fibrillose; apothecia unknown.——*L. U. p.* 492; *Syn.* 211, *auct. Nyl. Syn.* 1, *p.* 393. *P. chlorochroa*, *Tuckerm. Obs. Lich.* 1, *l. c. p.* 383.

On the earth, in sterile spots, in the Rocky Mountains (*Dr. Hayden*), Tuckerman *l. c.* 1860.——The same lichen is found in Soongaria (*Herb.* Spreng. nom. *Borr. Camtschadalis*), in Camtschatka (Tilesius in *herb.* Floerk., *nom. Parm. congruentis*), and in the steppes of the Volga in Russia (*Herb.* Krempelh., *nom. P. vagantis*, *Nyl.*). The last-cited plant of Nylander is the *P. molliuscula*, *v. vagans* of his *Syn. l. c.*, which is later subsumed by him under *P. conspersa* (*Scand. p.* 100) and is the natural key to the present. In a very narrow-lobed, fertile form of *P. conspersa* (rocks, Kansas, *Hall*), sufficiently agreeing in general habit with *Fellmann exs.* n. 79, and with the narrower form of Anz. *Lich. Ital. Sup.* n. 109, and, like them, referable to the *v. stenophylla* of authors, the lobes are not only convex, as, to some extent, in the Italian lichen last cited, but more or less channelled beneath; and the same convexity and channelling are observable in dwarfed, alpine specimens of the same species, growing over mosses (Rocky Mountains, *Dr. Parry*) and sufficiently explain the lichen before us.

17. *P. centrifuga* (L.) Ach.; thallus somewhat tartareous, many-cleft, from greenish- at length bright-straw-coloured, opake; beneath whitish with darker fibrils; lobes linear, convex, crowded, becoming complicate and rugose-plicate at the crust-like centre, which falling finally away leaves only the concentrically disposed periphery; apothecia middling-sized; disk chestnut, with a sub-crenulate margin. Spores ellipsoid, $\frac{8\text{-}12}{5\text{-}6}$ mic.—— *Ach. L. U. p.* 486. *Fr. L. E. p.* 71. *Tuckerm. Lich. Amer. n.* 78. *Nyl. Syn.* 1, *p.* 393.

Alpine and sub-alpine rocks, and descending, in high mountains, *Muhlenberg Catal.* 1818. Arctic America, *Vahl*, etc Newfoundland, *Despreaux*, etc. Mt. Desert, Me., and White Mountains, N. H., *Tuckerman*. North shore of Lake Superior, *Agassiz*.

18. *P. incurva* (Pers.) Fr.; thallus sub-cartilagineous, many-cleft, greenish-straw-coloured, opake, besprinkled with large, globular, sulphur-coloured soredia; beneath pale, with blackening fibrils; lobes very narrow, teretish, densely branching, and

closely approximate and intertangled, the tips somewhat incurved; apothecia smallish; disk chestnut with a somewhat entire margin. Spores ellipsoid, $\frac{7\text{-}12}{5\text{-}6}$ mic.——*Fr. L. E. p.* 70. *Tuckerm. Lich. Amer. n.* 76. *Nyl. Syn.* 1, *p.* 394. *P. recurva, Ach. L. U. p.* 490.

Sub-alpine (granitic) rocks in high mountains, rarely fertile. White Mountains, *Tuckerman* Enum. 1845. Also at Mt. Desert, Maine.

19. *P. ambigua* (Wulf.) Ach.; thallus membranaceous, stellate, straw-coloured, opake, besprinkled more or less densely with sulphur-coloured soredia; beneath brownish-black, shining, with blackening fibrils; lobes linear, applanate, dichotomously many-cleft, rather loosely disposed; apothecia small to middling; disk chestnut, with a sub-crenulate margin. Spores oblong-ovoid, commonly curved, $\frac{7\text{-}13}{2\frac{1}{2}\text{-}3\frac{1}{2}}$ mic. Spermatia acicular, bowed.——*Ach. L. U. p.* 485. *Fr. L. E. p.* 71. *Tuckerm. Lich. Amer. n.* 77. *Nyl. Lich. Scand. p.* 105.

b. albescens, Wahl.; whitish-ash-coloured, with white soredia; apothecia rather larger, shining. Spores rather larger.—— *Fr. l. c. P. hyperopta, Ach. Syn. p.* 208. *Th. Fr. Lich. Scand. p.* 120. *P. aleurites, Nyl. Lich. Scand. p.* 105.

c. Halei; thallus much as in *a*, but the apothecia rather larger, and wax-coloured, with a constantly sorediate-powdery margin. Spores as in *a*.——*Parmelia, Tuckerm. in litt.*

a, on trunks, and dead wood, and also on rocks, in alpine districts; and descending, in high mountains. Arctic America (*Richardson*), Hooker *l. c.* 1823. White Mountains, *Tuckerman.* British Columbia, *Macoun.*——*b*, with the last.——*c* is a southern lichen, found on coniferous trees from Louisiana (*Hale*) and South Carolina (*Ravenel*) to Virginia (*Tuckerman*), and northward in New Jersey (on pines, *Austin*), and rarely, on the south shore of Massachusetts (on white cedar, *Willey*).—— Spores of *b*, $\frac{7\text{-}15}{2\frac{1}{2}\text{-}4}$ mic., in all important respects like those of *a*; and the lichen scarcely differs but in colour. These two forms are high northern plants, and unknown in New England except in the highest mountains; but *c*, though geographically, it should seem, diverse, offers very little to distinguish it.

X.—PHYSCIA (DC., Fr.) Th. Fr.

Apothecia scutellæform; the disk thickish; the hypothecium colourless. Spores ellipsoid, bilocular (or, more rarely, in exotic species, 4-plurilocular) brown. Spermatia ellipsoid, or, mostly, oblong, on multi-articulate sterigmas; or, very rarely (n. 9) acicular, on sub-simple sterigmas. Thallus foliaceous, ramoso-laciniate, stellate, or now ascendant and Everniæform, sub-cartilagineous; more or less fibrillose, or rarely naked, beneath.——For the anatomy of the thallus see Schwendener *Unters. l. c.* 2, 161, and 3, 154–7. From *Physcia* proper (typified by *P. stellaris*) in which the cortical layer is parenchymatous, and thus distinguishable from the confused tissue which constitutes the same layer in *Parmelia*, certain ascendant species (typified by *P. ciliaris*, but including also *P. speciosa*) vary in exhibiting a more properly filamentous cortical layer: these differences finding however a degree of reconciliation, as shewn by Nylander, within the range of modifications of *P. pulverulenta*.

* *Hagenia (Eschw.) Fr. Cortical layer of intertangled filaments with a mostly longitudinal direction; thallus beneath often ecorticate.*

1. *P. erinacea* (Ach.) Tuckerm.; thallus cartilagineous, diffusely cæspitose, naked, glaucous-white; beneath ecorticate and very white; the ascendant, flexuous lobes irregularly torn-cleft, flattish, ciliate with long fibrils; apothecia smallish, scattered, pedicellate, the blackish-brown disk soon tumid, repressing the entire margin. Spores bilocular, $\frac{20\text{-}25}{8\text{-}12}$ mic.——*Obs. Lich. l. c.* 4, *p.* 388. *Borrera, Ach. L. U. p.* 499; *Syn. p.* 222. *P. ciliaris, var., Nyl. Syn.* 1, *p.* 414.

On shrubs, sea coast of California (*Menzies*) Ach. *L. U.* 1810; and later collectors. The thallus of this, of *P. comosa*, and of *P. hispida* are externally much alike when young.

2. *P. speciosa* (Wulf., Ach.) Nyl.; thallus cartilagineous-membranaceous, loosely stellate, appressed, greenish-glaucous; beneath corticate, whitish, with fibrils of the same colour; lobes sinuately pinnatifid, flat, obtuse, with more or less ascendant, powdery edges; apothecia smallish to middling-sized, sub-

sessile; the disk naked; the margin crenulate. Spores bilocular, $\frac{25-35}{12-16}$ mic.——*Nyl. Syn.* 1, *p.* 416, *a. Parmelia speciosa, Ach. L. U. p.* 480. *Fr. L. E. p.* 80, *a. Tuck. exs. n.* 81.

Trees and mossy rocks in woods. Pennsylvania (*Muhlenberg*), Hoffmann *D. Fl.* 1796. Common from New England southward, in the mountains at least, to Alabama, *Beaumont;* and westward to Wisconsin, *Lapham.*

2(*b*). *P. hypoleuca* (Muhl.) Tuckerm.; thallus ample, cartilagineous, rather loosely stellate, appressed, smooth and naked above, greenish-glaucescent; beneath largely ecorticate and very white (or now somewhat blackening, or now yellowish), and densely beset with hispid, black fibrils; lobes multifid, flat, the edges now ascendant, and now also powdery; apothecia middling-sized to large, sub-pedicellate (becoming crowded), the naked, blackening disk enclosed by a crenate-foliolate margin. Spores $\frac{27-38}{16-21}$ mic.——*Parmelia, Muhl. Catal. Tuckerm. Syn. N. E. p.* 33. *Lich. Amer. n.* 108. *P. speciosa, v. hypoleuca, Ach. Syn. p.* 211. *Physcia,* Nyl. Syn. 1, p. 417.

Trunks, Pennsylvania (*Muhlenberg*), Ach. *Syn.* 1814, and throughout the Atlantic and Gulf States; as west to Illinois, *Hall*; New Mexico, *Mex. Bound. Survey*; and Mexico. It is widely diffused through the warmer regions of the earth.

2(*c*). *P. Wrightii,* Tuckerm. herb.; thallus ample, cartilagineous, appressed, smooth, but densely beset at the centre with wart-like lobules, naked, brownish-glaucescent; beneath corticate, brown, with scattered, simple, pale fibrils; the sparingly divided lobes compaginate; apothecia ample, sub-sessile; disk blackish-brown; margin crenate. Spores $\frac{20-26}{11-16}$ mic.

Rocks, Valley of the Rio Grande, Texas (Mexican Boundary Survey), *Wright.*

2(*d*). *P. Ravenelii,* Tuckerm. herb.; thallus membranaceous-cartilagineous, stellate, appressed, smooth above; beneath corticate, brown, and blackening, with fibrils of the same colour; lobes closely imbricated, shorter, wider, and less deeply cleft than in *P. speciosa,* with minutely notched, powdery margins; apothecia of middling size, the crenate margin soon powdery. Spores smaller than in *P. speciosa,* $\frac{20-28}{10-15}$ mic.——*P. speciosa, v. granulifera, Tuckerm. Obs. Lich.* 1, *l. c. p.* 391, *in part.*

Trunks; low country of South Carolina (*H. W. Ravenel,* Esq.,) Tuckerman *l. c.* 1860. Louisiana, *Hale.* Texas, *Wright*; *Hall.*

——In size and general character comparable rather with *P. speciosa*, but a quite distinct member of the present group.

2(*e*). *P. granulifera* (Ach.) Tuckerm. herb.; thallus cartilagineous, appressed, glaucescent, and white, pruinose at least at the tips, and besprinkled with white, soon powdery granules; beneath corticate, pale, with black fibrils; lobes multifid, dentate-crenate, the margins neither elevated nor powdery; apothecia smallish to middling-sized, the inflexed margin crenate. Spores $\frac{20-23}{11-14}$ mic.——*Parmelia, Ach. Syn. p.* 212. *P. speciosa, v. granulifera, Tuckerm. Obs. Lich.* 1, *l. c. p.* 390, *in part.*

Trunks; Pennsylvania (*Muhlenberg*), Ach. *Syn.* 1814. Maryland, *Tuckerman.* Illinois, *Hall.*

2(*f*). *P. comosa* (Eschw.) Nyl.; thallus sub-stellate, becoming erectish and diffusely cæspitose, smooth; beneath ecorticate and very white; lobes abbreviated, dilated upward; the margins (and at length the whole upper surface) beset with long, branched fibrils of the same colour; apothecia middling-sized to largish, obliquely pedicellate; the pruinose disk enclosed by a thin, crenate, at length radiately lobate, ciliate border. Spores bilocular, $\frac{25-37}{16-20}$ mic.——*Parmelia comosa, Eschw. Bras. p.* 199. *Physcia, Nyl. Syn.* 1, *p.* 416. *P. speciosa, v. galactophylla, Tuckerm. l. c. p.* 392, *& Lich. exs. n.* 82. *P. leucomela, v. galactophylla, Nyl. Syn.* 1, *p.* 415. *Parmelia galactophylla, Willd. herb.*

On trees; Pennsylvania (*Muhlenberg*), Hoffman *D. Fl.* 1796; and occurring also rarely, and only infertile, northward to Maine, *Oakes*; but throughout the Atlantic and Gulf States southward; as also in Ohio, *Lea*; Illinois, *V. d. Bosch*; and Mexico, *Nylander.*——The lichen of Eschweiler cannot be distinguished from *P. speciosa, v. galactophylla* by merely the numerousness of the fibrils; and it is observable that the *Parmelia echinata*, Tayl., which is reduced by Nylander (*Syn. l. c.*) to *Physcia comosa*, is exactly (Tayl. *herb. !*) what the present writer published as *galactophylla.*

2(*g*). *P. leucomela* (L.) Michx.; thallus ascendant and elongated, mostly smooth, either sub-stellate, with the lobation of *P. speciosa*, when the tips are now similarly revolute and white-sorediate,—or at length diffuse, and the linear, attenuated, densely intertangled lobes more remotely and irregularly divided; beneath ecorticate and very white, the margins beset with strong,

branched, blackening fibrils; apothecia middling-sized, pedicellate, the disk white pruinose, the border radiately lobate. Spores larger than in other members of this group, typically bilocular, $\frac{35\text{-}46}{16\text{-}20}$ mic., and more.——*Nyl. Syn.* 1, *p.* 414, *in part. Parmelia speciosa* (*exc. excip.*), *leucomelas*, *Eschw. Bras. p.* 198. *Tuckerm. l. c. p.* 393.

Trees; mountains of North Carolina, *Michaux*, *Fl.* 1803; *Lesquereux*; the range of the lichen southward much the same with that of the last, reaching northward to near Albany, N. Y., *Peck*; and, even fertile, the coast of Connecticut, *Willey*; and, westward, the Californian coast, *Menzies*; *Bolander.*—— This extraordinary modification of a foliaceous genus was the earliest to attract attention of a group of lichens which, sparingly represented at the north, is conspicuous and elegantly varied in the warmer regions of the earth, and affords the best representation and reconciliation that we have of all the features of *Physcia*. This is the group typified in Europe by *P. speciosa*. Fries fully referred what cannot be separated from *P. leucomela* (*Moug. & Nestl. exs.* n. 941) to the same species that should include *P. speciosa*; and even Acharius, and Nylander have failed to reach any other opinion as to the well-characterized *P. hypoleuca*; while the last author has gone far to recognize a conspecific relation between *P. leucomela* and *P. comosa*. As *P. speciosa* is exhibited in the island of Cuba (Wright *Lich. Cub.* n. 84) it should seem to pass directly into that tropical form which has been called *P. podocarpa* (Mont. & V. d. Bosch *Lich. Jav.!* p. 21. Wright *Lich. Cub.* n. 82) and the latter cannot well be kept far apart from *P. comosa*. This last is the analogue in *P. speciosa sensu latiori* of the now generally accepted *P. stellaris*, *v. hispida*, and in fact no more separable. In an abbreviated and wider-lobed, ascendant form referred by some authors to *P. leucomela* (v. *latifolia*, Mey & Flot. *in herb. Beral.!* Nyl. *Syn.*) it is easy to see too close a relation to *P. comosa*; and Nylander, as has been said, goes far to admit this; but even the typical, elongated *P. leucomela* of all authors is found in states really not differing (one might say) at all from *P. speciosa* but in being more lax, and in the ecorticate under side. And the systematic value of the larger dimensions of the spores of the lichen now before us is certainly qualified by what is known of exactly similar spore-variations in other tropical species. These spores vary indeed (the spore-cells appearing

now apiculate, and these apices, next, free) and in *P. comosa* as well as *P. leucomela*, so as to suggest at least a quadrilocular structure, which Nylander has indicated also in the stock of *P. obscura*; but it will scarcely be pretended that this evident luxuriance is of great account; or that, in the present species at least, the spores are other than typically bilocular.

3. *P. ciliaris* (L.) DC.; thallus cartilagineous, diffusely cæspitose, more or less downy, whitish-ash-coloured becoming at length brown; beneath mostly ecorticate and whitish; the elongated, linear lobes many-cleft and soon imbricately intertangled, their edges beset, especially towards the tips, with simple fibrils; apothecia middling-sized to largish, pedicellate; disk flat, sub-pruinose, with an incurved, mostly toothed border. ——*Parmelia, Fr. L. E. p.* 77. *Physcia, Nyl. Syn.* 1, *p.* 414.

b. crinalis, Schær.; thallus much narrowed; apothecia also reduced. Spores bilocular, $\frac{33\text{-}48}{15\text{-}22}$ mic.——*Schær. Enum. p.* 10. *Borrera crinalis, Schleich.* 1823. *B. angustata, Delis.! in herb. Spreng. Parm. ciliaris, v. angustata, Tuckerm. Syn. N. Eng. p.* 32; *Physcia, Obs. Lich. l. c. p.* 388.

Upon rocks, and on the earth (only *b*), Arctic America (*Richardson*), Hooker *l. c.* 1823. Newfoundland, *Despreaux.* Rocky Mountains, *Herb. Hook.* Shores of the Great Lakes, *Miss M. L. Wilson.* Shore of Willoughby Lake, Vermont, *Frost.*——Our lichen agrees closely with the slender form of the European one, but has a more northern range, being scarcely known far south of Canada. Width of lobes for the most part less than $0^{mm.}$, 5, or about a quarter of the largest width of *a*, in Europe. Apothecia 2-$4^{mm.}$ wide; those of *a*, in Europe, having a width of 3-$6^{mm.}$.

4. *P. aquila* (Ach.) Nyl.; thallus cartilagineous, stellate, appressed, naked, tawny-brown; beneath corticate, pale with scattered, finally blackening fibrils; lobes multipartite, linear, at length much narrowed, those of the centre convex and densely crowded, those of the circumference more dilated and flat; apothecia smallish to middling-sized, sessile; the disk flat, brownish-black, soon naked, with a tumid, sub-crenate border. ——*Nyl. Syn.* 1, *p.* 422. *Parmelia, Ach. L. U. p.* 488.

b. detonsa, Tuckerm.; thallus commonly pale- but at length tawny-brown as in *a*, now isidiophorous, or the lobes oftener

fringed with small lobules; apothecia as in *a*, or the border fringed finally like the lobes. Spores bilocular, $\frac{30-46}{18-21}$ mic.——*Obs. Lich.* 1, *l. c. p.* 389. *P. detonsa*, *Fr. S. O. V. p.* 284. *Tuckerm. Syn. N. E. p.* 32; *Lich. exs. n.* 18. *Psoroma palmulata*, *Michx.*, *fide Müll.*

Rocks, and trees. *b*, North America, *Fries l. c.* 1825. Common from New England to Virginia, *Tuckerman*; and throughout the southern Atlantic and Gulf States (*Ravenel*, etc.); Ohio, *Lea*. And the same lichen was found in Japan by Mr. *Wright*; but it is not known from our Pacific coast.——Lobes more or less elongated, and at length exceedingly narrowed in the tree-form; and our lichen is generally noticeable for its paleness, and frequent luxuriance of lobation. It yet also occurs quite undistinguishable from the European. Spores of the foreign plant agreeing in every respect with those of ours. This is probably the *P. aquila* of Muhl. *Catal.*, whether or not determined by Acharius.

** *Physcia proper. Cortical layer of the upper side parenchymatous.*

5. *P. pulverulenta* (Schreb.) Nyl.; thallus cartilagineous, stellate, from greenish becoming brown, more or less pruinose; beneath black-fibrillose; lobes multifid, crenate, the tips rounded; apothecia middling-sized, sessile, the flat, blackish-brown, subpruinose disk bordered by a thick, at length lobulate, or leafy margin. Spores bilocular, $\frac{23-38}{15-21}$ mic.——*Parmelia*, *Fr. L. E. p.* 79. *Nyl. Syn.* 1, *p.* 419.

a. lobes narrower than in *b*, and the margins not elevated nor powdery; the thallus passing often at the centre into crowded, small, convex lobules.

b. leucoleiptes, Tuckerm.; lobes flat, interruptedly elevated and powdery at the margins, beneath black.——*Syn. N. Eng. p.* 32. *Lich. Amer. exs. n.* 107.

On trunks, and rocks; and on the earth. *a*, Pennsylvania, *Muhlenberg Catal.* 1818, and common northward; and westward to California, *Bolander*; the earth-form (*f. muscigena*, Auct.) having been observed in Newfoundland, *Despreaux* (*Herb.* Spreng.), and Arctic America, *Richardson* (*Herb.* Hook.).——*b*, Pennsylvania, *Muhlenberg*, and northward to New England; southward it is found in Virginia; and also in New Mexico, *Fendler*; and California, *Bolander*.

A variable species, exhibiting forms, recognized generally by authors as belonging to it, which should be quite as separable as *P. aquila* β. A perfectly smooth, brown condition, with scarcely any trace of the characteristical bloom, contrasts with another pale one, more common, which is pruinose throughout. These forms of our *a* are now black, and now pale beneath. *b* has only occurred to me with a black under side, and is otherwise scarcely referable to the *v. pityrea* of authors; which last may yet occur.

6. *P. Leana*, Tuckerm.; thallus membranaceous, smooth, loosely imbricate, glaucous-cinerascent; beneath pale, with few, elongated, marginal fibrils; the loosely-intertangled, narrow, flat lobes many cleft; apothecia smallish, sub-pedicellate, with an entire margin. Spores $\frac{18\text{-}23}{9\text{-}10}$ mic.——*Parmelia* (*Physcia*) *Tuck. in Lea Catal. Pl. Cincin. p.* 45. *Physcia, Obs. Lich. l. c. p.* 394, *& in Nyl. Syn.* 1, *p.* 422.

Growing over mosses, Ohio (*Lea*), *Tuckerman l. c.* 1848.—— With much the habit of conditions of *P. speciosa* this appears also to look toward, and to be closely approached by forms of the variable *P. obscura*. It has only occurred once.

7. *P. stellaris* (L.); thallus cartilagineous, stellate, appressed, whitish-glaucescent, epruinose; beneath pale, with pale fibrils; lobes sub-linear, many-cleft, rather convex, compaginate, or discrete, without soredia; apothecia smallish to scarcely middling-sized, sessile, the disk brownish-black, often grey-pruinose, the margin rather entire. Spores $\frac{17\text{-}25}{8\text{-}12}$ mic.——*Parmelia, Fr. L. E. p.* 82, *a. Tuck. exs. n.* 83. *Physcia, Tuckerm. Obs. Lich.* 1, *l. c. p.* 395, *a.*

b. aipolia, Nyl.; thallus becoming brown and finally blackening beneath, and clothed there, at length densely, with finally black and hispid fibrils; apothecia sub-crenate. Spores as in *a.* ——*Nyl. Scand. p.* 111. *Parmelia aipolia, Ach. Syn. p.* 215.

On trees, dead wood, rocks, and stones. Pennsylvania, *Muhl. Catal.* 1818, and common northward to Arctic America, *Richardson*; westward to the Pacific coast, *Bolander*; and southward to the Gulf States, *Ravenel*, etc., and Mexico, *Nylander*. But the southern plant tends to lose itself in the next member of the group.——This well-known lichen of the northern hemisphere is readily recognizable in its tree-forms, but departs a little from the type on rocks, where (*b, aipolia*) now otherwise quite similar

to *a*, it is differenced at length conspicuously, by the coloration of the under side. But these rock-forms are now pale beneath; and one from the Pacific coast (perhaps the named but not characterized *P. callosa*, Nyl. in *Flora*, 1869, p. 119), is noticeable for its coarser, thicker, rugose-verruculose thallus (Yosemite Valley, *Bolander*; Oregon, *Hall*), but the scanty specimens scarcely afford any other than this difference.——*P. stellaris*, *a*, perfectly characterized, has occurred in Florida with apothecia ciliate below, in the manner of *P. obscura; Austin.*

7(*b*). *P. astroidea* (Fr.) Nyl.; thallus smallish, sub-cartilagineous, stellate, appressed, microphylline; beneath pale with pale fibrils; the erose-multifid, much narrowed, flattened lobes beset, for the most part, with rounded, finally confluent soredia; apothecia smallish, closely sessile, the disk blackening, subpruinose, the margin entire. Spores $\frac{18\text{-}22}{7\text{-}10}$ mic.——*Parmelia*, *Fr. L. E. p.* 81. *Physcia*, *Nyl. Syn.* 1, *p.* 426. *P. stellaris β*, *Tuckerm. l. c. p.* 395.

* *hypomela*; commonly smooth and naked above; brown and at length black beneath, with fibrils of the same colour.——*Parmelia obsessa*, *Mont.! Cuba*, *p.* 227, *not of Ach. Tuckerm. l. c.*

Trees; New England, Pennsylvania, and Virginia, *Tuckerman l. c.* 1860. North Carolina, *Curtis.* South Carolina, *Ravenel.* Alabama, *Peters.* Louisiana, *Hale.* Texas, *Wright.* Mexico.——* Louisiana, *Hale*; which form proves, in Cuba, to be scarcely well separable always from *P. crispa.* This smooth form varies in the colour of the under side just as *P. stellaris*, and often well represents, in Texas, as in Cuba, the coarser northern lichen. Its apothecia are often ciliate below (*P. leucothrix*, *Tayl.!* New Lich. *l. c.* p. 170) as in *P. obscura.*

7(*c*). *P. crispa* (Pers.) Nyl.; thallus sub-membranaceous, stellate, appressed, platyphylline, greenish-glaucescent (often pale roseate) beneath pale with scattered pale fibrils; the rather wide, flat lobes interruptedly imbricate, palmately cut, the repand edges powdery, and now ascending; apothecia smallish to middling-sized, sessile, blackish-brown, the incurved margin crenate, or granulate. Spores as in *P. stellaris.*——*Nyl. Syn.* 1, *p.* 423. *Parmelia Domingensis*, *Mont. Cuba*, *p.* 225, *t.* 8, *f.* 3. *Physcia stellaris*, *v. Domingensis*, *Tuckerm. l. c. p.* 396.

* *hypomela*; brown, and at length black beneath, with similarly coloured fibrils.

Trees. Seaboard of South Carolina (*Ravenel*), Tuckerman *l. c.* 1860. Georgia, *Ravenel.* Florida, *Austin.* Louisiana, *Hale.* Texas, *Wright.*——* Louisiana, *Hale.*——*P. dilatata, f. integrata,* Nyl. *Syn.* 1, p. 424, 'sufficiently like *P. crispa*' but with wider lobes, the margins of which are not powdery, is found at Orizaba, Mexico, *Nylander l. c.*; where also *P. major,* Nyl. *ibid.*, of the same affinity, is said to occur. Neither is sufficiently known to me.

7(*d*). *P. tribacia* (Ach.) Tuckerm. herb.; thallus smallish, sub-membranaceous, sub-stellate, glaucescent; beneath white, and sparingly white-fibrillose; lobes abbreviated, those of the periphery appressed, more or less dilated or now narrowed, and flat, but with ascendant and erose-granulate edges, and crowded at the centre into a granulate crust; apothecia smallish to scarcely middling-sized, closely sessile, black, commonly grey-pruinose, with a sub-entire margin. Spores $\frac{15\text{-}22}{7\text{-}10}$ mic.——*Lecanora, Ach. Syn. p.* 191, *in part. Parmelia, Schær. Enum. p.* 39. *P. erosa, Borr.! in E. Bot. Suppl. n.* 2807. *P. stellaris, var. tribacia, Fr. L. E. p.* 83. *Physcia stellaris β, tribacia, Tuckerm. l. c.*; *& Lich. Amer.* n. 85.

Trees and rocks (in the former habitat thinner and flatter, and, in the latter, more cartilagineous, convex, and grayer—so that if we take the former for a descendant of *P. stellaris,* we might incline to consider the latter as in similar relation to *P. cæsia* (comp. Fr. *L. E.* p. 84, & Tuckerm. *l. c.* p. 397) but this is perhaps to set too high a value on the lichen last-named, the specific rank of which is confessedly open to question) common from New England, *Tuckerman* Syn. 1848, to Virginia. South Carolina, *Ravenel.* Louisiana, *Hale.* California, *Bolander.* ——A very common, quite distinct, and well-marked lichen.

7(*e*). *P. hispida* (Schreb., Fr.) Tuckerm. herb.; thallus small, sub-cartilagineous, glaucescent; beneath white; at first sub-stellate, but ascendant and diffusely cæspitose, and the shortened, erectish, imbricated lobes inflated and vaulted at the tips, and ciliate throughout with long, darkening fibrils; apothecia smallish to scarcely middling-sized, sessile, grey-pruinose, with mostly entire margin. Spores as in the last preceding.—— *Borrera tenella, Ach. L. U. p.* 498. *Parmelia stellaris b. hispida, Fr. L. E. p.* 82. *Physcia, Tuckerm. l. c. p.* 397.

Trees and rocks. Arctic America (*Richardson*), Hooker *l. c.*

1823. New England, not uncommon. Canada, *Macoun*. California, *Bolander*. Oregon, *Hall*. British Columbia, *Macoun*.—— The lichen is obviously the analogue, in the *stellaris*-group, of *P. comosa* in the *speciosa*-group; and the appressed forms of the former cluster stand in a similar relation to those of the latter. ——*P. stellaris*, as here taken, belongs especially to the colder regions of the earth. On this continent we find it beginning to be modified even in New England; and this process of differentiation continues as we go southward. Neither of the three New Granada lichens of Lindig's Collection (n. 712, 731, 2602) referred by Nylander to his *P. stellaris* is (in the published specimens) a satisfactory representative of the northern plant. We may then perhaps expect this, as it approaches, or enters inter-tropical regions, to assume new forms, abhorrent no doubt from the merely northern conception of the species, and requiring to be determined from a wider point of view. But if this diminish as well the systematic value of the generally accepted *P. astroidea*, *P. crispa*, *P. dilatata*, etc. (as assumed in the writer's earlier review of the American *Physciæ*, cited above), it may be said to enhance, from a comparison of the equally accepted *P. comosa*, the value of the now generally undervalued *P. hispida*.

8. *P. cæsia* (Hoffm.) Nyl.; thallus crustaceous-cartilagineous, stellate, pale ash-coloured, besprinked with rounded, grey soredia; beneath pale, now ash-coloured, and blackening, with black fibrils; lobes pinnately many-cleft; apothecia smallish, sessile, the soon naked and black disk bordered by a thin, inflexed, sub-entire margin. Spores bilocular, $\frac{15\text{-}23}{8\text{-}12}$ mic.——*Nyl. Syn.* 1, *p.* 426. *Parmelia*, *Fr. L. E. p.* 83. *Tuck. Lich. exs. n.* 86.

Old stone walls. Pennsylvania, *Muhlenberg Catal.* 1818. New York, *Halsey*; *Sartwell*. Massachusetts, *Tuckerman*.—— Our plant (*Lich. Amer.* n. 86) is in all respects like the European; but I have seen but little of it.

9 *P. obscura* (Ehrh.) Nyl.; thallus sub-membranaceous, orbicular and appressed (unless in muscicoline states) epruinose, glaucous-cinerascent becoming livid or brown, now sorediiferous; beneath black, and more or less densely black-fibrillose; lobes dichotomously many-cleft, flattish, sub-ciliate, now passing at the centre into minute, imbricated lobules; apothecia smallish to scarcely middling-sized, sessile, the exciple more or

less hispid, at least below, the reddish-brown, blackening, naked disk bordered by an entire margin. Spores bilocular, $\frac{18\text{-}25}{9\text{-}12}$ mic. Spermatia oblong.——*Th. Fr. Scand. p.* 142. *Tuckerm. Obs. Lich. l. c. p.* 399, *max. p. Parmelia, Fr. L. E. p.* 84, *max. p. Tuck. exs. n.* 87. *Schær. Spicil. p.* 441, *max. p.*

* *endochrysea*, Nyl.; thallus more or less saffron-coloured within.——*Var. erythrocardia, Tuckerm. l. c. Parmelia endococcina, Koerb. Parerg. p.* 36.

Trees, dead wood, and rocks. Pennsylvania, *Muhlenberg Catal.* 1818, and northward to Arctic America, *Richardson*; westward to the Pacific coast, *Bolander*; and southward to Louisiana, *Hale*, and Texas, *Wright.*——A very variable lichen, recognizable by the coloration (though this may vary even to glaucescent as to thallus and red as to apothecia in forms of the *v. chloantha*, Auct.) by the blackening, abundant fibrils, and especially by the occurrence of these more or less on the exciple, which is seldom quite naked, with us, and finally bristly all over. This peculiar exhibition of fibrils characterizes probably all the best conditions of *P. obscura*, and must be taken therefore for typical. The under side is not merely black-fibrillose beneath, as commonly described, but black, both in European and North American specimens, though doubtless varying in this.

9(*b*). *P. setosa* (Ach.) Nyl.; thallus much as in the immediately preceding but larger, and whitish-glaucescent becoming glaucous-cinerascent, the wider, linear lobes fringed by and cushioned on dense black fibrils. Spores rather larger than in the preceding, $\frac{20\text{-}25}{10\text{-}14}$ mic., but reaching $\frac{30}{17}$ mic. in a specimen from Japan.——*Nyl. Syn.* 1, *p.* 429. *Parmelia, Ach. Syn. p.* 203. *P. atricapilla, Tayl.! New Lich. l. c. p.* 162.

Rocks upon mosses, and trunks. Pennsylvania, *Muhlenberg Catal.* 1818. New England and New York, *Tuckerman.* Ohio, *Lesquereux.* New Mexico, *Fendler.* Mexico, *Nylander.*——The most conspicuous member of the commonly humble *obscura*-stock; and, beside the lichenographers above-named who have taken it for a distinct species, Nylander *l. c.* cites also Schærer, and Montagne; and yet, except in size and general luxuriance, the lichen differs in no respect from the preceding.

10. *P. adglutinata* (Floerk.) Nyl.; thallus small, membranaceous, closely adnate or as it were glued to the substrate, from

glaucescent becoming cinerascent and brown; pale and scarcely fibrillose beneath; the very thin, flat lobes compaginate, disappearing for the most part at the centre in a granulose crust; apothecia small, and very small; disk blackish-brown; margin entire, scarcely ciliate. Spores $\frac{14\text{-}22}{8\text{-}11}$ mic.——Spermatia elongated, acicular.——*Nyl. Syn.* 1, *p.* 428; *Flora*, 1862, *p.* 355. *Parmelia obscura, v. adglutinata, Schær. Spicil. p.* 444. *Physcia, Tuckerman l. c. p.* 399.

* *pyrithrocardia*, Müll.; thallus more or less saffron-coloured within.——*Flora*, 1880, *p.* 278.

Upon trees and shrubs. New England, *Tuckerman l. c.* 1860; westward to Illinois, *Hall*, and Wisconsin, *E. L. Greene*; southward to South Carolina, *Ravenel*; Florida, *Beaumont*; Alabama, *Peters*; Louisiana, *Hale*; and Texas, *Wright*.——* Massachusetts, *Willey*.——Remarkably characterized by the spermatia. The lichen is better exhibited here than in Europe, and appears at length, as Nylander has said, to pass into *P. obscura*. From that species the present differs very considerably in the important respect of the fibrils, or want of them; but agrees with it in the abnormal variation of the colour of the medullary layer.

XII.—PYXINE, Fr., Tuckerm.

Apothecia sub-scutellæform. Hypothecium black; and, in the second section, the whole exciple blackening and Lecideoid. Spores oblong-ellipsoid, bilocular (rarely, in tropical regions, 4-locular) brown. Spermatia oblong, on pauci-articulate sterigmas. Thallus now adnate and agglutinate (semi-crustaceous) and now rising into foliaceous and cartilagineous expressions; the under side more or less fibrillose.——In the parenchymatous cortical layer of the upper side of the thallus, as in some other respects of thalline structure, this genus resembles *Physcia*; and its very incongruous apothecia are found yet, in the first section always, and to some extent in the second, to offer no external differences from those of the other; with which it also agrees in its spore-history.

* *Dirinaria. Apothecia scutellæform. Thallus normally white within.*

1. *P. picta* (Sw.) Tuckerm. Thallus softish, closely agglutinate to the substrate, radiately plaited, white-glaucescent; beneath black, scarcely fibrillose; lobes confluent, flattened and pinnately many-cleft at the circumference, but passing finally at the centre into a wrinkled-warty crust, often besprinkled with rounded, white soredia; apothecia small, sessile, the vinous-red disk soon becoming black, and now pruinose, at length scarcely exceeded by the sub-crenulate margin. Spores bilocular, $\frac{15\text{-}23}{7\text{-}9}$ mic.——*Obs. Lich.* 4, *l. c. p.* 166. *Physcia, Nyl. Syn.* 1, *p.* 430, *& t.* 8, *f.* 53. *Parm. applanata, Fée; Mont. Cuba, p.* 223, *t.* 8, *f.* 1. *Tuckerm. Obs. Lich.* 1, *l. c. p.* 398.

* *erythrocardia*, Tuckerm.; thallus saffron-coloured within.

Trees, and dead wood in the low country of South Carolina (*Ravenel*), Tuckerman in Nyl. *Enum.* 1858, of Georgia, *Ravenel*; of Louisiana, *Hale*; Texas, *Wright*; and Mexico; as also on rocks, in Alabama, *Peters.*——* *erythrocardia*, in Texas, *Ravenel.*——Differenced from *Physcia* by its hypothecium, but sufficiently agreeing in this, as in general aspect, with *Pyxine*; which, in *P. Meissneri*, offers apothecia not always well distinguishable from those of the present.——*Parmelia confluens*, Fr., united by Nylander with the earlier *P. ægialita*, Ach., should, with little doubt, be referred here: at least no difference appears to be noted.

1(*b*). *P. Frostii*, Tuck., thallus crustaceous, closely adnate, stellate-radious, smooth, from glaucous-grey becoming cream-coloured; beneath black; divisions sub-palmately cleft, convex, concrete (besprinkled commonly with white soredia); apothecia small, sessile; the disk flat, black; the margin incurved. Spores bilocular, $\frac{14\text{-}20}{5\text{-}7}$ mic.——*Squamaria, Suppl.* 1, *l. c.*, p. 425, *dein Lecanora.*

Granitic rocks, New England (*Frost*) Tuckerman Suppl. 1858. Harper's Ferry, Virginia, *Tuckerman.*——Rarely observed in fruit; the want of which has heretofore obscured the affinity of the lichen. It is a greatly reduced, northern exhibition of the preceding tropical species. [1]

[1] And a still more marked reduction of this type is presented by a lichen from volcanic rocks of the Galapagos Islands (*Dr. Hill* in Hassler Exp.) in which while the apothecia offer no differences unless possibly rather smaller spores, the thallus has passed wholly into convex, glebous areoles, somewhat lobed only at the circumference (*P. glebosa, Mihi, herb.*).

** *Pyxine proper. Apothecia scutellæform, and more or less resembling at first those of the first section, but soon blackening all over, and Lecideoid. Thallus becoming yellowish within.*

2. *P. Cocoes* (Sw.) Nyl.; thallus membranaceous, white-glaucescent; beneath black and smoothish; lobes linear, flat, many-cleft, imbricated, sparingly sorediiferous, white within; apothecia, in Cuban specimens, very small, Lecideoid, sessile, flattish, the stout margin at length disappearing. Spores biocular, $\frac{15\text{-}22}{6\text{-}9}$ mic.——*Tuckerm. Obs. Lich.* 1, *l. c. p.* 401; *&* 4, *p.* 166. *Lecidea, Ach. L. U. p.* 216.

Trees in tropical America, and perhaps recognizable in some small forms from our extreme south. But I consider the name as only the first imperfect indication of the more delicate states of the two following forms of *Pyxine.*

2(*b*). *P. Meissneri,* Tuckerm.; thallus much as in *P. Cocoes,* but more or less yellow within, and scarcely sorediiferous; sparingly black-fibrillose beneath; apothecia scutellæform, small, a flat, black disk bordered by a sub-entire thalline exciple, itself at length blackening. Spores as in the preceding.——*Obs. Lich.* 1, *l. c. p.* 400. *P. Cocoes, v. Meissneri, Obs. Lich.* 4, *l. c.*

Trees, as the preceding, from which it is commonly taken for distinct; as it is often well distinguished. I have however seen no North American specimens.

2(*c*). *P. sorediata,* Fr.; stouter, cartilagineous, wrinkled-plaited; glaucous-cinerascent becoming greenish-olivaceous; more or less sulphur-coloured within; the lobes beset with rounded, white or grey soredia, and beneath densely fibrillose; apothecia commonly Lecideoid, small, at length dilated and flexuous, the hypothecium resting on a yellowish or fulvous stratum, the disk white-pruinose, or, more commonly, naked. Spores bilocular, $\frac{15\text{-}23}{6\text{-}10}$ mic.——*Fr. S. O. V. p.* 267. *P. Cocoes, v. sorediata, Tuck. Obs. Lich.* 1, *l. c. p.* 402. *Lecidea, Ach. Syn. p.* 54. *Parmelia, sect. Pyxine, Tuck. Syn. N. E. p.* 35, *& Lich. Amer. n.* 19.

* *Eschweileri,* Tuckerm.; spores 4-locular, $\frac{18\text{-}25}{8\text{-}10}$ mic.——*Obs. Lich.* 4, *l. c. Lecidea sorediata, pro p., Eschw. Bras. p.* 245. *Wright Lich. Cub. n.* 94, *pro p.*

Trees and rocks. Pennsylvania (*Muhlenberg*), Ach. *Syn.* 1814. Common from New England to Virginia, *Tuckerman,* and

westward to the Rocky Mountains, *Herb. Hook.* Also throughout the southern States (passing there into thinner forms hardly separable from *P. Cocoes*), from the Carolinas and Georgia, *Ravenel*, and Florida, *Austin*, to Texas, *Wright.*——The best-developed and most northern expression of *Pyxine*; and I possess it also from Japan, and the Himalayah, as well as from the West Indies, and Java. It was the type of the genus; but the apothecia are properly scutellæform only blackened, the hypothecium is well comparable with that of *P. picta*; and young apothecia not yet discoloured occur.——* Cuba, *Wright*; not yet observed here. The lichen is only a further development of *P. sorediata.* *

Fam. 3.—UMBILICARIEI.

Thallus horizontal, foliaceous, sub-monophyllous, coriaceous-cartilagineous, more or less blackish-brown; beneath fibrillose, or now naked; attached to the substrate at only a single point.

The family is obviously and strongly differenced from the preceding one; and yet, through the exotic *Omphalodium*, Mey. & Flot., Koerb., the two are brought into closest relations with each other. And it is generally allowed that Habit must dominate here; however marked the features that might suggest other arrangements. The natural place of the group appears indeed to be between *Parmeliei*, and *Sticta*, in the next succeeding family.

The author's explanation of the spore-history of this family may be found in *Genera Lichenum*, *pp.* 29, 30.

* A note by Dr. Nylander on the chemical reactions with potash observed by him in *Pyxine* may be found in his *Enum. Lich. Husnot*, *p.* 10; but I am unable to make use of his results. Here as elsewhere, these results cannot be said to possess any absolute value beyond the portions of thallus subjected to the test; and we have no right either to assume that what we have not examined shall accord with what we have, or to venture on constructing 'new species' out of what does not accord.

XIII.—UMBILICARIA, Hoffm.

Apothecia sub-scutellæform, variously difform, blackened, destitute of gonidia; for the most part at length lirellose-proliferous. Spores ellipsoid, from simple at length granulose; or, more rarely, muriform-multilocular, fuscescent. Spermatia oblong; on multi-articulate sterigmas. Thallus as above.——The anatomy of the thallus is largely illustrated by Schwendener, *l. c.* 3, *pp.* 150, 179; *t.* 8, *f.* 15–17; *t.* 10, *f.* 10–13.——Neither of the attempts heretofore made to divide this natural genus into two, can be called satisfactory. Acharius soon gave up his distinction based on the degree of external, atypical change in the apothecia; and if Nylander has indicated recently, with emphasis (*Flora Ratisb.* 1875, p. 303) that this external change, so obvious in the descent from *U. pustulata* to most species of our first section, is accompanied by a gradual modification or degeneration of the tissues of the same organs, we may admit the fact, embarrassed though it be by the difficult association of *U. anthracina* and *U. pustulata* to form the new genus *Umbilicaria*, Nyl., but hardly the inference that he draws from it. It is impossible, too, any longer to lay that stress on the spore differences which Fée, and Flotow, and most recent writers have attempted. And Schwendener has himself admitted the difficulties of his characterization of *Gyrophora* and *Umbilicaria*, from the thalline characters alone. The general structure of the thallus offers no prominent differences from that of *Parmelia* and *Physcia;* and the distinction of the group, marked as it is, may be said to rest on its peculiar coloration, taken in connection with the deficiency of gonidia in, and the denigration, and abnormal development of, its fruit; and the manner of attachment of the thallus to the substrate. In some states of the highest expressions of *Umbilicaria*, as *U. pustulata v. papillata* Hamp., a Cape of Good Hope lichen, there is now indeed nothing external which may not be taken for Parmelieine, the thalline exciple agreeing entirely in colour with the pale greenish-brown thallus; but in a full view of the fruit

of this species in its more normal conditions, as exhibited in the northern hemisphere, it is perhaps easier to compare it (externally) with that of *Sticta*, as in *S. faveolata*, etc.; however surprisingly the same fruit be afterwards modified, as in *U. pustulata*, *v. papulosa*, and *U. Pennsylvanica*. We do not find any approach to this more normal coloration, and greater Parmelieine or Sticteine regularity of the exciple in the other section of the genus, unless it be, rarely, in *U. rugifera*, Nyl., occurring now glaucous with fruit little darker (California, *Bolander*) and in the Himalayan *U. lecanocarpoides*, Nyl. This fruit is indeed now Lecideoid, as in *U. anthracina*, but quickly passes into those gyrose states which especially mark the section; or is developed into the starry clusters, more remarkable than anything else in the metamorphoses of the genus, which characterize *U. Muhlenbergii*.

* *Apothecia patellate, now angulate, or even oblong; for the most part plicate; or the oblong sort finally grouped in stellate clusters. Spores mostly simple, but now muriform-multilocular. Thallus not papulose; the cortical layer for the most part only imperfectly parenchymatous above, and scarcely at all so below. Gyrophora*, Fée, Flot., & other recent authors.

† *Stock of U. anthracina.* Alpine lichens; but 1, 5, and 6 descending.

1. *U. rugifera*, Nyl.; thallus middling-sized, one-leaved, coriaceous, at length rigid, more or less rugged with coarse, reticulated wrinkles; pale ash-coloured, at length darkening, or now olive-brown; beneath pale, with now a rosy tinge, and beset more or less with scattered, or more rarely dense, pale or darkening fibrils; apothecia small to middling, primarily adnate, orbicular, simple, with a thin, persistent, finally flexuous margin; becoming at last proliferous. Spores ellipsoid, simple, fuscescent, or decolorate, $\frac{7\text{-}15}{5\text{-}8}$ mic.——*Nyl. Lich. Scand. p.* 117. *Th. Fr. Lich. Scand. p.* 156.

Alpine rocks (Eastern Siberia, *Nyl.* Norwegian Alps, *Th. Fr.*), and descending. Greenland, *Giseke.* Yosemite Valley and Mountains of California (*Bolander*), Tuckerman *Gen.* 1872. Alpine region of Mt. Hood, Oregon, *Hall.*

2. *U. cylindrica* (L.) Delis.; thallus of middling size, commonly many-leaved, coriaceous, round-lobed, smoothish, bluish-grey, or now smoke-coloured, fringed for the most part with black fibrils; beneath pale and more or less sparingly fibrillose; apothecia small to almost middling, orbicular, from adnate and sub-simple soon elevated, convex, and copiously plicate. Spores ellipsoid, fuscescent, or decolorate, $\frac{9\text{-}14}{6\text{-}9}$ mic.——*U. proboscidea, β, Fr. L. E. p.* 356. *Gyrophora probosc., Turn. & Borr. Lich. Brit. p.* 219.

High alpine and arctic rocks. Bear Lake (*Herb. Hook.*), Tuckerman *Syn.* 1848. Greenland, *Vahl.* Labrador, *Herb. Schwein.* Newfoundland (*U. Delisœi*, Despr.), *Despreaux.*

3. *U. proboscidea* (L.) Stenh.; thallus middling-sized, one-leaved, sub-membranaceous, flattish, few-lobed, with irregularly scalloped, now lacerate edges, reticulately wrinkled, especially at the pruinose centre; blackish-brown; beneath paler, now grey-pruinose, rather sparingly fibrillose; apothecia small, orbicular, becoming elevated and plicate. Spores ellipsoid and oblong, simple, mostly decolorate, $\frac{12\text{-}18}{6\text{-}9}$ mic.——*U. proboscidea, a, Fr. L. E. p.* 354. *Tuck. exs. n.* 49. *Gyrophora deusta, Turn. & Borr. L. B. p.* 222.

b. arctica, Ach.; thallus thickened and rigid, very rugged, beneath naked.

Alpine rocks. Arctic America (*Richardson*), Hooker *l. c.* 1823. Greenland, *Vahl.* Newfoundland, *Despreaux.* White Mountains, *Tuckerman.* North shore of Lake Superior, *Agassiz.* Mexico, *Nylander.*——*b*, Newfoundland, *Despreaux.* Greenland, *Vahl.* White Mountains. Mexico, *Nylander.*

4. *U. anthracina* (Wulf.) Schær.; thallus of middling size, coriaceous, rigid, smooth, or areolate-rimulose; blackish-brown; beneath smooth, or minutely granulated, and for the most part black-pruinose, without fibrils; apothecia small, elevated, orbicular, simple. [Spores oblong, simple, decolorate, $\frac{12\text{-}17}{5\text{-}7}$ mic.] ——*U. atro-pruinosa, Fr. L. E. p.* 351. *Nyl. Scand. p.* 113.

b. reticulata, Schær.; reticulately wrinkled above.

Alpine rocks. Arctic America (*b.*) *R. Brown* (Parry's Voy.) 1824. Greenland, *Vahl.* Newfoundland, *Despreaux.* On the Yellowstone, *Herb. Willey.* White Mountains (*b.*), *Tuckerman.* ——The plant of the White Mountains does not differ, but is in-

fertile.——*Gyrophora Wenckii*, Müll. (*Flora Ratisb.* 1867, *p.* 433) from Greenland, appears, by the description, to differ from *b* in nothing but the plicate fruit, looking rather towards that of *U. proboscidea*; from which last the first-named shall differ in smaller spores. In an infertile specimen of *G. Wenckii* before me (*Herb. Krempelh.*) agreeing generally with the published description, I find small clumps of fibrils on the upper surface and at the margins here and there, once more suggesting *U. proboscidea*. Spores of *G. Wenckii* not rarely a little curved (Müll. *l. c.*), as is observable in *U. anthracina*; but also, more rarely, in *U. proboscidea*.

5. *U. polyphylla* (L.) Hoffm.; thallus small, cartilagineous, commonly many-leaved and clustered, with unequal, crisped, at length much-divided lobules, smooth; dark-olive-brown; beneath smooth and very black, without fibrils; [apothecia small, sessile, orbicular, plicate. Spores ellipsoid, decolorate, "$\frac{13-18}{7-8}$" mic.].——*Nyl. Scand. p.* 119. *U. œnea, a, Schœr. Spicil. p.* 92.

Alpine rocks, and descending. White Mountains, *Tuckerman Syn.* 1848. Mt. Desert, Maine. Newfoundland, *Despreaux.* Greenland, *Vahl.*

6. *U. flocculosa*, Hoffm.; thallus of middling size, sub-membranaceous; blackish-brown, scurfy with a sooty efflorescence; beneath nearly of the same colour, more or less reticulately pitted, without fibrils; ["apothecia small, sessile, orbicular, plicate. Spores oblong ellipsoid, now a little curved, $\frac{18-27}{7-9}$ mic."]—— *Nyl. Scand. p.* 119. *Gyrophora, Turn. & Borr. L. B. p.* 217.

Alpine rocks, and descending. White Mountains, *Tuckerman Syn.* 1848. Mt. Desert, Maine. Rocky Mountains, *Herb. Hook.* Behring's Straits, *Wright.*——As near to the next certainly as to the last; but with larger spores than in either. Not as yet found fertile here.

7. *U. hyperborea*, Hoffm.; thallus middling-sized, mostly one-leaved, coriaceous-membranaceous, sparingly lobed, with jagged edges, papulose-rugulose, now here and there perforate; olive-brown; beneath pitted more or less, smooth, mostly blackish; apothecia small, at first appressed, oblong, or angulate, but becoming orbicular and plicate. Spores ellipsoid, mostly decolorate, $\frac{12-18}{6-9}$ mic.——*Fr. L. E. p.* 353. *Tuck. exs. n.* 143. *Nyl. Scand. p.* 118.

Alpine rocks. Arctic America (*Richardson*), Hooker *l. c.* 1823. Newfoundland, *Despreaux*. Rocky Mountains, *Herb. Hook.* N. shore of Lake Superior, *Macoun*. White Mountains, and highest Green Mountains, *Tuckerman*. Mountains of California, *Bolander*.

†† *Stock of U. erosa.*

8. *U. phæa*, Tuckerm.; thallus middling-sized, one-leaved, cartilagineous, smooth; from ash-coloured becoming tawny-brown; beneath granulated, paler, but at length now blackening, without fibrils; apothecia smallish, innate, and now sunken in the thallus (which is then papulose below) but becoming more prominent; originally angulate, becoming many-angled; or also rounded; plicate. Spores ellipsoid, mostly decolorate, $\frac{11\text{-}14}{6\text{-}8}$ mic.——*Lich. Calif. p.* 115.

Rocks of the Pacific coast, alt. 1000–3000 ft. (*Bolander*) Tuckerman Calif. 1866.

9. *U. erosa* (Web.) Hoffm.; thallus of middling size, one-leaved, coriaceous-cartilagineous, of few, rounded lobes, which are soon rimulose, with irregularly torn edges, and more or less reticulately perforate; from olive- at length blackish-brown; beneath paler, or now darker, radiously more or less ridged, the ridges foraminous and this side finally wholly ragged, or passing into fibril-like extensions; apothecia small, appressed and oblong, passing into stellate clusters; or more prominent, rounded, and plicate. Spores ellipsoid, fuscescent or decolorate, $\frac{9\text{-}12}{5\text{-}7}$ mic. ——*Schær. Spicil. p.* 93. *Turn. & Borr. L. B. p.* 229. *Tuck. Exs. n.* 48.

Alpine rocks; now descending. Arctic America, *R. Brown* (Parry's Voy.), 1824. Newfoundland, *Pylaie*. White Mountains, *Tuckerman*. Mine mountain, Brattleborough, Vt., alt. about 1000 ft., *Russell*. Mt. Hood, and Rocky Mountains, *Hall*, etc.

10. *U. Muhlenbergii* (Ach.) Tuckerm.; thallus middling to large, one-leaved, coriaceous at length rigid, irregularly more or less reticulately pitted; olive-brown; beneath mostly darker, granulate, lacerate in anastomosing ridges, and shaggy finally with fibril-like extensions; apothecia small to middling, originally oblong and appressed, passing into irregular, often stellate, plicate clusters, without common margin.——*Ach. Syn. p.* 67. *Tuckerm. Syn.* N. *Eng. p.* 74; *Lich. exs. n.* 144.

Rocks. Pennsylvania (*Muhlenberg*) Ach. *L. U.* 1810; and common throughout the northern States and Canada; as in Arctic America, *Richardson.*——A reduced, thickened, scarcely pitted, and at length somewhat polyphylline state (v. *alpina*, Tuckerm. *l. c.*) occurs on alpine rocks in the White and Green Mountains, *Tuckerman*; and in Hastings county, Canada, *Macoun.*

Stock of U. vellea.

11. *U. hirsuta* (Ach.) Stenh.; thallus one-leaved, membranaceous, softish, somewhat powdery; pale ash-coloured; beneath pale, and hirsute with mostly dense and pale fibrils; ["apothecia small, appressed, orbicular, soon convex, plicate. Spores ellipsoid, simple, decolorate, $\frac{10\text{-}11}{5\text{-}6}$ mic."]——*U. vellea*, γ, *Fr. L. E. p.* 358. *Th. Fr. Scand. p.* 155.

β, *grisea*, Th. Fr.; small, finally blackening beneath, where it is granulate, and either naked, or very sparingly now fibrillose.——*U. murina*, *DC. Nyl. Scand. p.* 116.

Rocks in high mountains. Mexico (v. *papyrina*), *Nylander.* ——β, alpine county, California, infertile (*I. A. Lapham*), Tuckerman Calif. 1866. This variety is a distinct form, and taken for a species by Nylander, according to whom the spores also vary from those of *a*. The last is scarcely as yet known here.

12. *U. vellea* (L.) Nyl.; thallus large, one-leaved, coriaceous, smoothish; glaucous-ash-coloured; beneath brownish and blackening, very hirsute; apothecia small, appressed, orbicular, plicate, becoming convex, and immarginate. Spores rounded-or short-ellipsoid, simple, decolorate, $\frac{8\text{-}13}{6\text{-}8}$ mic.——*Nyl. Scand. p.* 114. *Th. Fr. Scand. p.* 153. *U. hirsuta*, *Tuck. Exs. n.* 47.

b. the under side granulate, fibrils mostly obsolete.——*U. tylorhiza*, *Nyl.*, *fide Th. Fr.*

Rocks in high mountains. White Mountains, *Tuckerman* (*U. hirsuta of Syn.* N. Eng.) 1848. Newfoundland, *Despreaux.* North Shore of Lake Superior, *Agassiz.* Rocky Mountains, infertile, *Hall.* North West coast, infertile, *Douglas.*——Fronds at length reaching six inches in diameter; but the fruit not exceeding one line.——*b*, Southern Colorado, *Brandegee* (Herb. Willey).

13. *U. Dillenii*, Tuckerm.; thallus large to very large, one-leaved, coriaceous, smooth; from tawny- at length sooty-brown; beneath very black, closely hirsute with short fibrils; apothecia middling-sized, attached only at the centre, orbicular, convex,

plicate, and becoming lirellose, and immarginate. Spores ellipsoid, simple, decolorate, $\frac{17\text{-}25}{9\text{-}15}$ mic.——*Lichenoides, Dill. Musc. p.* 545. *Tuckerm. Syn. N. E. p.* 72; *Lich. exs. n.* 46.

Rocks. New Jersey (*J. Bartram*), Dillenius *Musc.* 1741. Common, in the low country, throughout the northern Atlantic States; and southward, in the mountains, to Georgia (*Ravenel*). Shores of Lake Superior, *Agassiz*. Northward to Newfoundland.——The largest species known; the fronds exceeding at length nine inches in diameter, and the fruit now more than two lines, or four millim.——The lichen is quite distinct from *U. vellea.*

14. *U. angulata*, Tuckerm.; thallus scarcely middling, one-leaved, coriaceous, rigid, smooth; from ashy- at length tawny-brown, rendered purplish by a thin bloom; beneath black, granulate, lacerate, and clothed at length more or less with paler fibrils; apothecia small to middling-sized, appressed, angulate-patellate, flattish, plicate, with a thick, persistent margin. Spores ellipsoid, simple, decolorate, $\frac{16\text{-}23}{7\text{-}10}$ mic.——*Syn. N. Eng. p.* 74.

* *Semitensis*, Tuckerm.; scarcely differing in the specimens seen, except that the spores vary from simple and decolorate, when they resemble those of *U. angulata*, to brown, and muriform multilocular (transverse series of spore-cells, 5-8; of 3 to 4 members, in the middle), measuring then $\frac{23\text{-}32}{12\text{-}22}$ mic.——*U. Semitensis, Gen. p.* 31.

Rocks of the Pacific coast. *a*, maritime rocks, Monterey, California (*Menzies*), Tuckerman *l. c.* 1848. Observatory inlet, British Columbia, *Herb. Hook.*——* *Semitensis*, further inland, Yosemite Valley, and elsewhere (*Bolander*), Tuckerman *l. c.* 1872.——Fronds, of neither lichen, surpassing two inches in diameter. The spore-history of * is important as illustrating the view elsewhere taken by the author, of the inferior systematic value of merely gradal differences in spores. It was remarked (Lich. Calif. p. 7), that lichens which exhibit the ultimate condition or grade of their type of spore, exhibit also ideally, and in fact more or less, all the steps or grades in the preceding process of evolution. This is fully seen in *U. Semitensis*, which offers, in a full examination, simple, bilocular, and quadrilocular spores with entire spore-cells, and then every step beyond to perfectly muriform ones. And the simple spore of

this series agrees in size as in every other respect with the spore of *U. angulata*; and is yet accompanied, in the same lichen, with the larger, muriform ones. The bearing of this is obvious. *Gyrophora* of authors cannot be distinguished from their *Umbilicaria* by simple spores; and the latter organs are rather to be called decolorate than colourless.

* * *Apothecia sub-scutellate, becoming plicate, and proliferous. Spores muriform-multilocular. Thallus papulous; the cortical layer parenchymatous throughout. Spores solitary, or in twos. Umbilicaria, Fée, Flot., and many recent authors.*——In this section the genus reaches its best development. The denigration of the fruit is often less marked than in the first section, and its internal structure less divergent from that of Parmeliaceous types: and in these respects, and in the structure of the thallus as well, there is suggested a clear, if distant association with *Sticta*.

15. *U. Caroliniana*, Tuckerm.; thallus middling, membranaceous, becoming polyphyllous, and the rounded lobes complicated, very smooth, irregularly or obscurely papulous; from olive- at length blackish-brown; beneath pitted, granulate, very black; beset here and there with a few strong fibrils; apothecia small, attached only at the centre, and elevated, from simple with a thick margin soon plicate, and finally proliferous. Spores ellipsoid, muriform-multilocular, brown, $\frac{30\text{-}40}{20\text{-}23}$ mic.——*Obs. Lich.* 4, *l. c. p.* 167. *U. mammulata, Tuckerm. Syn. N. E. p.* 69, *non Ach., fide Nyl.*

Rocks, Grandfather mtn., North Carolina (*Curtis*), Tuckerman *Syn.* 1848. High mountains of North Carolina, *Buckley*.

16. *U. Pennsylvanica*, Hoffm.; thallus large, one-leaved, coriaceous, papulous; from ashy- at length smoky-brown, often white powdery at the centre; beneath granulate, brownish-black, without fibrils; apothecia small, attached at the centre, simple, flat; but becoming proliferous, and excluding finally the obtuse, soon striate, and flexuous margin. Spores solitary, ellipsoid, muriform-multilocular, blackish-brown, $\frac{46\text{-}70}{23\text{-}35}$ mic.——*Hoffm. Pl. Lich.* 3, p. 5. *Hook. in App. Frankl. exp. p.* 759. *Tuck. exs. n.* 40.

Rocks, Pennsylvania (*Muhlenberg*), Hoffmann *l. c.* 1801. The lichen occurs from Arctic America, *Richardson*, throughout the Atlantic States, to Georgia, *Ravenel*.

17. *U. pustulata* (L.) Hoffm.; thallus small to middling in the mountain forms, one-leaved, coriaceous, papulous; whitish-ash-coloured, more or less powdery or at length chinky; beneath reticulately pitted, granulated, dark-brown now grey-pruinose; apothecia small to almost middling, simple, flat, with an obtuse, at length irregular margin. Spores solitary, ellipsoid, muriform-multilocular, brown, $\frac{46-70}{25-40}$ mic.——*Fr. L. E. p.* 351. *Gyrophora, Turn. & Borr. L. B. p.* 232.

b. papulosa, Tuckerm.; thallus middling to large, darker, and often brownish; apothecia soon proliferous. Spores longer, $\frac{46-90}{25-40}$ mic.——*Syn. N. E. p.* 70; *Exs. n.* 141. *Gyroph. papulosa, Ach. Syn. p.* 67.

Rocks. *a*, New York, *Halsey* View, 1823. Alpine region of the White Mountains, *Tuckerman*. Organ Mountains, Texas, *Wright*. Mountains of New Mexico, *Fendler*.——*b*, though also alpine, is the common low-country lichen, and found from Pennsylvania (*Muhlenberg*), Hoffm. *D. Fl.* 1796, northward to Newfoundland, *Despreaux*; and southward to the mountains of the Carolinas, and Georgia (*Ravenel*). In this form the fibrous glomerules and fringe so common in the European plant are now observable.

Fam. 4.—PELTIGEREI.

Thallus plano-ascendant, frondose-foliaceous, coriaceous-membranaceous, beneath more or less villous, and marked now with veins, and now with little cups or heaps (cyphels). Gonimous layer varying in structure; the green cells composing it being now of the ordinary sort (gonidia) and now of the blue-green, gelatinous sort (gonimia).

Fries, Meyer, and Eschweiler have taken their *Peltigera* (equivalent to our *Peltigerei* excluding *Sticta*) for the highest exhibition of the foliaceous type in Lichens. And if *Sticta*, to which Meyer gave the second place and Nylander now assigns the first, be added, it will be easy to regard the family before us as constituting the true centre of the *Parmeliacei*.

Peltigera is readily seen to be very close, on the one hand to *Solorina*, and on the other to *Nephroma*; and the latter stands in most intimate and unquestioned affinity to *Sticta*.

Looked at from the point of view of the spores, almost the whole of the lichens referable here is grouped at one of the extremes,—the spores of *Sticta*, *Nephroma*, and *Peltigera* being 4-plurilocular, and seemingly of the Colourless Series—and the analogical centre of the tribe represented only, if at all, by the almost rather Pannariine *Erioderma*. Nor is this the only curious feature of the *Peltigerei*. Though the close affinity of *Sticta* to *Nephroma* be scarcely to be questioned, or of the latter to *Peltigera*, and the at length plainly acicular and colourless spores of the last should seem to refer it, unmistakably, to the Colourless Series, there is never entirely wanting some slight evidence of coloration; which becomes marked in *Nephroma*, and *Sticta*, and is at least observable in *Erioderma*. There appears, however, to be little doubt entertained by authors that in all these cases the spores differ in type from those of *Solorina*; and the same view is, with some hesitation, accepted here: and the genus last-named is therefore the only member of the family clearly referable to the Brown Spore-series. *Genera*, p. 31.

XIV.—STICTA (Schreb.) Fr.

Apothecia scutellæform, sub-marginal, elevated, now blackening. Spores fusiform, and acicular, 2-4-plurilocular; fuscescent or without colour. Spermatia oblong, thickened at the ends; on multi-articulate sterigmas. Thallus frondose-foliaceous, variously but for the most part wide-lobed, rounded or now elongated, coriaceous-cartilagineous; villous beneath, where it is commonly dotted with cyphels, or marked with bare spots. Gonimous layer constituted, now of gonidia, and now of gonimia.——Mainly a tropical genus, a large proportion of the species occurring also in, or confined to austral regions, but scarcely a fifth known in the northern temperate ones, where about half the prominent forms occur only sterile.

* *Thallus Parmeliiform; the under side only very rarely* (*and not at all in our species*) *bearing cyphels. Gonidia agreeing in all important respects with those of Parmelia, and Umbilicaria. Ricasolia, De Not.*

1. *S. amplissima* (Scop.) Mass.; thallus ample, orbicular, appressed, cartilagineous-coriaceous, smooth or with age transversely wrinkled; cinereous-glaucescent; beneath tawny darkening toward the centre, villous; the elongated lobes either wide and for the most part compacted, or now narrowed and the sinuate lobation marked; apothecia scattered, ample to large; the disk chestnut; the entire margin at length inflexed. Spores acicular, from bi- at length quadrilocular, soon colourless, $\frac{30\text{-}70}{5\text{-}7}$ mic.——*Parmelia, Schær. Spicil. p.* 450. *Sticta glomeruliféra, Fr. L. E. p.* 54. *Tuck. Exs. n.* 105. *Ricasolia, Nyl. Syn.* 1, *p.* 368.

Trunks and rocks, common at the north, from New England, *Tuckerman*, Enum. 1845, to Canada, *Macrae*, and Arctic America (*Parm. herbacea*), *Richardson*. Pennsylvania, *Muhlenberg* in *herb.* Willd. Ohio, *Lea*. Wisconsin, *Lapham*. And it follows the mountains southward to Virginia, *Curtis;* and North Carolina, *Ravenel.*——So far as seen the southern lichen is smallish, and now suggestive of the closely allied *S. erosa*.

2. *S. herbacea* (Huds.) Ach.; thallus membranaceous, appressed, smooth; from pale- at length dark-brown; beneath mostly pale, villous; lobes sinuately repand, with rounded tips; apothecia scattered, ample; the inflexed margin sub-crenate. Spores fusiform, 2-locular, $\frac{30\text{-}40}{9\text{-}11}$ mic.——*Del. Stict. p.* 132, *t.* 16, *f.* 56. *Fr. L. E. p.* 55. *Ricasolia intermedia, Nyl. Syn.* 1, *p.* 369.

Trunks, Orizaba, Mexico, *F. Müller* in *herb.* Willey.—— Scarcely differs from the European species; nor is any difference of importance noted in Nylander's cited description. The interest of the lichen lies in its affording us at last a good American representative of the European plant. Our northern *S. amplissima* is always without the "glomerules" so long taken for characteristical of the lichen in Europe, and was referred therefore, without doubt, in the catalogues of Muhlenberg, Halsey, and Hooker, who do not otherwise recognize it, to the really thinner and less divided *S. herbacea*; from which we now know it to be also separated by the spores. And the spores decide equally the place of certain wider-lobed conditions of the southern and tropical *S. erosa*, which might pass, and have passed with very experienced lichenists, for the present species.

3. *S. erosa* (Eschw.); thallus generally like that of *S. amplissima*, but smaller and more membranaceous, scrobiculate; glaucescent (fuscescent;) beneath villous and becoming blackish-brown; the lobes now more entire or erose-crenate, and now passing, as in the other species named into narrowed and looser, more or less strongly sinuate divisions; apothecia scattered, middling to ample, membranaceous; the disk chestnut; the inflexed margin at length lobulate-crenate. Spores slender-acicular, 2-4-locular, soon without colour, $\frac{44-70}{3-5}$ mic.——*Parmelia, Eschw. Bras. p.* 211. *Sticta Ravenelii, Tuckerm. Suppl.* 2, *l. c. p.* 203. *Ricasolia crenulata v. stenospora, Nyl. Syn.* 1, *p.* 373, *dein R. erosa, Nyl. in Prodr. Fl. N. Gran. p.* 21.

Trunks and rocks, in the low country of South Carolina and Georgia (*Ravenel*), Tuckerman l. c. 1859, Florida, *Austin*, and throughout the Gulf States, *Peters*, *Hale*, etc. Also in the Island of Cuba (*Lich. Cub.* n. 66), and elsewhere within the tropics.——Differing in its (at length deeply and reticulately) pitted upper side, and its crenulate-lobate apothecia, in which last feature it resembles at length *S. crenulata* (Hook.) Del., and *S. pallida* (Hook.).

4. *S. dissecta*, Ach.; thallus ample, orbicular, coriaceous, lacero-laciniate, more or less lacunose; cinerous-glaucescent; beneath villous in blackish anastomosing veins between naked, pale spots; the elongated lobes more or less deeply or even pinnately sinuate, with rounded and crenate circumference; apothecia middling to ample, scattered; disk chestnut, bordered by a sub-entire or finally lobulate margin. Spores broad-fusiform, 2-4-locular, fuscescent, $\frac{30-46}{12-16}$ mic.——*Ach. L. U. p.* 451. *S. peltigera, Del. Stict. p.* 150. *Ricasolia dissecta, Nyl. Syn.* 1, *p.* 370, *& R. sub-dissecta, Nyl. ibid. p.* 371.

b. corrosa, Ach.; lobes passing, more or less, at the margins, into a fringe of slender lobules.——*Ach. Syn. p.* 235. *S. dissecta, Del. Stict. p.* 148. *Ricasolia corrosa, Nyl. Syn.* 1, *p.* 372.

Trunks, Mexico, *Nylander l. c.* 1860.

Well distinguished by its veiny under side, and brown spores. It is admirably exhibited in Lindig's New Granada collection; for I cannot consider the Nos. 713, 2543 of the first, and 66 and 79 of the second series of this collection (*Ricasolia sub-dissecta*, Nyl.) as at all well separable in species from No. 113 (*R. dissecta*, Nyl.).

5. *S. pallida*, Hook.; thallus irregularly wide-lobed, membranaceous, smoothish; glaucescent; beneath villous, pale; the rounded, sparingly sinuate lobes repand or crenate. Apothecia sub-marginal, middling to ample; disk chestnut, bordered rather widely by the lobate-crenate margin. Spores acicular with more or less attenuate tips, 8-12-locular, scarcely coloured, $\frac{34\text{-}80}{7\text{-}9}$ mic.——*S. Kunthii*, *Del. Stict. p.* 126. *Ricasolia pallida*, *Nyl. Syn.* 1, p. 372.

Trees, Mexico, *Krempelhuber Exot. Flecht.* 1868; and elsewhere in tropical and austral America.——Another well-marked species; my specimens of which are from Venezuela (*Fendler*), New Granada (*Lindig* n. 2514, from which I cannot separate n. 13 of the second series, which is ticketed *Ricasolia crenulata*), and Bolivia (*Mandon*).

* * *Thallus lax, and, for the most part, large- or long-lobed; the under side bearing cyphels, or spotted. Gonidia agreeing generally with those of the first section.* Sticta, *Nyl.*

† *Thallus bearing cyphels, which are now* (*n.* 5) *urceolate, and now* (*n.* 6) *sorediiform, powdery heaps.*

6. *S. damæcornis* (Auct. pr. p.); thallus ample, loosely extended, membranaceous-coriaceous, smooth or now pitted; glaucescent (fuscescent, rufous or now yellowish) beneath from pale becoming dark-brown with a similarly varying, mostly thin nap (which is now deficient), besprinkled with urceolate cyphels; lobes elongated, now wide and rounded, flexuously sinuate or sub-pinnatifid, and now narrowed into linear, dichotomously multifid, at length densely intertangled divisions; apothecia sub-marginal, middling-sized; disk chestnut and blackening; the entire (or now irregularly dentate) margin often pilose, of the colour of the thallus. Spores fusiform, typically 4-locular, colourless when free, $\frac{25\text{-}40}{8\text{-}12}$ mic.——*S. damæcornis & S. laciniata*, *Ach. L. U. p.* 446, *pro p. Nyl. Syn.* 1, *p.* 354, 356 *pro max. p.*

On trees, Mexico, *Nylander*; and generally throughout the tropics.

One of the best-known of tropical lichens, and (confused more or less with *S. quercizans*) very early observed and described; the specific name being derived from the descriptive phrase of Plumier, 1703. This was the sub-linear, many-cleft plant, the segments of which, as Dillenius says (*Hist. Musc. t.*

29, 115), imitate more closely the figure of buck's-horns than those of any other species. Swartz, who recognized this lichen and gave its name the form it has since borne (*Prodr. Ind. Occ.*), undertook also to separate a wider-lobed one, which, as contrasting with his 'multipartite-dichotomous' *damæcornis*, he proposed to call *Lichen laciniatus*. He figured this last (*Lich. Amer.* t. 7) as Hoffmann had already done (*Pl. Lich.* 3, t. 65, 3), and it was received as a species by Acharius, who yet remarked (*l. c.*) that only the width of the lobes kept it from *damæcornis*. But Delise, who followed Bory in distinguishing specifically two members of Acharius's *S. damæcornis*, followed also the latter author in accepting *S. laciniata*, though he scarcely added to our knowledge of it. And finally both lichens have been reviewed, and set up once more as distinct by Nylander, *l. c.* The considerable material which has brought me to a different opinion embraces, beside the large collections of Fendler in Venezuela, and Wright in Cuba, not a few from the herbaria of Hooker, Greville, and Borrer, from the Berlin herbarium, and the Paris herbarium (the last, as some others, being determined by Nylander), and above all from the herbarium of Delise, and the admirable New Granada collection of Lindig, also named by Nylander. And all this scarcely leaves room for doubt that Acharius was right, and that the distinction of *S. laciniata* from the other is wholly an arbitrary one. The thalline characters by no means justify it; and the spores, in which Nylander appears willing to see some slight difference in the measurements, prove positively the same. It is true that the group, as thus understood, is a vast, and, like other tropical groups, a very varied one; it appears better however to keep it together, at least until sub-species can be indicated from the evidence of larger material, and more satisfactorily, than has yet been done. *S. damæcornis, v. macrophylla*, Nyl. *l. c.*, as respects my specimen of *S. macrophylla*, Del., from the herbarium of the latter, as also a specimen from the Paris Museum named by Nylander himself, should be excluded (by the criterion of the gonidia) from the species. And *S. patula*, M. & V. d. Bosch, which is referred by the same author, *l. c.*, to his v. *caperata*, differs yet, in the original specimens (as in another from Tahiti), in larger, often fuscescent spores, measuring $\frac{40\text{–}58}{12\text{–}16}$ mic., which suggest rather v. *platyphylla*, Nyl., now taken by him for a species.

7. *S. aurata* (Sm.) Ach.; thallus ample, coriaceous-membranaceous, broadly and deeply lobed, smoothish; from greenish-glaucescent soon reddening, and brownish-red, or at length rose-red; lemon-coloured within; beneath villous, tawny becoming of much the same colour at the circumference but blackening towards the middle, with minute sorediiform cyphels; lobes sinuately cut, with soon waved and crisped and yellow-powdery edges; apothecia [in Cuban and Brazilian specimens, ample, marginal, oblique, membranaceous; the disk dark-purplish; the narrow, sub-entire margin more or less inflexed. Spores irregularly fusiform, 4-locular, fuscescent, $\frac{21-30}{6-9}$ mic.]—— *Fr. L. E. p.* 50. *Parmelia Eschw. Bras. p.* 216. *Sticta, Nyl. Syn.* 1, *p.* 361.

Among mosses on trunks and rocks, always infertile. *Tuckerman Syn.* 1848; from the south shore of Massachusetts, *Willey*, Pennsylvania, *Michener*, and Ohio, *Lea*, to the Carolinas and Georgia, *Ravenel*, the Gulf States, *Hale, Wright*, etc.; and Mexico.

†† *Thallus without cyphels, but varied for the most part beneath with pale, naked spots.*

8. *S. pulmonaria* (L.) Ach.; thallus coriaceous, ample, loosely extended, lacunose-reticulate; tawny-olivaceous, and dark-tawny; (now sorediiferous, or also isidiophorous) beneath sparingly brown-villous in veins between pale naked spots; lobes elongated, deeply, at length narrowly, sinuate-lobate, with retuse-truncate ends; apothecia sub-marginal, middling-sized; the disk red-brown; the thin, entire or wrinkled, finally concolorous margin at length excluded. Spores cymbiform, 2-4-locular, colourless when free, $\frac{18-33}{6-10}$ mic.——*Ach. L. U. p.* 449, *nom. emend. Fr. L. E. p.* 53. *Tuck. Lich. exs. n.* 68. *Nyl. Lich. Scand. p.* 95.

b. hypomela, Del.; the veins of the under side black.—— *Del. Stict. p.* 144.

c. linita, Nyl.; the orbiculate thallus round-lobed, with crenate at length lobulate ends; less lacunose; and of much the same colour beneath.——*Nyl. Lich. Scand. p.* 96. *S. linita, Ach. Syn. p.* 234. *Nyl. Syn.* (*S. Garovaglii, Schær. incl.*) *p.* 353.

Trees and rocks. A common northern lichen from Pennsylvania, *Muhlenberg Catal.* 1818, to Newfoundland, *Pylaie*, and westward to Wisconsin, *Lapham.* Southward it follows the

mountains to N. and S. Carolina, *Ravenel*; and is found also on the N. W. Coast, *Douglas*; *Hall.*——*b* is a tree-form, found in Pennsylvania, *Krempelhuber Exot. Flecht.* 1868, and, well-marked, in California, *Fitch*, and Oregon, *Hall.*——*c*, a rock-form first noted as an United States plant by *Delise, Stict.* 1822, occurs, as distinguishable now from *a* as the European, at the White Mountains, *Tuckerman, Syn.*, 1848, and northward to islands of Behring's Straits, *Wright.*

9. *S. Oregana*, Tuckerm.; thallus coriaceous-membranaceous, ample, lacero-laciniate, lacunose-reticulate; greenish-glaucescent and flavescent; beneath reticulately brown-villous between naked, white spots; lobes elongated, rounded at the circumference, with erose, finally crenate-lobulate and dissected edges; apothecia scattered, middling-sized; the disk chestnut; the thin, denticulate margin finally excluded. Spores fusiform and acicular, 4-locular, without colour when free, $\frac{44\text{-}75}{6\text{-}9}$ mic.—— *Bull. Torr. Bot. Club, vol.* 5, 4, *p.* 20.

Trees, Oregon, *Hall.*

* * * *Thallus as in the preceding section, except that the place of gonidia is taken here by gonimia.* *Stictina*, *Nyl.*

† *Thallus bearing cyphels, which are either* (*n.* 9, 10, 11, 12) *urceolate or* (*n.* 13, 14) *sorediiform.*

10. *S. Humboldtii*, Hook.; thallus cartilagineous, wide-lobed, villous on both sides; ashy-grey above; beneath pale brown, more or less spongy-villous, and besprinkled with urceolate whitish cyphels; lobes irregularly and sparingly divided, with rounded undulate ends; apothecia scattered, middling-sized, externally villous; disk reddish-brown; margin entire. Spores fusiform, 2-4-locular, soon without colour.——*Del. Stict. p.* 69. *Nyl. Syn.* 1, *p.* 341.

Trees in Mexico, *Nylander, l. c.*

11. *S. tomentosa* (Sw.) Ach.; thallus smallish, membranaceous-coriaceous, widely laciniate, mostly pitted or now smooth; glaucescent passing into lurid-brown; beneath pale for the most part, spongy-villous, besprinkled with concave, at length ample, white cyphels; lobes deeply-divided, rounded at the ends and repand-crenate, or now narrowed and bifid, sub-ciliate; apothecia scattered or sub-marginal, at length middling to

ample; disk reddish-brown and blackening; the very entire (now also denticulate) margin becoming pilose or shaggy. Spores fusiform, 2-4-locular, soon without colour, $\frac{25-50}{8-12}$ mic.—— *Ach. L. U. p.* 450. *Nyl. Syn.* 1, *p.* 343.

Trees, Mexico; and elsewhere in tropical America, *Nylander*; *l. c.* A difficult species, closely related, on the one hand to *S. cometia*, Ach., and on the other to *S. quercizans*. It is understood here as represented by *Stictina tomentosa*, Nyl. in Lindig *Herb. N. Gran.* n. 120, and n. 119 (from which last however I cannot at all separate in species the *S. Lenormandi*, V. d. Bosch, Nyl., of Lindig n. 2522, which should seem to carry with it the other lichens of this collection so-named) and *S. tomentosa*, v. *dilatata*, Nyl. in Mandon *Lich. Boliv.* n. 1745. The *S. tomentosa* of Lindig n. 2521, differs only in smoothness, but is interesting as enabling us to connect with the species before us a Sandwich Island lichen with always rather longer and now 5-6-locular spores, which has sometimes passed with lichenographers for the equivocal *S. Ambavillaria*, Del. (Nyl. in *Herb. Mus. Par.*). And this latter plant associates itself readily with the Venezuelan *S. leucoblepharis*, Mont. & Tuck., already referred here by Nylander.——The lichen in Lindig *coll.* 2, n. 82, scarcely well associable with the other conditions of *S. tomentosa*, cited above, is at least comparable with some of the specimens of Wright *Lich. Cub.* n. 56 (*S. quercizans, v. damæcornifolia*).

12. *S. quercizans* (Michx.) Ach.; thallus cartilagineous-coriaceous, orbiculate and sub-imbricate, or loosely extended, laciniate-lobate, smooth; from greenish-glaucescent becoming reddish-brown, or passing into yellowish; clothed beneath with a mostly spongy, pale-brownish or blackening (now obsolescent) nap, which is besprinkled with urceolate, whitish cyphels; lobes deeply sinuate and now pinnatifid, with rounded and repand or crenulate ends, often at length crisped, and fringed densely with minute coralloid branchlets, passing also, in the tropics, into a narrowed, dichotomously-multifid, entangled form, like an analogous state of *S. damæcornis*; [apothecia, in tropical specimens, sub-marginal, smallish to middling; the disk reddish-brown; the thin, entire margin now denticulate and pilose, and finally concolorous. Spores fusiform, 4-locular, soon colourless, $\frac{25-40}{7-11}$ mic.]——*Tuckerm. Syn. N. E. p.* 22, *& Lich. exs. n.* 66. *Nyl. Syn.* 1, *p.* 344–6.

Trunks and rocks, Grandfather mountain, N. Carolina, *Michaux*, Fl., 1803, and common throughout the southern States, *Ravenel*, *Hale;* as, westward, to Ohio, *Lesquereux;* and, scarcely less so, northward to Canada; always infertile. Oregon, also infertile, *Hall.* Mexico, *Nylander.*

Michaux describes apothecia, which may probably have been derived from some tropical specimen, whether of *S. damæcornis*, as Nylander supposes, or of what we now should call *S. quercizans.* The only Sticta, beside *S. pulmonaria*, seen by me in *herb.* Michx. (*Herb. Mus. Par.*) which specimen is ticketed 'Lichen, Grandfather mont.,' is clearly the '*varietas sterilis marginibus pannoso-crispis*' of his *Flora*, and the common North American state of the present species. It is only in the tropical and austral regions of the earth that the lichen reaches its full development. And here it exhibits so close a relationship to *S. damæcornis* that the distinction of the two turns at length on the systematic value we assign to the two sorts of gonidia.

13. *S. sylvatica* (L.) Ach.; thallus cartilagineous-membranaceous, deeply laciniate; from greenish- becoming reddish-brown; beneath pale, villous, with urceolate, whitish cyphels; lobes difform with repand or lacerate edges, now somewhat pitted, and rather sparingly roughened with grey granulations; [apothecia as in the next, Nyl.]——*Ach. L. U. p.* 454. *Nyl. Syn.* 1, *p.* 348.

Rocks among mosses. Catskill Mountains, New York (*Peck*), Tuckerman *Gen.* 1872. Agrees with the European lichen, and differs like that from the next, as from *S. quercizans.* The *S. sylvatica* of Muhlenberg, and of Halsey, is doubtful; as they did not recognize the nearly akin lichen of Michaux.

13(*b*). *S. fuliginosa* (Dicks.) Ach.; thallus coriaceous-membranaceous, orbiculate, round-lobed; dark-lurid-grey; beneath pale, villous, with concave, whitish cyphels; lobes mostly very entire, wrinkled, and besprinkled, at length densely, with blackish granules; [apothecia, in a Welsh specimen from Mr. Borrer, marginal, smallish, biatoroid, the reddish-brown disk soon convex, and the thin, entire, paler margin disappearing. Spores fusiform, 2-4-locular, soon colourless, $\frac{25\text{-}46}{7\text{-}9}$ mic.]——*Ach. l. c. Nyl. l. c. p.* 347.

Rocks and trunks. New England, *Tuckerman Gen.* 1872; *Willey.* California, *Bolander.* Oregon, *Hall.* British Colum-

bia, *Lyall.* Mexico (fertile), Krempelhuber *Lich. exot.*——It is observable that while the present is a cosmopolitan lichen, so marked that it seems impossible not to give it a separate place, the near akin *S. sylvatica* is all but confined to Europe, and closely approaches the northern (and original) form of *S. quercizans.*——It is difficult to understand how such an observer as Dillenius should emphasize as he does the difference between the fruit of his t. 27, f. 101 (*S. sylvatica*) and that of his t. 26, f. 100 (*S. fuliginosa*), but much more difficult to suppose with Delise (*Stict. p.* 87) that the figure 101, etched as well as drawn by the author of the *Historia Muscorum*, should represent what was nothing less than a confusion of plants of different genera. But we cannot but note that the figure 100, exhibiting a lichen from Cader Idris in Wales, contrasts also with 101, irrespectively of the peltate difference of the last, in having the apothecia not even marginal, but scattered; a character which reappears in most books, though certainly qualified in Ach. *L. U.* And it is not then without interest that Mr. Borrer's already cited plant, which was also from Cader Idris, and determined by him as *S. fuliginosa*, has on its lobes forty odd apothecia, and that these are all but uniformly close to the margin. These small fruits (averaging 1–1, $5^{mm.}$) have furnished me with abundant spores; upon which compare Nyl. *l. c.*

13(*c*). *S. limbata* (Sm.) Ach.; thallus much as in the last but smallish, membranaceous, orbiculate, and sub-monophyllous; from leaden- at length liver-brown, smooth; the broad, rounded lobes beset toward the margins with conspicuous, rounded, grey soredia; [apothecia scattered, appressed; disk rusty-brown, finally excluding the margin.]——*Fr. L. E. p.* 52. *Nyl. Syn. p.* 346. *Mudd Man. Brit. Lich. p.* 88.

Oak trees, on the Coast range of mountains, Oregon, *Herb.*, J. W. Eckfeldt.

14. *S. crocata* (L.) Ach.; thallus membranaceous-coriaceous, irregularly laciniate, pitted more or less and at length reticulately ribbed, besprinkled commonly and edged with lemon-coloured soredia; from greenish-glaucescent becoming brownish, tawny, or russet-brown; beneath of much the same colour or blackening, the spongy nap speckled with lemon-coloured, sorediiform cyphels; lobes wide and rounded, with erose or crenate circumference, or (f. *laciniosa*) narrowed into sub-linear, pinna-

tifid divisions with retuse-bifid ends; [apothecia, in exotic specimens, now scattered and now marginal, smallish to middling-sized; the disk reddish-brown and blackening; the paler margin mostly entire. Spores cymbiform, 2-locular, brown, $\frac{23-35}{9-12}$ mic.] ——*Ach. L. U. p.* 447. *Tuck. Lich. exs. n.* 65. *S. crocata, & S. gilva, Nyl. Syn.* 1, *p.* 338.

Rocks among mosses, and rarely also on trunks, New England, *Tuckerman Syn.* 1848. Canada, *Macoun.* Mountains of North Carolina, *S. B. Buckley.* Oregon, *Hall.* It is unknown here in a fertile state.——The narrowed form (f. *laciniosa*) appears to connect the more familiar wide one with the at length palmately many-cleft plant of the Sandwich Islands, which does not differ from the var. *gilva*, Ach., from the Cape of Good Hope. The fruit of *S. crocata* varies in a manner perhaps not wholly without bearing on Dillenius's account of the fruit of *S. sylvatica.* It occurs now scattered, on the wider-lobed fronds, with the look of that of *Parmelia;* and, then again, on the narrowed conditions, it is marginal. And the shores of the Straits of Magellan furnish us, finally, with an otherwise marked state (v. *mallota* (*)) in which the conspicuous apothecia are not only exactly marginal and oblique (as in *S. aurata* in Mart. *Ic. Pl. Crypt. Bras.* t. 14, f. 1, 1) but occur moreover on somewhat extended lobules, and deserve the character of sub-peltate (Fr. *L. E.* p. 50) and a comparison with the peltate ones of the cited figure of Dillenius quite as much as those of *S. aurata.*

15. *S. anthraspis*, Ach.; thallus cartilagineous-coriaceous, wide-lobed, lacunose-reticulate, now conspicuously beset, like the following species, with grey soredia; olivaceous-brown becoming tawny, and russet-brown; rounded at the circumference which is sub-crenate, or now more deeply cut and retuse-bifid; beneath covered with a pale nap, darkening and denser toward the centre, and besprinkled with white, sorediiform cyphels; apothecia scattered; middling-sized; disk from red-brown becoming black and convex; excluding the thin, entire (or also now denticulate) margin. Spores fusiform, 2-4-locular, very soon colourless, $\frac{23-31}{7-11}$ mic.——*Ach. L. U. p.* 449; *Syn. p.* 233.

(*) *Sticta crocata,* var. *mallota, Mihi; thallo utrinque plus minus hirsuto; apotheciis marginalibus obliquis. Sporæ speciei nisi* 4-*loculares, longit.* 0,025–32$^{mm.}$; *crassit,* 0,008–11$^{mm.}$. *Ad Fretum Magellanicum, Rev. T. Hill.* Does not differ at all from the wider lobed condition of *S. crocata, a,* except in the points named.

Among mosses on rocks, and on trunks. Coast of California, *Menzies* in Ach. *Meth.* 1803. Coast of Oregon, *Hall.*

† † *Thallus without cyphels, but marked beneath with naked, white spots.*

16. *S. Hallii*, Tuckerm.; thallus cartilagineous-coriaceous, wide-lobed, reticulate-lacunose, delicately rimulose-granulate, and at length more or less villous, and beset now with lead-coloured soredia, ashy-glaucescent; beneath ribbed, pale-villous between naked whitish spots; lobes rounded, very entire; apothecia scattered, smallish to middling-sized, biatoroid, the exciple externally pilose; disk reddish-brown; the paler margin entire. Spores cymbiform, bilocular, brown, $\frac{23\text{-}36}{9\text{-}14}$ mic.——*Obs. Lich.* 4, *l. c. p.* 168.

On trunks, Oregon, *E. Hall;* to whom the lichen is gratefully inscribed.

17. *S. scrobiculata* (Scop.) Ach.; thallus ample, sub-orbicular, coriaceous, smooth, pitted, beset more or less with grey soredia; yellowish-green; beneath becoming densely dark-villous between naked, pale spots; lobes rounded, sub-crenate; [apothecia, in European specimens, scattered, smallish; disk red-brown; margin entire. Spores long-fusiform, 4-8-locular, at length colourless, $\frac{50\text{-}70}{5\text{-}8}$ mic.] ——*Ach. L. U. p.* 353. *Tuck. exs. n.* 67. *Nyl. Syn.* 1, *p.* 353.

Rocks among mosses; and on trunks; not seen fertile. Newfoundland, *De la Pylaie*, 1826. New England, not rare. Oregon, *Hall.* British Columbia, *Lyall; Macoun.*

XV.—NEPHROMA, Ach.

Apothecia reniform; innate in the under side of somewhat extended lobules; the entire margin disappearing. Spores sub-fusiform, quadrilocular, fuscescent. Spermatia oblong, narrowed a little at the middle; on multi-articulate sterigmas. Thallus frondose, more or less villous beneath (except in n. 3) but not veiny. Gonimous layer constituted now (sect. *) of gonidia, and now (sect. * *) of gonimia.—— Structurally close to *Sticta*, *Nephroma* is a well-distinguished, small group, having its main development in the cooler

regions of the earth. All the European species are also North American.

** Gonimous layer constituted of gonidia.*

1. *N. arcticum* (L.) Fr.; thallus large to very large, coriaceous; of flexuous, rounded lobes which are smooth, and greenish-straw-coloured above, and black beneath with a paler margin, and a coarse, appressed nap, becoming obsolete; apothecia large, to very large; disk brick-red. Spores fusiform-oblong, 4-locular, pale brown, $\frac{23\text{-}31}{3\text{-}5}$ mic.——*Tuckerm. Syn. N. E. p.* 18, *& Lich. exs. n.* 62. *Nyl. Syn. p.* 316.

Rocks among mosses, and on trunks, in alpine and arctic regions. Greenland, *Retz Fl. Scand.* 1779, and elsewhere in Arctic America, *Richardson*, etc. North West Coast, *Scouler*, etc. White Mountains, *Tuckerman*, Lich. N. E. 1838. Essex Mountains, N. Y., *Peck.*

2. *N. expallidum*, Nyl.; thallus ample, coriaceous-membranaceous, lobes rounded, smooth, undulate, crenate, and finally crisped; from greenish-glaucescent becoming tawny-brown; beneath blackish-brown with pale margin, and a delicate nap; apothecia of middling size; disk reddish-brown. Spores fusiform-ellipsoid and dactyloid; pale-brownish, $\frac{20\text{-}26}{4\text{-}7}$ mic.——*Nyl. Syn.* 1, *p.* 318 (*Nephromium*).

On the earth, dead wood, etc., in arctic regions. Great Bear Lake (*Richardson?*), Leighton in Ann. Nat. Hist. 1870. Green cells gonidia rather than gonimia; but Nylander takes them for intermediate between the two sorts—gonidimia, Nyl.

*** Gonimous layer constituted of gonimia.*

3. *N. tomentosum* (Hoffm.) Koerb.; thallus ample, cartilagineous-membranaceous; lobes sinuately cut, rounded-crenate, tomentose above more or less at the circumference, the fertile ones elongated; from greenish-glaucescent becoming lead-coloured or lurid-brown; pale and tomentose beneath, where they are beset commonly with minute white, confluent tubercles; apothecia middling to large; disk reddish-brown. Spores fusiform-ellipsoid and oblong, pale-brown, $\frac{20\text{-}26}{4\text{-}7}$ mic.——*Koerb. Syst. p.* 56. *N. resupinatum*, *Ach. L. U. p.* 522, *a. Tuckerm. Syn. N. E. p.* 18, *& Lich. exs. n.* 13.

Trunks in mountain forests, and also on rocks. Arctic Amer-

ica, *Richardson* (Frankl. Narr., & Leight. in Journ. Linn. Soc.), 1823. New England, etc., *Tuckerman*. Canada, *Macoun*. Oregon, *Hall*. British Columbia, *Macoun*.——Occurs naked and smooth above, and scarcely tomentose beneath.

4. *N. Helveticum*, Ach.; thallus membranaceous, smaller and more narrowly and deeply sinuate-laciniate than the last; smooth and for the most part naked above; and from grey soon tawny-brown; the rounded, undulate-crenate lobes fringed with tooth-like lobules; beneath blackening and tomentose; apothecia smallish to middling-sized; from reddish-brown soon blackening. Spores ellipsoid and sub-fusiform, brown, $\frac{18-23}{5-9}$ mic.——*Ach. L. U. p.* 523. *Tuckerm. Syn. N. E. p.* 18, *& Lich. exs. n.* 14.

On trees and rocks. Arctic America, *Richardson* (Frankl. Narr., & Leight. in Journ. Linn. Soc.), 1823. New England, etc., *Tuckerman*. Westward to Oregon, *Hall*, and California, *Bolander*. Southward common, and the characteristic species, from the Carolinas, *Ravenel*, to Alabama, *Peters*, and Louisiana, *Hale*. Also in Mexico, *Nylander*.——The lichen is well-distinguished here, and scarcely to be united with either of the other species. There is however a rock-form passing generally above into minute lobules (*N. asperum*, *Mihi*, *olim*) in which the under side is only obsoletely or scarcely tomentose, and which in other respects is not unlike *N. lævigatum;* itself likewise now obsoletely tomentose, as in Anz. *Langob.* n. 252.

5. *N. lævigatum*, Ach.; thallus coriaceous-membranaceous, rosulate, with smallish, rounded, undulate lobes, which are very smooth but at length wrinkled and pitted above; and from glaucescent becoming more or less chestnut-brown; beneath mostly pale, wrinkled, naked; apothecia smallish to middling-sized; disk reddish-brown. Spores fusiform-ellipsoid, and dactyloid, pale brown, $\frac{17-23}{4-7}$ mic.——*Ach. Syn. p.* 242. *Nyl. Syn.* 1, *p.* 320. *Peltigera bella*, *Spreng. Syst.*

b. parile, Nyl.; thinner and softer, at length darker; beneath blackening; the lobes besprinkled, especially at the margins, with grey soredia.——*Nyl. l. c. Nephroma*, *Ach. Tuckerm. Syn. N. E. p.* 18.

On mossy rocks, and also on trunks, in mountain forests. New England and northern States (*Torrey*), Sprengel *Syst. Veg.* (*Peltig. bella*, Spreng. !), 1827. Greenland, *Vahl. e* Th. Fr.

Oregon, *Hall.* British Columbia, *Macoun.*——*b*, New England, *Tuckerman*, Lich. N. E. 1841. Canada, *Macoun.*

5(*b*). *N. Lusitanicum*, Schær.; thallus coriaceous-membranaceous, sinuately at length deeply cut, with crenate tips, from smooth becoming more or less wrinkled above; and from brownish-glaucescent dark-reddish-brown: beneath smooth; yellow within; apothecia of middling size. Spores as in the last.—— *Schær. Enum. p.* 323.

Rocks, trees, and bushes. California, *Bolander.* Oregon, *Hall.*——*Nephromium sub-lævigatum*, Nyl. *Syn.* 1, p. 321, from the peak of Orizaba, Mexico, is, to judge by the diagnosis, distinguished especially from *N. lævigatum* by its more or less reticulately wrinkled thallus.——*N. cellulosum*, Ach., is another member of the stock of *N. lævigatum*, the whole difference of which (a difference sufficiently foreshadowed in the older species) is indicated by its name; and it is observable that Nylander inclines, *l. c.* to recognize this Australian lichen (Van Diemen's Land, *Herb. Hook.*) in Europe.

XVI.—PELTIGERA (Willd., Hoffm.) Fée.

Apothecia peltæform; with a sub-crenate margin; adnate to the upper side of extended lobules, or rarely marginal. Spores fusiform, or acicular, 4-plurilocular, at length colourless. Thallus frondose, veiny and villous beneath, where it is deprived of the cortical layer. Gonimous layer constituted now (n. 1, 2) of gonidia; but, in all the other species, of gonimia.——A familiar, small group of the northern hemisphere, which extends however into the cooler regions of the southern; and becomes even, in some forms, tropical. We have all the species.

* *Gonimous layer constituted of gonidia.*

1. *P. venosa* (L.) Hoffm.; thallus small, coriaceous, becoming fan-shaped, simple; greenish-ash-coloured; beneath white, variegated with coarse, divaricate, blackening veins; apothecia marginal, middling-sized, rounded, horizontal; disk from reddish finally blackish-brown. Spores fusiform, brownish, as in the other species, while in the thekes, 4-locular, $\frac{30\text{-}46}{7\text{-}10}$ mic.——*Fr. L. E. p.* 48. *Tuckerm. Lich. exs. n.* 63.

On the earth. Pennsylvania, *Muhlenberg Catal.* 1818. New York, *Torrey.* Vermont (argillaceous soil), *Russell.* Canada, *Macoun.* Greenland, *J. Vahl.* Behring's Straits, *Wright.* N. W. Coast, *Menzies*, etc. Rocky Mountains, *E. Hall.* New Mexico, *Fendler.*

2. *P. aphthosa* (L.) Hoffm.; thallus ample to large, coriaceous, softish, smooth; from apple-green becoming glaucescent; the broad, rounded, repand lobes besprinkled with appressed, crenate, brown warts; and beneath reticulated with blackening veins which disappear finally in a close nap; sparingly fibrillose; apothecia on somewhat extended lobules, middling to ample, round; disk reddish-brown. Spores acicular, 4-8-locular, $\frac{48\text{-}70}{4\text{-}7}$ mic.——*Fr. L. E. p.* 44. *Tuckerm. Lich. exs. n.* 9.

Rocks, among mosses, and on the earth, common in mountain forests. Pennsylvania, *Muhlenberg Catal.* 1818, and the northern States. Lake Superior shores, *Agassiz*, and northward throughout Arctic America, *Richardson*, etc. Ohio, *Lesquereux.* Rocky Mountains, *Hall.* N. W. Coast, *Scouler*, etc. Mountains of North Carolina, *Ravenel.*——A rather reduced and thinner state (f. *minor*, Tuckerm. *exs.* n. 102), with pale, conspicuously brown-reticulated under side, is common here, and is also European.——The apothecia occur now marginal (f. *marginalis*, Tuckerm. *Gen.* p. 37) as in the preceding species; the specimens (otherwise reduced) being from Behring's Straits, *Wright;* and the alpine regions of the Rocky Mountains, *Hall.*

* * *Gonimous layer constituted of gonimia.*

3. *P. horizontalis* (L.) Hoffm.; thallus ample, coriaceous, smooth; from glaucous-greenish becoming cinereous-rufescent; reticulated beneath with blackening veins which soon pass into a continuous, close nap; sparingly fibrillose; apothecia on abbreviated lobules or sub-marginal, middling-sized, transversely oblong, flat, horizontal; disk reddish-brown. Spores fusiform, 4-locular, pale-brownish, $\frac{33\text{-}46}{6\text{-}8}$ mic.——*Fr. L. E. p.* 47. *Tuckerm. Lich. exs. n.* 11, 12.

Moist rocks among mosses. Pennsylvania, *Muhlenberg Catal.* 1818, and throughout the middle and northern States. Canada, *Macoun.* Ohio, *Lea.* Rocky Mountains, *Hayden.* Shores of Behring's Straits, *Wright.* New Mexico, *Fendler.* Mountains of North Carolina, *Ravenel.*

4. *P. polydactyla* (Neck.) Hoffm.; thallus ample, for the most part thin, and very smooth and bright; from greenish-glaucescent becoming lead-coloured, or now brown; beneath somewhat naked, conspicuously reticulated with brown veins; the rather elongated fertile lobes digitately clustered; the middling-sized apothecia finally revolute; disk reddish-brown. Spores acicular; slender, 4-8-locular, $\frac{60\text{-}90}{3\text{-}4}$ mic.——*Ach. Syn. p.* 240. *Tuckerm. Lich. exs. n.* 10.

Rocks, and trunks, among mosses. Pennsylvania, *Muhlenberg Catal.* 1818. New York, *Halsey.* New England, *Tuckerman.* Ohio, *Drège*, etc. Low country of the southern States from South Carolina, *Ravenel*, to Louisiana, *Hale.* Rocky Mountains, *J. Wolf.* Pacific Coast, *Douglas*, etc. Mexico (f. *dolichorhiza*, Nyl.), *Nylander.*

5. *P. scutata* (Dicks.) Leight; thallus smallish, thin and paper-like, or now thicker as in the last, dull, and at length somewhat roughened; greenish-ash-coloured and rufescent; the narrowed, crisped lobes more or less grey-sorediate at the margins, the fertile ones very short and scattered; beneath white and reticulated with brown veins; apothecia smallish, rounded, or transversely oblong; disk blackish-brown. Spores acicular, 4-8-locular, $\frac{50\text{-}70}{3\text{-}4}$ mic.——*Peltidea*, *Ach. Syn. p.* 237. *Hook. Br. Fl.* 2, *p.* 215. *Peltigera*, *Leight. Lich.-Fl. Brit. p.* 210. *P. limbata*, *Delis. herb.*, *Hepp. Nyl. in Norrl. Lich. Fenn.*

On the earth, rocks, and trees, among mosses. Pennsylvania, *Muhlenberg Catal.* 1818. White Mountains, *Tuckerman.* Ohio, *Drège*, *Lesquereux*, etc. British Columbia, *Dr. Lyall.* Oregon, *Hall.* California, *Bolander.*——Differs both from the last and the next following species, and may properly take a place by itself. There is no doubt of the legitimateness of the long-received name, which can hardly yield now to Delise's manuscript one.

6. *P. pulverulenta* (Tayl.) Nyl.; thallus middling-sized, coriaceous, more or less furrowed and pitted, opake, rimulose-granulate; from greenish-glaucescent becoming ash-coloured and lurid brown; beneath white with brown at length confluent veins; the short fertile lobes digitately clustered; apothecia middling-sized; orbicular, disk dark-brown. Spores acicular, 4-8-locular, $\frac{60\text{-}94}{3\text{-}4}$ mic.——*Peltidea*, *Tayl. New Lich. in. Hook. Lond. Journ. Bot.* 1847, *p.* 184. *P. rufescens*, *var.*, *Nyl. Syn.* 1,

p. 325; *Scand. p.* 89. *P. scutata*, *Flot., Koerb. Syst. p.* 60, *pro p. P. scabrosa*, *Th. Fr. Lich. Arct. p.* 45.

Rocks, etc. Greenland, (*Breutel*) Koerber, *Syst.* 1855; *Wenck.* Kotzebue's Sound, *Herb. Babington.* White Mountains, with the other characters, but infertile and therefore doubtful, *Tuckerman.* Sometimes thinner, but distinct, so far as the specimens go, from the last. Taylor's lichen was from South America, and, more recently, Nylander has proposed to separate this (Lindig *N. Gran.* n. 2520) from the northern plant (Norrl. *Lich. Fenn.* n. 116) but he gives no reason for so doing. The spores of *P. pulverulenta* are longer than in any other species; now measuring, in the northern form, $\frac{75\text{-}100}{4\text{-}5}$ mic.; *Nyl.*

7. *P. malacea* (Ach.) Fr.; thallus middling-sized, spongy and softish, granulate more or less, but becoming downy; livid-brown; clothed beneath with a dense black nap which is paler and rarely white-foveolate at the margins; scarcely fibrillose; apothecia on extended lobules, middling-sized, orbiculate; disk brownish-black. Spores acicular, 4-6-locular, $\frac{52\text{-}72}{4\text{-}6}$ mic.——*Fr. L. E. p.* 44.

On the earth in high mountains. Sub-alpine region of the White Mountains, *Tuckerman*, Syn. N. E. 1848. Rocky Mountains (a small fragment, but appearing to belong here), *Willey herb.*

8. *P. rufescens* (Neck.) Hoffm.; thallus middling-sized, coriaceous, rigid, somewhat downy, and the narrowed, crowded, sub-imbricate lobes elevated and crisped; greenish-ash-coloured becoming at length dark-reddish-brown; beneath reticulated with brown veins, which are brown-fibrillose; apothecia on extended lobules, middling to ample, soon vertical and oblong, revolute; disk as in the next. Spores acicular, 4-8-locular, $\frac{42\text{-}60}{3\text{-}5}$ mic.——*Fr. L. E. p.* 46. *Tuckerm. Lich. exs. n.* 104.

On the earth, rocks, and trunks, among mosses, New England, *Tuckerman*, Syn. N. E. 1848. New Jersey, *Austin.* Canada, *Agassiz.* Arctic America, *Richardson.* New Mexico, *Fendler.* Oregon, *Hall.*——A long known and almost universally recognized lichen, with probably much the same range as the next species, but very often exhibited in embarrassing relations to that. The spore-dimensions are derived from but few measurements, of such specimens only as appeared tolerably certain; they closely however accord with Nylander's.——*Peltidea spuria*,

Ach., as understood by lichenists, has probably often included small forms of *Peltigera rufescens*, and was referred to the latter in Syn. N. Eng.; as later by Nylander.

9. *P. canina* (L.) Hoffm.; thallus ample to large, membranaceous, round-lobed, flaccid, furrowed, downy; greenish-grey (cinerascent, and brownish); beneath whitish, with veins and fibrils of much the same colour, or now darkening; the fertile lobules somewhat elongated; apothecia middling to ample, rounded, becoming semi-revolute and vertical; disk reddish-brown. Spores acicular, 4-8-locular, $\frac{44\text{-}70}{3\text{-}5}$ mic.——*Fr. L. E. p.* 45.

b. spongiosa, Tuckerm.; thallus sub-coriaceous; the pale veins of the under side passing into tufted fibrils of the same colour which finally run together into a dense, continuous, spongy nap.——*Lich. exs. n.* 103. *Gen. p.* 38.

c. membranacea, Ach. Nyl.; thallus very thin and scrobiculate, almost smooth above.——*Ach. L. U. p.* 517. *Nyl. Syn.* 1, *p.* 324.

β, spuria, Ach.; thallus much reduced, sub-coriaceous; the cream-coloured veins of the under side scarcely fibrillose, the fertile lobules somewhat digitately clustered; apothecia smallish.——*Ach. L. U.* p. 518. *P. pusilla*, *Koerb. Syst. p.* 59.

b. sorediata, Schær.; thallus as in *β* but mostly sterile and round-lobed; besprinkled with grey soredia; the under side now more fibrillose.——*Schær. Enum. p.* 21. *P. erumpens*, *Tayl. New Lich. l. c. p.* 184, *& herb. P. leptoderma*, *Nyl. Syn.* 1, *p.* 324, *& in Lindig Herb. N. Gran. n.* 2559. *P. canina*, *v. sorediifera*, *Tuckerm. Gen. p.* 38.

On the earth, rocks, and mossy trunks. Pennsylvania, *Muhlenberg Catal.* 1818, and throughout the northern, middle, and western States. Canada, *Agassiz.* Arctic America, *Richardson* (fide Leighton, *l. c.*). Mountains of the southern States, *Ravenel.* New Mexico, *Fendler.* Pacific coast, *Douglas; Bolander*, etc. ——*b, spongiosa*, sub-alpine regions of the White Mountains, *Tuckerman.* British Columbia, *Macoun.* One of the largest and most marked conditions of the species.——*c, membranacea*, North West coast, *Douglas.* Oregon, *E. Hall.* California, *Bolander.* Mexico, *Nylander.*——*β. spuria* has probably the same range as *a*, but I can only cite it from New Jersey (old fields), *Austin;* low country of South Carolina (on banks), *Ravenel;* California, *Bolander;* and British Columbia, *Macoun.*——*b, sore-*

diata passes however directly into β in the same district of South Carolina (on moist rocks), *Ravenel* (as the European lichen may be seen to do in Moug. & Nestl. n. 837, and Rabenh. *Lich. Eur.* n. 421, *c.*), and is found also (on moist rocks) in the White Mountains, *Tuckerman;* on banks of islands of Behring's Straits, *Wright;* in Illinois (on the earth), *Hall;* and in California (on the earth), *Bolander.* The best-developed, sorediiferous plant (now fertile) of the White Mountains is remarkable for the finally dense nap of its under side, which thus far resembles then the b. *spongiosa* of the same region. But this fibrillose nap disappears at length; and the common plant of the Atlantic coast is quite the same with the *P. erumpens*, *Tayl.!* (Dunkerron, Ireland) which I have myself observed in the north of Italy (Pallanza), but find scarcely any notice of in European writers. The Californian specimens (infertile, but unquestionably similar to the fertile Carolina lichen) are yet so reduced as to be mostly simple (from these, *P. leptoderma*, Nyl., of New Granada, as exhibited in Lindig's collection above-cited, offers no differences) and thus reproduce, at the end, this remarkable feature of *P. venosa*, at the beginning.

XVII.—ERIODERMA, Fée.

Apothecia scutellæform; marginal on the now extended lobules. Spores ovoid-ellipsoid, and becoming sub-fusiform; simple; at length colourless. Thallus frondose, villous, and now veiny beneath, where it is also now clothed interruptedly with a pannose hypothallus; a proper cortical layer wanting on this side. Gonimous layer constituted of gonimia.——Another small group, of especial interest as illustrating the near relationship of the *Peltigerei*, to which all other authors but Nylander have referred *Erioderma*, to the *Pannariei*. The species are tropical, or austral.

E. polycarpum, Fée; thallus membranaceous, hirsute; greenish-glaucescent; the summits of the laciniate lobes crenate-cut and crisped; beneath soft-cottony, whitish, beset with spongy tufts of black fibrils; apothecia marginal; hirsute below; the dark-brown disk soon excluding the thin margin. Spores ellipsoid, becoming colourless, $\frac{11\text{-}16}{5\text{-}8}$ mic.——*Fée, Essai sur les Crypt. p.* 145, *t.* 24, *f.* 2.

Trees, Mexico (var. *Mexicanum*), Nyl. *Enum.*——*E. Wrightii*, Tuckerm., is a native of the island of Cuba; and the few other species are cited from South America.

XVIII.—SOLORINA, Ach.

Apothecia rounded; innate in the upper side of the thallus; the margin obsolete. Spores from ellipsoid becoming fusiform-oblong, bilocular, brown. Thallus frondose; beneath villous, and veiny; the cortical layer mostly wanting on this side. Gonimous system constituted of gonidia (in the gonimous layer) and gonimia.——This little cluster is represented in the alpine and arctic regions of the earth by one marked species, and in the temperate ones of Europe and America by another; to which last the other described forms are very closely akin.

1. *S. crocea* (L.) Ach.; thallus smallish, coriaceous; reddish-brown; beneath orange-saffron, with darker, coarse, branching veins; apothecia middling to ample, appressed, at length somewhat tumid; disk red-brown. Spores in eights, $\frac{30\text{-}40}{10\text{-}14}$ mic.——*Ach. L. U. p.* 149. *Nyl. Syn.* 1, *p.* 329.

On the earth in alpine districts. Greenland, *Dillenius*, *Hist. Musc.* 1741. N. of Point Lake, *Richardson.* Labrador, *Wenck.* Rocky Mountains, *Hall.* Oregon, *Dr. Lyall.* Shores of Behring's Straits, *Wright.*

2. *S. saccata* (L.) Ach.; thallus membranaceous, sub-imbricate; greenish-ash-coloured; beneath white, cottony, fibrillose; apothecia middling-sized, appressed, soon sunken in pits; disk dark-brown. Spores mostly in fours, $\frac{36\text{-}56}{18\text{-}23}$ mic.——*Ach. L. U. p.* 149. *Tuck. Exs. n.* 64. *Peltigera*, *Fr. L. E. p.* 49.

b. spongiosa, Nyl.; thallus reduced to little more than an edge of the sunken apothecium.——*Nyl. Syn. l. c. S. limbata*, *Mudd Man. p.* 85.

On the earth, especially in calcareous regions. Newfoundland, *De la Pylaie*, 1826. Bear Lake, *Herb. Hook.* Greenland, *Vahl l. c.* Shores of Behring's Straits, *Wright.* New York, *Tuckerman.* Vermont, *Russell.*——*b*, *spongiosa*, on the same substrates, Greenland, *Vahl;* as elsewhere in Arctic America,

and in Newfoundland, *Nylander;* and at Behring's Straits, *Wright.* Rocky Mountains in Colorado, *Coulter. Wolf.*(*)—— The spores of this species occur in $2^{s.}$, $3^{s.}$, oftenest $4^{s.}$, and only very rarely $5^{s.}$. A bisporous condition of β, from Colorado, alt. 13,800 ft. (*Coulter*), was observed by Mr. Willey to contain spores measuring $\frac{54\text{-}110}{27\text{-}40}$ mic., and may well be compared with *S. bispora*, Nyl. *Syn.*, which has yet no characters to separate it from the present species.

Fam. 5.—PANNARIEI.

Thallus horizontal, various, in the highest forms distinctly foliaceous, either sub-monophyllous or many-cleft, coriaceous-membranaceous, only rarely cartilagineous,—passing then into squamulose conditions, which become in the end crustaceous; placed upon a conspicuous hypothallus (now obsolete). Gonimous layer variously constituted; very rarely, in whole or in part, of gonidia; but commonly of gonimia, which anticipate here, more or less, the typical structure of the next family.

The structural relations of this group have been considered by Schwendener, *l. c.*, 3, *pp.* 151, 178, 190, *etc.;* and reference may be made also to the writer's *Genera Lichenum*, p. 41. With the appearance of gonimia in the last family (*Peltigerei*) an important change begins in the Lichen-organism. This change finds further expression and much fuller development in the family now before us, which will be seen to pass, at more than one point, into the next-succeeding *Collemei*, wherein the gonimia complete their history.

The spore-history of this far humbler family is embarrassed

(*) This variety has been well said by Fries (L. E.) to look like young plants of *S. saccata*, growing on a foreign crust; the minute fronds, differing only in size from those of *a*, being connected together and overrun by another semi-crustaceous, pannariiform, lobulate-granulate thallus, the darker colour of which is due to gonimia, supplanting here the more common green gonidia of the species; but this second thallus is taken by recent authors to belong to our lichen equally with the first, or to be (as compare Nylander *l. c.* under *S. bispora*) an anamorphosis of that.

with much of the ambiguity of that of the *Peltigerei*. The spores are commonly without colour, and appear on the whole well-referable to the Colourless Series, the ultimate condition of which is the acicular spore. But yet indications of colour are sufficiently frequent to suggest that the organs we are considering are rather decolorate than colourless; and *Pannaria byssina*, which we cannot but regard as belonging here, offers us finally the perfected (if still decolorate) muriform type of the brown Spore-series. The *Pannariei* are conceivable then as decolorate members of the Series characterized by muriform (typically coloured) spores, and as contiguous therefore with *Umbilicariei*, and to some extent at least, if not with the bulk of, *Peltigerei*, on the one hand, as especially with *Collemei* on the other. *Genera*, p. 61.

XIX.—ENDOCARPISCUM, Nyl.

Apothecia sunken commonly in the thallus and indicated only by an ostiole, but becoming superficial and lecanorine. Spores very minute, simple, without colour; numerous in the thekes. Spermatia ovoid; on sub-simple sterigmas. Thallus foliaceous, peltate, monophyllous; free, and strongly corticate beneath; the hypothallus deficient. Gonimous layer consisting of gonimia.——Montagne (*Pl. Cell. Canar. l. infra cit.*) remarks "the considerable resemblance" both as respects habit and colour, of *Endocarpiscum Guepini* to *Heppia Despreauxii*. And Nylander, more recently, goes so far (*Obs. Lich. Pyren.* p. 56) as to say that "*Endocarpiscum*, properly considered, is *Heppia*, or scarcely a sub-genus of it." But the two types may be said notwithstanding to be well distinguished, no less by external habit than by structure.

1. *E. Guepini* (Delis.) Nyl.; thallus small, monophyllous, cartilagineous-coriaceous; from greenish- becoming brownish-olive, the repand, revolute edges gray-sorediate; beneath naked and smooth, wrinkled, from flesh-coloured at length tawny; apothecia deeply sunken in minute pits [but becoming superficial and lecanorine]. Spores very minute, and numerous in the thekes; rounded and oblong, simple, without colour.——*Endocarpon, Fr. L. E. p.* 410. *Guepinella, Bagl. in Nuov. Giorn. Bot. Ital.* 2, 171.

Rocks. Needham near Boston, and at Harper's Ferry in Maryland, *Tuckerman* in Nyl. *Pyrenoc.* 1858. Arkansas, *Peters.* California, *Bolander.*——Lecanorine apothecia have been only very recently detected in the European lichen; they have not been observed here.

2. *E. Bolanderi,* Tuck. herb.; thallus minute, crowded in imbricate patches, coriaceous-membranaceous; from olivaceous becoming dark-brown; crenate-lobate; with raised, scarcely powdery margins; beneath smooth, pale-brown; apothecia very small, innate-sessile, lecanorine; a tumid, entire margin bordering a red-brown disk. Spores very minute and numerous, ellipsoid, simple, without colour.——*Pannaria, sect. Endocarpiscum, Tuckerm. Gen. p.* 51.

Rocks. Ukiah, and elsewhere, California (*Bolander*), Tuckerman *l. c.* 1872. The smaller thallus is thinner and darker than that of *E. Guepini* (with which the present sometimes grows), and, together with the scutellæform apothecia—the only sort yet observed—suggests rather a *Collema.*

XX.—HEPPIA, Naeg.

Apothecia orbicular, immersed, and mostly depressed in the thallus, and immarginate. Spores ovoid, simple, decolorate; now (2) numerous in the thekes. Spermatia ellipsoid; on sub-simple sterigmas. Thallus squamose-foliaceous, monophyllous, more or less continuously corticate beneath, where it is closely attached to the matrix by pale hypothalline filaments. Gonimous layer constituted of gonimia.——The external resemblance of the very commonly saccate-depressed apothecia of n. 1 to those of *Solorina saccata* is the only feature associating it seemingly with *Solorina* rather than *Pannaria.*

1. *H. Despreauxii* (Mont.) Tuckerm.; thallus small to minute, orbicular, dull, smoothish, or at length rimulose-rugulose; from pale- becoming olivaceous-green; with finally raised, repand, and crenate-lobate edges; beneath mostly pale; apothecia solitary in small fronds, but now numerous in larger ones, small to middling; disk red-brown. Spores $\frac{15\text{-}25}{6\text{-}9}$ mic.——*Tuckerm. Gen. p.* 46. *Solorina, Mont. Pl. Cell. Canar. p.* 104, *t.* 6, *f.* 5 (*sporis excl.*).

On the earth, Ohio (*Lea*), Tuckerman in Lea. Catal. Cincin. 1848. New England. Illinois, *Hall.* North Carolina, *Curtis.* South Carolina and Florida, *Ravenel.* Alabama, *Peters.* Texas, *Wright.* And, on calcareous pebbles, Kansas, *Hall.*

In patches of the lichen from the Organ mountains, Texas (*Wright*), the exterior fronds are differenced from the small, round, interior ones, serving only as margins to the solitary apothecia, by their greater size and length, and their lobation; much as the radiant, exterior squamules of squamulose *Pannariæ*, when compared with the small, interior ones.

2. *H. polyspora*, Tuckerm. *in litt.;* thallus much as in the last, but besprinkled with the numerous, very small apothecia (scarcely exceeding $0^{mm.}$ 5, in width) which are even with the thallus, and blackening. Spores numerous in the thekes, rounded and ovoid, from brown becoming decolorate, 2–5 mic. in the longest diameter.

Mountains of Colorado, *T. S. Brandegee;* comm. by C. J. Sprague. The thallus appears to be more continuously corticate below than in n. 1.

XXI.—PHYSMA, Mass.

Apothecia scutellæform. Spores ellipsoid, simple, without colour. Thallus foliaceous; clothed beneath with a distinct, finally spongy hypothallus. Gonimous layer constituted of gonimia, which are concatenate, and dispersed, amid lax filaments, in a homogeneous pulp; as in *Collema.* ——It is to the genus last-named that the first species of *Physma* was always referred; as the other also, by Montagne. And it cannot well be questioned that the two are congenerical; but *P. luridum* is far closer to *Pannaria rubiginosa* and *P. fulvescens* than is *P. byrsæum* to any Collemeine lichen. No more pregnant example can be cited, among foliaceous species, of the intimate relationship of *Pannariei to Collemei;* or of the unnaturalness of attempting to place these families in different Orders.

1. *P. byrsæum* (Afzel.); thallus ample, orbicular, cartilagineous-coriaceous; minutely wrinkled; lead-coloured (cinerascent); the discrete, radiant, linear lobes dilated and crenate at

the tips, and clothed beneath with a blackening, spongy nap; apothecia middling to ample, concave; the red disk bordered by an elevated, rugose-plicate margin. Spores broad ellipsoid, simple, decolorate, $\frac{18-23}{8-12}$ mic.——*Collema byrsinum*, *Ach. L. U. p.* 642. *C. Boryanum*, *Pers.*, *Mont. in Ann.* 3, 10, *p.* 133.

Trees in tropical regions; Island of Cuba; and, probably, Mexico.

2. *P. luridum* (Mont.); thallus middling-sized, coriaceous, sub-monophyllous, wrinkled and powdery; from greenish-glaucous becoming yellowish-gray, and livid; the rather wide, irregularly radiant lobes imbricated, and sinuate; clothed beneath, more or less densely, with a pale but blackening hypothallus; apothecia middling-sized; a rugose-crenate margin bordering a reddish-brown disk. Spores rounded- and broad-ellipsoid, now pointedly tipped, simple, decolorate, $\frac{15-19}{7-10}$ mic.—— *Collema*, *Mont. Cent.* 3, 76, *& Bonite*, *p.* 115, *t.* 146, *f.* 3. *Parmelia* (*Amphiloma*), *Russellii*, *Tuckerm. Syn. N. E. p.* 35. *Pannaria*, *Nyl. Enum.*

Trees, dead wood, and rocks, New England (*Russell*), Tuckerman Enum. 1845. New Jersey, *Austin.* Virginia, *Tuckerman.* South Carolina, *Ravenel.* Alabama, *Peters.* Missouri, *Hall.* Occurring also in Japan (*Wright*), and in the tropics.——The distinctly parenchymatous cortex is the chief difference in structure between this and the preceding.

XXII.—PANNARIA, Delis.

Apothecia now scutellæform and lecanorine; now with both thalline and proper margins (zeorine); and now simply biatorine. Spores ovoid-ellipsoid and oblong; simple; or bi-quadrilocular; or rarely muriform-multilocular; brownish, or, more often, decolorate. Spermatia (in so far as known) oblong; on multi-articulate sterigmas. Thallus subfoliaceous, either monophyllous, or laciniate-multifid; or squamulose; becoming at last semi-crustaceous. Hypothallus spongy; or extenuate; or obsolete. Gonimous layer constituted either (sect. 1, 2) of gonidia, or (sect. 3) of both gonidia and gonimia, or, more often, and, in all the remaining sections, of gonimia alone; which, and as well the filamentous and parenchymatous tissues, anticipate variously the features of the next family.

* *Amphiloma*. Thallus foliaceous, membranaceous, round-lobed, softish, and deliquescent; upon a blackening hypothallus. Gonimous system of gonidia. (*Amphiloma*, Nyl., *emend.*)

1. *P. lanuginosa* (Ach.) Koerb.; thallus orbicular, white, powdery; the lobation distinct only at the circumference, and often disappearing, when only a crust, or cushion-like mass is left, determinable by the delicate hypothallus; apothecia scarcely known.——*Parmelia*, *Ach. L. U. p.* 465. *Parm.* (*Amphiloma*) *Fr. L. E. p.* 88.

Rocks, New England, *Tuckerman Syn.* N. E. 1848. Canada, *Drummond.* New York, *Peck.* Blue Ridge, Virginia, *Tuckerman.* Louisiana, *Hale.*——The pale-sulphur-coloured tint so common in the European lichen has not been observed by me in the North American; but the hypothallus is quite the same in both, and the general aspect.

* * *Psoroma*. Thallus squamulose. Hypothallus obsolete. Gonimous system of gonidia. Apothecia lecanorine (*Psoroma*, Nyl., *olim.*).——The only northern species is most readily associable with *Pannaria brunnea;* and, notwithstanding the difference in the gonidia, cannot be called at home in any other genus. The group attains its full development in the austral and antarctic regions, where species with laciniate-multifid and even frondose thallus, and otherwise remarkably differenced, occur.

2. *P. hypnorum* (Hoffm.) Koerb.; thallus of minute, rounded, at length granulate-crenate, ascendant and imbricate squamules; from yellowish becoming reddish-brown (with age dark ash-coloured); beneath pale, and naked; apothecia middling to ample, sessile; the disk red-brown; the thin, elevated margin crenate, and at length granulate-squamulose. Spores ovoid-ellipsoid and oblong, simple, decolorate, $\frac{16\text{-}24}{7\text{-}12}$ mic.——*Parmelia*, *Fr. L. E.p.* 98. *Tuck. Exs. n.* 20. *Psoroma*, *Nyl. Scand. p.* 121.

On the earth, growing over mosses and twigs, in alpine districts. Arctic America (*Richardson*), Hooker *l. c.* 1823. Rocky Mountains, *Hall.* Newfoundland, *Despreaux.* White Mountains of N. Eng., *Tuckerman.*

* * * *Euopsis*. Thallus tartareous, peltate. Hypothallus obsolete. Gonimous system constituted of both gonidia and gonimia. Apothecia lecanorine. (*Euopsis*, Nyl. *emend.*)——The

ordinary gonidia are sufficiently conspicuous in our lichen, together with more or less similar red gonidia, and, with these, as in the European, smaller and less abundant gonimia. And these differing forms of the gonidial cells belong all to the plant before us, and are neither to be referred, in part, to an intrusive, foreign Alga (as supposed in Nyl. *Scand.* p. 171) nor, in part, to a foreign *Lecanora* (as asserted in Nyl. *Lapp. Or.* p. 104). And they condition that red and white marbling of the thallus which is so conspicuous in section. The plant is thus referable neither to *Lecanora*, as supposed by Sommerfelt, and Nylander (*Scand.*) nor to *Pyrenopsis*, as by the latter author in *Lapp. Or.*; but must either find a place here, or as a distinct genus of *Parmeliei*.——In the group *Euopsis*, Nyl., which has not yet, that I am aware, been characterized, but is noted by its author as distinguishable from his *Pyrenopsis*, with which he associates it, in *Collemei*, by the form and higher structure of its apothecia (*Flora*, 1875, p. 363) I am compelled to include his *Pyrenopsis hæmatopis*.

3. *P. granatina* (Sommerf.); thallus minute, monophyllous, attached at a single point, rounded or difform, thickish, warted; brown-reddish; crowded often into a loose crust; beneath blackening but not otherwise differing; apothecia very small, adnate, the shining, red-brown, flat or swelling disk bordered by a sub-crenate margin. Spores oblong, simple, decolorate, $\frac{9\text{-}14}{4\text{-}5}$ mic.——*Lecanora, Sommerf. Suppl. Lapp. p.* 90. *Nyl. Scand. p.* 171. *Pannaria, Th. Fr. Lich. Arct. p.* 77.

Rocks, Notch of the White Mountains, *Tuckerman Gen.* 1872. Maine, *Willey*.——*Collema hæmaleum var. hæmatopis*, Sommerf. (*Pyrenopsis hæmatopis*, Nyl.; Th. Fr.) which was found in Greenland by Vahl, is considered to differ in its concave fruit; but the published European plant (Nyl. in Fellm. *Lich. Arct.* n. 5) has so entirely the structure of *Pannaria granatina* that I cannot venture, with the material before me, to separate it even as a variety. And it is observable that Nylander has referred one and the same lichen (the *Pyrenopsis rufescens* of his *Lich. Scand.* p. 27) at p. 288 of the same work to *P. hæmatopis*, and in *Lapp. Or.* to *P. granatina*.——*Pannaria granatina* var. *hæmalea*, Th. Fr. (*Collema hæmaleum*, Sommerf. *Euopsis hæmalea*, Nyl. in Norrl. *Lich. Fenn.* n. 101) also has the structure of *P. granatina;* of which it appears to be a reduced expression. It is unknown here.

* * * * *Pannaria* proper. The characters of this central group of the always equivocal genus before us, are sufficiently various. Thallus, in the highest expressions, foliaceous; but soon squamulose; and disappearing at length in crustaceous states; the spongy hypothallus becoming in like manner reduced, and now obsolete. Gonimous system constituted of gonimia, which are more or less concatenate, and distinctly gelatinous, interspersed, in the highest forms, among rather loose medullary filaments; these passing, in the inferior ones, into a parenchymatous tissue. Apothecia largely lecanorine; but also biatorine; and both sorts sometimes in one and the same species. Spores simple, except in n. 12. (*Pannaria*, Nyl. *emend.*).

4. *P. pannosa* (Sw.) Delis.; thallus ample, foliaceous, orbicular, thin-membranaceous, smooth; from livid-glaucous becoming ash-coloured and brown; the radiant, narrowed, flattish, many-cleft (now isidiophorous) divisions either connate or discrete, seated upon and bordered by a dense, black hypothallus; [apothecia, of the tropical lichen, of middling size, sessile; either lecanorine, with incurved, crenate margin; or zeorine; or biatorine; the disk from pale- at length dark-reddish-brown, and the entire, proper margin finally black. Spores ovoid-ellipsoid and sub-fusiform, commonly brownish, $\frac{17\text{-}24}{7\text{-}10}$ mic.—— *Parmelia, Ach. L. U. p.* 465.

Trees, in tropical countries; occurring here, but as yet only seen infertile, in the low country of South Carolina (*Ravenel*) Tuckerm. *Gen.* 1872; as of Louisiana, *Hale.*——The original lichen of Swartz (*Lich. Amer.* t. 5) and Acharius, had only biatorine fruit, while Nylander (*Disp. Psor. & Pann.*) has recognized only lecanorine. The lecanorine state is perhaps, to judge by my herbarium, the more frequent of the two; but I observe no other differences.

5. *P. rubiginosa* (Thunb.) Delis.; thallus smallish, foliaceous, orbicular, membranaceous, smoothish; from ashy-greenish becoming yellowish-gray, livid, and lead-coloured; the radiant, approximate, rather broad and concave, imbricate divisions with dilated and multifid tips, and raised, crenate margins; the dense, and margining hypothallus bluish-black; apothecia smallish to middling, lecanorine, sessile; disk rusty-brown, margin crenulate. Spores rounded, and ovoid, simple, decolorate, $\frac{16\text{-}23}{7\text{-}11}$ mic.——*Parmelia, Fr. L. E. p.* 88. *Schær. Spicil. p.* 462.

b. conoplea, Fr.; thallus beset densely with gray soredia, passing, at the centre, into a continuous crust, [apothecia zeorine and biatorine].——*Fr. l. c. Parmelia, Ach. L. U. p.* 467.

Trees and rocks, New England, *Tuckerman Syn.* N. E. 1848. Ohio, *Lesquereux.* North, and South Carolina, *Ravenel*, etc. Alabama and Mississippi, *Peters*, etc. Texas, *Hall.* California, *Dr. Palmer.* Oregon, *Hall.*——*b*, New England, *Tuckerman.*

6. *P. leucosticta*, Tuckerm.; thallus squamulose, cartilagineous-membranaceous; from brownish-ash-coloured becoming tawny-brown; squamules of the circumference expanded, elongated, and pinnately lobulate, those of the centre ascendant and imbricated, dissected, dentate-crenate, the teeth white-powdery; hypothallus thin, bluish-black; apothecia smallish to middling, lecanorine, appressed; the red-brown disk at length tumid, and excluding the thin, crenate, soon white-powdery margin. Spores rounded and ovoid, simple, decolorate, $\frac{17\text{-}22}{9\text{-}14}$ mic.——*Obs. Lich. l. c.* 4, *p.* 404.

Rocks, and also trunks, common from New England to southern Virginia, *Tuckerman* in Darlingt. *Fl. Cestr.* 1853. Ohio, *Lesquereux.* North Carolina, *Curtis.* South Carolina and Georgia, *Ravenel.* Alabama, *Peters.* Louisiana, *Hale.*

7. *P. pholidota* (Mont.) Nyl.; thallus of minute, membranaceous, rounded, crenate-lobulate, finally crowded and imbricate squamules which are predominantly pale-yellowish-gray, but are commingled more or less with lead-coloured ones; on a thin, blackening hypothallus; apothecia small, lecanorine, sessile, the incurved, crenate margin finally excluded by the pale- to dark-brown disk. Spores ovoid-ellipsoid, simple, decolorate, $\frac{18\text{-}22}{8\text{-}12}$ mic.——*Mont. Fl. Chil. p.* 146.

Trees, Mexico; *Nylander.*——The lichen (in Montagne's Juan Fernandez specimens) has not a little the aspect, in small, of a pale *P. Hypnorum*, and the light-coloured scales are characterized by gonidia, as in that; but a change takes place in some of these scales, whereby they assume a bluish colour (extending also in part to the exciples) and the scales exhibit then a peculiar and more delicate crenelation, and offer only gonimia; which appear to be regarded as determining the place of the lichen.

8. *P. Hookeri* (Sm.) Th. Fr.; thallus squamulose, sub-cartilagineous, more or less leaden-gray; squamules expanded,

sub-imbricate, bluntly lobed and notched, and longitudinally striate; those of the circumference elongated and radiant, the central ones crowded and crust-like; blackening beneath; apothecia small, lecanorine, appressed, the margin at length crenate, the flat disk from reddish-brown soon blackening. Spores broad-ellipsoid, simple, decolorate, $\frac{15\text{-}20}{7\text{-}11}$ mic.——*Th. Fr. Lich. Arct. p.* 73. *P. leucolepis* (*Wahl.*) *Nyl. Scand. p.* 123.

Rocks, Greenland (*Vahl*), Th. Fries *l. c.* 1861.

9. *P. brunnea* (Sw.) Mass.; thallus squamulose, sub-membranaceous, livid-ash-coloured and tawny-brown; squamules minute, now explanate and crenate, and now elongated and dissected, imbricate, and heaped together at length into a granulose mass; apothecia middling-sized, lecanorine, immersed, very numerous and soon confluent and difform, the reddish-brown disk becoming convex and even turgid, and excluding then the commonly persistent, incurved, crenulate margin. Spores oblong-ellipsoid, often pointed-tipped, simple, decolorate, $\frac{20\text{-}30}{10\text{-}14}$ mic.——*Parmelia, Fr. L. E. p.* 93. *Tuck. Lich. exs. n.* 89. *Pannaria, Nyl. Scand. p.* 123.

On the earth, Arctic America (*Richardson*), Hooker *l. c.* 1823. Greenland, *Vahl.* Islands of Behring's Straits, *Wright.* White Mountains, *Willey.* Coast of Massachusetts, *Oakes.* Cattskill Mountains, *Peck.* Rocky Mountains, *J. Wolf.*

10. *P. microphylla* (Sw.) Delis.; thallus squamulose, cartilagineous; livid-ash-coloured and glaucescent; the thickish, at first expanded but soon ascendant and imbricated, simply crenate squamules compacted at length into a continuous crust; beneath blackening; apothecia smallish; lecanorine; zeorine; and biatorine; superficial; the disk from pale becoming blackish-brown, soon convex, and excluding the crenate, thalline margin. Spores oblong-ellipsoid, simple, decolorate, $\frac{13\text{-}20}{5\text{-}7}$ mic. ——*Parmelia, Fr. L. E. p.* 90. *Tuck. Lich. exs. n.* 110. *Pannaria, Nyl. Scand. p.* 124.

Rocks, from New England to Virginia, *Tuckerman* Enum. 1845. New York, *Sartwell.* New Jersey, *Austin.* Ohio, *Lesquereux.* New Mexico, *Fendler.* California (f. *Californica*, a coarser plant, with larger spores, measuring $\frac{16\text{-}23}{5\text{-}9}$ mic.), *Bolander.*

11. *P. lepidiota*, Th. Fr.; thallus squamulose, coriaceous; yellowish-brown, lurid, and finally blackening; squamules mid-

dling-sized, expanded, crenate-lobulate with warty, often gray-sorediate edges; the external ones elongated and radiant; those more central becoming ascendant, closely imbricated, and heaped at last into a granulate, often gray-powdery crust; upon a thin, black hypothallus; apothecia smallish to middling, depressed, biatorine; disk from reddish becoming blackish-brown; the thin margin soon excluded. Spores ovoid-ellipsoid, pointed-tipped, simple, decolorate, $\frac{18\text{-}25}{7\text{-}11}$ mic.——*Th. Fr. Lich. Arct. p.* 74. *P. prætermissa, Nyl. Scand. p.* 124.

b. coralliphora; thallus passing into a dense mass of stout, torulose branchlets.

c. cyanolepra; thallus disappearing in minute, conglomerate, steel-blue granules.——*P. cyanolepra, Tuckerm. Lich. Calif. p.* 17.

On the earth, and rocks. Greenland (*Vahl*), Th. Fries, *l. c.* 1861. California, *Bolander*. Oregon, *Hall*. Rocky Mountains, *Brandegee*. Northern shore of Lake Superior, *Macoun*.——*b*, Vancouver's Island, *Macoun*.——*c*, California, on clay, *Bolander*. ——The Lake Superior specimens are very smooth, but scarcely referable to the next species; they are remarkable for a fibrillose ring on the under side of the apothecia. But the same feature (elsewhere not unknown in this genus, as compare the observation in Wright *Lich. Cub.* n. 98) is observable in *b*, a blacker plant than usual, and so far resembling the var. *tristis*, Th. Fr.; and I have detected it also in the European lichen last named. ——*c*, as originally considered, appeared to be a simply granulose lichen to be compared with *P. nebulosa* (Hoffm.), Nyl. In other specimens however the granules are seen to belong to squamules, which I incline (though not without some uncertainty) to refer to the present species.

12. *P. carnosa* (Dicks.); thallus squamulose-foliaceous, membranaceous; from pale-yellowish-brown becoming livid, and brownish-chestnut; the extended and lobe-like, deeply laciniate and erose-granulate squamules ascendant and loosely imbricated, or now heaped; beneath whitish; apothecia smallish, biatorine, sessile, flattish, the disk dark-red, the at first paler margin thin and entire. Spores from ellipsoid and simple; becoming oblong-fusiform and bilocular; mostly decolorate, $\frac{18\text{-}25}{6\text{-}11}$ mic.——*Parmelia, Schær. Spicil. p.* 566. *Pannaria muscorum, Nyl. Scand. p.* 127.

Rocks among mosses. Great Bear Lake, Arctic America.

(*Richardson*), Leighton in Linn. Soc. Journ. 1867.——Described from European specimens; I have seen no others. The lichen is so near to the last, that that was referred to it by both Sommerfelt and Fries. The spores become indeed bilocular, and incongruous therefore with the type of the present section; but they are perhaps more commonly like those of the last species, which attain finally to the same shape and size.

13. *P. tryptophylla* (Ach.) Mass.; thallus squamulose-foliaceous, membranaceous; from pale-yellowish soon becoming livid-brownish; squamules stellate-expanded, lacero-laciniate, erose and dentate-granulate, passing then into a densely coralline-granulose crust; upon a bluish-black hypothallus; apothecia small, biatorine, sessile; the disk chestnut-brown, finally convex; and the thin paler margin disappearing. Spores ellipsoid, simple, decolorate, $\frac{15\text{-}20}{5\text{-}8}$ mic.——*Th. Fr. Lich. Arct. p.* 76. *Nyl. Scand. p.* 125.

Trunks, and stones, New England and New York, *Tuckerman Syn.* N. E. 1848. South Carolina, *Ravenel.* Louisiana, *Hale.* ——The South Carolina specimens, and those from Louisiana, do not appear to differ from *P. nigro-cincta*, Nyl. in Lindig *herb. N. Gran.* n. 818; but all three are clearly referable, if I mistake not, to the older species before us. The other lichens named *nigro-cincta* in Lindig's collection (n. 2623, 2882, 18 of 2d collection) together with Montagne's original Juan Fernandez specimens of his species, and Wright *Lich. Cub.* n. 103 in great part at least, seem, in like manner, referable to a reduced *P. pannosa*; n. 18, in particular, not offering any differences from Wright *Cub.* n. 102, which should be the original *pannosa* of Acharius. The dimensions given in Nyl. *Prodr. N. Gran.* p. 27, might be supposed to mean that the spores of *P. nigro-cincta* are smaller than those of *P. pannosa*; but an examination of seven specimens of the former, four of them named by the author cited, shews that both species agree very well, in all respects, in their spores.

14. *P. melamphylla*, Tuckerm. *in litt.*; thallus orbicular, squamulose, membranaceous; from black-green becoming quite black; the minute squamules stellate-expanded and crenate at the circumference, but somewhat imbricated at the centre where they pass into a ragged crust; apothecia. . .

Rocks (schist) Vermont, *Frost.*——Texture parenchymatous

throughout; cells rounded; the gonimia (diam. 5-6 mic., but now larger) being mostly solitary. Spermatia ellipsoid; on sub-simple sterigmas. The place of the lichen to be further determined by the fruit, as yet unknown.

15. *P. crossophylla*, Tuckerm.; thallus effuse, membranaceous, terete-compressed, dichotomously much-branched, decumbent; leaden-gray; the outer portions plume-like, the inner ones densely imbricated, and crowded into a squamaceous-verrucose crust; beneath blackening at the centre; apothecia small, biatorine, immixt; the disk from flesh-coloured becoming chestnut-brown, soon convex and excluding the thin, pale margin. Spores ellipsoid, simple, decolorate, $\frac{17\text{-}23}{6\text{-}10}$ mic.——*Obs. Lich. l. c.* 4, *p.* 404.

Rocks, Vermont (*Russell*), Tuckerman *l. c.* 1861. New York, *Peck.* Pennsylvania, *Rau.* Ohio, *Lesquereux.* Alabama, *Peters.*

* * * * * *Coccocarpia.* Thallus foliaceous, sub-monophyllous. Medullary layer compact, with the habit of that of *Peltigerei.* Gonimous system constituted of gonimia; also comparable with those of the last family. Apothecia biatorine. Spores simple.——In this group *Pannaria* may be said to look back, so far as thalline structure is considered, to the preceding and higher, rather than forward to the next following family,—but, as regards the fruit, to be less typical than *Pannaria* proper.

16. *P. plumbea* (Lightf.) Delis.; thallus smallish, orbicular, coriaceous-membranaceous; from yellowish-brown becoming livid-lead-coloured; the more or less connate lobes dilated outwardly, radiately wrinkled, and, with age, concentrically zoned, with rounded and round-crenate tips; the centre passing into imbricate lobules; upon a dense, spongy, at length bluish-black hypothallus; apothecia smallish, biatorine; with flat, or swelling, from rusty- at length sanguineous-red disk; and thin, paler margin; finally confluent. Spores ellipsoid, simple, decolorate, $\frac{16\text{-}22}{6\text{-}8}$ mic.——*Parmelia, Ach. L. U. p.* 466. *Fr. L. E. p.* 87.

On an old oak, Newport mountain, Island of Mt. Desert, Maine, *Tuckerman Gen.* 1872. On a Birch stump, and on exposed rocks, Island of Grand Menan, *Willey.*

17. *P. molybdæa* (Pers.) Tuckerm.; thallus small to ample, orbicular, with the texture of the last, and the radiately plaited,

rather entire lobes similarly differenced; from pale whitish-passing into brownish- and dark-leaden gray; upon a hypothallus like that of the last; apothecia from smallish at length more than middling-sized, biatorine, appressed, soon rather applanate and ample, convex, immarginate; disk from reddish-orange or chestnut becoming black. Spores ellipsoid and cymbiform, bi-nucleolate, decolorate, $\frac{9\text{-}15}{3\text{-}5}$ mic.——*Tuckerm. Gen. Lich. p.* 52. *Lecidea Parmelioides* (*Hook.*) *Mont. Cuba, p.* 192. *Coccocarpia, Tuckerm. in Wright Lich. Cub. n.* 104–107.

b. cronia, Nyl.; lobes beset, at length densely, with isidioid branchlets; the marginate apothecia white-fibrillose beneath. Spores as in *a*. *Parmelia cronia, Tuckerm. Syn. N. E. p.* 36.

c. incisa, Nyl.; lobes narrowed, discrete more or less at the circumference, and many-cleft; at the centre isidiophorous. [Apothecia now as in *a*, and now as in *b*.]——*Nyl. in Prodr. N. Gran. p.* 27 *& Lindig herb. n.* 2538. *Coccocarpia incisa, Pers., Mont. in Ann. Sci.*

Trees, bushes, and dead wood; a tropical lichen, but extending throughout the United States; *Tuckerman* in Darlingt. *Fl. Cest.* 1853. Texas, *Wright.* Louisiana, *Hale.* Alabama, *Beaumont.* Florida, *Austin.* South Carolina, *Ravenel.* Pennsylvania, *Michener.* Western New York, *Sartwell.*——*b*, Rocks, and also trunks, etc., commonly infertile; from New England to Virginia, *Tuckerman Syn.* N. E. 1848. Illinois, fertile, *Wolf.* North Carolina to Texas, *Ravenel.* Alabama, fertile, *Peters.* Louisiana, *Hale.* As also Cuba, *Wright*; and New Granada, *Lindig.*——*c*, Trunks, Florida, *Ravenel.*——This species is closely akin to the preceding, but is differenced by the apothecia, and the spores. The colours are perhaps also a little unlike; but the present becomes remarkable in the tropics (where the other is wanting) for a certain luxuriance (*Coccocarpia incisa, ciliolata*, etc., of authors) which, rare enough in the northern lichen, is far from surprising in the tropical.

18. *P. stellata* (Tuckerm.) Nyl.; thallus minute, orbiculate, membranaceous; lead-coloured; the very narrow, linear, and flat lobes discrete, radiant, and many-cleft at the circumference, but becoming at the centre densely imbricated, and dentate-lobulate; white, and white-fibrillose beneath; apothecia very small, sessile; with a reddish-brown disk; white fibrillose below. Spores ellipsoid, as in *P. molybdæa*, but small, decolorate, $\frac{5\text{-}9}{3\text{-}4}$

mic.——*Coccocarpia, Tuckerm. Obs. Lich. l. c.* 5, *p.* 402. *Pannaria, Nyl. Disp. Psor. & Pann.*

Upon Holly, Low country of South Carolina (*Ravenel*), Tuckerman *l. c.* 1862. Florida, Messrs. *J. D. Smith*, & *Austin*. Alabama (*Herb.* Willey).

The apothecia and spores refer the plant to the present section, rather than the preceding. The thallus is also well-comparable with that of such specimens of *P. molybdæa, v. incisa*, as are given in Lindig *N. G.* Coll. 2, n. 68; except in its at length extreme narrowness and minuteness.

* * * * * * *Lecothecium.* Thallus reduced; squamulose-foliaceous; and crustaceous; the hypothallus mostly indistinct, or obsolete. Medullary layer, when defined, of compact, elongated cells. Gonimia more or less concatenate and distinctly gelatinous, with a Collemeine aspect. Apothecia lecanorine (n. 19, 20) or biatorine. Spores (except in 19) 2-4-locular. (*Lecothecium*, Trevis. *Pannariæ* sp., & *Pterygium*, Nyl.)

19. *P. Sonomensis*, Tuckerm.; thallus small, irregular; greenish-brown; made up of minute, discrete, elongated, linear, many-cleft lobes, of which the central are teretish and intertangled, and the outer ones expanded; beneath whitish, and naked, the hypothallus being obsolete; apothecia very small, lecanorine; the entire margin finally excluded; and the reddish-brown disk blackening. Spores fusiform, curved, simple, decolorate, $\frac{20\text{-}33}{2\text{-}3}$ mic.——*Obs. Lich. l. c.* 12, *p.* 169.

Granitic and other rocks, Sonoma, and Yosemite, California (*Bolander*), Tuckerman *l. c.* 1877.

20. *P. stenophylla*, Tuckerm.; thallus minute, orbiculate, stellate-expanded; greenish-brown; lobes terete, those of the circumference radiant, and branching; the central ones squamulose-granulose, falling away at length and leaving the zoned periphery; beneath pale without apparent hypothallus; apothecia very small, lecanorine; the disk brown; the margin soon disappearing. Spores ellipsoid and oblong, somewhat curved, bilocular, decolorate, $\frac{12\text{-}20}{3\text{-}5}$ mic.——*Obs. Lich. l. c.* 12, *p.* 169.

Calcareous rocks growing intermingled with the next, Alabama (*Peters*), Tuckerman *l. c.* 1877.——Apothecia appearing to be now zeorine; and so not impossibly biatorine also, at last.

21. *P. Petersii*, Tuckerm.; thallus squamulose-foliaceous, membranaceous, stellate-expanded; from livid-glaucous becoming olivaceous, and black; lobes appressed, flat, contiguous, now dispersed and soon falling away at the centre; radiant and many-cleft at the concentrically disposed circumference; the hypothallus obsolete; apothecia very small, biatorine, flat, black, with a thin margin. Spores ellipsoid and oblong, simple and bilocular, decolorate, $\frac{12\text{-}23}{4\text{-}6}$ mic.——*Gen. Lich. p.* 54. *Lecidea, Tuck. Pterygium, Nyl. Syn. p.* 93.

Calcareous rocks. Alabama (*Peters*) Tuckerman in Nyl. *Syn.* 1858. New York, *Willey.*——The regular, stellate, concentrically disposed thallus is not always to be seen; but only scattered lobules.

22. *P. flabellosa*, Tuckerm.; thallus squamulose-foliaceous, membranaceous; livid-ash-coloured; lobules narrow-linear, dissected, those of the circumference expanded and fan-shaped, flat, and longitudinally striate; those of the centre teretish and heaped; upon an indistinct, finally blue-black hypothallus; apothecia very small, immixt, flat; a red disk bordered by a pale-livid margin, and both finally blackening. Spores oblong-ellipsoid, 2-4-locular, decolorate, $\frac{16\text{-}18}{5\text{-}7}$ mic.——*Obs. Lich. l. c.* 5, *p.* 401; *Gen. Lich. p.* 54.

Granitic rocks. Vermont (*Frost*), Tuckerman *l. c.* 1862. White Mountains, *Willey.*——Apothecia 3-6 mic. wide, about twice the size of those of the last.

23. *P. nigra* (Huds.) Nyl.; thallus very minutely squamulose; leaden-ash-coloured; squamules now scattered and lobulate, but heaped, for the most part, into a broken, granulose or corallinoid crust; upon a thin, blue-black hypothallus; apothecia very small, biatorine, sessile (from reddish-brown) commonly black, the swelling disk soon excluding the thin margin. Spores oblong, 2-4-locular, decolorate, $\frac{11\text{-}16}{4\text{-}7}$ mic.——*Collema, Ach. L. U. p.* 628. *Pannaria, Nyl. Scand. p.* 126.

b. cæsia, Nyl.; thallus dark-gray, or whitish; the internal structure confused and obscure.——*Tuckerm. Gen. Lich. p.* 54. *Collolechia, Mass., Koerb. Syst. p.* 377.

Calcareous rocks, and sandstones, Pennsylvania and the northern States to Canada, *Muhlenberg Catal.* 1818. Illinois and Kansas, *Hall.* Alabama, *Peters.*——*b*, calcareous rocks,

Trenton, N. Y., etc., *Tuckerman Gen. Lich.* 1872.——Structure of the thallus of the present species, in its best conditions (as Fellm. *Lich. Arct.* n. 101) sufficiently agreeing with that of the other species of this section, and with *Pterygium*, Nyl., which is not well at home in *Collemei*; and the lichen differs in fact in nothing from *Lecothecium* of Authors but the very indistinct hypothallus.——Both the colour, and imperfectly defined, or confused structure of *b* may perhaps be attributable to the action of lime: like *a*, the lichen is inseparable from the *Pannariei*.

******* *Janella*. Thallus crustaceous, squamulose-granulose, parenchymatous throughout. Hypothallus obsolete. Gonimous system of gonimia. Apothecia biatorine. Spores muriform-plurilocular. (*Collema aut Leptogium, Auct.*)

24. *P. byssina* (Hoffm.) Tuckerm.; thallus effuse; of minute, granulose, or now corallinoid, ash-coloured squamules, passing into scurfy granules; apothecia small to very small, innate-sessile; margin depressed; disk reddish-brown. Spores ovoid-ellipsoid, decolorate, $\frac{18-30}{7-14}$ mic.——*Leptogium, Zwackh Exs. n.* 174. *Nyl. Syn.* 1, *p.* 120. *Collema, Koerb. Parerg. p.* 410. *Pannaria, Tuck. Gen. p.* 56.

On the earth, Illinois (*Hall*), Tuckerman *l. c.* 1872. Massachusetts, on bank-walls, *Willey*.

Fam. 6.—COLLEMEI.

Thallus various, exhibiting the whole range of variation in form of the Tribe,—now shrub-like and ascendant; or filiform and decumbent; now, and for the most part, foliaceous; and now, at length crust-like; when moist more or less gelatinous (whence the name Jelly-lichens); the hypothallus, except in rare cases, obsolete. Gonimous system exclusively of gonimia, which are now clustered in roundish groups, or more commonly linked together in necklace-like chains, nestling in a homogeneous pulp derived from the dissolution of the thickened membranes.

For a consideration of the relations of this much-disputed Family to the immediately preceding ones, and of the insupera-

ble difficulties in the way of continuing to regard it as ordinarily distinct from them, reference may be made to the author's *Genera Lichenum*, p. 56–64, etc.

The spore-history of the *Collemei* offers an evident contrast to that of the *Pannariei*, in that while in the latter the greater proportion of the forms, and all the more typical ones, have simple spores,—the higher features shewing themselves only in the receding sections, the confused and at length aberrant structure of which assimilates them to *Eucollemei*,—it is the bulk and most typical portion of the former which displays the higher spore-characterization, and only in general the reduced and receding clusters in which the spores are simple. We descend thus from the foliaceous *Pannariæ* to the sections *Lecothecium* and *Janella*; as we ascend from *Pyrenopsis* and *Omphalaria* to *Leptogium* and *Hydrothyria*. But in both alike the ultimate condition of the spore is that of the Coloured Series; and those spores therefore the structure of which represents earlier stages of spore-development, however without colour and apparently equivocal, are to be taken for decolorate members of the same Series.

Sub-Fam. 1.—Lichinei.

Thallus filamentous or shrub-like; the gonimia either constituting an axis (as in *Sirosiphon*, and other types of *Algæ*, with which Class the principal members of the present Sub-Family were formerly placed, as *Sirosiphon* is now, by some, with *Lichenes*) but interpenetrated and surrounded by filamentous elements (hyphæ), and crowded at length by the development of the latter into a regular gonimous layer (Sect. 1), or concatenate (Sect. 2). Medullary layer more or less parenchymatous. Apothecia globose; oftener biatorine.

Sect. 1. *Ephebei*. *Thallus filamentous, sirosiphonoid.*—— The plants to be now described are distinguished from *Algæ*, as well by the possession of apothecia, as of hyphæ. In other respects, however, the present section is so close to certain Algal types (especially *Sirosiphon*, Kütz.), and this resemblance appeared otherwise of such difficult explanation, that the question of parasitism long since suggested itself. *Ephebe pubescens*, in its

so-called fertile condition, was thus taken for an *Alga* infested by a *Fungus* (Hepp. *Flecht. Eur.* n. 712). De Bary illustrated this further, and proposed an alternative. Either the lichens now before us are the fully developed, fructifying states of plants, the less developed conditions of which ranked heretofore as *Nostochaceæ*, *Chroococcaceæ*, etc., among the *Algæ*, or the groups last-named are typical *Algæ*, which assume the form of *Collema*, *Ephebe*, etc., in consequence of being penetrated by certain parasitical *Ascomycetes*, which spread their mycelial cells through, and thus condition the growing thallus. (De Bary, *Morph. & Phys. d. Pilze*, etc., p. 291.) Schwendener's development of the latter hypothesis (*Die Algen-typen der Flechten-gonidien*, 1869, etc.) opened up an enquiry of deep interest, which yet neither his own profound researches, nor the later ones of Bornet (*Recherches sur les gonidies*, *Ann.* 5, 17, 1873) and Stahl (*Beitr. z. Entwickelungsgeschichte d. Flechten*, 1877) were sufficient to determine; and the question remained an open one, till it was settled, and in favour of the autonomy of the Lichens, by Minks (*Das Microgonidium*, 1879).——*Sirosiphon*, Kütz., of which several species are recognized here (*Prof. W. G. Farlow*), has lately found a place in certain Lichen-catalogues with the authority apparently of Dr. Nylander; but the group of *Algæ* in question, as constituted, is only hypothetically associable with Lichens; and the eminent author cited has not yet attempted to remove the difficulty of so associating it.——*Ephebella*, Itzigs., also North American (*Farlow*) is still further removed from Lichens.

[THERMUTIS, Fr., Born.

Apothecia very small, biatorine. Spores ellipsoid, colourless. Spermatia oblong; on simple sterigmas. Thallus slender filiform, densely tufted; the gonimia constituting, at the extremities, a single, central axis, which breaks up, in the older parts, into transverse rings.

T. velutina (Ach.) Fr.; thallus of very slender, decumbent, sub-simple, crisped, blackish-brown filaments intertangled into close, velvety cushions; apothecia a little concave, pale brown, with an obtuse margin. Spores roundish-ellipsoid, simple, "$\frac{9\text{-}10}{7}$ mic."——*Th. Fr. Lich. Arct. p.* 286. *Koerb. Parerg. p.* 450. *Gonionema*, *Nyl. Syn.* 1, *p.* 88, *t.* 1, *f.* 11.

Rocks and stones, Europe; but known to fruit only in the ex-

treme north. It has not yet been detected here.——There being no question of the plant's being the type of *Thermutis*, Fr. (*S. O. V.* p. 302; 1825) it is not a sufficient reason for supplanting this name by Nylander's, that Fries, many years later, referred incorrectly, *in litt.* (Schær. *Enum.* p. 248), an incongruous lichen to his genus.]

[SPILONEMA, Born.

Apothecia minute, lentiform, immarginate, black. Spores ellipsoid, colourless. Spermatia oblong; on multi-articulate sterigmas. Thallus slender filiform, branched, the large gonimia arranged at first in an axial column, as in the last, but soon exhibiting, like that, the dissolution of this column into transverse layers. Nyl. *ut infra*.

S. paradoxum, Born.; "thallus densely cæspitose, entangled, irregularly and somewhat one-sidedly branched, the filaments about an eighth of an inch in height; blackish-brown; apothecia hemispherical, without any margin, black. Spores ellipsoid, simple, 9–4 mic."——*Nyl. Syn. p.* 89, *t.* 2, *f.* 3. *Leight. in Mag. Nat. Hist.* 1865.

Rocks in the south of Europe; as also in North Wales; and in Finland.

This plant is also unknown here, having, like the last, been hitherto sought in vain among the Sirosophons, etc., of our rocks; but it may occur within our limits, however long obscured by the absence of fruit. The general agreement in thalline structure of the plants which constitute the present section (*Ephebei*) is such, that their distinction turns on their fruit-characters. *Spilonema* differs yet, by its branched and shrub-like habit, from *Thermutis;* as by its smaller size from *Ephebe.*

A minute, pulvinate lichen, looking like a small and lighter-coloured *Ephebe*, which Bornet (*in litt.*, *fide* Farlow) was inclined provisionally to refer to this genus, but infertile, has occurred, on calcareous rocks in Alabama, *Peters*; and, what is possibly the same, on granitic rocks in Massachusetts, *Willey.*]

XXIII.—EPHEBE, Fr., Born.

Apothecia minute, now persistently immersed in the thallus and endocarpeine, and now superficial and globose-

lecanorine; the coarctate disk punctiform. Spores ellipsoid, colourless. Spermatia ellipsoid; on simple sterigmas. Thallus coarsely filamentous, branched; the large gonimia grouped finally more or less together outside of the medullary parenchyma.

* *Apothecia (so far as known) immersed in the thallus.*

1. *E. pubescens*, Fr.; thallus much-branched, rather rigid, transversely somewhat wrinkled and scabrous, decumbent in loosely intertangled tufts; from blackish-green becoming black; [apothecia immersed several together in siliquose swellings of the thallus; the disk reduced to a point. Spores oblong-ellipsoid, bilocular, colourless, $\frac{11\text{-}16}{3\text{-}4}$ mic.]——*Nyl. Syn.* 1, *p.* 90, *t.* 2, 1, & 17–20. *Leight. l. c.*

Rocks, throughout New England, and northward, *Tuckerman Syn.* N. E. 1848. Greenland ♀ & ♂ Hornemann, fide *Bornet.* New York, *Peck.* New Jersey, *Austin.* Probably throughout the Appalachian system of mountains, as in Alabama, *Peters.* Always as yet (with the above noted exception of Greenland) seen here without apothecia, but occurring with spermogones, which resemble the apothecia of the next species. Reliance is hardly to be placed on the ordinarily dicœcious character supposed to distinguish this from the next (Nyl. *Syn. l. c.*) as compare the *E. Lapponica*, Nyl. in *Flora*, 1875, which can scarcely be said to differ at all from the present but in being monœcious.

2. *E. mammillosum* (Lyngb.) Fr.; thallus simple; softer than the last; the simple branches incrassated and spindle shaped, and thickly mammillated on all sides; apothecia unknown.——*Harv. Brit. Algæ*, *p.* 153.

Wet rocks near Norman's Woe, Gloucester, Mass., *Prof. Farlow.* Both Agardh, and Harvey have inclined to consider this a variety of the last, from which Fries (*Summ. Veg. Scand.*) has distinguished it.

* * *Apothecia superficial, and globose.*

3. *E. solida*, Born.; thallus generally like that of the first species in habit as in roughness, but much shorter, and perhaps more uniformly stouter-branched and shrub-like, and growing in smaller tufts; black; apothecia lateral and terminal; the punctiform disk at length evidently impressed; with an obtuse mar-

gin. Spores oblong, often a little curved, simple, colourless, $\frac{10\text{-}16}{35\text{-}55}$ mic., the slender paraphyses at length distinct.——*Born. in Ann. Sci.* 3, 18, 171. *Nyl. Syn.* 1, *p.* 90.

Rocks of the Blue Ridge in Georgia (*Lesquereux*), Bornet *l. c.* 1852. Vermont, *Frost.* Massachusetts, *Willey.*

Like a reduced, and more shrub-like *Ephebe*, with what might seem normal apothecia. Spermogones as in the last; but the sterigmas shorter.——*E. Lesquereuxii*, Born. *l. c.*, p. 170, from the Raccoon Mountains, Alabama (*Lesquereux*), is said by Bornet to differ from *E. solida* only in being thrice or four times as large; the fruit is unknown, and the plant no longer exists in *Herb. Lesq.* *E. pubescens* occurs now in Alabama (*Peters*) twice as large as in the ordinary state, there also found.

The more normal fruit being all in fact that distinguishes this section of *Ephebe* from the first, it appears undesirable to separate it generically as *Ephebeia*, Nyl. (*Flora*, 1875).

Sect. 2. *Eulichinei. Thallus fruticulose, the gonimia concatenate, and constituting a distinct layer.*

XXIV.—LICHINA, Ag., Mont.

Apothecia minute, terminal, globose-lecanorine; with a punctiform disk. Spores ellipsoid, simple, colourless. Spermatia ellipsoid; on simple sterigmas. Thallus shrub-like, cartilagineous-corneous, brownish-black; the texture Collemeine; but the necklace-like chains of gonimia distinctly separated from the mostly determinate cortical, as from the medullary layer.

L. confinis (Sm.) Ag.; thallus densely cæspitose, dichotomously branched; greenish-black; the slender branches terete, and somewhat fastigiate. Spores in cylindraceous thekes, the paraphyses finally distinct. *Koerb. Syst. p.* 430.

* *Willeyi*; thallus scarcely differing externally, but the cortical layer obsolete; and the gonimia supplanted, for the most part entirely, by a microscopical *Alga*, the long tapering points of which appear outwardly; apothecia also similar to those of the species; as well as the spores.——*Lichina L. confini prox., Schwend. Algentypen der Flechtengonid. p.* 19.

Rocks beyond the tides, but within reach of the sea in storms, Cape Ann, Mass., *Tuckerman* in Schwendener *l. c.* 1869. Hollows retaining water longest in otherwise dry rocks, at least five miles from the sea, New Bedford, Mass., *Willey*.

No exceptions having occurred, and the normal *L. confinis* being unknown to us, this remarkable medley of alien organisms must not only stand with us for *Lichina*, but, as Schwendener has remarked, must be admitted, without further investigation, to speak at any rate for, rather than against the theory of parasitism. At the same time, it cannot be denied that while *L. Willeyi* exhibits the living together in most intimate association of two plants of distinct Classes, the one penetrating indeed the other, and assuming the place even (it should seem) of a part of the typical, internal structure of the other, the two are always distinct; and the zigzag chains of *Lichina*-gonimia which are rarely found in thicker portions of the thallus offer no indication of genetic relationship to the *Alga* occupying the periphery. And thus, though at first sight appearing possibly to bear with force on the side of parasitism, the complex organism before us is really of smaller account in the argument than some other less pretentious facts.

Sub-Fam. 2.—Collemei proper.

Thallus foliaceous, now diminished or microphylline; or, at length, crust-like (granulose, or even filmy); only exceptionally fruticulose; the gonimia disposed in rounded, dichotomously branched clusters; or, more commonly, in necklace-like chains; dissolving for the most part, more or less, into a homogeneous pulp, traversed by the hyphæ. Medullary layer, in the lowest forms, parenchymatous. Apothecia normally scutellæform, but sometimes persistently undeveloped, or globose.

The difficulties of arrangement of the intricately correlated and perplexed groups which make up the present Sub-Family have been considered by the author in *Genera Lichenum*, pp. 69–77. The disposition there found preferable will be adopted here, with the single exception that *Synalissa symphorea* is separated from the granulose species in that work associated with it, and is united with *Omphalaria*; from which the writer had,

in the same place (*Gen.* p. 72), questioned whether it were "really dissociable." These granulose species (*Pyrenopsis*, Nyl.) make a group "precluded by its parenchymatous tissue from the chief structural peculiarities of *Collemei*; and, in the last resort, perhaps reconcilable with those only by a certain accordance in habit" (*Gen.* p. 77) separating them from low types of *Pannariei*. But *Synalissa symphorea* is, in every respect, a Collemeine lichen; and its structure is that, not of *Pyrenopsis* but *Omphalaria* proper, in which we already have fruticulose types. (*)

Sect. 1. *Omphalariei*, Koerb. *Thallus either granulose, fruticulose, or reduced-foliaceous, attached only at the centre; gonimia, for the most part, collected in clusters.*

XXV.—PYRENOPSIS, Nyl.

Apothecia very small, depressed-globose; the disk contracted and urceolate, or now at length open. Spores ovoid-ellipsoid, simple or bilocular, decolorate. Spermatia oblong, or now filiform and bowed (n. 5) on simple sterigmas. Thallus coralloid-granulose; or still more reduced and even filmy; the texture parenchymatous throughout; the gonimia in clusters; or, more rarely, in chains.

Humble plants, resembling brownish or blackish stains, which the lens shews to be scurfy; on rocks. But little is known as yet of them here.

* *Gonimia disposed in clusters.*

1. *P. Schæreri* (Mass.) Nyl.; thallus of minute, corallinoid granules, crowded together into areole-like groups, and forming a broken, blackish crust; apothecia very small, lecanoroid; the

(*) Nylander has indeed lately (*Collemacei & cætt. Cubani Novi*, in *Flora*, 1875) referred the most elegant of these (the Cuban *O. Wrightii* of the present writer) to his *Synalissa*; but the reference is determined perhaps rather by the marked fruticulose habit of the plant, as the Cuban lichen offers no important distinction in structure from his *Omphalaria*. "*In textura thalli,*" he remarks however, "*observatur, filamenta apice divisa in gonimia abire, ita ut hi apices filamentorum singuli in impressione gonimii levi infigantur, et sic* 3 *vel* 4 *sæpius gonimia sub-botryose infixa conspiciantur*" (Nyl. *l. c.*)—an observation capable perhaps of being understood in more than one way; and hardly to be taken as meant to suggest a structural difference between the two groups!

flat disk more or less reddish at least when wet; the thin margin now granulate-coronate. Spores ellipsoid, simple, decolorate, $\frac{14-21}{7-10}$ mic.; the paraphyses capillary, mostly conglutinate.—— *Pannaria, Mass. Ric. p.* 14. *Koerb. Parerg. p.* 46.

Calcareous rocks. Illinois (*Hall*), Tuckerman *Gen.*, 1874. Trenton Falls, N. Y., *Willey*. Alabama, *Peters*.

Our plant agrees with an excellent Bavarian specimen (*Arnold*) from which I cannot, however, distinguish one of the two (from the same substrate in Bavaria, *Arnold*) of *Omphalaria decipiens* given in Anzi *Venet.* 2. The Italian specimens of the present, so far as seen (Mass. *Ital.* n. 338; Anz. *Langob.* n. 430) are inferior.——What I have seen of *Psorotichia murorum*, Mass. (Mass. *Lich. Ital.* n. 300; Arn. in *herb.* Koerb.), scarcely makes clear the distinction between that lichen and *Pyrenopsis Schœreri*. The latter is rather distinguished in the lowly group before us by its well-characterized apothecia.

2. *P. melambola*, Tuckerm.; thallus of exceedingly minute, olivaceous granules compacted into finally thick and sub-stipitate, scabrous, black areoles, and forming a close crust; apothecia very minute, 1-6 in the areoles, innate, lecanorine, black; the thin margin persistent and of the same colour with the subpapillate disk. Spores ellipsoid, simple, decolorate, $\frac{10-12}{5-8}$ mic.; the paraphyses conglutinate.——*Synalissa, Obs. Lich.* 4, *l. c.* 12, *p.* 170.

Calcareous rocks, Alabama (*Peters*), Tuckerman *l. c.* 1877. The regular, raised areoles now exceeding 1 millim. in width, and almost reaching it in thickness; the apothecia from $0^{mm.}$, 1 to $0^{mm.}$, 3 wide.

3. *P. polycocca* (Nyl.); thallus of rounded blackish granules soon passing into a broken, pitch-black crust which is hidden mostly by the numerous apothecia; these are very small, concolorous, globose, with a coarctate, punctiform, urceolate disk. Spores ellipsoid, simple, decolorate, $\frac{11-12}{8}$ mic., the capillary paraphyses conglutinate.——*Synalissa, Nyl. Syn.* 1, *p.* 96.

Granitic rocks, Vermont (*Frost*), Tuckerman in Nyl. *l. c.* 1858.——Apothecia $0^{mm.}$, 3 to $0^{mm.}$, 4 wide.

4. *P. phœococca*, Tuckerm.; thallus coralloid-granulose, compacted into a thickish, broken crust like that of the last, but reddish-brown; apothecia scattered, very small, globose, concol-

orous; with a punctiform, impressed disk which becomes at length dilated and lecanorine. Spores ellipsoid and ovoid, simple and bilocular, decolorate, $\frac{14\text{-}25}{8\text{-}12}$ mic.; the capillary paraphyses at length distinct.——*Synalissa*, *Gen. Lich. p.* 80.

Granitic rocks, North Carolina (*Curtis*), Tuckerman *l. c.* 1872. Massachusetts and New Hampshire, *Willey*.——Apothecia $0^{mm.}$, 3 to $0^{mm.}$, 5 wide.

The colour of the thallus, passing from blood-red into reddish-brown, and no less the large internal cells each containing from one to four gonimia (now exactly comparable with those of *Omphalaria Phylliscum*) and the larger spores, separate this from the last; which is however unknown as yet except at its original station; and its range of variation therefore uncertain.

5. *P. phylliscina*, Tuckerm.; thallus thin, made up of very minute, brownish-black granules which are collected in an irregular, filmy crust; apothecia minute, globose, almost closed (Verrucariæform). Spores in sub-fusiform thekes, ovoid-ellipsoid, simple and bilocular, decolorate, $\frac{9\text{-}15}{5\text{-}7}$ mic.; the paraphyses few and short.——*Synalissa*, *Gen. Lich. p.* 80.

Granitic rocks, New Bedford (*Willey*), Tuckerman *l. c.* 1872.

Spermatia filiform, bowed. In this respect, as in the inexplicate, globular apothecia with the disk represented only by what seems a Verrucariine ostiole, and the fusiform thekes, the lichen reminds us of *Omphalaria Phylliscum*; nor are the large gonimia ill-comparable with those of that. Apothecia $0^{mm.}$, 2 to $0^{mm.}$, 3 wide.

* * *Gonimia disposed in chains.*

6. *P. corallina*, Willey; thallus coralloid, the pyriform, retuse granules becoming elongated, nodulose, and irregularly short-branched; and constituting finally a broken-areolate, dark-olivaceous (and blackening) crust; apothecia minute, globose-lecanorine; with a coarctate, impressed disk. Spores ellipsoid, simple, decolorate, $\frac{12\text{-}20}{6\text{-}10}$ mic.; the capillary paraphyses finally distinct.——*Willey*, *msc.*

On stones (granitic) near the ground in boggy places, on the coast of Massachusetts, *Willey*.——Chains of gonimia of 3–9 members.

7. *P. viridi-rufa*, Tuckerm.; thallus of rounded granules which are soon grouped in areole-like clumps, and crowded to-

gether finally into a broken crust; pale-bluish- or sage-green; apothecia very small, lecanoroid, innate, flattish; the disk rufous; the paler margin persistent. Spores ellipsoid, simple, decolorate, $\frac{16\text{-}18}{8\text{-}10}$ mic.; the paraphyses somewhat distinct.——*Synalissa*, *Obs. Lich. l. supra c.*

Calcareous rocks, Texas (*Wright*), Tuckerman *l. c.* 1877.——Gonimia mostly solitary or in twos, but occurring also in chains of fours and sixes; 10–17 mic. in the longest diameter.——Fragments from Bourbon County, Kansas (*Hall*), also calcareous, agrees, so far as they go, very well with this, except in their blackish colour, bringing them near to *Porocyphus areolatus*, Koerb.; which is similar in fact in the spores and paraphyses, and the gonimia. From this last *P. viridi-rufa* is distinguishable, with whatever ultimate rank, by the colours, and the different matrix. Apothecia, as seen, $0^{mm.}$, 3 to $0^{mm.}$, 4 thick.

XXVI.—OMPHALARIA, Dur. & Mont.

Apothecia very small, sub-globose; more or less immersed in the thallus, or superficial; rarely explicate and scutellæform. Spores ellipsoid, simple, decolorate. Spermatia ellipsoid, or now (n. 2, 3) filiform and bowed; on simple sterigmas. Thallus fruticulose, or, more commonly, foliaceous, attached to the substrate at only one point; the gonimia disposed in clusters, or rarely linked together in necklace-like chains, interspersed among anastomosing hyphæ in a homogeneous pulp.

Synalissa, *Fr. S. O. V.* p. 297 (1824) was founded on the type of the first section of *Omphalaria* as here understood; but placed with Sphæriaceous *Fungi*. It was long before Fries again reviewed the plant, and restored it to its proper affinity, but he took occasion at the same time (*Summ. Veg. Scand.* p. 563, 1849) to associate with it generically *Endocarpon phylliscum*, Wahl., which makes here the second section of the present genus. Before this, however, Montagne had distinguished (*Alger.* 1846) our third section (to which he afterwards referred also our second) as *Omphalaria;* and the group thus established has acquired, whether as *Omphalariei* or *Omphalaria*, *emend.*, of authors, an extent, and has received an amount of illustration which makes any attempt at superseding its well-known name by the older one impracticable.

* *Synalissa. Thallus fruticulose; the gonimia disposed in clusters. Apothecia globose-lecanorine. Spermatia either ellipsoid (n. 1) or filiform (n. 2).*

1. *O. symphorea* (DC.); thallus pulvinate, minute, rigid; sparingly or at length dichotomously divided, with short and stout, torulose branches; apothecia terminal, globose; the coarctate, concave disk at length dilated and bordered by an obtuse margin. Spores more commonly 12–16 in the thekes, ellipsoid and globular, simple, decolorate, $\frac{9\text{-}14}{7\text{-}9}$ mic.——*Synalissa, Nyl. Scand. p.* 27. *S. symphorea & sphærospora, Nyl. Syn.*

Calcareous rocks, Alabama (*Peters*), Tuckerman in *Nyl. Syn.* 1858.

The European lichen is not always as well-developed as ours, but the two are inseparable in species. The plant starts as a glebous-squamaceous frond with the aspect of *O. pyrenoides*. As this grows it takes on more of the look of *O. umbella*, above as well as below; and only finally assumes its fruticulose character.

2. *O. Texana*, Tuckerm.; thallus nodulose-sub-fruticulose, of the size and with the texture and colour of n. 1; apothecia unknown. Spermogones situated like and resembling apothecia, containing filiform, bowed spermatia; on simple sterigmas.—— *Synalissa, Gen. Lich. p.* 80.

Calcareous rocks, very sparingly, Texas (*Wright*), Tuckerman *l. c.* 1872.

Like a nodose or undeveloped form of n. 1, but becoming somewhat branched. Internal structure also similar, except that the larger gonimia (reaching 14 mic. at least in diameter) have much the look of those of the next following species though only of half the size.

* * *Endocarpoma. Thallus foliaceous, with the habit and texture of the following section, with which this also agrees in the evolution of the gonimia; but the latter larger than usual, and soon solitary. Apothecia immersed and persistently nucleiform. Spermatia filiform.*

3. *O. phyllisca* (Wahl.) Tuckerm.; thallus small, rigid, rosulate, black, the rounded lobules conspicuous at the periphery but less so at the centre, or more rarely somewhat imbricate; apothecia minute, depressed-globose; the urceolate disk with a

punctiform aperture. Spores in sub-fusiform thekes 9-18, ellipsoid and globular, simple, decolorate, $\frac{6\text{-}10}{4\text{-}5}$ mic.——*Tuckerm. Gen. p.* 84. *O. Demangeonii*, *Mont. in Ann. Sci. Sept.*, 1849. *O. Silesiaca*, *Koerb. Syst. p.* 423. *Phylliscum endocarpoides & P. Demangeonii*, *Nyl. Syn.* 1, 136, *t.* 3, *f.* 5. *P. endocarpoides*, *Koerb. Parerg. p.* 443. *Schwend. Undersuch. in Naeg. Beitr.* 1868, 4, 194.

Granitic rocks, White Mountains (*Russell*), Tuckerman *Gen.* 1872. Vermont, *Frost.* Massachusetts, *Willey.* Rhode Island, *J. L. Bennett.* Shores of Lake Superior, *Agassiz.* Oregon, *Hall.*

This plant, the whole aspect of which is that of *Omphalaria* proper, as is the general internal structure, differs yet in the early breaking up of the gonimous clusters which so commonly characterize the section, and the large size of the then solitary gonimia, as well as in the feebler development of gelatinous pulp; in both which respects it looks rather towards *Pyrenopsis.* It is possible then to regard it as an intermediate type between *Pyrenopsis* and *Omphalaria.* As now accepted as a genus by authors the distinction turns however, if we mistake not, less on the thalline differences than on the assumption of an essential difference in the fruit; that this namely, instead of being to be considered, in spite of its diffluent paraphyses, from the point of view of the Collemeine group to which the plant manifestly belongs by its other characters, and in which inexplicate apothecia, so surprisingly exhibited in *O. leptophylla* and *O. deusta* of the island of Cuba, are the rule, shall be reckoned a perithecium; an opinion which we take for untenable.

* * * *Omphalaria proper. Thallus foliaceous, attached to the substrate at only a single point; the gonimia in clusters; or rarely* (*n.* 8) *in chains; interspersed among hyphæ, in a homogeneous pulp.*——This group is distinctly gelatinous and Collemeine. The species with concatenate gonimia are indeed referred to *Collema* by Nylander (*Syn.*); but belong naturally, by the peculiar attachment, and whole habit, with the others.

† *Gonimia in clusters.*

4. *O. Kansana*, Tuckerm.; thallus pulvinate, rigid, black, made up of stipitate, erect, clavate fronds which become lobate above, or, from the dilated fruit, pileate; apothecia sub-terminal, concolorous, soon convex and the margin disappearing. Spores

in ventricose thekes 8–12 or more, from ellipsoid soon oblong and constricted at the middle, simple, decolorate, $\frac{5-9}{3-4}$ mic.——*Obs. Lich.* 4, *l. c.* 12, *p.* 170.

Calcareous rocks, Kansas (*Hall*), Tuckerman *l. c.* 1877. Fronds 1–1½$^{mm.}$ in height, with much the habit and internal structure of *O. corallodes* (Mass.), Nyl., but smaller, and with less of foliaceous character. Clusters of gonimia soon broken up, the solitary ones 12–19 mic., in the longest diameter; almost deficient at the centre. The spores become perhaps finally biocular? Apothecia 0$^{mm.}$, 5 to 0$^{mm.}$, 8 wide.

5. *O. pyrenoides*, Nyl.; thallus squamaceous, black; the small fronds rounded and convex; apothecia one in each frond, innate, concolorous, at length somewhat dilated, with an obtuse margin. Spores rounded-ellipsoid, simple, decolorate, $\frac{8-12}{6-8}$ mic. ——*Nyl. Syn.* 1, *p.* 100.

Calcareous rocks, Texas (*Wright*), Tuckerman in Nyl. *Syn.* 1858.——Spermatia minute, ellipsoid; on simple sterigmas.

6. *O. pulvinata*, Nyl.; thallus foliaceous, coriaceous-cartilagineous, black; of closely aggregated lobes, which are divided more or less, and pass into ascendant, wavy and crenate-cut, rounded lobules; [apothecia for the most part at the edges of the lobes, tuberculiform, pallescent. Spores short-ellipsoid, simple, decolorate, $\frac{10-12}{6-7}$ mic.]——*Nyl. Syn.* 1, *p.* 99.

Calcareous rocks. Poughkeepsie, N. Y., *G. R. Gerard.* Shores of Willoughby Lake, *Frost.* Mountains of Colorado, *Brandegee* in *herb.* Willey.——The apothecia have not as yet occurred here.

7. *O. Girardi*, Dur. & Mont.; thallus coriaceous, black; with much the aspect and texture of the last but fewer- and much-wider-lobed, and the lobes only sparingly divided and undulate; [apothecia urceolate. Spores short-ellipsoid, simple, decolorate, $\frac{9-11}{6-9}$ mic.——*Mont. Syll. p.* 380. *Nyl. Syn.* 1, *p.* 99. *Collema plutonium*, *Tuckerm. in litt.*

Calcareous rocks, Alabama (*Peters*), Tuckerman in Nyl. *l. c.* 1858. Apothecia unknown here.

† † *Gonimia commonly in chains.*

8. *O. Umbella*, Tuckerm.; thallus small, rounded, thick and rigid, sub-monophyllous, granulate; brown-olivaceous and black-

ening; beneath paler, passing with age into two or three obscurely distinguishable lobes, with lobulate and crenulate edges; apothecia numerous, superficial, lecanorine; the disk reddish-brown, bordered by an obtuse margin. Spores ellipsoid and cymbiform, simple, decolorate, $\frac{16\text{-}20}{7\text{-}8}$ mic.; the capillary paraphyses distinct.——*Tuckerm. in Nyl. Syn.* 1, *p.* 105. *Collema, Nyl. l. c.*

Calcareous rock, Alabama (*Peters*), Tuckerman *l. c.* 1858.—— Apothecia $0^{mm.}$, 3 to $0^{mm.}$, 4 wide.

Very close to *O. botryosa*, Nyl., which is by no means always as "endocarpeine" as described; and the latter occurs more or less with the gonidia concatenate, though it is accepted without question by Nylander as an *Omphalaria.* I find this true also of the gonimous system of the American *O. Girardi.*

Sect. 2. *Eucollemei. Thallus foliaceous* (*or only exceptionally fruticulose*), *the whole under side attached to the substrate; the gonimia in chains.*

XXVII.—COLLEMA, Hoffm., Fr.

Apothecia from very small at length middling-sized, scutellæform. Spores ovoid-ellipsoid and cymbiform, now simple; now fusiform and 2-plurilocular; and now muriform-plurilocular; decolorate. Spermatia ellipsoid or oblong; for the most part on jointed sterigmas. The cortical layer of the thallus obsolete; or, with rare exceptions, indistinct. Gonimia in chains.

* *Collemella. Thallus fruticulose. Spores simple.*

1. *C. cladodes*, Tuckerm.; thallus small, pulvinate, cartilagineous; blackish-green; the terete divisions longitudinally striate and fastigiately somewhat branched; those of the circumference stellate-radiant; apothecia minute, terminal, or lateral, depressed-globose. Spores rounded, simple, decolorate, 16–19 mic. in diameter.——*Gen. Lich. p.* 89.

Calcareous rocks, Trenton Falls, N. Y., *Tuckerman l. c.* 1872. The plant did not yield me spores; but Mr. Willey has since collected specimens which gave him the result above noted.

** *Lathagrium. Thallus foliaceous, sub-membranaceous, exhibiting now indications, at least interruptedly, of a cortical*

layer, which becomes at length distinct. Spores from simple and ovoid-ellipsoid becoming bilocular, and elongated and bi-quadri-plurilocular, with entire sporoblasts; only exceptionally sub-muri-form.

2. *C. myriococcum*, Ach., Arn.; thallus of middling size, sub-orbicular, cartilagineous; black; attached closely to the substrate in the manner and with the look of *Nostoc Commune;* the irregular, flexuous, variously complicated lobes repand, and more or less warted; apothecia minute, crowded, immersed, or emergent, lecanorine, the pale-brown disk bordered at length by a persistent margin. Spores rounded-ovoid and ellipsoid, simple, decolorate, $\frac{8\text{-}16}{7\text{-}9}$ mic.——*Ach. L. U. p.* 638. *Arn. Fragm. in Flora*, 1867. *Tuckerm. Gen. p.* 89.

Calcareous rocks, growing over mosses, Rockland County, New York (*Austin*), Tuckerman *l. c.* 1872. What is with little doubt the same plant but infertile, has occurred, in similar stations, at Trenton Falls, N. Y., *Tuckerman;* in New Jersey, *Austin;* and in Alabama, *Peters.*

The *C. chalazanum* of Leighton Lich.-Fl. Brit. p. 17, if we may judge by an Irish lichen of Herb. Taylor, is scarcely separable from the present; and Nylander (*Lich. Scand.* p. 29) has questioned the specific distinctness of the two; but, according to Arnold, the former is kept apart by longer and larger spores (Hepp. n. 662). The shape of the spores is however quite uncertain; and the supposed difference in the thekes is no more, in our plant at least, to be depended on; these organs occurring now narrowed, with the spores in a single series, and now ventricose.——The apparent distance between the present species and the one next following might seem perhaps to be reduced by *C. omphalarioides*, Anz. (*Lich. Etrur.* n. 46), which Arnold has referred to the group represented by *C. myriococcum* (*Lemmholemma*, Koerb.), but the relation of the Italian lichen to *C. pycnocarpum* appears to be far more intimate than to any form of the other group.

3. C. *pycnocarpum*, Nyl.; thallus middling-sized, sub-orbicular, membranaceous-cartilagineous; from pale- becoming blackish-green; lobes radiately expanded, soon irregularly narrowed, fenestrate, ribbed, with ascendant marginal lobules which are densely rugose-lobulate, and covered at length with the crowded fruit concealing the thallus; apothecia small, disk red, soon con-

vex, and excluding the thin, entire margin. Spores ovoid-ellipsoid, bilocular, decolorate, $\frac{11-16}{4-7}$ mic.——*Nyl. Syn. p.* 115.

Trunks, North America, *Nylander l. c.* 1858. Canada, *Drummond*, New England and Middle States, *Tuckerman*. Illinois, *Hall*. Carolina and Georgia, *Ravenel*. Florida, *Austin*. Alabama and Arkansas, *Peters*.——And also in New Granada, S. Amer., Nylander (*Lindig, herb.* n. 2872).

3(*b*). *C. cyrtaspis*, Tuckerm.; a stouter and rather larger lichen with more distinct lobation, better displaying the thalline features of *C. pycnocarpum;* apothecia larger (commonly 1-2$^{mm.}$ wide) scattered, the dark-chestnut, shining disk bordered more persistently by a thickish, crenulate margin. Spores subfusiform, 4-locular, decolorate, $\frac{16-25}{3-7}$ mic.——*Obs. Lich.* 2, *l. c.* 387.

Trunks in Pennsylvania, Maryland, and Virginia, *Tuckerman l. c.* 1862. It has occurred also in New Jersey, *Austin;* New York, *Sartwell;* and even in Massachusetts, *Willey;* but is better exhibited southward. Illinois, *Hall*. Ohio, *Lea*. North Carolina, *Curtis*. South Carolina, and Georgia, *Ravenel*. Alabama and Arkansas, *Peters*.——There is scarcely any difference, in the thallus, from *C. pycnocarpum*, beyond what is noted. Indeed *C. aggregatum* may be said to differ, in this respect, rather in that inferior regularity of arrangement which Sommerfelt has distinguished as 'cæspitose-fasciculate,' than anything else; and the thallus of the very distinct *C. callibotrys* is not easily otherwise describable; all these lichens depending mainly for their rank on the spore-characters. It may however be added, for what it may be worth, that while the apothecia and the spores of the present are larger than those of *C. pycnocarpum*, the collogonidia appear to be somewhat smaller; or to differ as 3-6 mic., from 4-7 mic.

4. *C. laciniatum*, Nyl.; thallus middling-sized, orbicular, cartilagineous, stellate; olive-green; the narrow, elongated, radiant lobes discrete, deeply laciniate, with rugose-nodulose tips; apothecia of middling size, elevated; the flattish disk bordered by a sub-crenate margin. Spores fusiform-ellipsoid, bilocular, decolorate, $\frac{14-18}{5-6}$ mic.——*Nyl. Syn.* 1, *p.* 116.

Calcareous rocks. Alabama (*Peters*), Tuckerman in Nyl. *l. c.* 1858. Kansas, *Hall*.

5. *C. microphyllum*, Ach.; thallus minute, sub-membranaceous, orbicular, or now fragmentary and effuse; olivaceous be-

coming blackish-green; lobes at the circumference explanate, at the centre reduced and sub-imbricate, granulate-crenate; apothecia numerous, small, sessile, urceolate, and flat; the thalline margin finally disappearing, and a pale, proper border margining the red disk. Spores ovoid-ellipsoid, sub-muriform (long. series of cells 4, transv. 1–2), decolorate, $\frac{17-23}{8-12}$ mic.——*Ach. Syn. p.* 310. *Schær. Spicil. p.* 527.

Elm-bark, Massachusetts (*Willey*), Tuckerman *Gen.* 1872. Illinois, *Hall.*——It is a character of the lichen to exhibit urceolate apothecia, but these become flat, and even convex. The fruit is properly zeorine, but conspicuously at length biatorine, as in the European plant, with which ours entirely agrees. The structure of the spore is exceptional as regards the present section, but the thalline characters bring the plant into close relation, on the one hand to *C. verruciforme*, Nyl., and *C. callibotrys*, and on the other to the European *C. conglomeratum*, Hoffm. (of which *C. verruculosum*, Hepp., with similarly exceptional spores, is a near relative), and *C. pycnocarpum*.

6. *C. callibotrys*, Tuckerm.; thallus with the size, general features and texture of that of *C. cyrtaspis*; from pale- at length dark-olivaceous; the irregularly narrowed, fenestrate, ribbed lobes giving off ascendant, botryose-difform lobules which are thickly covered with the minute fruit; apothecia concave; the disk red, the margin very entire. Spores at first and commonly squared, with four cells disposed crosswise, but at length ellipsoid, and the cells more or less divided, decolorate, $\frac{10-21}{8-12}$ mic.—— *Obs. Lich.* 2, *l. c. p.* 386.

Trees, in the low country of South Carolina (*Ravenel*), Tuckerman *l. c.* 1862. Florida, *Austin.* Alabama, *Peters.* Texas, *Hall.*

7. *C. verruciforme*, Nyl.; thallus minute, cartilagineous, of ascendant, crenate, and granulate, olivaceous, or olive-brown lobules; which are either crowded into small, rounded, complicated heaps, or fragmentary and effuse; apothecia numerous, very small; more or less urceolate, the reddish-brown disk bordered by a thickish, thalline margin. Spores squared, with four cells disposed as in the last species, and in like manner becoming ellipsoid and sub-muriform, decolorate, $\frac{11-18}{7-11}$ mic.——*Nyl. Syn.* 1, *p.* 112.

On Red Cedar and other trees, Weymouth and New Bedford

(*Willey*), Tuckerman *Gen.* 1872. Also on Red Cedar at Cambridge. On the same bark in New Jersey, *Austin.*

Like the somewhat similar *C. microphyllum*, this lichen, which, as represented in Schærer's excellent specimens (*Lich. Helv.* n. 416), corresponds with the definition of Acharius (*C. furvum v. verruciforme*, Ach. *Syn.* p. 323) in exhibiting dense, rounded, little cushions, which gave occasion to its name, passes, at least here, into an effuse and scurfy form, not otherwise differing. And this ends finally in an almost granulose and crustaceous one, from which *C. quadratum*, Lahm (*Koerb. Parerg.* p. 411), appears to be scarcely separable. *C. callibotrys*, with its well-developed, foliaceous thallus, offers evidently the other extreme of this series of lichens, so manifestly connected by the spores.

8. *C. aggregatum*, Nyl.; thallus of middling size, orbicular, membranaceous-cartilagineous, sub-monophyllous, lobate-plicate and fenestrate, marked with conspicuous, anastomosing, rugose-granulate ridges; from bright- becoming blackish-green; beneath pale; apothecia of middling size, somewhat elevated, flattish, mostly in bunches on the ridges; the disk reddish, the margin sub-entire. Spores long-fusiform, plurilocular, decolorate, $\frac{45\text{-}75}{4\text{-}5}$ mic.——*Nyl. Syn.* 1, *p.* 115. *Synechobl., Koerb. Parerg. p.* 419.

b. implicatum; scarcely differing but in now larger apothecia, and stouter spores, $\frac{48\text{-}70}{6\text{-}8}$ mic.——*C. implicatum*, *Nyl. Prodr. N. Gran. p.* 2; *& in herb. Lindig, n.* 749.

c. glaucophthalmum; like the last, but the apothecia white-pruinose. Spores $\frac{60\text{-}75}{5\text{-}7}$ mic.——*C. glaucophthalmum*, *Nyl. Syn.* 1, *p.* 114; *Prodr. N. Gran. p.* 2; *& in herb. Lindig, n.* 813.

Trees, *b*, Mexico, *Nylander*, 1863; as also in Cuba, *Wright*; Venezuela, *Wagner*; *Fendler*; and New Granada, *Lindig.*—— *c*, Mexico, *Nylander Syn.*, 1858. New Granada, *Lindig.*

These lichens have all the same thallus, and are generally similar.

8(*d*). *C. leptaleum*, Tuckerm.; with the thallus of *C. aggregatum*, and apothecia varying, like those of the varieties of that lichen, now to ample, but better characterized than the latter by its smaller, vermiform spores, with obtuse ends, $\frac{25\text{-}40}{3\text{-}5}$ mic.—— *Obs. Lich. l. c.* 6, *p.* 263.

Trees, not uncommon from New England to Virginia, *Tuckerman l. c.* 1863. New York, *Russell.* South Carolina, *Ravenel.* Alabama, *Peters.* Louisiana, *Hale.* Texas, *Wright.*——As also in Cuba, *Wright*; and Japan, *Wright.*

9. *C. microptychium*, Tuckerm.; thallus small, pulvinate, cartilagineous; blackish-green; lobes thickly crowded together, erectish, rounded, crenate, gyrose-complicate; apothecia small, sessile, flat; the disk rufous, the margin entire. Spores vermiform, plurilocular, decolorate, $\frac{30-44}{4-6}$ mic.——*Lich. Calif. p.* 35.

Trunks of Elm, Chestnut, and other trees, Amherst, Mass., *Tuckerman l. c.* 1866.——As *C. leptaleum* offers the thallus of *C. aggregatum* with distinct spores, the present lichen exhibits the spores, we may say, of *C. leptaleum* with an irreconcilable thallus, now approaching that of the next species. A rather larger but not dissimilar lichen, differenced similarly to this from *C. flaccidum* by its thicker thallus, has occurred, on trees, at Amherst, and in the White Mountains, *Tuckerman*; *Willey*; but always infertile.

10. *C. flaccidum*, Ach.; thallus middling-sized, membranaceous; olive-green; made up of ample, lax and bullate, rounded, entire lobes, which are besprinkled mostly with concolorous granules, and the ascendant margins plicate-undulate; beneath paler; apothecia smallish, scattered, sessile, flattish; the disk reddish-brown, the thin margin entire, now granulate. Spores ovoid and cymbiform, 4-6-locular, decolorate, $\frac{23-27}{8-9}$ mic.; becoming also long-fusiform, and 6-8-locular, $\frac{34-46}{5-7}$ mic.——*Ach. Syn. p.* 322. *Tuckerm. Gen. p.* 91.

Rocks and trunks, from New England to Virginia, *Tuckerman Syn.* N. E. 1848. Canada, *Drummond.* Ohio, *Lea.* Illinois, *Hall.* North and South Carolina, infertile, *Ravenel*; New Mexico, infertile, *Fendler.*

11. *C. nigrescens* (Huds.) Ach.; thallus middling-sized, orbiculate, thin-membranaceous, sub-monophyllous, closely adnate to the substrate, smooth, conspicuously marked with radiating wrinkles, and pustule-like prominences; olivaceous-green and blackening; the rounded, flexuous lobes entire; beneath paler, costate-lacunose; apothecia small, crowded; the disk reddish-brown, becoming convex and excluding the thin margin. Spores long-fusiform and acicular, plurilocular, decolorate, $\frac{46-70}{5-7}$ mic.——*Ach. L. U. p.* 646. *Nyl. Syn.* 1, *p.* 114.

b. leucopepla, Tuckerm.; a smaller lichen, with very small apothecia which are white-pruinose; and longer spores, $\frac{50\text{-}80}{3\text{-}5}$ mic. ——*Gen. p.* 92.

Trunks, *a*, northern and middle States, not rare, *Muhlenberg Catal.* 1818. Canada, *Macoun.* Ohio, *Lea.* Illinois, *Hall.* Maryland and Virginia, *Tuckerman.* South Carolina, *Ravenel.* Florida, *J. D. Smith.* Alabama, *Peters.* Oregon, *Hall.* California, *Bolander.*——*b*, South Carolina and Georgia, *Ravenel.* Florida, *J. D. Smith.* Alabama, *Peters.* Louisiana, *Hale.*——*a* occurs now white-pruinose; in Massachusetts, *Willey.*

11(*b*). *C. ryssoleum*, Tuckerm.; thallus membranaceous, rather loose, smooth; from olivaceous at length blackish-brown; the rounded, bullate lobes ascendant, with plicate-undulate and crisped edges, above rugose-papulose, beneath paler and reticulate-lacunose; apothecia smallish to almost middling-sized, scattered, or crowded; otherwise as in the last. Spores ovoid and cymbiform, 4-6-locular, decolorate, $\frac{18\text{-}32}{5\text{-}9}$ mic.——*Lich. Calif. p.* 34; *Gen. p.* 92.

Rocks. New England to Virginia, *Tuckerman l. c.* 1866. Peaks of Otter, Va., Beyrich in *herb. Spreng.* New York, and New Jersey, *Austin*; *Peck.* Mountains of North Carolina, *Curtis*; *Buckley.*——Apothecia now small; and the lichen is without doubt a member of *C. nigrescens*, but pretty well differenced; much as *C. leptaleum* from *C. aggregatum.*

* * * *Eucollema. Thallus foliaceous, coriaceous-cartilagineous, very gelatinous; the cortical layer deficient. Spores for the most part ovoid-ellipsoid; or now elongated; from bi-quadrilocular with entire sporoblasts* (*rarely persistently entire*) *soon passing into muriform, which last state especially characterizes the section.*

12. *C. pulposum* (Bernh.) Nyl.; thallus of middling size, orbicular, coriaceous, very gelatinous when wet, more or less rosulate; from leek-green blackening; the thick, entire, or repand-crenate lobes explanate at the circumference, but irregularly imbricate and plicate at the centre, where they become reduced and finally granulose; apothecia of middling size, flattish; the disk rufous, the margin rather entire. Spores ovoid-ellipsoid, from 4-locular becoming sub-muriform, decolorate, "$\frac{16\text{-}24}{7\text{-}10}$ mic."——*Nyl. Syn.* 1, *p.* 109. *Tuckerm. Gen. p.* 93.

On the earth in calcareous soils. Pennsylvania, *Muhlenberg Catal.* 1818.——Muhlenberg's plant may very probably have been determined by Acharius; but the species is taken here for a collective one, as by Nylander *l. c.*, and more thoroughly yet by Arnold (*Fragm.* in *Flora*, 1867). It is without doubt largely represented in North America, but abounds peculiarly in difficulties, which do not appear to be as yet resolvable in Europe; as certainly not here. With present knowledge, beside what may vaguely be taken for true *C. pulposum*, the group may be considered as represented with us by the five following, at least sub-species, the claims of which to higher rank are left open. Three of them are received as species by most authors; the other two are recent determinations.

12(*b*). *C. Texanum*, Tuckerm.; thallus sub-stellate; the more or less narrowed, radiant, finally ascendant lobes palmately multifid, and beset at length with wart-like lobules; apothecia as in 12. Spores ovoid, persistently bilocular, decolorate, $\frac{11\text{-}18}{5\text{-}8}$ mic.——*Suppl.* 2, *l. c. p.* 200.

On dead twigs, etc., in the valley of the Rio Grande, and on calcareous earth in the valley of the Blanco, Texas (*Wright*), Tuckerman *l. c.* 1859. On calcareous earth, Alabama, *Peters.* ——The lobation of the originally described lichen suggests that of *C. laciniatum*, but the earth specimens depart less from *C. pulposum*; and the distinction turns on the spores.

12(*c*). *C. tenax* (Sw.) Ach.; thallus thinnish, the ample lobes expanded and appressed (or now also ascendant and complicate); lead-coloured or yellowish-green; apothecia immersed but becoming superficial; the rufous disk bordered by a thick, from entire becoming rugose-crenulate margin. Spores as in 12.——*Ach. Syn. p.* 314. *Tuck. Lich. exs. n.* 148.

On the earth in calcareous soils. Pennsylvania (*Muhlenberg*), Acharius, *Syn.* 1814. Vermont, *Russell.* New York, *Sartwell.* Ohio, *Lesquereux.* Missouri, *Hall.*——Conspicuous, for the most part, as well by the colours, as the sunken fruit; but the characters do not always hold.

12(*d*). *C. crispum*, Borr.; thallus thinnish; olivaceous-green; lobes of the circumference explanate, those of the centre with raised, dentate-granulate and plicate edges, the whole covered with and concealed by the numerous fruit; apothecia more or

less concave, disk dark-rufous, margin granulate. Spores as in 12, $\frac{16-32}{7-12}$ mic.——*Borr. in E. Bot. Suppl. t.* 2716, *f.* 1. *Hook. Br. Fl.* 2, *p.* 212. *Mudd. Man. Brit. Lich. p.* 40. *Nyl. Syn.* 1, *p.* 110.

On the earth, Canada (*Drummond*), Tuckerman *Gen.* 1872. Massachusetts, *Willey*. Vermont, *Frost*. New York, *Sartwell*. Ohio, *Miss Biddlecome*. Colorado, *Rothrock*. British Columbia, scarcely diverse, *Macoun*.——Our lichen is noticeable for its hollowed apothecia; and appears to be less distinctly calcareous than the last, to which however it is near. Nylander's plant (*Lich. Fellm.* n. 7; *Lich. Norrl.* n. 151) scarcely differs from that of Borrer (*herb.* Taylor), who first made clear its difference.

12(*e*). *C. limosum*, Ach.; thallus thin, cartilagineous, more or less scattered; from leek-green becoming dark-green; the variously irregular, soon obliterated lobes dentate-crenate, or narrowed now into ascendant, blunt lobules; apothecia immersed, becoming superficial and dilated; the disk rufous, the attenuate margin rather prominent and channelled. Spores commonly in fours in the thekes, ellipsoid, soon muriform-plurilocular, the transverse series of spore-cells four to eight, decolorate, $\frac{23-40}{11-16}$ mic.——*Nyl. Syn.* 1, *p.* 110. *C. glaucescens, Koerb. Syst. p.* 403.

On the earth in clay soil. Illinois (*Hall*), Tuckerman *Gen.* 1872. New York, *Clinton*. South Carolina, *Austin*; *Ravenel*. Oakland hills, California, *Bolander*.——Well distinguishable by the mostly crowded, flat, at length ample apothecia, with little other appearance of thallus than the sharp and channelled border of the fruit, as also by its large spores, which are very commonly in fours. Our plant is the same with that of Borrer (E. Bot. Suppl. t. 2704, f. 1, & in *herb.* Taylor!), who had opportunities of knowing Acharius's lichen; and the same also as that of Torssell (*herb.!*) who knew Fries's; from which last, according to Nylander *l. c.*, his own does not differ. Hoffmann's description of his *C. glaucescens* (*D. Fl.* p. 100) is scarcely sufficient.

12(*f*). *C. coccophorum*, Tuckerm.; thallus small, orbicular, coriaceous; black; made up of minute, erect, round-headed lobules or stalked granules, which here and there coalesce, and expand at the circumference into crenate-cut and granulate lobes; apothecia flat; the disk reddish-brown, the margin thin, finally granulate. Spores ovoid-ellipsoid, bilocular, mostly decolorate, $\frac{11-21}{7-9}$ mic.——*Obs. Lich. l. c.* 5, p. 385.

On the earth. In the valley of the Rio Grande, Texas (*Wright*), Tuckerman *l. c.* 1862. Oakland, California, *Bolander.* ——Reduced European conditions of *C. pulposum* are described much as this; but I have seen nothing like our plant; which appears also to be distinguishable by the spores.

[12(*g*). *C. plicatile*, Schær.; thallus orbicular, coriaceous, laciniate; blackish-green; the centrifugal, ascendant divisions undulate-plicate, the centre imbricate-lobate; apothecia smaller than in *C. pulposum*, commonly concave, very entire. Spores ovoid-ellipsoid, sub-muriform, oftener with four series of spore-cells, and measuring $\frac{18-25}{6-8}$ mic., according to Nylander; but at length with six to eight series, and measuring $\frac{25-38}{12-15}$ mic., according to Arnold.——*Schær. Spicil. p.* 543; *Enum. p.* 258. *Nyl. Syn.* 1, *p.* 109.

Calcareous (and other) rocks. Iceland; and, in Europe, from Norway to the Mediterranean; Nyl.——The *C. plicatile* of Acharius, the only lichen of the name, so far as appears in print, that he knew, was from granitic rocks of Lake Wettern in Sweden, and, according to Nylander (*Scand.* p. 29) is really *C. furvum* Ach.; which I have myself seen referred to *C. plicatile* by Floerke, probably not without authority. But, according to Schærer (*Spicil.* l. c.), his calcareous plant which now passes for *C. plicatile*, is the same at once with that of Acharius, as with the differing one of Fries (*Lich. Suec.* n. 96). The two appear to approach, as in the *C. plicatile v. riparium*, Krempelh. *herb.*; but the latter (*C. plicatile*, Schær.) is evidently and closely akin to *C. pulposum*, under which in fact, Arnold (*Fragm.*) has reckoned it. This lichen is most unsatisfactorily exhibited in the published *Lich. exsicc.*; as in such other specimens as are known to me. It may well occur here.]

13. *C. melænum*, Ach.; thallus middling-sized, orbiculate, coriaceous, lacero-laciniate; black-green; the radiant, elongated divisions narrow, zigzag, channelled, with elevated, wavy, crisped, and crenate edges, which are often complicate; apothecia sub-marginal, small to middling-sized, flattish; with a somewhat entire or crenate thalline margin. Spores ovoid-ellipsoid, from 4-locular soon becoming sub-muriform, decolorate, $\frac{18-27}{8-12}$ mic.——*Ach. L. U. p.* 636. *Nyl. Syn.* 1, *p.* 108.

b. polycarpum, Schær.; reduced, the lobes much narrowed,

crowded, and complicate; apothecia smallish, and crowded. ——*Schær. Enum. p.* 255.

Calcareous, and other rocks. Greenland (*J. Vahl*) Th. Fries *l. c.* 1861.——*b*, Islands of Behring's Straits, *Wright.*

14. *C. cristatellum*, Tuckerm.; thallus scattered, microphylline, coriaceous; olivaceous-black; the very minute lobes ascendant, with crenate-cut, rugose-granulate edges, reduced now at the centre to erect, club-shaped lobules; apothecia small to middling-sized, flattish; the disk dark-chestnut, the thin margin granulate. Spores ovoid-ellipsoid, from 4-locular becoming sub-muriform, decolorate, $\frac{16-30}{7-9}$ mic.——*Lich. Calif. p.* 29.

On the earth. Gravelly soil, New Mexico (*Fendler*), Tuckerman *l. c.* 1866. And a very similar plant is found in California, *Bolander.*——The New Mexican lichen is possibly only a very reduced state of the *C. cristatum*, Schær. (*Lich. Helv.* n. 417), which is reckoned by Nylander (*Syn.*) a condition of the last species.

15. *C. multipartitum* (Sm.) Tayl.; thallus of middling size, coriaceous, laciniate; brownish-olivaceous and blackening; the radiant, narrow, repeatedly forked divisions convex, with ascendant, rather entire, undulate-plicate edges; apothecia small to middling, flattish; the disk dark-red and blackening, the margin very entire. Spores linear-oblong, mostly curved, from 4-locular becoming 6-8-locular with entire spore-cells, decolorate, $\frac{25-45}{5-7}$ mic.——*Hook. Brit. Fl.* 2, *p.* 210. *Nyl. Syn.* 1, *p.* 116.

Calcareous rocks near Stewart's Lake, British Columbia, *Macoun.* The specimens are fragmentary, but perhaps to be referred to a reduced, smooth form of this species. In the complicate edges of the thallus the lichen is better indeed comparable with *Synechobl. Laureri* Koerb. (Anz. *Langob.* n. 5) than with Smith's Irish lichen (*Herb.* Tayl.), but agrees with the latter in its scarcely concatenate collogonidia, and its spores.

16. *C. furvum* (Ach.) Nyl.; thallus middling-sized, sub-membranaceous, lobate, complicate; olivaceous-green and blackening; soon besprinkled with concolorous granules; lobes rounded-difform, erectish, with wavy, entire, or sub-crenate edges, becoming now oblong and sinuate-laciniate; apothecia scattered, smallish, flattish; the disk dark-brown, the margin very entire. Spores ellipsoid, 4-locular becoming sub-muriform, de-

colorate, $\frac{18-25}{9-12}$ mic.——*Nyl. Syn.* 1, *p.* 107. *C. furvum pro p., & C. tunæforme, Ach. Syn. p.* 322.

Calcareous rocks. Pennsylvania (*Muhlenberg* in *herb.* Willd.), Tuckerm. Syn. N. E. 1848. Found by Mr. Russell in Vermont; and by myself in Canada, New York, and Maryland, but only twice observed fertile. It is similar to *C. flaccidum*, but has a thicker thallus, and is quite distinct in the spores.

17. *C. granosum* (Wulf.) Schær.; thallus of middling size, coriaceous-membranaceous, rigid, very gelatinous when wet, irregularly laciniate, dirty-yellowish-green (lead-coloured and blackening); the divisions sinuously lobed, imbricate; either ample and rounded, with entire or crenate-cut edges; or elongated and variously divided; transversely or reticulately sharp-wrinkled; and more or less coarsely granulate; [apothecia, in European specimens, scattered, of middling size, innate or sessile; the disk dark-red, the margin thick, and wrinkled or granulate. Spores ellipsoid and cymbiform, soon sub-muriform (the transverse series of spore-cells 4-6), decolorate, $\frac{25-35}{8-12}$ mic.]—— *Schær. Spicil. p.* 540; *Enum. p.* 253. *C. auriculatum, Hoffm. D. Fl. C. dermatinum, Ach. L. U. p.* 648.

Calcareous districts, growing over mosses, on rocks. Ohio (*Lesquereux*), Tuckerman *Gen.* 1872. Illinois, *Hall.*——Agreeing not ill with the last, but the ultimate lobation is different, as well as the coloration, and especially the minute wrinkling. Fruit rare; seen only, in our plant, very young.

18. *C. pustulatum*, Ach.; thallus almost middling-sized, coriaceous-membranaceous, sub-monophyllous; brownish-olive; with rounded, lobate-crenate periphery; becoming lacero-laciniate, and often convolute and sinuately many-cleft; besprinkled with the pustular fruit; apothecia minute, crowded, adnate; the concave or flattish, dark-red disk scarcely exceeded by the entire border. Spores rounded-ovoid and ellipsoid, from biocular becoming quadrilocular and sub-muriform, decolorate, $\frac{11-23}{9-11}$ mic.——*Ach. Syn. p.* 317. *Nyl. Syn.* 1, *p.* 108.

Calcareous rocks. Pennsylvania (*Muhlenberg*), Acharius *Syn.* 1814. Alabama, *Peters.* Illinois, *Wolf.*——Comparable as respects the lobation with the last, but very different, especially in the fruit, which neither Acharius nor Nylander have well described from the lecanorine point of view.——*C. stenophyllum,*

Nyl. *Syn.* p. 107 (from North America, *Drummond*), is unknown to me; but the description scarcely makes clear its distinction from the present, in which the thallus is often convolute, and the fruit becomes regular.

XXVIII.—LEPTOGIUM, Fr., Nyl.

Apothecia sub-scutellæform, lecanorine, or zeorine, in the higher forms, but commonly biatorine in the lower. Spores ovoid-ellipsoid (occurring now simple; or the spore fusiform-elongated and bi-plurilocular with entire spore-cells; but, most commonly), muriform-plurilocular. Spermatia oblong; on articulate sterigmas. Thallus foliaceous; or rarely fruticulose; membranaceous; the cortical layer distinct; the gonimia (with rare exceptions) linked together in chains. The whole thallus, in the less developed species, now parenchymatous.

* *Polychidium. Thallus fruticulose.*

1. *L. dendriscum*, Nyl.; thallus very minute, effuse, slender, dichotomously much-branched; pale-green; the intertangled branches terete and smooth; [apothecia, in a Cuban specimen, small, biatorine; the disk brownish-red, the paler margin entire. "Spores ellipsoid, simple, decolorate, $\frac{10\text{-}16}{6\text{-}8}$ mic."——*Nyl. Syn.* 1, *p.* 135.

Trees in inter-tropical regions. Also in Florida (*Herb.* Michener), *Tuckerman Gen.* 1872.

2. *L. intricatulum*, Nyl.; thallus very minute, effuse, depressed; dichotomously branched; chestnut-brown, dull; the shortish branches crowded together, unequally cylindraceous; apothecia unknown.——*Nyl. Syn.* 1, *p.* 135.

Beech trunks in the White Mountains (*Oakes*), Nylander *l. c.* 1858.——This humble but interesting because little known plant is comparable in some respects with the next, with which it also agrees in the collogonidia occurring only in very short chains, or solitary.

3. *L. muscicola* (Sw.) Fr.; thallus minute, pulvinate, irregularly much-branched; from greenish-brown passing into olive-black; the densely interwoven branches mostly terete, and more or less

longitudinally striate; apothecia of middling size, biatorine, appressed; the disk flattish, brown-red; the thin, paler margin nearly entire. Spores cymbiform and fusiform-oblong, bilocular, decolorate, $\frac{18-30}{4-7}$ mic.——*Nyl. Syn.* 1, *p.* 134.

Growing over mosses on rocks in mountains. White Mountains, *Tuckerman Gen.* 1872. Brattleborough, Vermont, *Frost.* California (in the Yosemite Valley, 7–8000 feet altitude, and also at 1500 feet altitude on coast-rocks exposed to the sea-fog), *Bolander.* Islands of Behring's Straits, *Wright.*

4. *L. bolacinum*, Stizenb.; thallus minute, pulvinate, terete, sub-dichotomously much-divided; pale-lead-coloured and ash-coloured, the tips much diminished, dissected, and darker; apothecia unknown.——*Parmelia lacera v. bolacina* (*Ach.*) *Schær. Spicil. p.* 519. *Cornicularia Umhausensis, Auerswald in Hedwigia*, 1869, *& Rabenh. Lich. Eur.* 862.

Rocks among mosses, Massachusetts, *Tuckerman Gen.* 1872; *Willey.* New Jersey, *Austin.* Illinois, *Hall.* South Carolina, *Ravenel.*——Acharius marks this as unknown to him, having taken it up from Dill. t. 29, f. 35, the reference of our plant to which seems a little uncertain; but it is possible that the Swedish lichenographer, who cites Schleicher's published specimen of *Coll. lacerum, a*, Ach., may also have seen the present (*C. lacerum, e*, Ach.) known at least later to Schleicher, according to Schærer. The latter described but did not publish what he took for the lichen; I cannot however but regard it as represented by the right-hand specimen (in my copy) of his *P. atrocærulea d, lophœa* (*Lich. Helv.* n. 407), which agrees with the description of his *bolacinum*, and is well-distinguished from all *L. lacerum.* Nylander (*Flora*, 1876, p. 578) first pointed out that the 'glomerules' of the European *Sticta amplissima* are quite the same with *Leptogium bolacinum*; and he regards this as an analogous growth to the European '*Stereocaulon nanum*,' "which is," he declares, "no *Stereocaulon*, nor anything related to that genus, but a kind of *Lepraria*, and, like '*Parmelia lanuginosa*,' and other leprarioid crusts, never produces apothecia." The *Stereocaulon* is unknown here; but it is curious that our form of the *Sticta* named (Tuckerm. *Lich. Amer. exs.* n. 105, which is accepted in Nyl. *Syn.*) never bears 'glomerules.'

* * *Lathagrium. Thallus foliaceous. Spores from cymbiform bilocular, becoming long-fusiform and plurilocular, with entire spore-cells.*

5. *L. rivale*, Tuckerm.; thallus minute, tufted, microphylline; greenish-lead-coloured; the narrow, ligulate, flexuous, repand lobes crowded and imbricate; apothecia (so far as seen) immersed, and indicated by an ostiole. Spores cymbiform, bilocular, decolorate, $\frac{16-23}{5-8}$ mic.——*Obs. Lich.* 4, *l. c. p.* 170.

"On small pebbles on the bottom of a clear brook, Big Trees, Mariposa," California, growing with and on *Hydrothyria*, Russ. (*Bolander*), Tuckerman in Schwend. *Flecht. als Parasit. l. c.* 1869.——Known as yet only in minute portions adhering to and accompanying *Hydrothyria*. The sunken fruit was first observed, in the course of his examination of the thallus, by Prof. Schwendener.

6. *L. albociliatum*, Desmaz.; thallus middling-sized, rosulate, laciniate-lobate, greenish-lead-coloured becoming blackish-olivaceous; the rounded divisions sinuately cut, crisped, and crenate, and finally lacerate-denticulate, minutely ciliate with white fibrils, now granulate or minutely lobulate at the centre; paler beneath where there is more or less of a fleecy nap; apothecia scattered, smallish, biatorine, sessile; the red-brown disk soon convex, and the thin, paler margin disappearing. Spores cymbiform, bilocular, soon decolorate, $\frac{18-28}{6-9}$ mic.——*Desmaz. in Ann. Sci.* 4, 4, *p.* 132. *Nyl. Scand. p.* 35. *Tuckerm. Gen. p.* 95. *Polychidium Cetrarioides*, *Anz. Catal. Sondr. p.* 7.

Among mosses on rocks, California (*Bolander*), Tuckerman *Gen.* 1872. Silverton, Oregon, *Hall.*——The European lichens are probably all referable to the same reduced and ascendant form (v. *Cetrarioides*) described by Anzi (*Lich. Langob.* n. 13) and contrast sufficiently with the depressed and regular Californian plant (formerly distinguished by me as *L. leucothrix*), which differs also in the free extension of the white fibrils of the upper side to the under; but the latter is certainly no more than the fully developed condition of the former. The medullary layer is compact in this species.

* * * *Euleptogium. Thallus foliaceous. Spores ovoid-ellipsoid, soon muriform.*

7. *L. cæsiellum*, Tuckerm. herb.; thallus crust-like, granulate-squamulose; greenish-glaucescent, becoming sky-blue when wet; the very minute, scurfy squamules finally expanded, subimbricate, and crenulate; apothecia smallish, biatorine, adnate,

a little concave, or flat; the disk reddish-brown, the paler margin entire. Spores ovoid-ellipsoid, muriform-multilocular (the transverse (*) series of spore-cells 4-8), soon decolorate, $\frac{18-38}{8-14}$ mic.

On moist clay, growing in patches of an inch at length in diameter, and conspicuous by its light-blue colour. Illinois, *Hall.*——Comparable in several respects with *Pannaria byssina*; but differs in the colour of the thallus, as in its strictly Collemeine texture of mostly solitary or 2-3-concatenate gonimia (8-12 mic. diameter), nestling in pulp among anastomosing filaments; and in a distinguishable cortical layer.

8. *L. tenuissimum* (Dicks.) Koerb.; thallus pulvinate, very minute, lacero-laciniate; from glaucescent passing into olivaceous-brown; the unequally linear, ascendant, acutish divisions digitate-multifid; apothecia scattered, biatorine, small, to at length almost middling-sized, adnate-sessile; the concave, reddish disk bordered by an entire margin. Spores ovoid-ellipsoid, muriform-multilocular (the transverse series of spore-cells 4-8), soon decolorate, $\frac{23-37}{9-16}$ mic.——*Dicks. Pl. Cr.* 1, *p.* 12, *t.* 2, *f.* 8, *e descr., & Auct. Angl., fide herb. Tayl. Koerb. Syst. p.* 419, *fide Zw. exs. n.* 173. *L. lacerum minus, Auct. quorund. L. subtile, Nyl. Scand. p.* 34, *fide ipsius. Tuckerm. Gen. p.* 96.

On sandy banks among mosses, and on dead wood, New England (*Wright*; *Willey*), Tuckerman *l. c.* 1872. New Jersey, *Austin.* Ohio, *Lea.* Illinois, *Hall.* British Columbia, *Macoun.* Islands of Behring's Straits, *Wright.*——The fully developed lichen is commonly pale, but becomes brown, when it is now much reduced, and the erect lobes take on a granulose look, without any difference in internal structure. The name has been much confused. The *Leptogium subtile* of Nyl. *Syn.* (including not only *L. tenuissimum*, in part, but, according to this author (*Scand.*) a small form of *L. lacerum*, as according to Arnold (*Fragm.*) conditions also of *L. minutissimum* and *L. spongiosum*) is admitted now, as emended (*Scand.*) by him, to be the *tenuissimum* of Smith, as it is probably also of Dickson, and certainly of Taylor. The lichen appears to be well separated from both *L. lacerum* and *L. minutissimum.*

9. *L. minutissimum* (Floerk., Schær.) Mass.; thallus micro-

(*) 'Longitudinal' is now incorrectly used instead of transverse in the author's *Genera Lich.* p. 96, etc.

phylline, lobate; from lead-coloured becoming rufous; the expanded, finally crowded and imbricate lobules crenate or at length cut; apothecia finally almost middling-sized, biatorine, elevated-sessile, flattish; the disk reddish-brown; the entire margin pale. Spores ovoid-ellipsoid, soon muriform-multilocular (the transverse series of spore-cells 4-8), decolorate, $\frac{16-30}{7-11}$ mic. ——*Collema*, *Schær. Spicil. p.* 520, *& Lich. Helv. n.* 498. *Moug. & Nestl. Crypt. Vog. n.* 1239. *Rabenh. Lich. Eur. n.* 125, 589. *Anz. Lich. Langob. n.* 411.

On sandy earth among mosses. Illinois, *Hall.*——The name appears to be tolerably certain, but scarcely happy; the lichen being the largest of the minute *Leptogia*, and suggesting even finally *L. Tremelloides*, with conditions of which it grows.

10. *L. lacerum* (Sw.) Fr.; thallus of middling size, lacero-laciniate, reticulately wrinkled; lead-coloured and reddish-brown; the more or less closely aggregated divisions dilated above and sinuate, with finely jagged and fringed edges; apothecia small, biatorine, sub-sessile, from concave, flattish; the disk red; the paler margin entire. Spores ovoid-ellipsoid, muriform-multilocular (the transverse series of spore-cells 6-12), decolorate, $\frac{25-52}{10-18}$ mic.——*Ach. L. U. p.* 657; *Syn. p.* 327.

On rocks, among mosses, in the northern and middle States, common, *Muhlenberg Catal.* 1818. Canada, *Mr. Drummond.* Maryland, *Tuckerman.* Ohio, *Lea.* Northern Alabama, *Peters*; *Ravenel.*

The North American lichen scarcely ever as well developed as the European finally is; our plants having commonly the character of the more reduced European states, as, for instance, Schærer's v. *lophœum* (*Lich. Helv.* n. 407, in part only, in my copy) and the still smaller, and brown v. *pulvinatum* (Moug. & Nestl. n. 637), it being understood however, in Arnold's words, that the *Exsiccati* do not always agree in what they exhibit under these names.

11. *L. sinuatum* (Huds.) Schær.; thallus of middling size, sinuate lobate, reticulately wrinkled; dark-glaucous-green, lead-coloured, and fuscescent; the imbricated, plaited lobes rounded and nearly entire; apothecia smallish, zeorine, and biatorine, sessile, from concave becoming flat; the disk red, with a paler margin. Spores ovoid-ellipsoid, muriform-multilocular (the transverse series of spore-cells 6-11), decolorate, $\frac{34-48}{11-18}$

mic.——*Schær. Enum. p.* 250. *C. scotinum, Ach. Meth. p.* 237; *Syn. p.* 323.

Only known here in

11(*b*). *L. Californicum*, Tuckerm.; a rather larger lichen, becoming blackish-brown; the irregular lobes either dilated and much elongated, with regularly crenate edges, finely and sharply wrinkled, and at length granulate (f. *platynum*) or much narrowed and aggregated and becoming sub-fimbriate, or finally pulvinate, dark-brown, and the densely crowded, erect, sublinear lobes with granulate-dentate tips (f. *lophotum*); apothecia small to middling, but according generally, as do the spores, with those of n. 12.——*L. scotinum, var. Tuckerm. Gen. p.* 96.

Rocks, California (*Bolander*; *Mann*), Tuckerman *Gen.* 1872. ——Some of the intermediate states between the two named forms of the Californian plant do not differ from European ones of *L. sinuatum* (*L. scotinum*, Auct.), and the lichen seems to be scarcely referable, in any condition, to *L. lacerum*, which is unknown as yet on the West Coast. The whole aspect of the f. *platynum* (the lobes of which exceed at length an inch in length) is rather that of *Collema granosum* (as in Hepp. n. 648). The pulvinate f. *lophotum*, offering densely crowded, narrow linear, erect branches, the summits of which constitute a longish fringe, is clearly analogous to, though perhaps more regular than, *L. lacerum v. lophœum* of some (Anz. *Langob.* n. 412, hardly to be removed from *L. lacerum*), which variety Acharius always took for a form of his *Collema scotinum*.

12. *L. palmatum* (Huds.) Mont.; thallus middling-sized, cæspitose, irregularly laciniate, sharply more or less wrinkled and pitted; from lead-coloured rufescent and finally chestnut; the divisions convolute and at length much narrowed and tubulose-fruticulose, with 2-3-4-corniculate, obtuse tips; apothecia small, biatorine, sessile, a little concave; the disk red-brown, the paler margin entire. Spores ovoid-ellipsoid, muriform-multilocular (the transverse series of spore-cells 6-10), decolorate, $\frac{30\text{-}56}{11\text{-}20}$ mic.——*Mudd. Man. Brit. Lich. p.* 48. *Collema corniculatum* (*Hoffm.*), *Schær. Enum. p.* 249. *Leptogium palmatum & Obryzum corniculatum* (*fungo parasit. excluso*), *Nyl. Syn. pp.* 126, 136.

On the earth among mosses, California (*Menzies*; *Bolander*),

Tuckerman *Gen.* 1872. Oregon, *Hall.* British Columbia, *Lyall*; *Macoun.*——A similar lichen but infertile was found in the Organ Mountains, Texas, *Wright*, but the species is unknown to us except on the West Coast.——The plant varies, from wider states (8mm. wide in the larger, and 2mm. in the narrower parts) with something of the aspect of *L. lacerum*, *a*, as figured in Schær. *Enum.* t. 10, f. 2, to much narrowed, suffruticulose ones, with the colour and whole appearance of conditions of *Cetraria aculeata.*

13. *L. Apalachense* (Tuckerm.) Nyl.; thallus of middling size, stellate, multifid; brownish-olivaceous; the narrow, radiant, imbricated divisions mostly convex and branch-like, with obtuse tips, delicately rugulose; beneath paler and a little channelled; apothecia small, scattered, or in botryoid clusters, innate-sessile, from zeorine becoming biatorine; the rufous disk at length flat, the paler margin entire. Spores ellipsoid, from 4-locular becoming sub-muriform, decolorate, $\frac{18\text{-}25}{11\text{-}14}$ mic.——*Nyl. Syn.* 1, *p.* 133. *Collema*, *Tuckerm. Suppl.* 2, *l. c. p.* 200.

Calcareous rocks. Alabama (*Peters*), Tuckerman *l. c.* 1859. Georgia, *Ravenel.* Missouri, *Hall.*

14. *L. crenatellum*, Tuckerm.; thallus effuse, from squamiform soon dilated and imbricate-lobate; glaucous-cinerascent and lurid; the small, ascendant, smooth lobes with wavy and crenate edges; apothecia small, zeorine, sessile; the reddish disk finally tumid, and the thin, crenulate, thalline margin disappearing. Spores always in fours in the thekes, ovoid-ellipsoid, from 4-locular becoming sub-muriform, decolorate, $\frac{16\text{-}20}{7\text{-}9}$ mic. ——*Suppl.* 2, *l. c. p.* 201.

At the base of trunks of White Ash in swamps, Vermont (*Frost*), Tuckerman *l. c.* 1859. Base of button-bushes (*Cephalanthus*) in pond-holes, Illinois, *Hall.*

15. *L. pulchellum* (Ach.) Nyl.; thallus middling-sized, rosulate, round-lobed; from glaucous-green becoming lead-coloured and lurid; the entire lobes plicate-papulose and delicately wrinkled above, paler and deeply pitted and also wrinkled beneath; apothecia middling-sized, lecanorine, sub-pedicellate; the flattish, brown disk at length excluding the thin and smooth or finally plicate-rugose, thalline margin. Spores ovoid-ellipsoid, sub-muriform (the transverse series of spore-cells oftener

6), decolorate, $\frac{20-30}{7-12}$ mic.——*Collema, Ach. Syn. p.* 321. *Leptogium, Nyl. Syn.* 1, *p.* 123. *Collema corticola, Tayl. in Hook. Journ. Bot.* 1847, *p.* 195. *Leptogium cimiciodorum, Mass. Mem. p.* 86.

Trunks and rocks. From Canada and New England throughout the northern and middle States (*Muhlenberg*), Acharius *Syn.* 1814. Ohio, *Lea.* Illinois, *Hall.* Mountains of Carolina & Georgia, *Ravenel.* Alabama, *Peters.* Texas, *Wright.*——Occurring also in New Granada, S. America, Lindig *herb.*, 2, n. 15; as in southern Europe, Anzi *Lich. Venet.* n. 14, etc.

16. *L. Tremelloides* (L. *fil.*) Fr.; thallus middling to ample, and large, loosely aggregated, round-lobed; lead-coloured; the smooth and very entire lobes becoming crisped and complicate, and beset, more or less, all over, at length densely, with concolorous, finally isidioid granules, passing now into minute lobules; apothecia middling-sized, lecanorine; from flat becoming convex, and excluding the thin, thalline margin. Spores ovoid-ellipsoid, sub-muriform (the transverse series of spore-cells oftener 4), decolorate, $\frac{18-27}{7-9}$ mic.——*Tuckerm. Gen. p.* 97. *Collema Tremelloides, C. azureum, & C. diaphanum, Ach. L. U. p.* 654. *Leptogium Tremelloides max. p., L. diaphanum, L. reticulatum, & L. foveolatum, Nyl. Syn.* 1, *p.* 124.

Rocks and trunks, in the northern and middle States, common, *Muhlenberg Catal.* 1818. Canada, *Macoun.* Ohio, *Lea.* Carolina and Georgia, *Ravenel.* Florida (v. *reticulatum*), *Austin.* Alabama, *Peters.* Mississippi (v. *azureum*), *Veatch.* Louisiana (*a*, and also v. *azureum* & v. *reticulatum*), *Hale.* Texas, *Wright.* New Mexico, *Fendler.*——Widely diffused, and distinguished by many names. Our northern form is the common European lichen (v. *cyanescens*, Ach. *Collema cyanescens*, Schær.), which differs from the last species as well by its originally smooth, as its less regular thallus: this is not confined to cooler regions, but occurs equally well-marked in Louisiana. It is however in the tropics that the best developed conditions of the lichen are found; and these appear also in our southern States, the f. *azureum* being distinguishable by its more regularly rosulate habit of growth, and its perfectly smooth and cœrulescent thallus, which in the scarcely otherwise differing f. *reticulatum*, Mont., becomes regularly and at length very deeply (*foveolatum*, Nyl.) lacunose-reticulate. There remains

only to notice the f. *laciniatum*, Tuckerm. in Wright *Lich. Cub.*, the narrowed and elongated, branching divisions of which simply follow the stems of the mosses on which the plant grows. This is often a well-marked West Indian lichen; but it has also occurred in Canada, *Macoun*.

16(*b*). *L. juniperinum*, Tuckerm.; thallus smallish, microphylline, rosulate, laciniate-lobate; lead-coloured, and dark-green; the rounded, smooth lobes ascendant, and imbricate-complicate, with undulate, crenate edges; apothecia small to middling-sized, zeorine, sub-sessile, flat; the disk rufous, thinly margined. Spores ovoid-ellipsoid, 4-locular becoming sub-muriform, decolorate, $\frac{15\text{-}20}{7\text{-}9}$ mic.——*Suppl.* 2, *l. c. p.* 201. *L. Tremelloides v. microphyllum*, *Tuckerm. Gen. p.* 97.

On the earth, growing over twigs, etc., in "cedar-brakes," Texas (*Wright*), Tuckerman *l. c.* 1859. On the earth, Alabama, *Peters*. On rocks, Lookout Mountain, Tennessee, *Ravenel*. Illinois, *Herb. Willey*. On rocks, Massachusetts, *Tuckerman*.—— With something of the habit of growth of the European *Collema cheileum*, and well-distinguished in this respect from all our *L. Tremelloides*.

16(*c*). *L. dactylinum*, Tuckerm.; thallus microphylline, effuse; from lead-coloured becoming black; the originally squamaceous, ascendant, rounded lobules finally erect, with crisped, entire, or crenate edges, soon fringed and beset above with crowded, isidioid branchlets, and constituting at length a broken-areolate, granulate crust; apothecia small, biatorine, sub-sessile, flat; the disk red-brown; the paler margin soon disappearing. Spores ovoid-ellipsoid, from 4-locular sub-muriform, decolorate, $\frac{16\text{-}25}{7\text{-}11}$ mic.——*Obs. Lich.* 1, *l. c. p.* 383. *Nyl. Syn.* 1, *p.* 123.

Calciferous schist, Vermont (*Frost*), Tuckerman in Nyl. *l. c.* 1858. Calcareous rocks, Missouri, *Hall*. And I cannot distinguish a rather more developed, always lead-coloured lichen which much lessens the distance between *L. dactylinum* and *L. Tremelloides*, and occurs on calciferous shale in New York, *W. R. Gerard*; on limestone at Trenton Falls, New York, *Tuckerman*; as in New Jersey, *Austin*; and Illinois, *Herb. Willey*.——In all these the collogonidia are however commonly solitary, or in very short chains.

17. *L. marginellum* (Sw.) Mont.; thallus sub-orbicular, mid-

dling-sized, laciniate, more or less strongly and reticulately wrinkled; lead-coloured; made up of longish, much-divided, now wider and depressed and now narrowed and (from below) branch-like segments, with plicate undulate and crisped, rather entire edges; apothecia minute, marginal, biatorine, from globular becoming flat; the disk rufous, the rather stout, paler margin granulate, and encircled at length with a ring of leaflets. Spores ovoid-ellipsoid, sub-muriform (the transverse series of spore-cells 4-6), decolorate, $\frac{20\text{-}30}{10\text{-}12}$ mic.——*Mont. Cuba, p.* 115. *Tuckerm. Gen. p.* 98. *Collema vesicatum, Tayl. l. c.* 1837, *p.* 196. *Leptogium corrugatulum, Nyl. Syn.* 1, *p.* 132.

On bark. Southern Alabama (*J. F. Beaumont*), Tuckerman *l. c.* 1872. Florida, *Ravenel.* Texas, *Hall.* Mexico, *Galeotti, e* Nyl., as in the West Indies.——Sufficiently distinguished always from *L. Tremelloides* by its longer, more divided, and wrinkled divisions; and the plant occurring now (exactly as the next species) in a wider, depressed state, and now in a narrowed and crisped one. *Leptogium corrugatulum*, Nyl. *l. c.* (*Herb.* Lindig n. 2659) is quite the same with the earlier *Collema vesicatum*, Tayl. *l. c.* (*herb.*), and relates to the depressed and more prominently wrinkled condition of the lichen described by Swartz, Acharius, etc. The fruit is the most important feature of the plant; and this is exactly the same in both forms.

18. *L. chloromelum* (Sw.) Nyl.; thallus middling to ample, orbiculate, becoming rigid, sharply wrinkled, and at length densely granulate; dark-green, and lead-coloured; the lobes of the circumference expanded more or less, those of the centre complicate, and crisped; apothecia middling-sized, lecanorine, sub-sessile; the flattish, rufous disk bordered by a thin, plicate-rugose, now granulate, thalline margin. Spores ovoid- and acuate-ellipsoid, sub-muriform (transverse series of spore-cells 4-6), soon decolorate, $\frac{18\text{-}34}{9\text{-}15}$ mic.——*Nyl. Syn.* 1, *p.* 128. *Tuckerm. Gen. p.* 98. *L. Brebissonii, Mont., pro p.*

a. conchatum; thallus sub-monophyllous, becoming lobate-laciniate; the depressed, rounded lobes ascendant, shell-like, gyrose-plicate.

b. stellans; thallus narrowed; the radiant divisions with erect, crisped edges.

Trunks and rocks throughout the United States, *Tuckerman Gen.* 1872. Canada, *Drummond.* New England, *Dr. J. Porter,*

etc. New York, *Peck.* New Jersey, *Austin.* Pennsylvania, *Michener.* Ohio, *Lesquereux.* Illinois, *Hall.* Maryland and Virginia, *Tuckerman.* South Carolina, *Ravenel.* Florida, *Austin.* Alabama, *Peters.* Louisiana, *Hale.* Texas, *Wright.*—— The two forms differ much as the two conditions of *L. marginellum*; or as Wright *Lich. Cub.* n. 6 from n. 7 of the same collection. The first of the last-named is not indeed to be well-distinguished from the present species, unless when fertile. *a* may also be compared with *L. Tremelloides*, but is readily seen to differ in its (at least finally) rigid, and always strongly wrinkled thallus.——*b* now occurs (Florida, *Austin*) in a state (f. *fusisporum*) otherwise undistinguishable, with spores at length perfectly fusiform, reaching 48 mic. in length, and with 8-10 entire spore-cells. But this is only another instance of the anomaly noted elsewhere in *Collema flaccidum* (*Gen.* pp. 88, 91), and these elongated spores not only revert to acuate-ovoid ones, but exhibit now a divided spore-cell, suggesting at once the submuriform stage.

18(*b*). *L. adpressum*, Nyl.; thallus, as described, and apothecia, offering no differences from *L. chloromelum*; but the fusiform, 10-locular spores measuring $\frac{50\text{-}60}{7\text{-}8}$ mic.——*Nyl. Syn.* 1, *p.* 131.

On bark, Orizaba, Mexico (*F. Müller*), Nylander *l. c.* 1858. At the same station, *Dr. F. Mohr.*——Thallus, in Dr. Mohr's specimen, which though small cannot well be diverse from Nylander's lichen, larger and lighter coloured than that of *L. chloromelum* f. *fusisporum*, and the apothecia larger. The spores (measuring $\frac{44\text{-}54}{7\text{-}9}$ mic.) scarcely differ at all, and also now shew a divided spore-cell, but are longer, and their anomalous features perhaps better marked. There can certainly be no question that the cited form of *L. chloromelum* sufficiently explains the present lichen.——*L. Brebissonii*, Mont. *emend.*, *Syll. p.* 378, with an ample, sub-monophyllous thallus, otherwise similar, as the plant is in the apothecia, to *L. chloromelum*, from which neither Montagne nor Nylander at first separated it, differs yet, like *L. adpressum*, in its long-fusiform or even acicular, 8-12-locular spores, measuring 56-64 mic. in length (Hepp.), and has occurred in France, in the Canaries, in India, in Surinam, and in Tahiti (*Montagne*), but is not as yet known as North American.

19. *L. bullatum* (Ach.) Mont.; thallus orbiculate, middling to ample, membranaceous, at length rigid, sharply wrinkled;

lead-coloured and cœrulescent; lobes irregularly rounded and more entire, or sinuate-laciniate and sub-crenate, the margins more or less ascendant and plicate-undulate; apothecia middling to ample, elevated, zeorine; the red disk bordered by a paler margin, which is inclosed by a finally leafy thalline one. Spores acuate-ovoid, sub-muriform (transverse series of sporecells 4-6), decolorate, $\frac{25\text{-}34}{8\text{-}14}$ mic.——*Collema*, *Ach. Lich. p.* 655. *Mont. in Ann. Sci.* 1841, *p.* 74.

a. vesiculosum; apothecia terminating bladdery podetia, which are now drawn together above into plaited coronals encircling the fruit.——*Collema bullatum*, *Sw. Lich. Amer. t.* 16. *Leptogium*, *Nyl. Syn.* 1, *p.* 129.

b. phyllocarpum; apothecia less or at length scarcely elevated; the thalline margin from simply plicate becoming densely leafy and crisped, and the whole fruit at length large.——*Collema phyllocarpum*, *Pers. Nyl. Syn.* 1, *p.* 130.

Trunks, *a*, Mexico, *Nylander l. c.* 1858. *b*, Texas, *Wright.* Florida, *Austin.* Mexico, *Nylander.*——*L. Javanicum*, Mont. (*L. sphinctrinum*, Nyl.), to judge by my specimens from *Herb.* Junghuhn (*V. d. Bosch*), is hardly separable from *b*; and *L. bullatum*, Mont. & V. d. B., from the same herbarium, is possibly too near the same; and sufficiently illustrates Montagne's earlier judgment, which is accepted above. The species is also most closely akin to *L. chloromelum*; and it is difficult to see why one of the two specimens called *L. phyllocarpum* in (my copy of) Lindig *Herb. N. Gran.* n. 1660, should not pass equally well for the lichen first-named.

20. *L. Burgessii* (Lightf.) Mont.; thallus ample, loosely aggregate, laciniate-lobate; from glaucous-greenish and lead-coloured passing into purplish-brown; the imbricate lobes rounded, sinuate, from smoothish becoming granulate, and beset at length densely with finger-shaped lobules, cristate-lacerate; beneath ash-coloured, and more or less delicately downy; apothecia subsessile but appearing depressed, middling-sized to ample, flattish, zeorine; the dark-brown disk bordered by a paler margin, which is crowned with a densely leafy and crisped thalline one. Spores ellipsoid, apiculate, muriform-multilocular, decolorate, $\frac{32\text{-}46}{16\text{-}18}$ mic.——*Collema*, *Ach. L. U. p.* 645. *Leptogium*, *Mont. Canar. p.* 129.

Trunks, White Mountains, fertile, *Tuckerman Gen.* 1872.

Maine, fertile, *Oakes*. And infertile specimens, probably referable here, by the characters of the under side, have been found by me in Massachusetts; and in the Blue Ridge of Virginia. The lichen has also occurred in Madeira, *Mandon!*——From the Madeira plant, which is well referred here by Nylander, the *L. inflexum* of this writer (*Syn.* 1, p. 132; and found in Mexico; Venezuela, *Fendler!* New Granada, *Lindig* n. 127! 2504! and Bolivia, *Mandon!*) offers no differences beyond a rather better thalline development (*e. g.* wider sinuses than appear to be common in the northern lichen), and none are indicated in the published diagnosis. As in the next species the upper side is now also downy, both in the northern and southern plants. This side is said now to be 'isidioso-furfuraceous,' and the margins of the lobes to be 'isidioso-dissected' in a New Granada form (*L. inflexum v. isidiosulum*, Nyl., which we are further told 'ought perhaps to be distinguished in species,' though no other difference is noted, Nyl. *Prodr. N. Gran.* p. 4), and our New England plant varies in like manner, the whole upper side being covered now with isidioid lobules.

21. *L. myochroum* (Ehrh.; Schær.) Tuckerm.; thallus ample, coriaceous-membranaceous, from rosulate and sub-monophyllous passing readily into polyphyllous and loosely aggregate states, laciniate-lobate; lead-coloured (rufous-glaucous) and blackish-green; smooth at first, but becoming now rugose, and always more or less granulate; the rounded, undulate lobes entire beneath clothed with a whitish-ash-coloured nap; apothecia middling-sized, lecanorine, sub-sessile, flattish; the disk red-brown, with a plicate-rugose, thalline border, which becomes now granulate-leafy, and now white-hirsute. Spores ellipsoid, from 4-locular becoming sub-muriform, decolorate, $\frac{23\text{-}30}{7\text{-}9}$ mic.——*Collema, Schær. Spicil. p.* 534; *Enum. p.* 256. *Leptogium, Tuckerm. Gen. p.* 99. *L. saturninum, L. Hildenbrandii, & L. Menziesii, Nyl. Syn.* 1, *p.* 127.

a. saturninum, Schær.; commonly glaucous, or now rufous and somewhat rugose above; fleecy beneath.——*L. saturninum* (*Sm.* 1788), *Mass. L. Hildenbrandii, Garov., & Authors.*

b. tomentosum, Schær.; thinner, blackish-green, now narrowed and sinuate-lobate, and passing into small-lobed, imbricate-complicate states; velvety beneath.——*Collema tomentosum, Hoffm. C. saturninum* (*Dicks.* 1790), *Ach., Nyl.*

Trunks, and also rocks, not uncommon, but exceedingly rare in fruit. In the extreme north *b* is the well-marked form,—Bear Lake (*Richardson*), Hooker *l. c.* 1823; Greenland (*Vahl*), Th. Fr. *l. c.*; Islands of Behring's Straits, *Wright*; extending also southward, to Canada, *Agassiz*; and New England; as also to the Rocky Mountains (fertile), *Herb. Hook.*; and Oregon, *Hall.* But *a* is the more common state, especially southward, occurring from New England to Virginia, *Tuckerman*; in Illinois (fertile), *Hall*; in the low country as well as in the mountains of South Carolina, *Ravenel*; in Alabama, *Peters*; and New Mexico, *Fendler.*——The abundant fruit of *a*, as exhibited in the south of Europe, averages, in my specimens, 1-2$^{mm.}$ in diameter, reaching 3$^{mm.}$ in some from the north of Italy collected by myself; and is regularly scutellæform, with a plicate-rugose margin. These features are equally well-marked and quite the same in Japanese specimens (*Wright*), important also as exhibiting the less regular and polyphylline thallus of the common United States lichen; and, like that, the thallus of these is only occasionally wrinkled. In one of these more especially resembling the plant of the United States, there is now a ring of white fibrils on the under side of the exciple, and finally a downiness over the whole, thus preparing the way for the otherwise altogether similar Illinois lichen (*Hall*) in which the whole exciple is as hirsute as in many *Stictæ*. *b* is only known here, in a fertile state, in the specimen from the Rocky Mountains (*Herb. Hook.*), in the dozen apothecia of which, apparently always smaller, and much rarer in this form of the species, all the mature ones (scarcely exceeding 1^{mm} in diameter) are convex, and have excluded the thalline border, which is represented by a crown of finger-shaped lobules, now also visible at the edges of the lobes. There is some indication of this overgrowth in my European specimens, the fruit of which is occasionally also hirsute beneath (Bavarian Alps, *Krempelhuber*) as in *a*.

XXIX.—HYDROTHYRIA, Russ.

Apothecia biatorine. Spores cymbiform, quadrilocular, decolorate. Thallus foliaceous, membranaceous, with a distinct, parenchymatous, cortical layer; a gonimous one of gonimia in short chains; and a medullary one of compact filaments; veiny beneath.

H. venosa, Russell; thallus ample, loosely aggregated, thin and fragile, laciniate-lobate; lead-coloured; beset beneath with branched, divaricate, pale-brown veins; lobes more or less fan-shaped, irregularly cut, with rounded, repand-crenate summits; apothecia sub-marginal, middling-sized; the disk reddish-brown, soon convex, and excluding the pale, lacerate-dentate margin. Spores cymbiform, and fusiform, 4-locular, decolorate, $\frac{23-33}{7-9}$ mic. ——*Russ. in Proc. Essex Inst.* 1, *p.* 188. *Tuckerm. Gen. p.* 102. *H. fontana* (*Russ. olim*), *Tuck. Lich. exs. n.* 150 (*sub Lept.*). *Nyl. Syn.* 1, *p.* 135.

On stones under water in mountain brooks, Vermont and New Hampshire, *Russell l. c.* 1856. Connecticut, *Prof. D. C. Eaton.* Mariposa, California, *Bolander.*

Fam. 7.—LECANOREI.

Thallus crustaceous; very rarely papillose-ramulose; in a much larger number of instances lobed at the circumference, or squamulose and sub-imbricate; but, in far the greater proportion, uniform; adnate to the substrate; the hypothallus inconspicuous or obsolete. *Gen.* p. 103.

We revert, in the family now before us, from the extraordinarily differenced but still Parmeliaceous *Collemei* to the remote *Parmeliei.* Of this, the first Sub-Family (*Eulecanorei*) may be easily regarded as a contiguous section, differing as it scarcely does otherwise than in its crustaceous instead of foliaceous thallus. But this distinction in the thallus has been proved to have value in the system; and the *Eulecanorei* pass, without a break, into the very marked, crustaceous Sub-Family which is distinguished by its typically compound fruit (*Pertusariei*) as this last stands in close relation to forms even more alien to the tribal type (Sub.-Fam. *Urceolariei*), suggesting now (and often indeed referred to) *Lecideacei*; and *Verrucariacei*; and even, we might add, *Graphidacei.*

Sub.-Fam. 1.—EULECANOREI.

Apothecia scutellæform.

XXX.—PLACODIUM (DC.), Naeg. & Hepp.

Apothecia sub-scutellæform; either regular (lecanorine), or shewing also a proper margin (zeorine), or only the latter (biatorine), the disk, for the most part, yellowish-orange. Spores ellipsoid, polar-bilocular (rarely of the more common bilocular type, or, more rarely yet, simple), colourless. Spermatia oblong, or staff-shaped; the sterigmas almost always multi-articulate. Thallus crustaceous; either lobed at the circumference; or, very rarely, suffruticulose; or uniform; oftener more or less yellow.

* *Thamnoma. Thallus fruticulose; orange.*

1. *P. coralloides*, Tuckerm.; thallus slender, solid, cartilagineous, decumbent; bright-orange-yellow; branches terete, nodulose, obtuse, sub-dichotomously divided; apothecia of middling size, lateral and terminal, somewhat elevated, zeorine; the flattish, rough, dark-orange disk bordered at length only by the thin, entire, proper margin, which is finally excluded. Spores oblong, the sporoblasts approximate, the isthmus deficient, $\frac{10\text{-}15}{5\text{-}6}$ mic.——*Obs. Lich.* 3, *l. c. p.* 287.

Maritime rocks, near San Francisco, California (*Bolander*), Tuckerman *l. c.* 1864. The biatorine apothecia bordered more or less, or coronate, with the finally powdery nodules of the thallus; 1–2$^{mm.}$ wide.

2. *P. cladodes*, Tuckerm.; thallus short, slender, solid, erect, made up of terete, fastigiately branched, pale trunks, which blacken below, and are crowded together into a cæspitose, papillate, orange-yellow crust; apothecia small, sessile; the flat, powdery, fulvous disk sub-marginate, bordered by a stout, crenulate, thalline margin. Spores solitary, obtuse-ellipsoid, the spore-cells connected by an isthmus, $\frac{20\text{-}25}{15\text{-}20}$ mic.——*Obs. Lich.* 3, *l. c. p.* 265.

On the earth, in the alpine regions of the Rocky Mountains (*Hall*), Tuckerman *l. c.* 1864. Looking like an uniform, warted crust. Apothecia about 1$^{mm.}$ wide. The short thekes have not been seen to contain more than a single spore, which is at first brownish.

** *Euplacodium. Thallus typically lobed at the circum-*

ference, but passing finally into scarcely effigurate forms; yellow or orange in 1, 2, 3, *as are the apothecia only in* 4 *and* 5; *the other species being otherwise coloured.*

3. *P. elegans* (Link) DC.; thallus stellate-radious, appressed, naked on both sides; orange; the linear, loose, branched divisions convex and torulose, wavy, and more or less lacunose-uneven, discrete or sub-imbricate, or finally contortuplicate; apothecia smallish to middling-sized, zeorine or biatorine; of nearly the same colour with the thallus, the thin margin mostly entire. Spores ovoid-ellipsoid, $\frac{9\text{-}18}{5\text{-}9}$ mic.——*Parmelia, Fr. L. E. p.* 114. *Tuck. exs. n.* 109. *Nyl. Scand. p.* 136. *P. diversicolor, Ach. Syn. p.* 210, *fide Nyl.*

On rocks, North America, *Acharius Syn.* 1814. Arctic America, from Newfoundland, *De la Pylaie*, and Great Bear Lake, etc., *Richardson*, to Melville Island, *R. Br.*, and islands of Behring's Straits, *Wright.* Rocky Mountains, *Hayden*; *Hall.* Organ Mountains, Texas, *Wright.* Eastern and Middle States, *Halsey.*——The present species, in typical conditions, might easily be taken to differ from the next, as a foliaceous lichen from a crustaceous; and this is in fact exactly Schærer's latest judgment (*Enum.*). But we have, notwithstanding, strictly crustaceous members of the group before us which certainly appear to hang between *P. elegans* and *P. murorum.* A case of this sort is presented by a western lichen (North Platte, accompanied by undoubted *P. elegans*, *Hayden*; Montana, also so accompanied, *M. A. Brown*; Wyoming, *Lapham*; Nevada, *Bolander*) marked by a crustaceous, dark-orange thallus, the whole surface of which, instead of being pitted is roughened by minute granules now like those of shagreen and now coarser, and which becomes finally, in the Wyoming plant, as closely applied to the substrate as any *P. murorum*, but yet appears on the whole to descend rather from *P. elegans.* The lichen may be conveniently distinguished as the var. *trachyphyllum.*

4. *P. murorum* (Hoffm.) DC.; thallus crustaceous, orbicular, closely adnate to the substrate, contiguous; bright-yellow; the warted centre passing at the circumference into cut-crenate lobules; apothecia smallish, sessile, zeorine; disk naked, orange-red, the thicker thalline margin sub-crenate. Spores much as in the last, but perhaps, on the whole, larger.——*Parmelia, Fr. L. E. p.* 115, *a* (*excl. d–f.*) *Th. Fr. Scand. p.* 170.

North America (*Lecan. miniata*), *Muhlenberg Catal.* 1818. Arctic America, *Richardson.* Maritime rocks, Massachusetts, *Tuckerman.* Coast of California, *Bolander* (rather resembling *Amphiloma Heppianum*, Müll.; Rabenh. n. 671, which it is difficult to separate). Beside this yellow one, there is a Californian form with all the features of the present except that the colour is dark-orange, in which respect it suggests *P. elegans*; this may be called v. *miniatum.*

4(*b*). *P cirrochroum* (Ach.) Hepp.; thallus of *P. murorum* but small, and perhaps thinner, and bursting at the centre into lemon-coloured soredia; the tips of the peripheral lobes more or less white-pruinose; [apothecia rare and not seen here, minute. "Spores oblong, $\frac{13\text{-}18}{5\text{-}6}$ mic."]——*Ach. Syn. p.* 181. *Koerb. Parerg. p.* 49. *Parmelia murorum, f., Fr. L. E. Lecanora, Schær. Enum. p.* 64.

Rocks containing lime, Willoughby Lake, Vermont. *Prof. W. G. Farlow.*

5. *P. fulgens* (Sw.) DC.; thallus foliaceous-crustaceous, orbicular, soft and friable, closely appressed; pale-yellow or lemon-coloured; made up of narrow, laciniate-multifid, and crenate, flexuous, concrete lobes, which become radious-plicate at the circumference; apothecia of middling size, sessile, zeorine; tawny-red; the pale, irregular, thalline margin finally excluded by the swelling disk, which is bordered by a thin, entire, proper one. Spores ellipsoid, sub-simple, $\frac{8\text{-}11}{4\text{-}6}$ mic.——*Parmelia, Fr. L. E. p.* 119, *a. P. friabilis, Schær. Spicil. p.* 426.

b. bracteatum, Ach.; thallus passing into a verrucose-lobulate crust; the radious circumference disappearing.——*Schær. l. c. P. fulgens v. alpinum, Th. Fr. Lich. Arct. p.* 81.

Calcareous soils. Greenland (*b*), *Vahl e* Th. Fr. *l. c.* 1861. On the North Platte in Nebraska, and Wyoming (*a*, *b*), *Hayden.* Montana, *M. A. Brown.*——The spores of the variety, though often simple, occur also in variously imperfect (or even perfect, according to Koerb. *Syst.* p. 112) bilocular conditions; and I observe not wholly dissimilar spores in some of my foreign specimens of *a.* Both forms belong naturally together; and to *Placodium.*

6. *P. eugyrum*, Tuckerm.; thallus crustaceous, orbicular, adnate, applanate; from dirty-brownish-green becoming dark-

fulvous; rimose-areolate, passing at the circumference into short, paler, white-powdery, crenate lobes; apothecia small, zeorine; the flat, rufous disk bordered by a thin, crenulate, thalline margin. Spores ovoid-ellipsoid, $\frac{9-13}{4-6}$ mic.——*Suppl.* 1, *l. c. p.* 425.

On limestone, Texas (*Wright*), Tuckerman *l. c.* 1858.——Best comparable perhaps externally, except in colour, with the European *Lecanora circinata*. Apothecia $0^{mm.}$, 5 to $0^{mm.}$, 8 in width.

7. *P. galactophyllum*, Tuckerm.; thallus crustaceous-adnate, areolate-squamulose; white and mealy (becoming yellowish-brown when rubbed), the areoles passing at the circumference into crenate lobules; apothecia small, zeorine, adnate, flat; an obtuse, entire thalline margin bordering the dark-orange, marginate disk. Spores $\frac{10-16}{5-7}$ mic.——*Obs. Lich.* 4, *l. c. p.* 171.

Lime-rocks, Chase county, Kansas (*Hall*), Tuckerman *Gen.* 1872. Apothecia of the size of those of n. 6.——When this and the last are more fully known, they may possibly prove to be nearer akin than appears.

8. *P. peliophyllum*, Tuckerm.; thallus crustaceous, adnate, verrucose; cinereous-glaucous (and blackening) with a laciniate, linear-multifid circumference; apothecia of more than middling size, sessile; the disk chestnut-brown, the stout, entire thalline margin finally flexuous. Spores ellipsoid, $\frac{14-21}{5-9}$ mic.——*Gen. Lich. p.* 108.

On granitic rocks, Yosemite Valley, California (*Bolander*), Tuckerman *l. c.* 1872. The specimens of this marked lichen were only obtained with difficulty, and are scanty. It should be further studied where it grows. Apothecia exceeding $2^{mm.}$ in width.

9. *P. variabile* (Pers.) Nyl.; thallus crustaceous, adnate, rimose-areolate; lurid-ash-coloured; the areoles of the circumference scarcely now effigurate; apothecia of middling size or smallish, adnate, rather flat; the dark-chestnut (blackening) disk bordered conspicuously by a white (powdery) entire at length flexuous margin, which is now concolorous with the disk; or obsolete, and the apothecia lecideoid. Spores ellipsoid, $\frac{14-18}{5-8}$ mic.——*Nyl. Scand. p.* 138.

b. atro-album, Tuckerm.; thallus yellowish-brown; apothecia small, distinctly zeorine; a thin, demiss, white thalline mar-

gin bordering a black and naked, marginate disk. Spores obsoletely polar-bilocular (the spore-cells mostly approximate), $\frac{14-25}{5-9}$ mic.——*Obs. Lich.* 4, *l. c. p.* 172.

a, Jurassic rocks, Rocky Mountains (*Hayden*), Tuckerman *Gen.* 1872. Ancient potsherds, Utah, *Dr. Palmer* (Herb. Willey).——*b*, cretaceous sandstone, and chalcedony, North Platte, Rocky Mountains, *Hayden.* Lime-rocks, Utah, *Lapham.*——*P. variabile* is associable, through *P. chalybæum* (not as yet detected here), with the effigurate species of the genus, but loses at length every trace of a lobed margin. This is quite deficient in *b*, which was referred by me at first to the near neighbourhood of *Lecanora erysibe.*——Another state of *P. variabile* with depauperate or obsolete thallus and wholly black (lecideoid) apothecia (on limestone, Alabama, *Peters*) is best comparable with the European form *Agardhianum*, at least as exhibited in a specimen from herb. Koerb.; upon which compare this author's observation in *Parerg.* p. 68.

* * * *Callopisma. Thallus not effigurate* (*though now squamulose*) *uniform; the fruit more or less orange, except in n.* 20, 21, 22.

† *Spores polar-bilocular, except in* 18; *in eights.*

10. *P. bolacinum*, Tuckerm.; thallus squamulose; tawny-yellow; the scattered scales coarse, convex, glebous-difform, finally crenate; apothecia middling-sized, sessile, soon convex; the orange, rusty-powdery disk with a thin, concolorous margin, the thalline one mostly obsolete. Spores ellipsoid, $\frac{11-18}{5-7}$ mic.——*Lich. Calif. p.* 18.

On sandstone and serpentine rocks (and what is perhaps the same on mud walls), on the coast of California (*Bolander*), Tuckerman *l. c.* 1866. Apothecia $1^{mm.}$ to more than $2^{mm.}$ wide.

11. *P. cinnabarrinum* (Ach.) Anz.; thallus rimose-areolate and sub-effigurate; or the now scattered areoles passing from the first into often applanate and crenate-lobulate scales; themselves crowded together at length into a sub-imbricate crust; becoming dark-orange; apothecia minute, adnate; disk orange, the paler margin entire. Spores ellipsoid, $\frac{7-11}{5-7}$ mic.——*Lecanora, Ach. L. U. p.* 402. *Parmelia, Fr. L. E. p.* 165.

A common rock-lichen throughout the United States, inhabiting alike granitic and calcareous rocks, from New England to

Virginia, *Tuckerman Gen.* 1872. Kansas, on limestone, *Hall.* South Carolina (on rocks, and apparently now on dead wood), *Ravenel.* Texas, on limestone, *Wright.* California, on sandstone, *Bolander.* Varying considerably in the development of the thallus, as above noted; and the spores commonly longer in the Californian plant. The black hypothallus, described by Acharius, and Fries, is not always to be made out.

12. *P. microphyllinum*, Tuckerm. herb.; thallus squamulose; from dirty-greenish-yellow at length dirty-orange; the adnate scales crowded together into broken masses at the centre but crenate-lobulate more or less at the circumference, bursting into, and often concealed by heaps of yellow granules; apothecia smallish, zeorine, adnate, flat; dark-orange, the proper margin sub-entire, the thalline one crenulate. Spores ellipsoid, $\frac{9-15}{4-7}$ mic.

On dead wood common on the coast of New England. Pennsylvania, *Dr. J. W. Eckfeldt.* Illinois, *Hall.* Texas, *Wright.* California, Herb. Willey.——Reminding one of the rupicoline *P. aurantiacum*, *v. coronatum*, Krempelh. (Hepp. n. 637. Rabenh. 723), but very different in fact in its more or less distinctly lobulate thallus. The habitat is yet one deforming many lichens; but I know not where to refer the plant.

13. *P. citrinum* (Hoffm.) Leight.; thallus effuse, minutely granulose, conglomerate at length in areole-like masses; lemon-coloured; on a white coanescent hypothallus; apothecia small, appressed; disk waxy-yellowish and orange, the soon depressed thalline margin sub-granulose, the thin, proper one often obsolete. Spores ellipsoid, $\frac{8-15}{4-7}$ mic.——*Lecanora, Ach. Syn. p.* 176, *a. Callopisma, Koerb. Syst. p.* 128.

Lime-rocks, Neosho river, Kansas, *Hall.* Stones and mortar in walls, Pennsylvania, *Dr. J. W. Eckfeldt.*

14. *P. aurantiacum* (Lightf.) Naeg. & Hepp.; thallus uneven and chinky becoming soon warted and wrinkled, and broken at length into areoles; lemon-coloured, pale yellow, yellowish-gray, gray, or finally now white; bordered and decussated by a blackening hypothallus, which is often obsolete; apothecia almost middling-sized, sessile, zeorine, flattish; the orange, saffron, or tawny disk bordered by a thin proper margin, and a stouter, at length crenulate thalline one, which is now obsolete, and the fruit then quite biatorine. Spores ellip-

soid, $\frac{12-18}{5-9}$ mic.——*Parmelia, Fr. L. E. p.* 165, *a. Lecanora, Nyl. Scand. p.* 142.

Trees and rocks, as also on dead wood, throughout. Northern and middle States, *Muhlenberg Catal.* 1818. Arctic America, *Richardson.* Illinois, Kansas, and Missouri, *Hall.* Arkansas, *Peters.* Maryland and Virginia, *Tuckerman.* Carolina and Georgia, *Ravenel.* Alabama, *Peters.* Louisiana, *Hale.* Texas, *Wright.* California, *Bolander*; occurring now on cow-dung, *Dr. J. G. Cooper.*

15. *P. rupestre* (Scop.) Br. & Rostr.; thallus tartareous, rimose-areolate; ash-coloured; often much reduced and at length obsolete; apothecia smallish, convex, adnate, biatorine, but the proper margin soon disappearing; wax-coloured, and tawny, becoming olivaceous-brown, and blackening. Spores ellipsoid, simple, $\frac{10-16}{6-8}$ mic.——*Lecanora calva, Nyl. Scand. p.* 147. *Lecidea rupestris, Th. Fr. Scand. p.* 423.

Calcareous rocks. New York, *Tuckerman Gen.* 1872. Vermont, *Messrs. Russell and Frost.* Georgia, *Ravenel.* Alabama, *Peters.*——Spores commonly simple, but now rather suggestive of the type of the present group; from which the lichen cannot naturally be separated.

16. *P. cerinum* (Hedw.) Naeg. & Hepp.; thallus originally contiguous, becoming chinky, and warted, and now sub-areolate; from pale- at length very dark-ash-coloured, or leaden-gray, or now disappearing; upon a bluish-black hypothallus; apothecia middling-sized to small, lecanorine, sessile, often rather elevated; wax-coloured, reddish-fulvous, olivaceous-brown, or at length livid, sub-pruinose, the thin, opake thalline margin often well distinguished in colour from the disk, but at length concolorous, for the most part entire. Spores ellipsoid, $\frac{11-20}{5-11}$ mic.——*Parmelia, Fr. L. E. p.* 168, *b & c excl. Tuck. exs. n.* 93. *Lecanora, Nyl. Scand. p.* 144.

b. sideritis, Tuckerm. *in litt.*; thallus thickened; of contiguous, scale-like, becoming convex and warty areoles; iron-gray; apothecia appressed, the fulvous-ferrugineous, naked disk soon turgid and excluding the thin thalline margin. Spores as in *a*, but scarcely as large. *Lecanora, Tuckerm. Suppl.* 1, *l. c. p.* 426.

c. pyracea, Nyl.; thallus thin; whitish ash-coloured when not obsolete, the hypothallus scarcely differing in colour; apothecia

small, becoming convex; the yellowish-orange disk soon excluding the thalline margin, but bordered more or less by a thin proper one. Spores as in *a*, but smaller.——*Nyl. l. c. Fr. l. c. var. b, and c.*

Throughout our territory, common: *a*, on trees, as also on dead wood, and mosses, and probably on stones. Northern and middle States, *Muhlenberg Catal.* 1818. Arctic America (on mosses), *Wright.* Athabasca Lake, *Macoun.* Canada, etc., *Agassiz.* Ohio, *Lea.* Illinois, *Hall.* Virginia, *Tuckerman.* Carolina and Georgia, *Ravenel.* Alabama & Arkansas, *Peters.* Louisiana, *Hale.* Texas, *Wright.* California, *Bolander.* Oregon, *Hall.*——*b*, on granitic rocks. New England, *Frost*, etc. Virginia, *Curtis.* This variety is a well-marked lichen which has been referred (in Frost's original specimens) to *P. ferrugineum* (v. *fusco-atrum*, Bayerh.; Zw. *exs.* n. 96!) by an European lichenologist of experience: but I decidedly prefer the present place for our plant; and Koerber (*Syst.* p. 127) has taken a similar view of Von Zwackh's. Whether ours is to be kept separate or not, must depend upon a larger view of the foreign one than I am able to take.——*c* differs from *a*, much as a *Biatora* from a *Lecanora*, and is now often separated as a species, but with hardly sufficient reason. A similar lichen, which is in fact subsumed under his var. *pyracea*, by Nylander *l. c.* (the *Lecidea ulmicola* of Borrer! in Hook. Brit. Fl. p. 185, and the *Caloplaca luteoalba* of Th. Fr. *Scand.* p. 190), exhibits, it is supposed always, spores varying from the type in having the sporoblasts approximate; but has not occurred here.

17. *P. Jungermanniæ* (Vahl); thallus encrusting mosses, very thin; whitish or cinerascent; apothecia middling to smallish, crowded, sessile, flattish, now lecanorine but soon taking on a biatorine aspect; the orange, finally fulvous, sub-pruinose disk becoming tumid, and the at first stout, entire, or flexuous margin thinning out and disappearing. Spores ellipsoid, $\frac{12\text{-}25}{7\text{-}12}$ mic. ——*Caloplaca, Th. Fr. Scand. p.* 179. *Lecanora fulvolutea, Nyl. Scand. p.* 146.

On the earth, upon mosses, Arctic America. Greenland (*Vahl*), Th. Fries *l. c.* 1861. Great Bear Lake, etc., *Richardson e* Leight. *l. c.* Islands of Behring's Straits, *Wright.* British Columbia, *Macoun.*

18. *P. nivale* (Koerb.); thallus much as in the last, but often

perhaps darker; apothecia small, crowded, adnate, now distinctly lecanorine and now of biatorine aspect; the flattish, finally tumid disk brownish-orange, fulvous, or rust-coloured, the entire border often darker. Spores linear-oblong or cymbiform, simple, becoming at length bilocular with approximate sporoblasts, $\frac{23\text{-}40}{5\text{-}7}$ mic.——*Callopisma*, *Koerb. Syst. p.* 129. *Lecanora*, *Nyl. Lapp. Or. p.* 129.

On mosses, Greenland (*Breutel*), Nylander *l. c.* 1866.—— Known to me in an European specimen from the author. It is another offshoot of the *cerinum*-stock, separated, more widely than the last, by the long spores, which are not polar-bilocular. The lichen occurs in Greenland, according to Nylander *l. c.*, with the whole aspect of the muscicoline *P. cerinum* v. *stillicidiorum* of authors.

19. *P. sinapispermum* (Auct.) Hepp.; thallus running over mosses, thin, granulate; whitish; apothecia small to very small, appressed, biatorine, soon convex and sub-globose; fulvous-ferrugineous, becoming ferrugineous-brown, and blackening; the obtuse, entire, concolorous margin soon disappearing. Spores ovoid-ellipsoid, $\frac{16\text{-}22}{7\text{-}11}$ mic.; but in three otherwise similar specimens from Behring's Straits the spores occur $\frac{23\text{-}37}{16\text{-}20}$ mic.——*Blastenia*, *Koerb. Syst. p.* 184. *B. leucoræa*, *Th. Fr. Scand. p.* 392.

Upon mosses, in arctic and alpine regions. Greenland (*Vahl*), Th. Fries *l. c.* 1861. Islands of Behring's Straits, *Wright*. British Columbia, *Macoun*. Rocky Mountains, *Hall*.——An extreme member of the stock of *P. cerinum*, looking toward the next species.

20. *P. ferrugineum* (Huds.) Hepp.; thallus sub-cartilaginous, at first contiguous, becoming chinky, verruculose, and rugged; more or less ash-coloured, or now whitish; upon a black, more or less obvious, or now even obsolete hypothallus; apothecia from almost middling to small, for the most part biatorine, sessile, flattish; disk opake, sub-pruinose, rust-coloured, passing into red, and fulvous, bordered by a finally crisped, persistent proper margin, which is now inclosed in a demiss thalline one. Spores ellipsoid, $\frac{12\text{-}21}{7\text{-}11}$ mic.——*Parmelia*, *Fr. L. E. p.* 170. *Caloplaca*, *Th. Fr. Scand. p.* 182.

b. Pollinii; thallus thin, whitish, or obsolescent; apothecia biatorine, soon turgid; olivaceous and blackening, more or less greenish-pruinose; the paler margin at length excluded, or

concolorous.——*Blastenia, Mass. Blast.*; *Koerb. Parerg. p.* 129. *Placodium, Anz. P. ferrugineum, v. nigricans, Tuck. in litt.*

c. discolor, Willey *in litt.*; thallus thin; pale yellowish except where blackened by the hypothallus; bursting into heaps of yellow granules; apothecia biatorine.

d. Wrightii, Tuckerm. *in litt.*; thallus thickish; whitish-glaucescent besprinkled densely with white granules which become isidioid; apothecia appressed, lecanorine, zeorine, and biatorine, soon flexuous; the disk dark-red.

Trees, dead wood, and rocks, as also, in high northern regions, on mosses, common throughout our territory. *a.* Greenland (*Vahl*), *Th. Fries l. c.* 1861; as also in Alaska, *Dr. Kellogg.* New England to Virginia, *Tuckerman.* Illinois, *Hall.* N. Carolina, *Curtis.* Georgia, *Ravenel.* Alabama, *Peters.* Texas, *Wright.* California (where among other rupicoline states there is one, f. *Bolanderi* with obsolete thallus, but bright vermillion-coloured apothecia, comparable with the f. *miniacea*, Mihi, *Obs. Lich.* 4, *l. c. p.* 171, on bark, in South Africa, which last differs in nothing but the colour from the S. African *a*), *Bolander.* Oregon, *Hall.*——*b*, on coniferous trees, especially Red Cedar, and also on Elm, Massachusetts, *Tuckerman.* Vermont, *Russell.* Maryland, *Tuckerman.*——*c*, on Tupelo, and Oak, Mount Desert, Maine, *Tuckerman.* New Bedford, *Willey.* ——*d*, on trees, Western Texas and New Mexico, *Wright.*—— The forms *c*, and *d*, deserve separate notice as much perhaps as *b*, which is now recognized as European by authors. And other probable conditions of the species, beside the curious f. *Bolanderi*, have been sent to me from the Pacific Coast, but are not as yet clear.

21. *P. diphasium*, Tuckerm.; thallus sub-tartareous, originally contiguous, becoming rugged and verrucose-granulate; greenish-glaucescent; apothecia small, adnate, lecanorine; disk plano-convex, from wax-coloured becoming reddish-brown and livid-black, thinly green-pruinose, bordered now by a thin proper margin, and always inclosed by a depressed, crenulate thalline one. Spores ovoid-ellipsoid, $\frac{16\text{-}23}{7\text{-}14}$ mic.—— *Lecanora, Suppl.* 1, *l. c. p.* 426. *Placodium, Obs. Lich.* 3, *l. c. p.* 287.

On various trees, Texas (*Wright*), Tuckerman *l. c.* 1858.

22. *P. camptidium*, Tuckerm.; thallus thin and sub-cartilagineous, originally contiguous, from smooth becoming chinky

and broken, and finally warted; brownish-ash-coloured; conditioned more or less in colour and bordered by a black hypothallus; apothecia of middling size and smallish, biatorine, sessile; the flattish, rufous, white-pruinose disk surpassing at length the obtuse, white, entire or finally fuscescent and flexuous proper margin, which is rarely surrounded by an obscure thalline one. Spores ellipsoid, $\frac{10\text{-}16}{5\text{-}8}$ mic.——*Lecanora, Obs. Lich.* 2, *l. c. p.* 403. *Placodium, ibid.*, 3, *l. c. p.* 287.

Trees and rails from southern Pennsylvania and Maryland throughout Virginia, *Tuckerman l. c.* 1862. Massachusetts, on Beech, *Willey*. Ohio, *Miss Biddlecome*. Illinois, *Hall*. North Carolina, *Curtis*. South Carolina and Georgia, *Ravenel*. Texas, *Wright*. Oregon, *Hall*. A well marked lichen; but states of it may be passed over for *Lecanora subfusca*; or now for forms of the variable *Biatora* rubella.

23. *P. Floridanum*, Tuckerm.; thallus thin, contiguous, uneven at length broken; glaucous-cinerascent, limited more or less and otherwise conditioned by a black hypothallus; apothecia minute, adnate; disk flat, brownish-black, opake, obsoletely marginate, with an entire, at length concolorous thalline border. Spores ellipsoid, $\frac{10\text{-}16}{5\text{-}8}$ mic.——*Lecanora, Obs. Lich.* 2, *l. c. p.* 402. *Placodium, ibid.*, 3, *l. c. p.* 287.

On bark, West Florida (*Beaumont*), and Texas (*Wright*), Tuckerman *l. c.* 1862. Also in the island of Cuba, *Wright*.—— Resembling small states of *Rinodina sophodes*.

† † *Spores with approximate spore-cells* (*not polar-bilocular*), *for the most part numerous in the thekes. Thallus now stalked, now effigurate, and now uniform.*

24. *P. Spraguei*; thallus effuse, made up of short trunks which are crowded together into a papillate crust, expanding now at the outer edge into lobulate squamules; greenish-yellow; apothecia of middling size, flattish; disk tawny-yellow, the obtuse margin soon flexuous, and crenate. Spores from fusiform at length club-shaped and acicular, bilocular and irregularly broken up within, often curved, $\frac{25\text{-}46}{3\text{-}5}$ mic.

On the earth upon rocks, Colorado, *Brandegee*; *comm.* Ch. Jas. Sprague.——With the aspect of the finer conditions of *P. vitellinum*, but clearly, though often only obscurely, stalked. I also regard the remarkable development of the spores as indi-

cating only an advance in the same direction of known conditions of the *vitellinum*-spore. Apothecia seen 1mm. to 1mm., 5 wide. Paraphyses becoming thickened and like the spores. The last seen only in eights.

25. *P. crenulatum* (Wahlenb.); thallus orbicular, crenate-granulose, opake; lemon-coloured; radiately effigurate at the circumference, the lobes crenate incised; apothecia of almost middling size; pale-lemon-coloured, bordered by a crenate thalline margin. Spores 20-40 and more in the thekes; ellipsoid and oblong, simple and obsoletely bilocular, $\frac{9\text{-}15}{4\text{-}7}$ mic.——*Lecanora crenata, Nyl. Lapp. Or. p.* 130. *Caloplaca crenulata, Th. Fr. Scand. p.* 187.

Maritime rocks, Greenland (*Vahl*), Th. Fries *l. c.* 1861.—— The only specimen known to me as yet by this name (Labrador, *Krempelhuber*) might quite as easily be called a well-developed, high-northern condition of the next species; and little more is suggested by Nylander's character of the lichen. Wahlenberg however (*Fl. Lapp.* p. 416) describes his plant as having thin, and exceedingly narrow (and Th. Fries adds sub-linear) lobes, which suggests something different.

26. *P. vitellinum* (Ehrh.), Naeg. & Hepp.; thallus effuse, tartareous, of small, rounded, at length squamaceous and crenate-lobulate granules, which are crowded mostly into areole-like heaps, but occur now scattered; bright-greenish-yellow; apothecia clustered for the most part, middling to small, sessile, flat, or at length convex; tawny-yellow, darkening also, and olivaceous, with a soon granulate-crenate thalline border. Spores numerous (12-30 and more) in the thekes; simple and bilocular, $\frac{9\text{-}18}{4\text{-}7}$ mic.——*Fr. L. E. p.* 162, *excl. b. Nyl. Scand. p.* 141.

b. aurellum, Ach.; thallus dispersed and disappearing; the small apothecia entire.

Dead wood and rocks, common; as also occurring on the earth. Northern and middle States, *Muhlenberg Catal.* 1818. Arctic America (Fort Franklin), *Richardson.* Behring's Straits, *Wright.* Illinois and westward, *Hall.* Rocky Mountains, *Parry*; *Hall.* Texas, *Wright.* New Mexico, *Fendler.* California, *Bolander.*——*b*, on rocks, Canada, *Mr. Drummond.* Missouri and Kansas, possibly, *Hall*; but not clear.——The spores of this

species vary from 8 (Nylander; including probably the *Caloplaca subsimilis*, Th. Fr. *Scand.* p. 181, which is not said to differ otherwise) to 12, 24, and apparently now as to many as 40. Our plant appears to be better developed than the European as known to me, and abundant apothecia are now found of 1½-2 mic. diameter.

27. *P. luteo-minium*, Tuckerm.; thallus crustaceous, thin, squamaceous-glebous, granulose, and obsolescent; dirty-white; apothecia of almost middling size, biatorine; the flat disk from orange becoming vermillion-coloured, and the entire, obtuse margin radiately striate. Spores 8-12 and more in the thekes; oblong and bean-shaped, bilocular, $\frac{16\text{-}23}{4\text{-}5}$ mic.——*Lich. Calif. p.* 18.

On the earth. San Diego, California, *Dr. J. G. Cooper*. The spores are very various in number, occurring 3,-4,-8 (the last commonly),-10,-12, and over, in the thekes; and once observed 4-locular.

XXXI.—LECANORA, Ach., Tuckerm.

Apothecia scutellæform, now zeorine. Spores from ellipsoid passing into oblong; simple; or rarely 2-4-locular; or elongated-fusiform and 4-plurilocular, colourless. Spermatia oblong, or staff-shaped; or needle-shaped and bowed; on sub-simple sterigmas. Thallus crustaceous; either lobed at the circumference; or, very rarely, suffruticulose; or, and for the most part, uniform.

* *Cladodium. Thallus fruticulose. Spores simple.*

1. *L. Bolanderi*, Tuck.; thallus cæspitose, dichotomously much-branched; greenish-straw-coloured; the branches of the rounded, rather loose clumps erect, terete, with papillæform, obtuse tips; apothecia of middling size, sub-terminal; the disk naked, from yellowish-flesh-coloured becoming tawny, with a tumid, rather entire thalline margin. Spores ovoid-ellipsoid, $\frac{10\text{-}14}{5\text{-}7}$ mic.——*Obs. Lich. l. c.* 6, *p.* 266. *Gen. Lich. p.* 111.

Metamorphic sandstone rocks on the Pacific Coast, Marin county, California (*Bolander*), Tuckerman *l. c.* 1864.

1(*b*). *L. thamnitis*, Tuck.; thallus papillate-fruticulose, made up of short, erect, fastigiately divided trunks which are crowded densely together in an effuse crust (or pass now into compact,

rounded peltate clumps); pale-straw-coloured; apothecia middling to ample, sub-terminal; disk from pale-yellowish passing into tawny-red, margin crenate. Spores ovoid-ellipsoid, $\frac{10-14}{6-8}$ mic.——*Lich. Calif. p.* 20.

Sandstones of the Pacific Coast; Oakland hills, and S. Bruno (*Bolander*), Tuckerman *l. c.* 1866.——*L. Bolanderi* offers effuse conditions; as *L. thamnitis*, first observed only in such state, passes finally into peltate ones, like the other; but the two lichens, in large sets of specimens, are, so far, distinguishable. They are placed however here, with the next following one, under the same number, as probably only forms of one species. ——*L. rubina*, of the next division, which exhibits monophyllous, and peltate, together with complicate, almost branched states, illustrates the transition of *Squamaria* into *Cladodium*; and sufficiently perhaps explains the rather surprising diversity of the latter group.

1(*c*). *L. phryganitis*, Tuck.; thallus ochroleucous; stout, rimulose-rugulose, forming rounded patches, made up at the centre of short, erect, obtuse branches, which are elongated, and decumbent at the circumference; apothecia middling to ample, lateral, sub-sessile; disk pale-brick-coloured, margin flexuously lobed. Spores oblong-ellipsoid, $\frac{12-16}{5-7}$ mic.——*Lich. Calif. p.* 19.

Coast standstones ("usually in depressions, forming in them round patches") from Mission Dolores to the Ocean (*Bolander*), Tuckerman *l. c.* 1866.

** *Squamaria. Thallus lobed; sub-foliaceous. Spores simple.*

2. *L. lentigera* (Web.) Ach.; thallus crustaceous-foliaceous, thickish, radious; greenish-white, more or less white-pruinose; at the circumference lobed, sinuately cut, and crenate, but broken at the centre into areole-like divisions; [apothecia of middling size, adnate; the disk reddish-buff-coloured, the thin thalline margin persistent. Spores oblong-ellipsoid, c. $\frac{12}{5}$ mic.] ——*Parmelia, Fr. L. E. p.* 103. *Lecanora, Nyl. Scand. p.* 130. *Parmelia crassa, a, Schær. Spicil. p.* 431.

Calcareous earth, Bad Lands of Judith, Nebraska (infertile), *Hayden.*——Referable here rather than to the closely allied *L. crassa*; which has not occurred with us.

3. *L. gelida* (L.) Ach.; thallus crustaceous, adnate, chinky,

but more or less radious; dirty white; with a laciniate-lobate circumference; smooth, or beset often with white soredia; and bearing also a large central, or several smaller and scattered, brown, radiately chinky warts; apothecia smallish, adnate; disk pale brick-coloured and blackening, with a very entire, tumid thalline margin. Spores ellipsoid, $\frac{16\text{-}20}{8\text{-}10}$ mic.——*Squamaria, Nyl. Scand. p.* 134.

Rocks, Greenland (*Vahl*), Th. Fr. *l. c.* 1861. White Mountains, *Willey*. Oregon, *Hall*. British Columbia, *Macoun*.

4. *L. thamnoplaca*, Tuck.; thallus tartareous; tawny; of turgid, crenate scales which are crowded together at the centre and become coalescent, but pass at the circumference into rather lax, narrowed, convex, sinuately cut lobes; apothecia middling-sized, innate-superficial; disk reddish-black, exceeding the stout, entire margin. Spores ovoid-ellipsoid, $\frac{9\text{-}16}{5\text{-}8}$ mic. ——*Gen. p.* 113, *note*.

Rocks, near Humboldt city, Nevada (*Bolander*), Tuckerman *l. c.* 1873. Rocky Mountains (Yellowstone exp., *Coulter*), Herb. Willey.——Apothecia $1^{mm.}$, $5\text{-}2^{mm.}$, wide.

5. *L. rubina* (Vill.) Ach.; thallus cartilagineous, sub-foliaceous, peltate; now monophyllous; but passing oftener into several to many round-lobed, cut-crenate, finally branch-like divisions; greenish-straw-coloured; for the most part black beneath; apothecia middling to ample, appressed; disk from pale yellowish becoming tawny and red; the thin, flexuous thalline margin disappearing. Spores ellipsoid, $\frac{9\text{-}16}{5\text{-}8}$ mic.—— *Parmelia chrysoleuca, Fr. L. E. p.* 113. *P. rubina, Schær. Spicil. p.* 435. *Squamaria chrysoleuca, Nyl. Scand. p.* 131.

b. heteromorpha, Ach., thallus more or less rimose-rugulose, pitted beneath; apothecia concolorous becoming pale-brown. *L. rubina, β heteromorpha, Ach. L. U. fide Nyl. Squamaria peltata, Nyl. Scand. p.* 132.

c. opaca, Ach., Fr.; disk decolorate, pale-olivaceous and black. ——*Squamaria melanophthalma, Nyl. l. c.*

Rocks. *a*, Arctic America (*Richardson*), Hooker *l. c.* 1823. New England, *Tuckerman*. Shores of Lake Superior, *Agassiz*. Kansas, *Hall*. Rocky Mountains, *Hayden*. New Mexico, *Fendler*. Texas, *Wright*. California, *H. Mann*. Oregon, *Hall*.——*b*, Organ Mountains, Texas (with *a*), *Wright*. Oregon (with *a*),

Hall.——*c*, Organ Mountains, Texas, with *a* and *b*, *Wright.* Rocky Mountains, *M. A. Brown.* California, *Bolander.* The New England lichen, however clearly related to the western forms of *a* (through Anz. *Ital.* n. 158; comp. Tuck. *Gen.* p. 113) is always inferior, and passes at length into an effuse, glebous, scarcely lobed condition, here observed on dead wood, but in Kansas (*E. Hall*) on rocks, which is not the same with the European v. *disperso-areolata*, of Schærer, and Anzi.

6. *L. Haydeni*, Tuck.; thallus sub-foliaceous, thickish, coriaceous-cartilagineous, lacero-laciniate, chinky; greenish-straw-coloured; beneath reddish-brown, naked; the divisions sinuately lobed, crenate, white tipped, convolute . . . . ——*Obs. Lich.* 3, *l. c. p.* 297.

Upon the earth ("in most places detached and blown about by the wind, sometimes even drifted; found *in situ* where the ground is moist: there is no wood or rocks for it to be attached to"), Laramie plains, Nebraska (infertile) (*Hayden*), Tuckerman *l. c.* 1864.——The specimens are all alike, and could not have been attached to any substrate. Apothecia unknown.

7. *L. muralis* (Schreb.) Schær.; thallus tartareous-cartilagineous, crustaceous-foliaceous; from glaucous-greenish becoming pale-yellowish-brownish; lobes of the circumference sinuately divided, multifid, passing at the centre into crowded, crenate scales, or finally areolate; apothecia small to middling, appressed; from pale-yellowish becoming tawny-brown, with an at length crenate and flexuous thalline margin.——Spores ellipsoid, $\frac{9\text{-}16}{5\text{-}7}$ mic.——*Squamaria saxicola*, *Nyl. Scand. p.* 133. *Parmelia*, *Fr. L. E. p.* 110, *max. p. P. muralis*, *Schær. Spicil. p.* 417, *max. p.*

a. saxicola, Schær.; lobes flattish, normally coloured.——*L. saxicola*, *Auctt. pl.*

b. Garovaglii, Anz.; the elongated, convex, flexuous lobes plicate-radious, normally coloured.——*Anz. Lich. Langob. n.* 270. *Placodium*, *Koerb. Parerg. p.* 54.

c. diffracta, Fr.; thallus darkened more or less, and even fulvous, and brick-coloured; the scales reduced to discrete areoles and black-margined; lobes of the circumference abbreviated.——*Lich. Eur. p.* 111.

d. Semitensis; thallus reduced to scattered, small, glebous, straw-coloured scales which become finally crenate-lobate and

black-edged, but form no effigurate circumference; apothecia soon turgid and heaped; disk livid-brown, white-pruinose, the blackening margin soon excluded.——*L. Semitensis, Tuck. Obs. Lich.* 4, *l. c. p.* 172.

e. versicolor, Fr.; thallus reduced, thinner, concrete, very pale, white-powdery.——*Nyl. Scand. l. c.*

Rocks (and rarely dead wood), *a*, northern and middle States, *Halsey* View, 1823; and, following the mountains southward, to Alabama, *Peters.* Texas, *Wright.* Missouri & Kansas, *Hall.* California, *Bolander.*——*b*, North Platte, *Hayden.* Nevada, *Bolander.*——*c*, California, very common and varied, *Bolander.* ——*d*, Yosemite, *Bolander*; not to be separated widely from *c.* ——*e*, confined to calcareous rocks; Missouri, *Prof. C. U. Shepard.* Kansas, *Hall.*

8. *L. pinguis*, Tuck.; thallus incrassated-tartareous, adnate, areolate-verrucose; dull-olivaceous-gray, becoming sulphur-coloured; as always within; areoles of the centre scarcely a little discrete and squamiform, but becoming at the circumference radious-plicate; apothecia ample, adnate; the turgid, yellowish-flesh-coloured disk sub-pruinose, the crenate margin at length flexuously lobed. Spores oblong, $\frac{14\text{-}18}{4\text{-}6}$ mic.——*Obs. Lich.* 3, *l. c. p.* 268.

Coast sandstones, Oakland, etc., California (*Bolander*), Tuckerman *l. c.* 1864.——Scarcely less effigurate than *L. circinata*, and now recalling even *L. concolor* to mind. Apothecia $2^{mm.}$, 5 to $5^{mm.}$ wide.

* * * *Eulecanora. Thallus uniform. Spores ellipsoid, and small, and, in the larger number of species, simple* (*n.* 9-24), *but, in a few, bi-quadri-locular* (*n.* 25-27), *or they occur elongated and needle-shaped, and* 4-*plurilocular* (*n.* 28-30), *or very large and simple* (*n.* 31, 32). *Spermatia in the larger part long and bowed; but short, and straight in n.* 19, 20, *and* 28; *as in n.* 31 *and* 32.

† *Spores ellipsoid, simple.*

9. *L. pallida* (Schreb.) Schær.; thallus thin, membranaceous-cartilagineous, smoothish; cream-coloured and darkening; apothecia sessile, tumid; whitish-buff, white pruinose, the thin, very entire margin disappearing. Spores ellipsoid, $\frac{9\text{-}20}{7\text{-}11}$ mic.—— *Parmelia, Schær. Spicil. p.* 396. *L. albella, Auctt.*

b. cancriformis, Tuck.; thallus thickening and finally verrucose; apothecia middling to ample, turgescent; with a livid-flesh-coloured and reddish, gray-pruinose disk, and a thick, flexuous, and at length crenate and lobate margin; now finally proliferous.——*Verrucaria cancriformis*, *Hoffm. D. Fl. p.* 171. *Lecanora cæsio-rubella*, *Ach. L. U. p.* 366; *Syn. p.* 167.

c. angulosa, Hoffm.; apothecia small, soon crowded and angulate-difform; the livid-brownish disk glaucous-pruinose. ——*L. albella v. angulosa & v. cinerella*, *Auctt.*

Trees and rails, throughout North America, *Hoffmann l. c.* 1796. Northern and middle States, *Muhlenberg.* Maryland, *Tuckerman.* Virginia and Carolinas, *Curtis*; *Ravenel.* Georgia, *Ravenel.* Alabama, *Beaumont.* Florida, *Chapman.* California, *Bolander.* Oregon, *Hall.* Arctic America, *Richardson.*

10. *L. miculata*, Ach.; thallus thin, granulate, dirty-white; apothecia flat or with age a little convex, brownish-glaucous, pruinose, the persistent, tumid thalline margin at length flexuous and crenate.——*Syn. p.* 164.

Trees, North America (*Muhlenberg*), Ach. *l. c.* 1814.—— Quite unknown to me. I associate with it provisionally however a not uncommon *Lecanora* (Pennsylvania and Virginia, *Myself*; Ohio, *Lea*; Arkansas, *Peters*; South Carolina, *Ravenel*; Louisiana, *Hale*; Texas, *Wright*), the granulate-verrucose, glaucescent thallus of which, as well as the flattish, reddish-brown, pruinose apothecia may keep it apart. Apothecia of this $1^{mm.}2$, to $2^{mm.}$ wide; spores $\frac{12-22}{7-11}$ mic.

11. *L. frustulosa* (Dicks.) Mass.; thallus tartareous, glebous-sub-squamaceous, the roundish, turgid warts becoming flattened and effigurate; either dispersed, or crowded and subimbricate; from glaucous- now yellowish-white; apothecia smallish to middling, sessile; disk reddish-brown and blackening, soon convex, naked; the persistent margin entire or subcrenate. Spores ellipsoid, $\frac{9-15}{5-8}$ mic.——*Parmelia*, *Fr. L. E. p.* 141. *Lecanora*, *Koerb. Syst. p.* 139. *L. argopholis*, *& L. frustulosa*, *Ach.*, *Nyl. Scand. p.* 166.

Rocks. Greenland (*Vahl*), Th. Fries *l. c.* 1861. White Mountains, alpine, *Tuckerman.* Vermont, *Frost.* Colorado, *Brandegee* in *herb.* Sprague. California, *Bolander.*

12. *L. Cenisia*, Ach.; thallus tartareous, made up of coarse,

glebous granules, which are scattered, or pass finally into a verrucose-areolate crust; glaucous-whitish or cinerascent; apothecia smallish to middling, sessile, more or less evidently zeorine; disk finally convex, dirty-yellow, livid, and blackening, with a thin ashy bloom; the thalline margin now persistent and soon crenate, or depressed and disappearing, leaving only the sub-marginate disk. Spores ellipsoid, $\frac{10-18}{5-9}$ mic.——*Syn.* 163. *Parmelia, Fr. L. E. p.* 180. *Zeora, Koerb. Syst.* 137.

Rocks; and on the earth. On schist, Wantastiquet Mountain, Vermont (*Frost*), Tuckerman *Gen.* 1871. Metamorphic sandstone, on the coast of California; and on the earth in the Yosemite, *Bolander.*——So close to *L. subfusca*, v. *atrynea*, Ach., that some do not separate the two; but the present is a marked lichen, and is admirably represented in the cited specimens.

13. *L. sordida* (Pers.) Th. Fr.; thallus tartareous, contiguous, rimose-areolate, now somewhat effigurate; glaucous- and brownish-white; apothecia smallish to middling, innate becoming superficial, and from flattish soon convex or even globular, more or less zeorine; the disk from pale becoming livid, and black, pruinose; the depressed, entire thalline margin disappearing at length, and the apothecia quite lecideoid. Spores ellipsoid, $\frac{9-16}{6-8}$ mic.——*Parmelia, Fr. L. E. p.* 178, *max. p. excl. β. Lecanora, Th. Fr. Scand. p.* 246. *L. glaucoma, Ach., Nyl. Scand. p.* 159.

Rocks. Arctic America (*Richardson*), Hooker *l. c.* 1823. New York, *Halsey.* New England, *Tuckerman.* Colorado, *Brandegee* in *herb.* Sprague. California, *Bolander.*——The lichen is now at length readily mistaken for a *Lecidea.*

14. *L. subfusca* (L.) Ach.; thallus cartilagineous, contiguous, soon chinky, and becoming granulate-verrucose; glaucescent, dirty-white, or cinerascent; apothecia plano-convex; disk reddish-brown, and blackening, naked; the persistent, erect thalline margin entire, or now flexuous, or crenate. Spores ellipsoid, $\frac{9-20}{7-11}$ mic.——*Syn. p.* 157, *pr. p. Parmelia, Schær. Spicil. p.* 389, *pr. p.*; *Enum.* 73, *max. p. Lecanora, Nyl. Scand. p.* 159, *pr. p. Stizenb. in Bot. Zeit.* 1868, *n.* 52, *pr. p.*

a. allophana, Ach.; thallus soon granulate-verrucose; apothecia at length middling-sized; dark-brown; the at first entire margin becoming flexuous and crenate. Spores of the full size

attained by the species.——*Lich. Univ. p.* 395. *L. allophana, L. rugosa, L. mesophana, & L. Parisiensis, Nyl.*

b. hypnorum, Schær.; thallus running over mosses, variously irregular; whitish; apothecia at length middling-sized. Spores as in *a.*——*L. subfusca, v. epibryon, Sommerf., & Auct. L. epibrya, Nyl.*

c. argentata, Ach.; thallus thinner and smoother; whitish; apothecia smaller; with mostly entire margin. Spores smaller. ——*Lich. Univ. p.* 393. *Nyl. l. c. Stizenb. l. c.*

d. coilocarpa, Ach.; thallus thinnish but becoming wrinkled and broken; whitish; apothecia small, sub-entire, black. Spores as in *c.*——*Lich. Univ. p.* 393. *Nyl. l. c. Stizenb. l. c. L. coilocarpa, Nyl.*

e. distans, Ach.; thallus thin, pale; apothecia small, flattish, pale, with a crenulate margin; often minute. Spores still smaller than in the preceding.——*L. distans, Ach. L. U. p.* 397. *L. distans, v. chlarona, Ach. l. c. L. subfusca v. chlarona, dein L. chlarona, Nyl.*

Trees, dead wood, rocks, stones, etc., throughout North America, *Muhlenberg Catal.* 1818; *b* being however confined to alpine districts; as Mackenzie river; Great Slave Lake; etc., *Richardson*; and islands of Behring's Straits, *Wright.*—— Although it doubtless requires some experience to recognize this very common lichen in its various forms, nothing appears to have been gained by the recent attempts to break up the natural group into so-called species. Some twenty of these have been named, but their characterization is far from sufficient.——In *L. subfusca,* as here understood, the naked disk is without proper margin: but this feature shews itself at length in a minute southern form referable to *e* (f. *diploloma*) South Carolina, *Ravenel.*

15. *L. Hageni,* Ach.; thallus thin but passing into verruculose conditions, or, more often, disappearing; dirty-greenish, or ash-coloured, or whitish; apothecia small to very small, adnate, thin, flattish; from pale to reddish-brown, becoming livid, and blackening, naked or gray-pruinose; the thin margin very commonly and now persistently crenate; or at length entire; often concolorous with the disk; or now excluded. Spores ellipsoid, $\frac{7\text{-}14}{5\text{-}6}$ mic.——*Lich. Univ. p.* 367, *excl. v.* β; *Syn. p.* 167, *excl.* β.

Koerb. Syst. p. 143. *Th. Fr. Scand. p.* 250. *L. umbrina, Mass. Nyl.*

b. Sambuci (Pers.); thekes 12-16-sporous.——*Lecanora Sambuci, Nyl. Th. Fr.*

a, Rocks, dead wood and trees. Greenland (*Vahl*), Th. Fries *l. c.* 1861. Canada, *Drummond.* Northern and middle States, *Michener*; *Tuckerman*, etc. Ohio, *Lea.* Illinois, *Hall.* Virginia, *Curtis.* Kansas and Missouri, *Hall.* Alabama and Arkansas, *Peters.* Rocky Mountains, *Hayden.* California, *Bolander.* Oregon, *Hall.*——*b*, trees, Weymouth and New Bedford, *Willey.* ——I am unable at present to discriminate here a *L. albescens*, Th. Fr., var. *β* of which, as exhibited in Hepp. n. 65 has been referred by Nylander to the present species, as later to the one first-mentioned, under the name of *L. galactina*, Nyl.; though it may occur with us. The two plants are very similar.

16. *L. granifera*, Ach.; thallus papillate-granulate, becoming at length warty-rugged; glaucescent and cinerascent; more or less lemon-coloured within; upon a blackening hypothallus; apothecia smallish, sessile, flattish; the disk (pale, livid) reddish-brown and blackening, now sub-marginate, the stout, very entire thalline margin at length crenulate. Spores ellipsoid, $\frac{16-28}{9-16}$ mic.——*Syn. p.* 163. *L. granifera & L. mesoxantha, Nyl. N. Gran. p.* 33; *Syn. N. Caled. p.* 28. *L. sorediifera, Fée Ess. p.* 114, *t.* 28, *f.* 3.

Trees in the warmer regions of the earth. Florida, at Gainsville, *Ravenel*; at Cotoosa river, *Austin.*

17. *L. atra* (Huds.) Ach.; thallus cartilagineous, soon granulate, and rugged-warty; or the warts passing into areoles; glaucescent, or whitish-ash-coloured; apothecia smallish to middling, innate becoming sessile, flattish; the very black polished disk at length tumid; black within; the persistent thalline margin for the most part very entire; now blackening. Spores ellipsoid, $\frac{10-14}{5-8}$ mic.——*Ach. Syn. p.* 146, *a. Nyl. Scand. p.* 170. *Parmelia, Fr. L. E. p.* 142, *a.*

Rocks and trunks. Northern and middle States, *Muhlenberg Catal.* 1818. Arctic America, *Richardson.* Carolina and Florida, *Ravenel.* Alabama, etc., *Peters.* Louisiana, *Hale.* Texas, *Wright.* California, *Wright.*——Spermatia scarcely bowed.

18. *L. atriseda*, Nyl.; thallus of scattered or contiguous, more

or less convex, coppery-brown areoles with a black edge becoming at length elevated; apothecia smallish to middling, appressed; disk chestnut-brown, soon convex, and finally excluding the thin, entire thalline margin. Spores ellipsoid, obtuse at the ends, $\frac{10-13}{5-6}$ mic.——*Nyl. Scand. p.* 170. L. *atrocincta*, *Th. Fr. Scand. p.* 268.

Alpine rocks, White Mountains, *Tuckerman.*——I have but little of our lichen, but consider it not to differ from one of the specimens of Fr. *Lich. Suec.* n. 369, answering perfectly to the description of *L. atriseda*; from which last *L. atrocincta*, Th. Fr. is mainly distinguished by the full evolution of the black edge of the areoles; this black edge being at first less obvious, though plainly determined by the hypothallus common to both.——The present is certainly a member of the *badia*-stock; it is interesting therefore that, according to Dr. Th. Fries, the spermatia, in his cited plant return, in all respects, to the ordinary type of those of the *subfusca*-group.

19. *L. badia* (Pers.) Ach.; thallus cartilagineous, rimose-areolate, now sub-squamulose, or now warty; from ash-coloured becoming lighter or darker olivaceous brown, often polished; apothecia smallish to middling-sized, sessile, flat or finally convex; dark-chestnut and black, shining; with a thick, persistent margin which is entire, or at length flexuous-crenate, and becomes concolorous with the crust, or blackens. Spores fusiform-ellipsoid, $\frac{10-14}{3-5}$ mic.——*Syn. p.* 154. *Koerb. Syst.* 138. *Nyl. Scand. p.* 170.

Rocks, sub-alpine. Arctic America (*Richardson*), Hooker *l. c.* 1823. White Mountains, *Tuckerman.* Tadousac, Canada, *Drummond.*——The passage of true *Lecanora badia* (Anz. *Lich. Ital.* n. 167) into Lecideoid conditions (*Psora ænea*, Anz. n. 111, & *Psora Garovaglii*, Anz. n. 112) appears scarcely questionable. ——The spermatia of this species are short and straight.

20. *L. phæobola*, Tuckerm.; thallus papillate-granulose, the minute granules polished, olivaceous-brown; apothecia smallish, appressed; disk reddish-brown, shining, soon turgid, and the thin, entire thalline margin disappearing. Spores fusiform-ellipsoid, $\frac{9-15}{3-5}$ mic.——*Gen. Lich. p.* 115.

On bark of *Libocedrus* and *Abies*, California (*Bolander*), Tuckerman *l. c.* 1872.——The lichen has the aspect of a *Biatora*; but much to associate it with *L. badia*; with which it agrees in the spermatia. The specimens are scanty.

21. *L. Willeyi*, Tuckerm. *in litt.*; thallus verruculose, heaped and rugged; dark-greenish-ash-coloured, and, in the exciples, olivaceous; apothecia small, appressed, flattish soon flexuous; the dark-red disk somewhat polished; bordered by a thin, entire, or at length crenulate margin, which is finally excluded by the now irregularly turgid disk. Spores ellipsoid, $\frac{8\text{-}11}{4\text{-}7}$ mic.

Chestnut rail fences, Amherst, *Mr. Willey*; and others. New Jersey, *Austin.*——The common, final condition of the apothecia is cuplike, the turgid circumference of the disk enclosing its depressed centre. A similar deformation is observable in another rail-lichen with pale crust, and brownish-red fruit which is rather perhaps comparable with *L. varia f. aitema* of some. But there is also some similarity in *L. Willeyi* to conditions of *L. badia.*

22. *L. Pacifica*, Tuckerm. herb.; thallus thin, contiguous, smoothish, becoming chinky and verruculose; dirty-white; apothecia at length middling-sized, appressed, flattish; disk from pale-yellowish soon tawny, and finally black, with a thin greenish or whitish bloom; the persistent margin soon flexuous and crenulate. Spores ovoid-ellipsoid, $\frac{12\text{-}18}{7\text{-}12}$ mic.

Trees on the Pacific Coast. California, *Bolander.* Oregon, *Hall.*——Close to *L. subfusca v. sylvestris*, Nyl. (Mandon *Lich. Mader.* n. 1, which is made by Stizenberg *l. supra c.*, to include an Italian lichen—*L. subfusca v. glabrata f. azurea*, Anz., with pruinose fruit) but neither the colours nor the spores seem quite to agree. The plant is common and very observable among the bark-lichens of our Western Coast.

23. *L. atrosulphurea* (Wahl.) Ach.; thallus tartareous, of glebous, heaped granules, finally running together and becoming areole-like; pale-sulphur-coloured; apothecia smallish, appressed; the soon convex, black, naked disk excluding the thin, entire thalline margin. [Spores ellipsoid, $\frac{8\text{-}13}{4\text{-}6}$ mic.]—— *Nyl. Scand. p.* 166. *Th. Fr. Scand. p.* 257. *Parmelia, Fr. L. E. p.* 160.

Rocks, Arctic America. Greenland (*Vahl*), Th. Fries *l. c.* 1861.

24. *L. varia* (Ehrh.) Nyl.; thallus areolate-verruculose; pale-greenish or yellowish, or whitish; apothecia smallish to middling-sized; the disk from pale-yellowish passing into buff,

flesh-coloured, and rufescent, thin; as is the erect, entire, or crenulate, finally excluded margin. Spores oblong-ellipsoid, $\frac{9\text{-}16}{4\text{-}7}$ mic.——*Nyl. Scand. p.* 163.

a, thallus thin, cartilagineous; apothecia small to very small, crowded, sessile, flattish; the persistent thalline margin subentire, or crenulate, or deliquescent and powdery.——*Parmelia varia, a, pr. p. Fr. L. E. p.* 156. *Tuck. exs. n.* 92. *Th. Fr. Scand. p.* 259.

b. polytropa, Nyl.; thallus thickened, becoming sub-tartareous, rimose-areolate, or now granulate and heaped, or subsquamulose, or obsolete; apothecia at length middling-sized, sessile, flat; concolorous, or yellowish-flesh-coloured, finally flexuous; with a very entire margin, which is at length excluded.——*Nyl. l. c. Parm. varia v. polytropa, Fr. L. E. p.* 158, *pro p.*

c. intricata, Nyl.; areoles distinct, flat, and sub-effigurate; apothecia of the size of those of *a*, adnate; soon black and lecideoid.——*Nyl. l. c.*

d. symmicta, Ach.; thallus thin; the apothecia of the size of those of *a*, soon convex and biatoroid; disk pale-yellowish to pale-brick-coloured, and rufous, and blackening, quite excluding the thin, entire margin.——*Fr. L. E. l. c. Nyl. l. c.*

e. sæpincola, Fr.; thallus thickened, glebous-granulate; apothecia of the size of the last, semi-immersed, convex, immarginate, reddish, olivaceous, and black, slightly pruinose.——*Fr. L. E. l. c. Nyl. l. c.*

a, common on trees, dead wood, and stones, northern and middle States, *Muhlenberg Catal.* 1818. Ohio, *Lea.* Illinois, *Hall.* Maryland, *Tuckerman.* Carolina, *Ravenel.* Texas, *Wright.* California, *Bolander.* Oregon, *Hall.*——*b, c*, alpine and sub-alpine rocks, Arctic America (*Richardson*), Hooker *l. c.* 1823. White Mountains, *Tuckerman.*——*d*, as *a*, common throughout.——*e*, dead wood, common.

24(*b*). *L. Cupressi*, Tuckerm. *in litt.*; thallus granulate, becoming densely verrucose; greenish-glaucescent; apothecia smallish to middling-sized, sessile, flattish; the finally turgid disk naked, from bright-lemon-coloured at length brownish-orange; the incurved margin crenulate. Spores oblong, $\frac{11\text{-}16}{4\text{-}5}$ mic.

On *Cupressus Thyoides*, North Carolina, *Curtis*. New Jersey, *Austin*. Massachusetts, *Willey*. On *Taxodium*, South Carolina, *Dr. Mellichamp*. Florida, *Austin*.——This, and the next, are our two finest exhibitions of the stock of *L. varia*.

24(*c*). *L. orosthea* (Sm.); thallus thin, powdery, pale-greenish-sulphur-coloured; apothecia smallish to middling-sized, sessile; pale-buff, white-pruinose, the disk equalling the entire, at length flexuous thalline margin, or tumid and excluding it. Spores ellipsoid, $\frac{14-21}{8-12}$ mic.——*L. expallens*, *Ach. L. U. p.* 374; *Syn. p.* 171. *Borr.! in Hook. Br. Fl.* 2, *p.* 181. *L. varia*, *v. conizæa*, *Nyl. Scand. p.* 163.

Beech and other trunks in New England, *Tuckerman*. New Jersey, *Austin*.——This lichen is ill-represented by such European specimens as I have seen. In Japanese (f. *Japonica*, Mihi *Obs. Lich.* 4, l. c. p. 173) the apothecia reach $3^{mm.}$ in diameter, and the spores $\frac{20-23}{8-12}$ mmm., but the plant is entirely the same with the North American; as that is with that of Europe.

25. *L. Oregana*, Tuckerm.; thallus of coarse, crowded and heaped, now confluent, wart-like areoles, which become somewhat stalked at the centre; greenish-yellow; apothecia middling to ample ($1^{mm.}$ 5, -$3^{mm.}$ wide); the rufous, naked disk bordered by an incurved, flexuous-crenulate margin. Spores broad-ellipsoid, and rounded, simple, colourless, $\frac{8-14}{6-8}$ mic. Spermatia bowed.

Rocks, coast of Oregon, *Herb.* Sprague. The colour and habit of the thallus relate the lichen to *L. varia*, but the apothecia rather recall those of *L. subfusca*.

‡ ‡ *Spores ellipsoid*, 2-4-*locular*.

26. *L. Brunonis*, Tuckerm.; thallus of minute, glebous, becoming confluent and squamaceous, and imbricated granules; tawny-brown, also pallescent; apothecia smallish; disk rusty-brown and blackening, sub-marginate, at length turgid and excluding the finally crenulate, now concolorous thalline margin. Spores ellipsoid-oblong, bilocular, $\frac{11-18}{4-7}$ mic.—— *Gen. Lich. p.* 116.

Sandstone and serpentine rocks, Mountains of San Bruno, and on the Oakland hills, California (*Bolander*), Tuckerman *l. c.* 1872. Apothecia $0^{mm.}$, 8 to $1^{mm.}$, 5 wide.

27. *L. athroocarpa* (Dub.) Nyl.; thallus very thin, verrucu-

lose, or oftener disappearing; brownish-ash-coloured or white; apothecia small to very small, sessile; the disk soon convex, from pale becoming dark-brown and blackening, excluding the thin, entire thalline margin. Spores 8-16 in the thekes, oblong, often a little curved, 2-4-locular, $\frac{11-21}{4-7}$ mic.——*Nyl. Scand. p.* 168. *Lecania fuscella, etc., Mass. Koerb.*

Trees and shrubs, *Tuckerman Gen.* 1872. British North America, *Richardson* in *herb.* Tayl. Canada, and British Columbia, *Macoun.* Massachusetts, on Poplar, etc., *Willey.* Illinois, *Hall.* North Platte, *Hayden.* California, *Bolander.*——Spores various; often very largely simple; and again appearing as if only bilocular, though really reaching finally the 4-locular stage. ——*L. dimera*, Nyl., Th. Fr. (Norll. *Fenn.* n. 141, agreeing entirely with plants, also on Poplar, from British Columbia, *Macoun*, and New Bedford, Mass., *Willey*) is separable by no other note than that the spores do not exceed the bilocular condition. ——Spermatia here first observed by Mr. Willey, needle-shaped, and arcuate, about $16^{mmm.}$ long.

28. *L. castanea* (Hepp.) Th. Fr.; thallus granulose, cinerascent, or obsolete; apothecia of middling size, thin and flat; disk from reddish-brown becoming dark-liver-coloured, more or less sparingly pruinose; the thin, sub-entire margin soon concolorous, and disappearing. Spores oblong-ellipsoid becoming fusiform-oblong, very commonly simple but at length 2-4-locular, $\frac{16-23}{6-10}$ mic.——*Biatora, Hepp. exs. n.* 270. *Lecanora, Th. Fr. Scand. p.* 272. *L. rhypariza, Nyl. Scand. p.* 169; *Lapp. Or. p.* 134. *Pannaria curvescens, Mudd Man. p.* 125.

Growing over mosses, in alpine districts. Greenland (*Vahl*), Th. Fries *l. c.* 1861. Rocky Mountains, with *Pannaria Hypnorum*, *Hall.* Twin Lakes, Colorado, *Wolf.*——Spores now obsoletely 1-3-septate according to Nylander (*Lapp. Or.*), on which compare Th. Fr. *Scand.* p. 271. I find the spores commonly and quite regularly 2-3-4-locular in Hepp's specimen; as in Anz. *Langob.* n. 277; and perfectly bilocular, with septum, in our Colorado one.

‡ ‡ ‡ *Spores needle-shaped, 4-plurilocular.*

29. *L. punicea*, Ach.; thallus thin, chinky, then wrinkled and granulate; glaucescent; apothecia small, closely sessile; the flattish disk scarlet, about equalling the thin, sub-entire, or finally flexuous and crenulate margin. Spores needle-shaped,

8-16-locular, $\frac{35-60}{4-6}$ mic.——*Ach. Syn. p.* 174. *Nyl. Syn. N. Caled. p.* 30.

Trees, and also on rocks. South Carolina (*Ravenel*), Tuckerm. *Gen.* 1872. Florida, *Beaumont.* Alabama, *Peters.* Louisiana, *Hale.* Texas; and New Mexico (rocks), *Wright.*

30. *L. ventosa* (L.) Ach.; thallus incrassated, tartareous, areolate-verrucose, the areoles at length rimulose-rugulose; greenish-sulphur-coloured; apothecia middling to ample, appressed, more or less zeorine, at length irregular; disk blood-red, naked, sub-marginate, soon convex and excluding the entire (or more rarely rugose-crenate) thalline margin. Spores acicular, 4-8-locular, $\frac{40-50}{3-5}$ mic.——*Syn.* 159. *Parmelia, Fr. L. E. p.* 153. *Schær. Spicil. p.* 405. *Tuck. Lich. exs. n.* 21.

Alpine rocks. Arctic America (*Richardson*), Hooker *l. c.* 1823. Greenland, *Vahl.* Islands of Behring's Straits, *Wright.* White Mountains, *Tuckerman.* Adirondack Mountains, New York, *Peck.*

31. *L. elatina*, Ach.; thallus thin and powdery, becoming densely granulate; pale-yellowish-white; apothecia smallish to middling, sessile, more or less distinctly zeorine; disk from pale at length dark-reddish-brown, somewhat pruinose, soon convex and knobby; the obscure, irregular thalline margin soon disappearing. Spores fusiform-acicular, curved, 4-6-locular, $\frac{40-56}{4-6}$ mic. ——*Nyl. Scand. p.* 174. *Parmelia, Fr. L. E. p.* 152.

b. ochrophæa; thallus incrassated and sub-tartareous, smoothish but soon wrinkled and verrucose; glaucescent; apothecia elevated-sessile, flattish; the thalline margin sub-persistent. ——*Biatora, Tuckerm. Syn. N. E. p.* 61. *Parmelia, Ejusd. Lich. exs.* 91, 111.

c. minor; thallus very thin, cartilagineous, smoothish, rimulose; greenish-ash-coloured; apothecia small to very small, flattish, bimarginate; the disk white-pruinose.——*Hæmatomma Cismonicum, Beltram. cit. Hepp. in Fl. Eur. n.* 104?

Bark and dead wood of coniferous trees. New England, *Tuckerman Syn.* 1848. Adirondack Mountains, New York, *Peck.* Canada, *Drummond.* Black Mountains of North Carolina, *Curtis.*——*b* is perhaps the most perfect state of the species, and may well occur in Europe, as compare Th. Fr. *Scand.* p. 299, on a Norwegian specimen; but the ordinary European form occurs

also here, and is marked by its densely powdery, yellowish thallus, in which the fruit comes to appear immixed; such specimens contrasting with the smooth, glaucescent thallus and elevated, finally also larger fruit of the other.——*c* is a small but marked form, not appearing to differ from the cited Italian one.

‡ ‡ ‡ ‡ *Spores very large, simple.*

32. *L. pallescens* (L.) Schær.; thallus from sub-cartilagineous and chinky or plicate, at length sub-tartareous and tuberculose-rugose; dirty-white; apothecia middling to ample, tumid; the more or less white-pruinose, and roughened disk from pale- or now yellowish-white becoming flesh-coloured; the erect margin very entire, or now rugose-verrucose. Spores ellipsoid, $\frac{50\text{-}90}{22\text{-}40}$ mic. ——*Schær. Enum. p.* 78. *Parmelia, Fr. L. E. p.* 132. *Tuck. Exs. n.* 90.

b. rosella, Tuck.; the margin of the apothecia throwing out several to many processes meeting at the centre, and dividing the disk radiately into smaller ones.——*Gen. Lich. p.* 125.

Upon rocks (rarely with us), dead wood, trees, and mosses probably throughout North America. Northern and middle States, *Muhlenberg Catal.* 1818. Arctic America, *Richardson.* Maryland and Virginia, *Tuckerman.* North Carolina, *Curtis.* South Carolina, *Ravenel.* Florida, *Chapman.* Texas, *Wright.* California (rocks, well-marked), *Bolander*; and also trees.—— *b*, northern and middle States, *Muhlenberg*, etc.——I incline to refer also here rather than to the next species a common bark-lichen of the Pacific Coast (California, *Bolander*; Oregon, *Hall*; British Columbia, *Macoun*; Alaska, *Kellogg*) which, with the thinner, chinky crust of the present, offers entirely naked, and at length reddish-brown apothecia.

33. *L. tartarea* (L.) Ach.; thallus thick, tartareous, granulate-conglomerate passing into nodulose, and isidioid conditions; grayish-white; apothecia middling to ample, at length large; the rugulose disk from yellowish-brown becoming brick-coloured, naked; the thick thalline margin very entire or wavy. Spores ellipsoid, $\frac{30\text{-}60}{18\text{-}30}$ mic.——*Parmelia, Fr. L. E. p.* 133.

Upon rocks, and on the earth, mosses, etc. Northern and middle States, *Halsey*, 1823. Arctic America, at Cumberland Gulf, *Howgate exp.* Ohio, *Miss Biddlecome.* Virginia and North Carolina Mountains, *Curtis.* Mountains of South Caro-

lina, *Ravenel.*——Specimens on bark, referable here, are sent from Oregon (*Lyall*; *Hall*), in which the large apothecia become perfectly zeorine.——A f. *rosella*, entirely analogous to *L. pallescens*, *b*, has been found at Cumberland Gulf (Howgate exp.), and might seem possibly the key to the also arctic *L. tartarea v. pertusarioides*, Th. Fr. *Lich. Arct.* p. 100; but this author now makes of his lichen a *Pertusaria rhodoleuca*, *Lich. Scand.* p. 306.——Rock specimens of this and the immediately preceding species are well-distinguishable; and *L. pallescens* is a familiar tree- and dead wood-lichen; but the present is not so satisfactorily determinable on bark.——So far as observed by me the spores of the present are rather smaller than in *L. pallescens*; and this appears also to be noted by European lichenographers.

* * * * *Aspicilia. Thallus now lobed (n.* 33*) or uniform. Apothecia innate, more or less concave. Spores ellipsoid, simple. Spermatia now needle-shaped, and now short-staff-shaped, straight.*

34. *L. melanaspis* (Wahl.) Ach.; thallus thick becoming turgid, crustaceous-foliaceous; ash-coloured and whitish; passing at the centre into wart-like areoles, but extended at the circumference into linear, multifid, stellate-imbricate lobes; apothecia smallish to middling, closely sessile; the more or less tumid, blackish-brown disk sub-marginate, and now pruinose; the thalline margin very entire. Spores ellipsoid and rounded, $\frac{8\text{-}14}{5\text{-}9}$ mic.——*Parmelia, Fr. L. E. p.* 122. *Lecanora alphoplaca, Nyl. Scand. p.* 152.

Rocks. Greenland (*Vahl*), Th. Fries *l. c.* 1861. Bourbon County, Kansas (on limestone), *Hall.* Yosemite Valley, California, *Bolander.*——The specimens all belong to the f. *alphoplaca*; from which a Lapland form, not as yet known here (*L. alphoplaca, v. melanaspis*, Nyl. *l. c. L. melanaspis*, v. *stellata*, Th. Fr. *Scand.* p. 229) differs in its smaller size, and thinner and darker-coloured thallus.

35. *L. oculata* (Dicks.) Ach.; thallus cartilagineous-tartareous, papillate-ramuliferous; ashy-whitish; apothecia smallish to middling, sessile, flattish; disk black, sub-marginate; the turgid, entire thalline margin often blackish, at length excluded. Spores ellipsoid, $\frac{23\text{-}30}{11\text{-}16}$ mic.——*Ach. Syn. p.* 148. *Parmelia, Fr. L. E. p.* 135. *Lecanora, Nyl. Scand. p.* 156.

Incrusting mosses, etc., in alpine districts. Greenland (*Vahl*), Th. Fries *l. c.* 1861. Islands of Behring's Straits, *Wright.*

35(*b*). *L. glaucomela*, Tuckerm.; thallus cartilagineous, contiguous, smooth finally wrinkled; greenish-glaucescent; apothecia smallish to middling, sessile, flat; the rugose-crenulate thalline margin scarcely surpassing the black, sub-marginate disk. Spores (in a single series in strap-shaped thekes) ellipsoid, $\frac{18-23}{9-13}$ mic.——*Gen. Lich. p.* 118, *note.*

On *Abies*, and *Pinus*, California (*Bolander*), Tuckerman *l. c.* 1872. Oregon, *Hall.*——Spores now similarly disposed in *L. oculata*; of which the present is scarcely more than a subspecies.

36. *L. verrucosa* (Ach.) Laur.; thallus tartareous, verrucose; glaucous-white; apothecia small, from immersed becoming superficial and sub-sessile, concave, and urceolate; the black disk bordered by a thin proper margin hidden more or less by the rounded, inflexed thalline one. Spores roundish-ellipsoid, $\frac{32-54}{16-40}$ mic.——*Th. Fr. Scand. p.* 273. *Urceolaria, Ach. Syn. p.* 240.

b. mutabilis, Th. Fr.; thallus thinner, wrinkled and warted; from ash-coloured becoming pale-yellowish, and livid.

a, upon mosses and the earth in alpine districts. Greenland (*Vahl*), Th. Fries *l. c.* 1861. Rocky Mountains, *Brandegee in herb.* Sprague. Yosemite Valley, California (on an old stump, but not differing), *Bolander.*——*b*, on dead wood, New York, *Miss Wilson.* Massachusetts, *Mr. Willey.*

37. *L. cinerea* (L.) Sommerf.; thallus sub-tartareous, areolate-rimose; glaucous-ash-coloured, whitish, and now blackening; the hypothallus also blackening; apothecia small to almost middling, innate (or emergent) flattish; the mostly persistent, entire thalline margin commonly blackening. Spores rounded, ovoid, and ellipsoid, $\frac{14-27}{9-18}$ mic.——*Nyl. Scand. p.* 153.

b. lævata, Fr.; thallus thin, smooth, less chinky; glaucous-lurid; the hypothallus continuing pale; apothecia immersed, concave, often irregular. Spores as in *a*.——*Fr. L. E. p.* 145.

c. gibbosa, Nyl.; thallus tartareous, thickish, rugged and soon warted or glebous; dark-ash-coloured; apothecia becoming superficial. Spores rather larger.——*Nyl. Scand. l. c.*

Rocks. *a*, Arctic America (*Richardson*), Hooker *l. c.* 1823. Canada, *Drummond.* New York (as throughout New England, and northern and middle States), *Halsey.* Alabama, *Peters.* California, *Bolander.*——*b*, rocks in moist places, White Mountains, *Tuckerman.* Alabama, *Peters.*——*c*, Canada, *Drummond.* New England, where also on rails, *Tuckerman.* California, very fine, *Mann*; *Bolander.*

37(*b*). *L. calcarea* (L.) Sommerf.; thallus tartareous, areolate-verrucose; glaucescent, or white, now mealy; apothecia as in the last preceding, but a thin proper margin becoming at length distinguishable; and the disk commonly gray-pruinose. Spores as in the preceding, *b.*——*Nyl. Scand. p.* 154.

b. contorta, Fr.; areoles discrete, irregular, depressed at the circumference; pale-greenish-lead-coloured,——*L. calcarea*, *f. Hoffmanni*, *Nyl. l. c.*

Calcareous rocks. New York (as throughout the northern and middle States), *Halsey*, 1823. Kansas, *Hall.* Utah, *Lapham.* Rocky Mountains, *Hayden.*——*b*, Greenland (*Vahl*), Th. Fries *l. c.* 1861. Kansas, *Hall.* Texas, *Wright.* Alabama, *Peters.*

37(*c*). *L. cinereo-rufescens*, Nyl.; thallus tartareous, smooth, rimose-areolate, the areoles commonly discrete; upon a black hypothallus; apothecia of the size of those of *L. cinerea*, but the flattish naked disk rusty-red. Spores ovoid, smaller than in any other member of the group, $\frac{8\text{-}12}{5\text{-}6}$ mic.——*Nyl. l. c. p.* 154.

Rocks, alpine summit of Mt. Hood, Oregon, *Hall.*——The lichen of Hepp. n. 625; but doubtless the *L. alpina* of Th. Fr. *Scand.* p. 283, as well by the locality, as the reaction with potash.

37(*d*). *L. lacustris* (With.) Nyl.; thallus thin, smooth, rimulose; pale-brick-coloured; apothecia small, immersed, and more commonly urceolate; reddish or brownish. Spores ellipsoid, $\frac{12\text{-}18}{5\text{-}6}$ mic.——*Nyl. l. c. p.* 155.

Rocks often inundated. Greenland (*Vahl*), Th. Fries *l. c.* 1861. New England, *Tuckerman.* Alabama, *Peters.*

38. *L. odora* (Ach.); thallus tartareous but thin, rimulose-areolate; pale-ash-coloured; apothecia small to very small, immersed, concave; disk yellowish-flesh-coloured; the thin, depressed, smooth margin paler. Spores ovoid-ellipsoid, $\frac{10\text{-}13}{4\text{-}6}$ mic. ——*Gyalecta, Schær. Spicil. p.* 80. *Fr. L. E. p.* 197.

Granitic rocks. Notch of the White Mountains, *Tuckerman Gen.* 1872.

39. *L. epulotica* (Ach.) Leight.; thallus tartareous, rimulose, pale; apothecia immersed, concave, colourless, or pale-roseate; the thick, irregular margin angled or contracted. Spores as in *b*.

b. subepulotica, Nyl.; thallus thickened, coarsely verrucose-areolate; apothecia small, soon superficial and plano-convex; pale flesh-coloured and reddish. Spores ovoid-ellipsoid, $\frac{14\text{-}18}{7\text{-}10}$ mic. ——*Nyl. in litt. olim.*

a, on limestone; not observed here.——*b*, on granitic rocks. Vermont, *Russell.* Massachusetts, *Tuckerman.* Canada, *Drummond.*——This and the last-preceding species are closely akin. What is here referred to *L. odora* does not differ from Schær. *Lich. Helv.* n. 36, but has only been found once. *L. subepulotica* was determined by Nylander in the Vermont specimen; but the others now closely approach Zw. *exs.* n. 114, referred by Koerber to a state of *L. odora*; our American specimens differing however from the last species in smaller spores.

40. *L. Bockii* (Fr.) Th. Fr.; thallus tartareous, areolate-verrucose; from pale becoming tawny- and blackish-brown; on a black hypothallus; the discrete areoles now flat and angulate, and now gibbous and wart-like, commonly scattered; apothecia small, sessile; disk (now continuing punctiform) black, now papillate or at length plicate; the thick, entire thalline margin persistent. Spores ovoid-ellipsoid, $\frac{16\text{-}23}{10\text{-}15}$ mic.——*Th. Fr. Scand. p.* 269. *Parmelia, Fr. L. E. p.* 150. *L. sophodopsis, Nyl. in Flora*, 1876, *p.* 233; 1878, *p.* 204.

Granitic rocks, New England, *Tuckerman, Frost*, etc.——A not uncommon but difficult lichen, which is easily overlooked or misunderstood.

* * * * * *Acarospora. Thallus lobate or squamulose passing into areolate; or deficient. Apothecia innate for the most part and concave. Spores very minute and numerous.*

41. *L. molybdina* (Wahl.) Ach.; thallus tartareous, adnate, stellate-radious, the lobes linear, breaking up more or less into verrucose areoles; from light- becoming dark-umber-brown, and black; apothecia small to very small, innate, becoming a little prominent; disk urceolate, brownish-black; with a proper mar-

gin more or less distinct from the tumid thalline one. Spores oblong, very numerous and minute.——*Nyl. Scand. p.* 173. *Parmelia, Fr. L. E. p.* 126.

a. vulgaris, Schær.; thallus thick; the proper margin of the apothecium mostly undistinguishable.——*Lichen molybdinus, Wahl. Lapp. p.* 418, *t.* 29, *f.* 1. *Lecanora, Ach. L. U. p.* 430.

b. ereutica, Wahl.; rather less thick and coarse; the proper margin distinct.——*Wahl. l. c. Fr. l. c.*

c. microcyclos, Wahl.; smaller, the thallus thinner and flatter; the apothecia impressed.——*Wahl. l. c. Fr. l. c.*

a, Maritime rocks. Greenland, Fries *l. c.* 1831. Elsewhere in Arctic America, *Kane.*——*b*, Tadousac, Canada, *Drummond.* ——*c*, Mt. Desert, Maine, *Tuckerman.*

42. *L. chlorophana* (Wahl.) Ach.; thallus tartareous, adnate, areolate-verrucose, smooth, lobed and radious at the circumference; bright-lemon-coloured; apothecia small to almost middling, becoming superficial and sessile; the pale, naked disk at length brownish- or gamboge-yellow, and turgid, excluding the entire, now flexuous thalline margin. Spores at length oblong; very numerous and minute.——*L. U. p.* 436. *Lichen, Wahl. Lapp. p.* 416, *t.* 28, *f.* 2. *Parmelia, Fr. L. E. p.* 117.

Alpine rocks, as also on those of lower elevation, westward. Greenland (*Vahl*), Th. Fries *l. c.* 1861. Organ Mountains, Texas, *Wright.* Rocky Mountains, Colorado, *Lapham.* Islands of Great Salt Lake, Utah, *Watson.* Alpine County, and Monte Diablo, California, *Lapham*; *Bolander.* Dalles of the Columbia, *Hall.*——None of our plants appear to be referable to the var. *oxytona* of the south of Europe, which is indeed (at least in Schær. *Helv.* n. 335) ill enough distinguishable; though generally admitted by authors.

43. *L. xanthophana*, Nyl.; thallus squamulose; scales peltate, round-lobulate, soon reduced to angulate areoles, either flat or turgescent, scattered or crowded; lemon-yellow; apothecia small to almost middling, innate; disk impressed or flat, dark-red (and blackening) with an entire, more or less evident, thalline margin. Spores very numerous and minute.——*Nyl. Lich. And. Boliv. in Ann. Sci.* 4, 15, *p.* 379. *L. bella, Nyl. Chil. in Ann.* 4, 3, *p.* 156. *L. chrysops, Tuckerm. Suppl.* 1, *l. c. p.* 425.

b. dealbata, Tuck.; thallus white; disk of the apothecium black.

Rocks. Organ Mountains, Texas, and Mt. Carmel, Mexico (*Wright*), Tuckerman *Gen.* 1872. Rocky Mountains, *Hayden.* Uintah Mountains, Utah, *Watson.* Nevada, *Lapham.* Coast of California, *Bolander.* Coast of Oregon, *Hall.* Missouri and Kansas, *Hall.* Arkansas, *Peters.* Aiken, South Carolina, *Ravenel.* New Jersey, *Austin.* Rivière du Loup, Canada, *C. G. Pringle.*——As also in Chili and Bolivia, alt. 13,000 ft. *Nyl.*——*b*, calcareous rocks. Organ Mountains, Texas, *Wright.* Rocky Mountains, *Hayden.* California, *Bolander.*——Spores, as defined by Nylander, of about the size of those of the last species; but I find them also larger, and varying, in *b*, from ovoid-ellipsoid, about $3^{mmm.}$ long, and from 60-80 in number in the thekes, to oblong, $\frac{6\text{-}11}{4\text{-}5}$ mic., and now only about 30 in the thekes.

44. *L. Schleicheri* (Ach.) Nyl.; thallus tartareous, softish, areolate-sub-lobate; the areoles soon crowded, convex, and rugulose; sulphur-yellow; apothecia small to middling-sized, innate; disk flat, dark-reddish-brown, and black, marginate; with a thin sub-crenulate thalline margin. Spores rounded; very minute, and numerous.——*Urceolaria, Ach. L. U. p.* 332. *Schær. Spicil. p.* 356. *Parmelia, Fr. L. E. p.* 130.

On the earth, Rocky Mountains, alpine (*Hayden, Parry*, etc.), Tuckerman *Gen.* 1872. Coast of California, at San Diego, *Dr. Cooper*; at Mission Dolores, *Bolander.*

45. *L. cervina* (Pers.) Nyl.; thallus tartareous-cartilagineous, areolate-squamulose; scales sub-peltate, crenate-lobate, crowded more or less and finally imbricate; from yellowish- becoming dark-livid-chestnut; apothecia smallish to middling-sized, impressed becoming superficial; the flat disk reddish-brown, naked; the entire thalline margin at length obsolete. Spores very minute and numerous.——*Nyl. Scand. p.* 174. *Acarospora castanea, Koerb. Parerg. p.* 58. *a. squamulosa, Th. Fr. Scand. p.* 213.

b. thamnina, Tuckerm.; thallus developing below into crowded, branched trunks which support the scales.——*Gen. Lich. p.* 120.

Rocks in the Western mountains, and on the Pacific Coast. Mountains of Montana, and Nevada, *Lapham.* Yosemite Val-

ley, California, *Bolander*. A much less developed lichen referable here has occurred in Vermont, *Frost*. The western plant is now undistinguishable from Schær. *Lich. Helv.* n. 341 (on limestone)—to which the Vermont lichen (on granitic rocks) comes nearest,—but passes into ascendant and imbricate conditions of far greater luxuriance, explained however, if I mistake not, by Anz. *Langobard.* n. 328; which suggests also the remarkable overgrowth of *b*. The last development may be said indeed to take its start from the very commonly observable and long since described stalked or peltate structure of the scales in *a*; and to stand therefore to *a*, in a relation not unlike that of *L. rubina* v. *complicata*, Anz., to the peltate type of that species.—— Spores not satisfactorily exhibited in any of my specimens: they should be considerably larger than those of the next following lichen; as compare the European descriptions cited. There can be no doubt however that our *L. cervina* is a member of the same species with the European.

45(*b*). *L. glaucocarpa* (Wahl.) Ach.; thallus of rounded, scattered, or more rarely crowded and imbricate scales; pale-greenish-brown; apothecia middling to ample, solitary, flat; reddish-brown, gray-pruinose; the entire thalline margin persistent. Spores very minute and numerous.——*Ach. L. U. p.* 410. *Nyl. Scand. p.* 175. *Th. Fr. Scand. p.* 211.

b. verrucosa, Anz.; scales reduced to small, scattered, roundish, convex, green areoles; bloom of the fruit fugacious.—— *Lich. Langob. n.* 329.

Calcareous rocks. Vermont (*Frost*), Tuckerman *Gen.* 1872. Utah, *Watson*. Arctic America, *Richardson fide* Leighton.—— *b*, Kansas, *Hall*. Texas, *Wright*.

45(*c*). *L. fuscata* (Schrad.) Th. Fr.; thallus cartilagineous, squamulose; the scales flattish or concave, crowded or scattered, lobulate; from pale- at length dark-chestnut; apothecia small, immersed becoming superficial; the rufous-brown, naked disk rugged and papillose. Spores very minute and numerous. ——*Th. Fr. Scand. p.* 215. *L. fuscata & L. peliscypha, Nyl. Scand. p.* 175. *L. peliscypha, Tuckerm. Calif., Gen. Lich.* 121.

b. rufescens, Th. Fr.; scales flat, and more or less discrete; the imperfect apothecia immersed, punctiform.——*Th. Fr. l. c.*

Parm. cervina, v. discreta, Fr. L. E. p. 127. *Acarospora smaragdula, Auctt.*

c. Sinopica, Schær.; the last, tinged red by oxide of iron. ——*Nyl. l. c.*

d. oligocarpa, Nyl.; spores much larger, and reverting finally to the normal number, in the thekes.——*Acarospora glebosa, Koerb. Syst. p.* 156. *L. cervina, v. glebosa, Tuckerm. Gen. p.* 121.

Granitic rocks. *a, b,* Arctic America (*Richardson*), Hooker *l. c.* 1823.——*b,* throughout the northern and middle States, common; and west to Kansas, *Hall;* and California, *Bolander.* ——*c,* alpine rocks, White Mountains, *Tuckerman.*——*d,* California, *Bolander.*

45(*d*). *L. privigna* (Ach.) Nyl.; thallus deficient; apothecia small to minute, sessile, appressed; scattered or crowded densely into clumps; orbicular becoming variously difform (angulate, lirellate), the dark-red disk finally black; bordered by an elevated, persistent, black margin; and finally rugged and contorted. Spores ellipsoid, very numerous and minute.——*Lecidea, Ach. Meth. p.* 49. *Sarcogyne, Koerb. Syst. p.* 266, *a. Lecanora simplex* (*Dav.*) *Nyl. Biatorella, Th. Fr. Scand. p.* 407.

b. pruinosa, Auctt.; apothecia small to middling, scattered, appressed, or now sunken in the matrix; the rather convex disk gray-pruinose.——*Sarcogyne, Koerb. l. c. Lecanora, Nyl. Scand. p.* 176.

c. Clavus, Koerb.; apothecia middling to ample; short-stipitate, rounded, becoming wavy and difform; disk reddish and blackening, naked; the thick, wrinkled, and chinky margin finally disappearing; the hypothecium at length blackening. ——*Koerb. Syst. p.* 266. *Biatorella, Th. Fr. Scand. p.* 409. *Lecanora cervina, v. eucarpa, Nyl. Stereopeltis Carestiæ, De Not.* (Anz. *Langob.* n. 381.)

d. revertens, Tuck.; apothecia not unlike those of the last, but smaller and more regular; with thinner margin. Spores few, and at length in 8^{s}, in the thekes; ellipsoid, and oblong-ellipsoid, $\frac{8\text{-}18}{3\text{-}7}$ mic.——*Gen. Lich. p.* 122.

Rocks, *a,* granitic, from Canada, *Drummond,* and the northern States, to Tennessee, *Ravenel,* Alabama, *Peters,* and California, *Bolander.*——*b,* limestone, Canada, *Drummond.* New

England, *Tuckerman*. Kansas, *Hall*. Texas, *Wright*.——*c*, New England, *Tuckerman*. Georgia, *Ravenel*. California, *Bolander*. ——*d*, Colorado, *Herb. Sprague*. California, *Bolander*.——The earlier name, *simplex*, Dav., recently revived, is wholly without signification, which can hardly be said of the other.

XXXII.—RINODINA, Mass., Stizenb., Tuckerm.

Apothecia scutellæform, more often zeorine; now lecideine. Hypothecium mostly colourless. Spores ellipsoid, bilocular; rarely 4-plurilocular; brown. Spermatia oblong or staff shaped; on sub-simple sterigmas. Thallus crustaceous; lobed at the circumference in a few species; but more commonly uniform.

* *Dimelæna. Thallus lobed. Spores bilocular.*

1. *R. radiata*, Tuckerm.; thallus crustaceous-adnate, tartareous-cartilagineous, rimose-areolate becoming radiously lobed at the circumference; glaucescent; the hypothallus black; apothecia small, innate, now emergent; disk plano-convex, finally tumid, black, white-pruinose; the thalline margin entire; now blackening; or disappearing. Hypothecium brownish-black. Spores short-ellipsoid, obtuse, $\frac{7\text{-}12}{5\text{-}7}$ mic.——*Obs. Lich.* 4, *l. c. p.* 173. *Buellia*, *Lich. Calif. p.* 25.

b. fimbriata, Tuck.; thallus depauperate, uniform, but fringed by the hypothallus.——*Obs. Lich. l. c.*

Rocks on the coast of California (*Bolander*), Tuckerman *l. c.* 1866.——Apothecia $0^{mm.}$, $5\text{–}0^{mm.}$, 8 wide.

2. *R. thysanota*, Tuckerm.; thallus adnate, verrucose-areolate, with a radiously lobed circumference; brownish-olivaceous; apothecia small, lecanorine, sessile; disk blackish-brown; the tumid margin entire. Spores short-ellipsoid, obtuse, $\frac{10\text{-}14}{5\text{-}6}$ mic. ——*Obs. Lich.* 4, *l. c. p.* 174.

Rocks at about 7000 ft. alt., Alpine County, California, *Lapham*. Coast of Oregon, *W. C. Cusick in herb.*, Sprague.——A marked species; but the specimens are scanty.

3. *R. nimbosa* (Fr.) Th. Fr.; thallus membranaceous-cartilagineous, squamulose; scales crowded more or less and coales-

cent, or now reduced and glebous at the centre, but expanding, imbricate, lobate and crenate at the circumference; pale-yellowish becoming tawny, often gray-pruinose; apothecia smallish to almost middling, innate; disk flattish, brownish-black, submarginate; thalline margin tumid, entire. Spores $\frac{14-20}{7-10}$ mic.—— *Parmelia*, *Fr. L. E. p.* 129. *Lecanora*, *Nyl. Scand. p.* 148.

Naked earth in alpine districts. Greenland (*Vahl*), Th. Fries *l. c.* 1861. Rocky Mountains in Colorado, *Brandegee in herb.* Sprague.

4. *R. oreina* (Ach.) Mass.; thallus adnate, tartareous-cartilagineous; verrucose-areolate; from greenish-straw-coloured becoming yellowish; areoles now crenate, passing into a radiously lobed circumference, which is more or less black-edged; apothecia smallish, lecanorine, innate, at length superficial and sub-sessile; the disk becoming turgid, and black; the thalline margin obtuse and very entire, or now disappearing, and the apothecia lecideoid. Spores short-ellipsoid, obtuse, $\frac{9-12}{5-7}$ mic.—— *Lecanora*, *Schær. Enum.* p. 67. *Nyl. Scand. p.* 147. *Parmelia*, *Fr. L. E. p.* 113.

Rocks. New England and Canada, *Tuckerman* Enum. 1845. Tennessee, *Ravenel.* Kansas, *Hall.* Rocky Mountains, *Hayden.* California, *Bolander.*——Peripheral lobes now obsolete.

5. *R. chrysomelæna* (Ach.) Tuckerm.; thallus sub-membranaceous, areolate-squamulose; scales commonly discrete, flat, rounded, more or less lobed; pale- to bright-yellow; apothecia almost middling-sized, lecanorine, appressed, flat; disk dark-red, and blackening; the persistent, stout, entire thalline margin at length wrinkled and flexuous. Spores $\frac{18-30}{10-16}$ mic.——*Syn. p.* 148. *Tuck. Syn. N. E. p.* 37.

Rocks. Pennsylvania, *Muhlenberg Catal.* 1818. North Carolina, *Schweinitz.* Georgia, *Ravenel.* Massachusetts, *Willey.* ——Apothecia 1$^{mm.}$ to 1$^{mm.}$, 5 wide.

* * *Eurinodina. Thallus uniform. Hypothecium colourless; except in n.* 13, *and* 14. *Spores bilocular; except in n.* 15.

6. *R. Ascociscana*, Tuckerm.; thallus of membranaceous, adnate, rounded, concentrically wrinkled, scale-like areoles, which run together more or less, forming a chinky crust; from greenish- becoming pale-cinnamon-brown; apothecia smallish to middling-sized, sessile; disk plano-convex, scabrous and

wrinkled, from pale- at length reddish-brown, and blackening; the thick, entire, or at length crenate thalline margin persistent. Spores $\frac{25\text{-}40}{11\text{-}18}$ mic.——*Gen. p.* 124. *Pannaria, Tuck. Suppl.* 1, *l. c. p.* 424.

Trunks and rocks. White Mountains, *Tuckerman l. c.* 1858. Vermont, *Frost.* Massachusetts, *Willey.* Illinois, *Hall.* Canada, *Drummond.* Arctic America, *Richardson in herb.* Taylor. ——Apothecia $0^{mm.}$, 8 to $1^{mm.}$, 5 wide.

7. *R. turfacea* (Wahl.) Nyl.; thallus incrusting, verrucose-granulate; from white at length brownish-ash-coloured; apothecia from smallish to middling-sized, appressed or sessile, flattish; disk brownish-black, dull; thalline margin elevated, entire or rugulose, persistent. Spores $\frac{20\text{-}38}{10\text{-}16}$ mic.——*Th. Fr. Scand. p.* 195, *a.*

b. roscida, Th. Fr.; apothecia white-pruinose.——*Th. Fr. l. c.*

c. mniaræa, Nyl.; apothecia soon convex, excluding the margin; the disk from dark-cinnamon-coloured blackening.——*Nyl. Scand. p.* 151.

On the earth, and running over mosses, in alpine districts. Greenland (*Vahl*), Th. Fries *l. c.* 1861. Islands of Behring's Straits (*a*, *b*, *c*), *Wright.* White Mountains (*a*), *Tuckerman.* North shore of Lake Superior (*a*), and British Columbia (*c*), *Macoun.* Rocky Mountains, *Wolf.* California (*c*, = *Lecanora mniareiza*, Nyl. in Flora, 1870, p. 33; & in Norrl. *Lich. Fenn.* n. 158), *Bolander, teste* Nyl.——A certain difference between *a* and *c* proves scarcely well determinable; nor are the two Scandinavian authorities cited above to be clearly reconciled. Spores equally large in these forms.——*b* is the var. *microcarpa* of Anzi (Lich. *Langob.* n. 106), but the name becomes inappropriate in our plant, which offers the largest fruit of any of our specimens.

8. *R. sophodes* (Ach.) Nyl., emend.; thallus tartareous but thin, granulate-areolate; from ash-coloured passing into olive-brown; on a black hypothallus; apothecia small, zeorine, appressed; disk flattish, brown to brownish-black; thalline margin sub-entire. Spores $\frac{14\text{-}23}{6\text{-}12}$ mic.——*Nyl. Scand. p.* 148, *a. Th. Fr. Scand. p.* 199, *a.*

b. atrocinerea, Nyl.; thallus squamulose-areolate; glaucescent; the thinnish areoles scattered more or less on the conspicuous, black hypothallus; apothecia small, adnate; the thin,

entire thalline margin often excluded, and the black apothecia lecideoid. Spores as in *a*.——Exs. *Anzi Lich. Langob. n.* 321. *Zw. exs. n.* 61. *Ejusd. exs. n.* 68, *β. Nyl. Lich. Par. n.* 43.

c. tephraspis, Tuck. herb.; thallus thickened; of crenulate but soon turgid, verrucose-irregular and crowded areoles; brownish-ash-coloured; apothecia at length middling-sized, becoming turgid; but the thalline margin persistent. Spores as in *a*.——*Lecanora, Tuckerm. Suppl.* 1, *l. c. p.* 425.

d. confragosa, Nyl.; thallus coarser; verrucose, often conglomerate, and now sub-lobulate; white; apothecia at length middling-sized. Spores a little larger than in the preceding forms.——*Nyl. l. c. max. p.* Exs. *Fr. Lich. Suec.* 283.

e. exigua, Fr.; thallus reduced; now scurfy, or disappearing; whitish; hypothallus obsolete; apothecia small to very small, finally convex; the entire margin at length crenulate, or excluded. Spores as in *a*, or a little smaller.——*Nyl. l. c.*—— Spores now occurring from 8 to 12-16-20-30 in the thekes.——*R. polyspora, Th. Fr. Scand. p.* 206. *Lecanora, Nyl.*

Trees, stones, and dead wood, throughout North America, *Muhlenberg Catal.* 1818. *a*, common on bark, and noticeable by its dark thallus.——*b*, only on rocks, where its colour, flattish areoles, and lecideoid fruit, sufficiently indicate it.——*c*, also a rock-lichen, I have tried to bring under *b*, taking our plant for a better developed condition (with fruit now $2^{mm.}$ in width) of such European lichens as Zw. *exs.* n. 68, *A*, and Hepp. *Lich. Eur.* n. 646; both which are referred by their authors to *R. atrocinerea*; as the first-named is also by Koerber: but cannot, for the present, but keep it separate.——*d* offers apothecia larger than in any other form of the species except the last-named; and its coarse, white thallus aids also in making *R. sophodes*, in this condition, conspicuous on the rocks and the earth of our Pacific Coast; where a bark-form (*Lecanora Roboris*, Duf., *e* Nyl. in Mandon *Lich. Mader.* n. 38) is also found, inhabiting the Oaks of California. The last appears as yet to be rare with us elsewhere.——*e*, on bushes, trees, and dead wood, everywhere: the smallest form; though passing into the tree-form of *d*.

9. *R. Hallii*, Tuckerm.; thallus cartilagineous, contiguous, chinky; from pale-brownish becoming light-umber-coloured; on a black hypothallus; apothecia smallish, biatorine, adnate, plano-convex; disk passing from reddish- into blackish-brown,

finally turgid and excluding the paler, entire, obtuse margin. Spores $\frac{15-30}{8-15}$ mic.

On various trees of the Pacific Coast. California, *Bolander*. Oregon, *Hall*.——In a part of the specimens the apothecia shew a white bloom; but there is no trace of this in the majority.—— Apothecia 0$^{mm.}$, 8 to 1$^{mm.}$, 2 wide.

10. *R. Bischoffii* (Hepp.) Koerb.; thallus thin, mealy or granulose, or obsolescent; whitish, ash-coloured, or brownish; apothecia small, zeorine, sessile, flat, or finally convex; the disk blackening; the entire thalline margin also blackening, and the fruit at length lecideoid. Spores broad-obtuse-ellipsoid; the wide interval between the spore-cells suggesting a dark band; $\frac{14-20}{7-14}$ mic.——*Koerb. Parerg. p.* 75. *Th. Fr. Scand.* p. 204.

Lime-rocks, Texas (*Wright*), Tuckerman *Gen.* 1872. Kansas, *Hall*. Rocky Mountains, *Hayden in hb.* Willey.

11. *R. flavo-nigella*, Tuckerm. *in litt.*; thallus tartareous, contiguous, granulate-rugose; from greenish- becoming bright-lemon-yellow; apothecia smallish, appressed, zeorine, flattish; the scabrous disk brownish-black, at length convex; the thalline margin sub-entire. Spores $\frac{17-30}{9-15}$ mic.

Rotten wood. Gainesville, Florida, *Ravenel*. Cotoosa River, Fla., *Austin*. Mobile, Alabama, *Dr. Mohr*.——Apothecia 0$^{mm.}$, 8 to 1$^{mm.}$, 2 wide.

12. *R. aterrima* (Krempelh.) Anz.; thallus effuse, thin, granulose or scurfy; dark-greenish-black, consisting of brown gonidia; apothecia minute, lecanorine, innate-sessile, very black. Spores soleæform, $\frac{14-20}{5-9}$ mic.——*Anz. Symb. Lich. Rar. p.* 11, *& Lich. Langob. n.* 461. *Microthelia Metzleri, Koerb.*

Granitic rocks, Yosemite Valley, California, abundant, *Bolander*. San Diego, Cal., *Miss Plummer in hb.* Farlow.—— Spores rarely 4-locular. But this can hardly be taken for sufficient to make two species of the lichens cited. Compare Lahm *Anmerk.* in Rabenh. *Lich. Eur. Fasc.* 29; and also *Hedwigia*, 1867, p. 154–5.

13. *R. Thomæ*, Tuckerm. *in litt.*; thallus tartareous, chinky; smooth; straw-coloured; on a black hypothallus; apothecia small, lecanorine, adnate, flattish; disk black; the entire, ob-

tuse, persistent thalline margin soon blackening, and the fruit lecideoid. Hypothecium black. Spores $\frac{12-20}{6-10}$ mic.

Sandstone rocks, Moulton, Alabama, Hon. *T. M. Peters.*——Apothecia $0^{mm.}$, 5 to $0^{mm.}$, 8 wide.

14. *R. milliaria*, Tuckerm.; thallus thin, chinky, granulate, and rugulose; greenish-fuscescent; apothecia minute, adnate; disk flattish, blackish-brown and black, opake; the thin, entire margin blackening or excluded. Hypothecium blackening. Spores $\frac{9-15}{5-8}$ mic.——*Obs. Lich.* 4, *l. c. p.* 175.

Trees and shrubs, about Boston, *Tuckerman.* New Bedford, *Willey.* Western New York, *Miss Wilson.*——Spores, according to Mr. Willey, now in $12^{s.}$, as in the now similar *R. sophodes*, *e*, in *Biatora exigua* and in *Lecidea myriocarpa.*

15. *R. Conradi*, Koerb.; thallus incrusting, thin, chinky and granulate; greenish-glaucescent and cinerascent; apothecia zeorine, small, sessile, flattish; the plano-convex disk blackish-brown, distinctly marginate; the thalline margin sub-entire, or rugose-crenulate. Spores from bilocular passing into quadrilocular, and the two middle cells then divided, $\frac{24-32}{10-16}$ mic.——*Koerb. Syst. p.* 123. *Th. Fr. Scand. p.* 198. *Lecanora pyreniospora*, *Nyl. Scand. p.* 151. *Rinodina sabulosa*, *Tuck. Calif. p.* 21.

On gravelly earth near the ocean, San Francisco, California (*Bolander*), Tuckerman *l. c.* 1866.——The European lichen (unknown to me at the time of the publication of the American one, and now only in the too scanty Rabenh. *Lich. Eur.* n. 880) is described as lecanorine, and the spores as "constantly quadrilocular" (*Koerb. l. c.*), but I can scarcely doubt the identity of the two plants. Apothecia of ours $0^{mm.}$, 5 to $0^{mm.}$, 8 wide.

* * * *Maronea. Spores very numerous in the thekes.*

16. *R. constans* (Nyl.) Tuckerm.; thallus verruculose; greenish-ash-coloured, and brownish; on a black hypothallus; apothecia small to almost middling-sized, zeorine, sessile; the flat, brownish-black and black disk bordered by a tumid, sub-entire thalline margin; the fruit at length flexuously irregular. Spores very minute and numerous in the thekes, and, in general, colourless.—— *Tuckerm. Gen. p.* 124. *Lecanora, Nyl. classif.* 2; *Ejusd. Prodr. Gall. p.* 89. *Maronea Berica, Mass. in Flora*, 1856, *n.* 19, *& Lich. Ital. n.* 346. *Lecanora, Tuck. Obs. Lich.* 2, *l. c. p.* 403. *Maronea Kemmleri. Koerb. Parerg. p.* 90.

On living and dead wood, not uncommon in New England, and southward to Maryland, and Virginia, *Tuckerman l. c.* 1862. New Jersey, *Austin.* Pennsylvania, *Michener.* Ohio, *Lea.* North Carolina, *Curtis.* South Carolina, *Ravenel.* Alabama, *Peters.*——Our common plant is the *M. Kemmleri*, Koerb. (Hepp. n. 771; Rabenh. n. 633), but this is most easily to be regarded as only the more perfect state of Massalongo's. Smaller forms of our lichen occur, resembling the cited one of the Italian author; and, in such states, the disk is scarcely marginate. It was remarked, in the place first-cited above, that, in addition to the general resemblance of *R. constans* to familiar conditions of *R. sophodes* as here taken, the former agreed also with *Rinodina* in its truly bilocular spores becoming at length constricted at the middle; "one of the best indications of the coloured spore in its bilocular stage, when colour is wanting." And Mr. Willey has now completed this observation, and removed all doubt of the position of our plant by the discovery of such spores as those just mentioned coloured exactly as those of the otherwise not very dissimilar *R. sophodes*, v. *exigua*; itself now polysporous.

Sub-Fam. 2.—PERTUSARIEI.

Apothecia typically closed; composite; and difform; but reverting largely to lecanorine forms.

XXXIII.—PERTUSARIA, DC.

Apothecia globular-difform, closed; including (1–00) nucleiform hymenia opening by pores (ostioles); or explanate and lecanoroid. Spores (only excepting n. 6) large to very large, ellipsoid, simple; or rarely bilocular (n. 9); typically colourless. Spermatia staff-shaped, straight; upon simple sterigmas. Thallus crustaceous; uniform in our species.

* *Apothecia more or less lecanorine.*

‡ *Spores simple.*

1. *P. bryontha* (Ach.) Nyl.; thallus incrusting, verrucose-conglomerate; whitish; apothecia middling-sized, and over,

sessile, a little elevated, thick; the lecanorine disk flattish, rugulose, soon dilated so as to depress and exclude the turgid thalline margin; from brownish-liver-coloured becoming livid, and blackening. Spores solitary, $\frac{150\text{-}230}{50\text{-}75}$ mic.——*Lecanora*, *Ach. L. U. p.* 392; *Syn. p.* 156. *Pertusaria*, *Nyl. Scand. p.* 178.

On the earth, growing over mosses, etc., in alpine districts. Greenland (*Vahl*), Th. Fries *l. c.* 1861. Islands of Behring's Straits, *Wright.* Shores of River St. Mary, Lake Superior, *Richardson* (Leighton *l. c.*).

2. *P. velata* (Turn.) Nyl.; thallus cartilagineous, smooth, becoming plicate-rugose and chinky; glaucescent, and white; with a zonate and more or less brighter-coloured circumference; apothecia small to almost middling-sized, adnate, lecanoroid; disk flattish, pale-yellowish- to reddish-flesh-coloured; densely white-powdery; the thick, entire thalline margin becoming finally indistinguishable in the now difform, and often 2-3-thalamous fruit. Spores solitary for the most part; exceeding $\frac{180\text{-}250}{60\text{-}80}$ mic.——*Turn. in Act. Linn. Lond.* 9, *p.* 143, *t.* 12, *f.* 1. *Pertusaria*,*Mudd. Man. Brit. Lich. p.* 274.

Trees, and also on rocks, throughout the Atlantic regions from New England to Virginia, *Tuckerman Gen.* 1872. Canada, *Macoun.* North Carolina, *Curtis.* Alabama, *Peters.* Ohio, *Lea.* Illinois, *Hall.* Texas, *Hall.*

3. *P. panyrga* (Ach.) Th. Fr.; thallus incrusting, thin, wrinkled; white; apothecia small to almost middling-sized, lecanoroid but often 2-3-thalamous; the depressed disk black, white-powdery; the thalline margin irregular. Spores "solitary; $\frac{110\text{-}220}{60\text{-}80}$ mic."——*Th. Fr. Scand. p.* 308. *P. velata* * *multipuncta v. leucotera*, *Nyl. Scand. p.* 180.

On the earth, running over mosses, etc., in alpine districts. Greenland (*Vahl*), Th. Fries *l. c.* 1861.

4. *P. multipuncta* (Turn.) Nyl.; thallus sub-cartilagineous, oftener thin and chinky but becoming rugose-verrucose; glaucescent and pale-ash-coloured; zonate more or less at the circumference, as in n. 2, but less distinctly; apothecia small to almost middling-sized, lecanoroid, adnate, at length elevated; mono- or now 2-4-thalamous; with flat, blackening disk; but becoming depressed and very irregular; and, excluding the soon gaping thalline margin, passing into difform, powdery

heaps. Spores solitary; or often in twos; $\frac{70\text{-}180}{23\text{-}70}$ mic.——*Nyl. Scand. p.* 179. *Th. Fr. Scand. p.* 309. *P. faginea, Tuck. Syn. N. E. p.* 84, *max. p.*

Trees, and more rarely rocks, throughout the United States, *Tuckerman Gen.* 1872. Common equally throughout the North and South, reaching Texas, *Wright*; and also California, *Bolander*; and Oregon, *Hall.*

5. *P. dactylina* (Ach.) Nyl.; thallus incrusting, thin; white; producing finger-shaped, erect, thickish, somewhat divided, (now undeveloped and inconspicuous) cylindrical branchlets, in the tips of which the small, sub-lecanoroid apothecium with pale-flesh-coloured disk, concealed more or less by a thalline veil is contained. "Spores solitary; $\frac{125\text{-}220}{65\text{-}80}$ mic."——*Nyl. Lapp. Or. p.* 240. *Th. Fr. Scand. p.* 310.

On the earth, running over mosses, etc., in alpine districts. Islands of Behring's Straits (*Wright*), Tuckerman *Gen.* 1872. White Mountains.

6. *P. ambigens* (Nyl.) Tuck.; thallus cartilagineous, smooth becoming rugose-verrucose; glaucescent; apothecia small to almost middling-sized, lecanorine, sessile or a little elevated; 1-2-thalamous; disk flat, from flesh-coloured becoming dark-greenish and livid, with a thin bloom; thalline margin irregularly torn-crenate, and at length repeatedly duplicated. Spores in eights; $\frac{17\text{-}23}{8\text{-}12}$ mic.——*Tuck. Obs. Lich.* 4. *l. c. p.* 176. *Lecanora, Nyl. in Prodr. Fl. N. Gran. p.* 40, *note.*

Trunks, Oregon, *Dr. Lyall. Hall.* Elsewhere known only at the Cape of Good Hope; *Zeyher* in *herb.* Sonder.

7. *P. lecanina*, Tuckerm.; thallus thin, contiguous, smooth, becoming granulate; pale-yellowish; bordered by the black hypothallus; apothecia small, lecanoroid, sessile, at first white-pruinose; disk pale-flesh-coloured, sub-marginate; thalline margin entire. Spores in twos; $\frac{92\text{-}142}{30\text{-}50}$ mic.——*Gen. Lich. p.* 126, *note.*

On various trees in California, *Bolander*; seen only in small patches accompanying *P. leioplaca*, and *P. pustulata.*

8. *P. flavicunda*, Tuckerm.; thallus cartilagineous, smooth, verrucose-areolate; pale sulphur-coloured; the areoles becoming radiously concrete toward the circumference; apothecia

small to almost middling-sized, adnate; monothalamous; the dilated, discoid ostiole yellowish-powdery, little exceeded by the margining portion. Spores in twos and threes; $\frac{60-80}{40-50}$ mic.——*Obs. Lich.* 4, *l. c. p.* 177.

Rocks, San Diego, California, *Dr. Cooper.*——Fruit rarely 2-thalamous.

‡ *Spores bilocular.*

9. *P. rhodocarpa*, Koerb.; thallus membranaceous; from greenish-glaucescent becoming white; and densely granulate; apothecia small, sub-sessile, sub-globose; from mono- at length 2-3-thalamous; bursting from the first into soredia, and the thalline exciple soon obsolete; disk flesh-coloured, concealed by a white powdery veil, but afterwards, as this disappears, reddish-dotted. Spores solitary; $\frac{230-322}{60-112}$ mic.——*Koerb. Syst. p.* 384. *Tuckerm. Gen. p.* 128. *Varicellaria, Th. Fr. Scand. p.* 322. *V. microsticta, Nyl. Scand. p.* 183. *t.* 1, *f.* 8.

On bark. Arctic America, *Nylander Scand.* 1861. British Columbia, *Macoun.*——The apothecia differ in no respect from others of forms of *P. multipuncta*, also at length "reddish-dotted," except in the spores being bilocular.

* * *Apothecia compound, difform.*

10. *P. communis*, DC.; thallus cartilagineous, from smooth and even becoming chinky and rugose-verrucose; glaucescent; now zonate at the circumference; apothecia small to middling-sized, adnate, depressed-sub-globose and variously difform; closed except at the sunken, and for the most part blackening, and numerous ostioles. Spores solitary; or in twos; very rarely in threes and fours; $\frac{92-207}{40-73}$ mic.——*Porina pertusa* (*L.*) *Ach. Syn. p.* 109. *Pertusaria, Tuck. Syn. N. E. p.* 84. *P. communis, Nyl. Scand. p.* 178. *Th. Fr. Scand. p.* 317.

Trunks and rocks. Northern and middle States, *Muhlenberg Catal.* 1818. Canada, *Macoun.* Ohio, *Lea.* Illinois and Missouri, *Hall.* Virginia, *Tuckerman.* North Carolina, *Curtis.* South Carolina, *Ravenel.* Alabama, *Peters.* Texas, *Wright.* California, *Bolander.*

11. *P. leioplaca* (Ach.) Schær.; thallus cartilagineous, rather thin, becoming chinky and rugged; glaucescent, and pale-yellowish; apothecia small to middling-sized, adnate, globular

and difform; either discrete, or crowded and running together; closed; depressed often at the centre and thus falsely-lecanoroid; the solitary or few, rarely depressed ostioles either blackening, colourless, or indistinct. Spores in fours; sixes; and eights; varying no little in size, as from $\frac{40\text{-}92}{20\text{-}40}$ mic. to $\frac{115\text{-}184}{30\text{-}56}$ mic. ——*Schær. Spicil. p.* 66. *Nyl. Scand. p.* 181; *Prodr. N. Gran. p.* 36.

Trees and rocks. Northern and middle States, *Muhlenberg Catal.* 1818. Canada, *Richardson.* Ohio, *Miss Biddlecome.* Illinois, *Hall.* Maryland and Virginia, *Tuckerman.* North Carolina, *Curtis.* South Carolina, *Ravenel.* Alabama, *Beaumont.* Florida, *Austin.* Louisiana, *Hale.* Texas, *Wright.* Oregon, *Hall.* Very various: now not easily distinguishable from the last; and the depressed and marginate forms resembling now *P. Wulfenii*, except in colour.

12. *P. pustulata* (Ach.) Nyl.; thallus membranaceous, chinky, now verruculose; brownish-cream-coloured, now greenish, pale-yellowish, or white; apothecia small to very small, hemispherical and difform; from only slightly prominent becoming globular and sub-sessile; flattened at length above, when the now confluent, scarcely depressed black ostioles become disk-like. Spores in twos; $\frac{46\text{-}136}{24\text{-}56}$ mic.——*Porina, Ach. L. U. p.* 309; *Syn. p.* 110. *Pertusaria, Nyl. Prodr. Gall. p.* 195.

Trees, common from New England to Virginia, *Tuckerman Gen.* 1872. North Carolina, *Curtis.* South Carolina, *Ravenel.* Florida, *Austin.* Alabama, *Beaumont.* Texas, *Wright.* Oregon, *Hall.*——*P. concreta*, Nyl. *Enum. Gen.* p. 117; & *Add.* in Flora, 1876, p. 233 (*P. Westringii*, Nyl. *Obs. Pyren.* p. 35), is said to occur, on granitic rocks, in "northern and arctic America," as well as in Ireland, and the south of France; but the lichen is unknown to me, and the published notices of it are not quite clear. In the place first-cited above the plant is placed in the 5-8-sporous section, but in the later diagnoses it is said to belong to the other, or 1-2-sporous section; as it is said in one place to have an areolate thallus (*Obs. Pyren.*) and, in another, a continuous, chinky one (*Add.* in *Flora*), and the fruit to be convex and wart-like) *Obs. Pyren.*) or immersed and endocarpoid (*Add.* in Flora). Spores in twos; $\frac{115\text{-}250}{52\text{-}80}$ mic. (*Add.* l. c.)

13. *P. glomerata* (Ach.) Schær.; thallus incrusting, cartilagineous; glaucescent, and white; apothecia small to middling-

sized, globular, sub-sessile, with mostly solitary, protuberant ostioles; but soon agglomerate and confluent into large, difform, crowded, pleiothalamous clusters. Spores very commonly in twos; but occurring also in fours; sixes; and eights; $\frac{70-200}{20-70}$ mic. ——*Ach. Syn. p.* 111. *Schær. Spicil. p.* 66. *Tuck. Exs. n.* 22 (*Sub. Parm. verr.*). *Nyl. Scand. p.* 182. *Th. Fr. Scand. p.* 314.

On the earth, running over mosses, etc., in alpine districts. White Mountains, *Tuckerman* Syn. N. E. 1848 (spores almost always in twos; and rarely solitary). Adirondack Mountains, N. Y., *Macrae* (spores as in the last). Islands of Behring's Straits, *Wright* (spores in fours; and eights).——The species-name suits our lichen perhaps quite as well as it does the European one; and ours (Tuckerm. *exs.* n. 22) is certainly like the other in the earlier conditions of the fruit, but passes at once into a confluent, difform state—with the look of largest apothecia of *P. communis*, but the ostioles of the present—of which my few foreign specimens scarcely afford a trace. The spores might appear also to suggest difference in the plant of our mountains from the European, the thekes of which have always been taken for 4-sporous; but the distinction is a slight one, and Dr. Th. Fries has recently shewn (*l. c.*) that the Swedish lichen varies from 3 to 8-sporous.

14. *P. globularis*, Ach.; thallus incrusting, thin, granulate; whitish-ash-coloured; granules globular, becoming finger-shaped, and finally somewhat branched; apothecia small to almost middling-sized, sub-sessile, depressed-globose; the commonly few ostioles collected in the sunken centre. Spores in twos; threes; and fours; $\frac{65-115}{35-50}$ mic.——*Ach. Syn. p.* 212. *Tuckerm. Syn. N. E. p.* 85.

Rocks among mosses. Northern and middle States, *Muhlenberg Catal.* 1818. Alabama, *Peters.* Arkansas, *The same.*—— Granules varying in size; and in some of the specimens, both northern and southern, they do not become isidioid; but I see no other differences.

15. *P. Wulfenii*, DC.; thallus cartilagineous and smooth, but becoming thicker and rugose-verrucose; sulphur-coloured, and pale; apothecia small to more than middling-sized, sub-sessile, depressed-hemispherical; the numerous black ostioles largely running together into a depressed, lecanoroid disk, bordered by a tumid, somewhat gibbous-flexuous thalline margin.

Spores in eights; $\frac{60-120}{25-45}$ mic.——*Fr. L. E. p.* 244. *Th. Fr. Scand. p.* 312. *Thelotrema hymenium, Turn. & Borr. Lich. Brit. p.* 185, *max. p. Pertusaria, Tuckerm. Syn. N. E. p.* 85. *Porina fallax, Ach. Syn. p.* 110, *a.*

Trunks. Northern and middle States, *Muhlenberg Catal.* 1818; *Halsey*, etc. California, *Bolander.*

Sub-Fam. 3.—URCEOLARIEI.

Apothecia typically urceolate, descending even to apparently Verrucariaceous forms; but in fact Lecanorine, which affinity is often sufficiently expressed.

XXXIV.—CÒNOTREMA, Tuckerm.

Apothecia urceolate, truncate-conoid; at length somewhat explanate, and patellæform; consisting of a black proper exciple clothed with an evanescent veil of the thallus. Spores cylindraceous, plurilocular, colourless. Spermatia oblong, straight; on simple sterigmas. Thallus crustaceous; uniform.

C. urceolatum (Ach.) Tuckerm.; thallus cartilagineous-membranaceous, smooth, becoming chinky and rugged; whitish; apothecia small, sub-sessile; more or less white-pruinose within. Spores long-cylindraceous; 30-40-locular; $\frac{100-160}{3-5}$ mic.——*Lecidea, Ach. L. U. p.* 671. *Gyrostomum, Fr., Tuck. Lich. exs. n.* 100. *Conotrema, Tuck. Syn. N. Eng. p.* 86; *Gen. Lich. p.* 129.

On trees. Northern and middle States (*Swartz*), Acharius *l. c.* 1810, *Muhlenberg*, etc. Illinois, *Hall.* Maryland and Virginia, *Tuckerman.* Mountains of South Carolina, *Ravenel.*—— Apothecia $0^{mm.}$, 5 to $1^{mm.}$ in diameter.

XXXV.—GYALECTA (Ach.) Anzi.

Apothecia urceolate-sub-biatorine, with a somewhat crenulate margin; consisting of a coloured (rarely black) proper exciple, connivent, or now explanate, margined or veiled by a lecanorine, or variously imperfect thalline one. Spores (in

narrowed and for the most part cylindraceous, not seldom more than 8-sporous thekes, with thread-shaped paraphyses) ellipsoid; passing into fusiform; and acicular; 2-4-plurilocular; and more rarely muriform-plurilocular; not coloured. Thallus crustaceous; uniform.

* *Secoliga emend. Apothecia coloured.*

† *Spores 2-4-plurilocular.*

1. *G. lutea* (Dicks.) Tuckerm.; thallus thin membranaceous; greenish-ash-coloured; apothecia small to almost, and, in the tropics, more than middling-sized, sessile; soon explanate and flat, or plano-convex; the pale-yellowish- or reddish-flesh-coloured disk scarcely at length surpassed by the paler, obsoletely radiate-striate margin. Spores fusiform-ellipsoid; bilocular; $\frac{6-11}{3-4}$ mic.——*Tuck. Gen. p.* 136. *Lecidea, Borr. in Hook. Brit. Fl.* 2, *p.* 185. *Nyl. Scand. p.* 192; *& in Prodr. N. G. p.* 53.

On bark, New England, *Tuckerman l. c.* 1872. New York, *Peck.* Illinois, *Hall.* Florida, *Austin.* Alabama, *Beaumont.* ——Varies no little in the size and coloration of the apothecia, as sufficiently shewn in the Cuba lichen (Wright Lich. Cub. n. 176, 177) and the New Granada one (Lindig n. 2581, 2596, 2627). ——*G. Friesii*, Koerb. (*G. denudata*, Th. Fr.) is not unlike, and has been referred here, but differs in its larger, 4-locular spores. ——The green cells differ finally more or less, in the present stock, from the ordinary gonidia, in being connected together in short strings; an observation first made by Bornet, and now taken advantage of by Dr. Müller to separate his genus *Biatorinopsis* (Müll. *Lich. Beitr.* n. 12, in *Flora*, 1881, n. 15) which he considers referable, together with *Cœnogonium* (*Flora*, 1881, p. 236) to the in every other respect widely discrepant *Graphidacei.* But the disposition of the gonidia in question appears not to be confined to this group of *Gyalectæ*; nor is it perhaps time, in the present state of knowledge of the gonimous system, to appreciate the value of the character.

2. *G. Pineti* (Schrad.) Tuckerm.; thallus thin, membranaceous; from green passing into lead-coloured, and pale-ash-coloured; apothecia minute, sessile, urceolate; yellowish-flesh-coloured; the rounded margin almost concolorous, scarcely striate. Spores fusiform-ellipsoid; bilocular; $\frac{10-14}{3-5}$ mic.——*Tuckerm. l. c.*

Lecidea, Borr. in Hook. Brit. Fl. 2, *p.* 183. *Nyl. Scand. p.* 191; *Lich. N. Caled. p.* 40.

On bark, etc., at the base of trees, Pennsylvania, *Muhlenberg Catal.* 1818. New England, *Frost*; *Willey*. New York, *Ravenel*. New Jersey, *Austin*.

3. *G. Valenzueliana* (Mont.) Tuckerm.; thallus thin, chinky, soon becoming densely granulate; glaucescent; apothecia minute, sessile, globular; consisting of a flesh-coloured proper exciple, clothed below by the thallus; connivent and radiately cleft above; and opening by a pore-like at length somewhat enlarged aperture, with a finally rounded, and blackening margin. Spores 12-30 in the thekes; ellipsoid; bilocular; $\frac{12\text{-}16}{6\text{-}8}$ mic. ——*Parmelia* (*Urceolaria*) *Mont. Cuba, p.* 205. *Gyalecta, Tuck. Calif. p.* 30. *G. asteria, Tuck. Obs. Lich.* 2, *l. c. p.* 414, *& in Wright Lich. Cub. n.* 173.——Apothecia $0^{mm.}$, 3 to 0^{mm}, 5 wide.

* *absconsa*, Tuckerm.; thallus uncertain; spores smaller, 4-locular; $\frac{10\text{-}14}{4\text{-}6}$.——*Gyalecta absconsa, Obs. Lich.* 2, *l. c. p.* 414.

On bark, *a*, Cuba, *Wright*. Cotoosa river, Florida, *Austin*. ——* on Red Maple, low country of South Carolina, *Ravenel*. The specimens of this last are very meagre, and it is hard to say whether the thallus belong not entirely to the accompanying *Arthonia spectabilis*. Spores finally numerous in the thekes, as in *a*, but smaller, and always 4-locular. The lichen is insufficiently known.——*G. radiatilis*, Tuckerm. Calif. p. 30, is a still more minute apothecium exceedingly like that of *G. Valenzueliana* (being globular, from flesh-coloured becoming black, connivent and radiately cleft above; but with simple spores in eights, and giving no reaction with iodine), which infests (in New England always) a white thallus with little doubt to be referred to *Pertusaria multipuncta*; as the parasitic fruit to Fungi. It is easy, with the scanty material in hand, to suppose that *G. absconsa* may, in like manner be only parasitic on the thallus of *Arthonia spectabilis*; but there is no doubt of the close relation of the former to *G. Valenzueliana*, which is in every point of view a lichen.

4. *G. geoica* (Wahl.) Ach.; thallus obscure, somewhat powdery; pale-greenish-ash-coloured; apothecia minute, immersed becoming superficial, urceolate; the elevated, radiously uneven, pale margin enclosing a yellowish-brown disk. Spores oblong-

ellipsoid; 4-locular; $\frac{12\text{-}20}{5\text{-}7}$ mic.——*Syn. p.* 9. *Th. Fr. Lich. Arct. p.* 139. *Nyl. Scand. p.* 190.

* *trivialis*, Willey *herb.*; apothecia very small, and always immersed.

On sandy earth and about walls (*). New Bedford, *Willey*. Illinois, *Wolf.*——The larger European lichen has not occurred; but ours, measuring about $4^{mmm.}$ in diameter is hardly distinct from it.

5. *G. carneo-luteola*, Tuckerm.; thallus very thin, leprous; whitish; apothecia minute, adnate, explanate; the flat, yellowish-flesh-coloured disk but little surpassed by the rounded, entire, paler proper margin. Spores in sixes and eights; fusiform-ellipsoid; bilocular passing into 4-locular; $\frac{12\text{-}16}{4\text{-}6}$ mic.——*Obs. Lich.* 3, *l. c. p.* 271.

On bark in the island of Cuba, *Wright*; and to be looked for in Florida. Resembles the European *G. carneo-lutea*, but has higher-coloured fruit of only one-third the size (about $0^{mm.}$ 25–$0^{mm.}$ 4) and an entire margin. The specimen is however small.

6. *G. nana*, Tuckerm.; thallus very thin, chinky; glaucescent and white; apothecia very minute, innate-emergent, concave; the elevated margin of the originally somewhat crenate proper exciple rounded, pale; the disk brownish-flesh-coloured. Spores 8-12 in the thekes; fusiform; 4-6-locular; $\frac{14\text{-}22}{4\text{-}6}$ mic.——*Obs. Lich.* 2, *l. c. p.* 415.

On bark, Island of Cuba, *Wright*; and to be expected where the last preceding species occurs.——Apothecia $0^{mm.}$, 2 to $0^{mm.}$, 3 wide.

7. *G. fagicola* (Hepp.) Tuckerm.; thallus very thin, chinky; pale greenish or brownish; or obsolete; apothecia minute, at length sub-sessile, concave; from pale- becoming rusty- and dark-red, and blackening; the scarcely uneven margin mostly concolorous. Spores 8-12-20 in the thekes; acuminate-fusiform; 4-10-locular; $\frac{14\text{-}40}{3\text{-}6}$ mic.——*Biatora, Hepp., fide Arn. in Flora. Secoliga, Koerb. Parerg. p.* 112. *Gyalecta corticola, (Lönnr.) Tuckerm. Gen. Lecidea congruella, Nyl. Scand. p.* 191, *fide Ohlert. Gyalecta ceratina, Tuckerm. Obs. Lich.* 2, *l. c. p.* 415.

On bark. Ash- and Elm-bark, Amherst, *Tuckerman l. c.* 1862. Red Cedar, New Bedford, *Willey*.

† † *Spores muriform.*

8. *G. Flotovii*, Koerb.; thallus thin, powdery; whitish; or obsolete; apothecia minute, adnate, urceolate; the disk flesh-coloured; the coarctate, pale, sub-crenulate margin soon rounded. Spores in eights; rounded and ovoid; from 4-locular (the cells disposed crosswise) becoming muriform-plurilocular; $\frac{12\text{-}16}{8\text{-}10}$ mic. ——*Koerb. Syst. p.* 171. *Lecidea Querceti*, *Nyl. Scand. p.* 191, *fide Ohlert.*

On bark, Amherst, *Tuckerman Gen.* 1872. Not a *Secoliga*, as defined by Koerber (*Parerg.* p. 109) but notwithstanding nearest to *G. abstrusa* (*Secoliga* Koerb. *l. c.*) the spores of which pass at once (Zw. *exs.* n. 90. Hepp. *exs.* n. 27) into more or less muriform conditions, sometimes closely comparable with the spores of the present.

9. *G. cupularis* (Hedw.) Schær.; thallus thin, at length chinky; greenish-ash-coloured; apothecia superficial, urceolate becoming more open; disk pale-brick-red; the white margin radiately striate or cleft, but at length rounded. Spores in eights; ellipsoid; $\frac{15\text{-}20}{7\text{-}10}$ mic.——*Schær. Spicil. p.* 79. *Nyl. Scand. p.* 189.

Lime-rocks. Pennsylvania, *Muhlenberg Catal.* 1818. New York, *Halsey*. Vermont, *Russell*. Alabama, *Peters*.——So far as seen, our lichen has always small, pale, urceolate fruit, which is scarcely cleft above, and is best comparable with Fr. *Lich. Suec.* n. 401, in my copy: that of the European plant becomes however much larger, more open, and with higher-coloured disk, and the radiately-cleft margin is now very marked.

* * *Sagiolechia. Apothecia black.*

10. *G. rhexoblephara* (Nyl.) Tuckerm.; thallus very thin; whitish, or obsolete; apothecia small to middling-sized, closely sessile, explanate, the flat disk dark-rufous and blackening; the thick, elevated, persistent, black margin radiately cleft. Spores in eights; fusiform-ellipsoid; 4-locular; $\frac{18\text{-}22}{6\text{-}8}$ mic.——*Gyalecta, Tuckerm. Gen. p.* 132. *Lecidea*, *Nyl. Scand. p.* 240. *Rhexophiale coronata*, *Th. Fr. Lich. Arct. p.* 204.

On the earth, growing over mosses, etc., Greenland (*Vahl*), Th. Fries *l. c.* 1861. Islands of Behring's Straits, *Wright*.—— The place of this curious lichen may perhaps be taken for satisfactorily determined (as is suggested in the present writer's observations above-cited) by that of *G. protuberans* (Ach.) Anz.;

as that is brought in accord with other *Gyalectæ* by *G. lecideopsis*, Mass., and *G. leucaspis*, Krempelh., compared with *G. carneolutea*, and *G. cupularis*.

XXXVI.—URCEOLARIA.

Apothecia urceolate-scutellæform; consisting of a connivent, black proper exciple at length for the most part explanate, the margin of which is finally discrete from the lecanorine (rarely obsolete) thalline one. Spores ovoid-ellipsoid; muriform-plurilocular; brown. Spermatia oblong, or staff-shaped; on sub-simple sterigmas. Thallus crustaceous; uniform.

1. *U. scruposa* (L.) Nyl.; thallus tartareous, areolate-verrucose becoming rugose-plicate; glaucous, ash-coloured, or now white; apothecia from immersed becoming superficial, and from small to more than middling-sized, scutellæform finally explanate; black; the disk gray-pruinose; the more or less denticulate proper margin hidden by the tumid thalline one; or the latter disappearing and the former prominent and incrassated. Spores $\frac{20\text{-}38}{10\text{-}14}$ mic.——*Nyl. Scand. p.* 176. *Th. Fr. Scand. p.* 302.

On rocks, and on the earth (when calcareous, the thallus becoming white and mealy—v. *gypsacea*, Nyl.) growing also over mosses, etc. (and now on *Cladoniæ*, without thallus—v. *parasitica*, Sommerf.), throughout our territory; *Muhlenberg Catal.* 1818. Arctic America, *Richardson*. Kansas, *Hall*. Nebraska, *Hayden*. Rocky Mountains, *Hall*. South Carolina, *Ravenel*. New Mexico, *Fendler*. California, *Bolander*. Oregon, *Hall*.

2. *U. actinostoma*, Pers.; thallus tartareous, originally smoothish, then chinky and breaking finally into areole-like portions; grayish-ash-coloured and whitish; apothecia minute, immersed; a black, always connivent proper exciple, with a radiately striate, gray-pruinose margin bordering a pore-like at length a little extended aperture; disk black; thalline margin deficient. Spores broad-ellipsoid; $\frac{18\text{-}25}{12\text{-}20}$ mic.——*Verrucaria, Ach. L. U. p.* 288. *Parmelia* (*Urceolaria*) *striata, Fr. L. E. p.* 192.

Rocks. Connecticut (*Wright*), Tuckerman *Gen.* 1872. Kansas, *Hall*. South Carolina, *Ravenel*.

XXXVII.—THELOTREMA (Ach.) Eschw.

Apothecia urceolate, very various, but illustrating by their modifications the scutellæform type; consisting of a variously coloured proper exciple, with somewhat torn margin, which is concrete with a (now obsolete) thalline one, and includes a disciform or nucleiform hymenium, itself clothed more or less with an interior exciple, or veil. Spores from ellipsoid often oblong; bi-plurilocular; or muriform-multilocular; brown or decolorate. Spermatia scarcely known. Thallus crustaceous, uniform.——A certain luxuriance of difference is observable in the characters of this as of other intertropical groups, which, while little was known of them, were taken to indicate more than a few genera and species. But, with advance of knowledge, it has become clear that the strongest structural contrasts of *Thelotrema*, as here taken, find their sufficient reconciliation within the group; and that it is from this larger point of view that (as elsewhere so here) we best observe and follow Nature. As respects our own handfull of species it should yet be said that much is doubtless to be added to it from the extreme southern States; and that, at any rate, all attempt at an arrangement in sections must, for the present, be only provisional. Some illustration of the above remarks may be found in the writer's *Genera Lichenum*, pp. 135–139.

* *Spores bi-pluri-locular with entire spore-cells, colourless for the most part but not always; and finally brown in* 5.

1. *T. microporum*, Mont.; thallus cartilagineous, chinky; glaucescent; apothecia minute, immersed, urceolate, open; a white interior exciple concrete for the most part with, and not exceeding the thallus, bordering a pale-flesh-coloured disk; thalline exciple obsolete. Spores ellipsoid; 4-locular; $\frac{12\text{-}14}{6\text{-}8}$ mic. ——*Mont. in Ann. Sci.* 3, 12, 130; *Syll.* 36.

Bark of *Magnolia grandiflora*, Gainesville, Florida, *Ravenel.* ——Differs from the *T. microporum* published by me in *Lich. Cub.* n. 124, which is exactly Montagne's plant (*Herb.* Junghuhn) much as the *T. album* of *Lich. Cub.* n. 127: but the specific distinctness of the two Cuba lichens is not clear; any more

than that of the *T. album* of Nyl. *Syn. N. Caled.* p. 36, from the *T. microporum* of the same place. *Myriotrema*, Fée *Exs.* p. 103, with its two supposed species, covers probably precisely the same ground as Montagne's species, and is an older arrangement; but Montagne first really understood and described the plant.

2. *T. lathræum*, Tuckerm. *in litt.*; thallus thin-membranaceous; glaucescent; apothecia very minute, immersed, open; the softish, white interior exciple discrete from the thallus, bordering with an elevated, rounded margin, a blackening disk; the exterior exciple deficient. Spores oblong; 6-9-locular; $\frac{16\text{-}28}{4\text{-}6}$ mic.

On various trees, Cotoosa river, Florida, *Austin.*——Apothecia barely $0^{mm.}$, 1 in diameter: those of the next following species, reach $0^{mm.}$, 8.

3. *T. subtile*, Tuckerm.; thallus membranaceous, smoothish, becoming chinky, or at length powdery; glaucescent, cinerascent now quite dark, or white; apothecia immersed becoming superficial, small to minute, depressed-hemispherical and difform, open; interior exciple discrete, lax, its white, thin margin which encloses the flat, blackening, white-pruinose disk much surpassed by the exterior exciple. Spores fusiform-oblong; 8-16-locular; $\frac{16\text{-}54}{6\text{-}14}$ mic.——*Suppl.* 1, *l. c. p.* 426. *T. bicinctulum*, *Nyl. Lich. N. Caled. in Ann. Sci.* 4, 15, *p.* 46.

On various trees, New England (*Frost*), Tuckerman *l. c.* 1858. Virginia, *Tuckerman.* South Carolina, and Georgia, *Ravenel.* Alabama, *Beaumont.* Texas, *Ravenel*; *Hall.*

4. *T. granulosum*, Tuckerm.; thallus cartilagineous, smooth, verrucose-granulate; glaucescent; apothecia small, depressed-hemispherical, adnate, granulate, with an ample aperture; the margin of the exterior exciple elevated and at length acute; the depressed disk black, concealed by a white, crustaceous, finally perforated veil. Spores oblong-ellipsoid; 6-10-locular; $\frac{20\text{-}24}{6}$ mic.——*Suppl.* 1, *l. c. p.* 426.

On Bald Cypress, Louisiana (*Hale*), Tuckerman *l. c.* 1858. Florida, *Austin.*——The proper exciple, constituting the interior part of the exterior one, brown or blackening; often at length more or less visible at the margin. Apothecia of about the size of those of *T. subtile.*

5. *T. Domingense* (Fée; Nyl.) Tuckerm.; thallus cartilagineous, smoothish, becoming wrinkled and granulate; glaucescent, passing now into brownish-cream-coloured; or now white; apothecia small to almost middling-sized, adnate, globular, at length depressed; more or less thickened; urceolate; aperture poriform, obtusely margined by the exterior exciple, through which the toothed border of the black proper exciple finally protrudes; disk colourless, without interior exciple. Spores solitary, or in twos; fusiform; 20-40-locular; $\frac{120\text{-}190}{25\text{-}30}$ mic., fuscescent or colourless.——*Tuckerm. Gen. p.* 137. *Ascidium* (*Fée*) *Nyl. Enum. Gen.*; *& in Prodr. N. Gran. p.* 50.

b. rhodostroma, Nyl.; the white interior of the exciple becoming rose-coloured.——*Nyl. l. c. Ascidium, Mont. Guy. n.* 46, *t.* 16, *f.* 4.

On various trees, Mississippi (*Dr. Veitch*), Tuckerman *l. c.* 1872. South Carolina, *Ravenel.* Florida, *Austin.*——*b*, Louisiana, *Hale.* Georgia, *Ravenel.*——Ascidium, as understood by Montagne, the chief illustrator of this type, offers nothing to distinguish it generically from his *Thelotrema depressum* but the at length doubtless marked thickening of the thalline portion of the exterior exciple; and it is perhaps easier to refer the type to the present genus, than, with Nylander, to undertake to make the cited *Thelotrema* into an *Ascidium.*

* * *Spores muriform-plurilocular, brown.*

6. *T. interpositum* (Nyl.) Tuckerm. *herb.*; thallus thin, uneven; glaucescent and pale-cream-coloured; apothecia of the size of the last, superficial, globular; scarcely thickened; urceolate; the poriform aperture bordered obtusely (much as in the last preceding) by the exterior exciple; the black disk covered thickly by a white veil, contrasting in section with the thick, black proper exciple. Spores solitary or in twos; fusiform; the transverse series of spore-cells about forty, of about six members each, in the middle; $\frac{125\text{-}184}{28\text{-}42}$ mic.——*Ascidium, Nyl. in Prodr. N. Gran. p.* 50, *note.*

On bark, Texas, *Hall.* An *Ascidium*, like the last species; from which it more especially differs in the spores. *Thelotrema postpositum*, Nyl. (*in litt.* 1864; before referred by him to his *T. monosporum, Prodr. N. Gran.* p. 46), a Louisiana lichen (*Hale*), has a little smaller fruit, in the scanty specimen received, but is otherwise undistinguishable.

7. *T. lepadinum*, Ach.; thallus commonly thin-membranaceous and smoothish, but becoming thicker, wrinkled and dull; whitish, and cream-coloured; apothecia superficial, small to almost middling, truncate-conoidal; or also depressed and at length urceolate-scutellæform; interior exciple lax, persistent; as is normally the exterior one; disk blackening above, white-pruinose. Spores solitary; or in twos, threes, and fours; fusiform; the transverse series of spore-cells about thirteen to twenty, of two to five members, the smaller-sized spores $\frac{25-50}{6-8}$; the larger and fewer $\frac{54-126}{15-20}$ mic.——*L. U. p.* 312. *Fr. L. E. p.* 428. *Koerb. Syst. p.* 330.

Trees, Arctic America (*Richardson*), Hooker *l. c.* 1823. New England, rare, *Tuckerman*; *Willey*. Low country of South Carolina, *Ravenel*. Louisiana, *Hale*. California, *Bolander*. Oregon, *Scouler*; *Hall*.——Exterior exciple often pale-brownish, indicating the presence of a thin, brown proper exciple, constituting the inner side of the other, but now apparently obsolete; as is also rarely the whole exterior exciple (Louisiana, *Hale*). Interior exciple, in a depressed form of the fruit, now doubled (f. *diploloma*, South Carolina, *Ravenel*).

8. *T. leprocarpum* (Nyl.) Tuckerm.; thallus very thin, uneven; glaucescent; apothecia middling-sized, innate, dilated; rounded and difform; the exterior margin irregularly reflexed and cleft; and, as well as the flat, colourless disk, white-powdery; interior exciple deficient. Spores solitary, or in twos, or fours; oblong; the transverse series of spore-cells ten to fourteen, of four to five members in the middle, $\frac{50-80}{8-20}$ mic.——*Gen. Lich p.* 139. *Graphis, Nyl. in Prodr. N. Gran. p.* 85.

On Bald Cypress, Louisiana (*Hale*), Tuckerman *Gen.* 1872. ——The high authority of Nylander in *Graphidacei* gives a peculiar weight to his reference of this lichen, but appears still insufficient to obscure its affinity to the *Thelotrema leucastrum* of the present writer's *Obs. Lich.* 3, *l. c.* p. 269, or of the latter to the *T. platycarpum* and *T. platycarpoides* of the same memoir.

9. *T. Auberianum*, Mont.; thallus membranaceous-cartilagineous, chinky, rugulose, or granulate; greenish-glaucescent, and brownish-cream-coloured; apothecia innate becoming superficial, small to middling-sized, rounded and variously difform and confluent; the elevated exterior exciple from rounded

above at length sharp and uneven, shewing more or less at the edge the brown proper exciple, and finally reflexed; the blackening disk concealed by a crustaceous, perforated white veil. Spores ellipsoid and oblong; the transverse series of spore-cells four to six, the cells more or less divided; $\frac{16\text{-}24}{8\text{-}10}$ mic.——*Mont. Cuba, p.* 163, *t.* 8, *f.* 2.

Trees, Florida (*Austin*), Tuckerman *Gen.* 1872.——The species, as understood by the writer, is in part exhibited in Wright Lich. Cub. n. 145, 146, 147. According to this view it must include *T. Auberianoides*, Nyl. *N. Gran.* p. 43, & Lindig *Herb.* n. 2711, differing only in the spores being decolorate; *T. epitrypum*, Nyl. *l. c.* p. 49, Wright *Cub.* n. 147, considered also to differ in the spores, which a larger view of these organs scarcely confirms; and *T. metaphoricum*, Nyl. *l. c.*, & Lindig herb. n. 2814, which is certainly undistinguishable from admitted conditions of Montagne's species.

10. *T. Santense*, Tuckerm.; thallus sub-tartareous, incrassated, rugulose, beset, more or less, with finger-shaped excrescences; glaucescent, ash-coloured, or dark-gray; apothecia small to middling-sized, innate, urceolate-scutellæform; the dilated, flat disk black, thinly white-pruinose; the elevated exterior exciple incurved, torn-crenate; the interior one deficient. Spores ellipsoid, the transverse series of spore-cells three to five, the cells irregularly divided; $\frac{14\text{-}28}{7\text{-}12}$ mic.——*Obs. Lich.* 2, *l. c. p.* 406.

Elm-trunks, low country of South Carolina (*Ravenel*), Tuckerman *l. c.* 1862. In Southern Alabama, *Beaumont.*

11. *T. glaucescens*, Nyl.; thallus cartilagineous, incrassated, punctulate; glaucescent, and pale ash-coloured; apothecia very small to minute, innate, variously difform; and scarcely bordered except by the lax, white interior exciple; but becoming dilated and sub-scutellæform, and the flat, black, thinly white-pruinose disk margined at length by an elevated and sub-crenate thalline border, with which the thickened interior exciple is concrete. Spores ellipsoid; the transverse series of spore-cells commonly four, irregularly divided, $\frac{10\text{-}16}{6\text{-}10}$ mic.—— *Prodr. N. Gran. p.* 47, *note.*

Trunks and rocks in the low country of South Carolina, Georgia, and Florida (*Ravenel*), Nyl. *Prodr. N. Gran.* 1864. Alabama, *Beaumont.* Louisiana, *Hale.* As also in Cuba,

Wright.——The lichen is very near to *T. compunctum* (Sm.) Nyl. (Wright *Lich. Cub.* n. 152; Lindig *Herb. N. Gran.* n. 2855), but differs in the ultimate development of its fruit, and distinctly smaller spores. The white exciple which is so conspicuous in the dilated condition of the apothecium is clearly identical, as respects at least its interior portion, with the interior exciple which makes the only visible envelope in *T. compunctum*, however undistinguishable finally from the thallus. I see no reason to question this view (*Genera Lichenum*, p. 136) which applies to not a few other species in which the interior exciple has been wrongly taken for the proper exciple.

12. *T. Wightii* (Tayl.) Nyl.; thallus coriaceous-cartilagineous, smooth but minutely rugulose; greenish-glaucescent and cinerascent; shewing, in section, scarlet particles here and there within; apothecia very minute, included in the thallus; and offering only a pore-like aperture bordered by the entire, pale interior exciple which is concrete with the thallus. Spores rounded and ellipsoid; dark-brown; the transverse series of spore-cells about four, soon irregularly disposed; $\frac{12\text{-}26}{12\text{-}16}$ mic.—— *Endocarpon, Tayl. in Hook. Journ. Bot.* 1847, *p.* 155. *Thelotrema, Nyl. N. Gran. p.* 50, *& in Herb. Lindig n.* 2662. *T. Ravenelii, Tuckerm. Suppl.* 1, *l. c. p.* 426.

Trunks, low country of South Carolina to Texas (*Ravenel*), Tuckerman *l. c.* 1858. Louisiana, *Hale.*

12(*b*). *T. Ravenelii* (Tuckerm.) Nyl.; thallus thinner for the most part, and without the scarlet particles of the preceding; apothecia perhaps a little larger and more open; and the excipular margin blackening. Spores pale-brown; oblong-ellipsoid; narrower; the transverse series of spore-cells commonly six to eight; $\frac{14\text{-}22}{7\text{-}10}$ mic.——*Nyl. N. Gran. p.* 50, *note. Tuckerm. Gen. p.* 139.

Trunks, South Carolina (*Ravenel*), Nylander *l. c.* 1864. Alabama, *Beaumont.*——Close enough to *T. Wightii*, but offering the differences noted.

XXXVIII.—GYROSTOMUM, Fr.

Apothecia from urceolate becoming explanate; either orbicular or oblong; consisting of a black proper exciple with entire margin, clothed more or less with a finally dis-

appearing thalline veil. Spores ellipsoid; muriform-plurilocular; brown. Spermatia not seen. Thallus crustaceous; uniform.

G. scyphuliferum (Ach.) Fr.; thallus cartilagineous, smoothish; greenish-ash-coloured becoming olivaceous-brown, deepening into lead-colour; apothecia small to minute, sessile or often a little elevated; rounded passing into lirellæform; the rather elevated proper margin radiously striate or entire, bordering a brown, powdery disk; itself thinly more or less marginate. Spores in fours, sixes, and eights; oblong-ellipsoid; the transverse series of spore-cells six to ten, of two to three members, $\frac{20\text{-}42}{10\text{-}16}$ mic.——*Fr. S. O. V. p.* 268. *Nyl. in Prodr. N. Gran. p.* 50; *Syn. n. Caled. p.* 39. *Tuckerm. Gen. p.* 140. *Lecidea, Ach. Syn. p.* 27.

Trees and shrubs. South Carolina, Florida and Texas (*Ravenel*), Tuckerman *Gen.* 1872. Louisiana, *Hale.*——The radious grooving of the proper exciple reminds one of a characteristic feature of *Gyalecta*; but the triple envelopes of the fruit point rather to the type of *Thelotrema*, which also varies in directions pointing towards *Graphis*.

Trib. II.—LECIDEACEI.

Apothecia free, rounded, patellæform, open, becoming more or less convex, or cephaloid; the disk bordered by a proper exciple; the thalline exciple of the first Tribe normally deficient here.

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Fam. 1.—CLADONIEI.

Thallus two-fold; a horizontal one, squamulose or granulose (now obsolete); and a vertical, caulescent one, becoming shrub-like (podetium).

XXXIX.—STEREOCAULON, Schreb.

Apothecia patellæform; solid. Spores fusiform, or acicular; 4-plurilocular; colourless. Spermatia from oblong becoming oftener staff-shaped; or acicular; on simple sterigmas. Podetia shrub-like, erect, solid; clothed more or less with certain granules (*phyllocladia*); which become squamiform, or pass into coralloid branchlets; being also now extended, at the base of the podetia, into a horizontal crust.——For the anatomy of the thallus see Schwendener *Untersuch. l. c.* 2, *p.* 173, *t.* 7, *f.* 10, 11. That remarkable and common excrescence of the thallus which Nylander has considered, under the name of *cephalodium*, in his *Syn.* p. 231, etc., has been further examined by Dr. Th. Fries (*Flora*, 1868) and lastly by Schwendener (*Die Algentypen d. Flechtengonid.* p. 16, 27, 33); but remains still unexplained.—— For the distribution of *Stereocaulon* see *Gen. Lich.* p. 144.

* *Eustereocaulon. Phyllocladia always present.*

1. *S. ramulosum* (Sw.) Ach.; podetia tufted, erectish, sparingly for the most part and irregularly long-branched; continuously at first corticate-granulate at least at the summits, and now also tomentose; phyllocladia ashy-gray, and whitish, pass-

ing into at length crowded, short branchlets, which are now deficient below, and the finally thickened podetia quite naked (these conspicuously beset everywhere with stalked, pale, pitted cephalodia); apothecia terminal; smallish to middling-sized; soon globular. Spores from fusiform soon acicular, 4-8-plurilocular; and varying also greatly in size, from about 30 much exceeding 100 mic. in length, and from 3 to 6 mic. in width.—— *Ach. L. U. p.* 580; *& in Sw. Lich. Amer. t.* 14. *SS. ramulosum, vimineum, implexum, claviceps, & piluliferum, Th. Fr. Mon. Stereoc. p.* 24. *SS. ramulosum, proximum, mixtum, &c., Nyl. Syn. p.* 235.

Pico de Orizaba, and other mountains of Mexico, *Liebmann e* Th. Fr. *l. c.*——The examination of my numerous specimens of this stock, from South America, Polynesia, Australia, and Asia, leaves me without doubt that the earlier, presumably larger conception of the species by the first describers is clearly the natural one; and should be returned to. Dr. Nylander has indeed already (*l. c.*) reduced the new species of this group proposed by Dr. Th. Fries; as the latter author, for his part, has well disallowed Nylander's discriminations based on the differences in constitution of the cephalodia. The species (as here received) is much the noblest of all; and as might be expected from its geographical range, varies into not a few marked forms, from less than one to more than five inches in height, and more or less tufted and branching; with no little diversity, as has been noted, in the spore-measurements; but is always distinguishable by the strigose podetia, to which it owes its name; its soon globular apothecia; and its curious cephalodia. ——A specimen of the present species in *Herb. Taylor*, is marked "North America, Mr. J. Bradbury"; and Dr. Fries finds specimens, in *Herb. Swartz*, of the var. *macrocarpum*, Bab., which are said to have been collected in North America, by Menzies; but both references must be considered doubtful.

2. *S. coralloides*, Fr.; podetia smallish, rather compressed, densely tufted; for the most part digitately-divergent; much branched especially above, smooth and naked below; the more or less scattered phyllocladia grayish-white, passing into digitately divided, corallinoid, finally crowded branchlets; (cephalodia sessile, warted, soon bluish-gray;) apothecia commonly smallish, lateral, and often heaped; but occurring now also

terminal, solitary and dilated. Spores sub-fusiform-acicular, commonly 4-locular, $\frac{22\text{-}38}{2\frac{1}{2}\text{-}4}$ mic.——*Fr. L. E. p.* 201 (*corallinum*). *Tuck. Lich. exs. n.* 94. *Th. Fr. Mon. p.* 35; *Scand. p.* 44. *Nyl. Syn.* 1. *p.* 241.

Rocks, in the New England mountains, *Tuckerman* Syn. N. E. 1848. Arctic America (Franklin's 1st Voy.), *Hooker herb.* Vancouver's Island, *Macoun.* Mountains of South Carolina, *Buckley.*

3. *S. paschale* (L.) Fr.; podetia at length longish, but lax, commonly rather slender, many crowded together but not cæspitose-conjoined; rather compressed; somewhat tomentose or now almost naked; much branched; phyllocladia glaucescent, and ash-coloured, passing into short, squamaceous and crenate branchlets; (cephalodia as in the last;) apothecia subterminal; somewhat dilated; flattish. Spores much as in the last.——*Fr. L. E. p.* 202. *Tuck. Lich. exs. n.* 112. *Th. Fr. Mon. p.* 57; *Scand. p.* 46. *Nyl. Syn.* 1, *p.* 242.

On the earth, and on stones, in the mountains of New England, *Tuckerman* Syn. N. E. 1848. Canada, *Agassiz*; *Macoun.* Arctic America, *Herb. Hooker*; *Herb. Spreng.*, etc. Northwest Coast, *Lyall.*

4. *S. tomentosum* (Fr.) Th. Fr.; podetia stout; rounded, loosely tufted, or now sub-solitary; the divergent branches much divided above; densely white-tomentose; phyllocladia from greenish- at length grayish-white, squamaceous, blunt-toothed, at length finger-lobed, crowded on the upper side, but almost wanting on the under; (cephalodia as in the last). Apothecia lateral; small to minute. Spores as in the preceding, or now a little narrower.——*Fr. L. E. p.* 201. *Tuck. Lich. exs. n.* 23. *Th. Fr. Mon. p.* 50; *Scand. p.* 48. *Nyl. Syn.* 1, *p.* 243.

b. alpinum, Th. Fr.; more or less dwarfed; and less constantly tomentose; the phyllocladia glaucous-white, becoming wart-like especially above; the apothecia commonly terminal; and dilated.——*Th. Fr. l. c. S. alpinum*, *Laur. in Fr. L. E. p.* 204.

On the earth, New England mountains, *Tuckerman* Syn. N. E. 1848. Canada, *Agassiz.* Arctic America (Franklin's 1st Exp.), *Hooker herb.*, etc. Rocky Mountains, *Bourgeau.* Brit-

ish Columbia, *Macoun.* Alaska, *Dr. Kellogg.*——*b*, Greenland, *Vahl*, *e* Th. Fr. l. c. 1861. Elsewhere in Arctic America, *Herb. Hook.* Islands of Behring's Straits, *Wright.* Islands of Cumberland Gulf, *Howgate* exp. Summit of Mt. Hood, *Hall.* Mountains of Mexico, *Nylander.*

5. *S. denudatum*, Floerk.; podetia smallish and rather slender, loosely, or now often densely cæspitose, and fastigiately much branched; smooth throughout, and naked below; phyllocladia grayish-white, squamaceous, rounded and crenate, becoming turgid, nodulose, and confluent-irregular; (cephalodia conspicuous, otherwise much as in the last, but olivaceous-brown, and blackening;) apothecia minute, flat. Spores as in the last.——*Fr. L. E. p.* 204. *Tuck. Lich. exs. n.* 114. *Th. Fr. Scand. p.* 50. *Nyl. Syn.* 1, *p.* 247.

Rocks. Greenland, *Dillenius Hist. Musc.* 1741. Newfoundland, *Despreaux.* New England, *Tuckerman.* New Jersey, *Austin.* Pennsylvania, *Dillenius.* Alaska, *Dr. Kellogg.*

6. *S. condensatum*, Hoffm.; podetia short, and now deficient, for the most part simple, delicately tomentose; phyllocladia glaucous, verrucose-sub-squamulose passing into blunt branchlets, densely clothing the podetia; and collected also at their base into a horizontal crust; (cephalodia as in the last; from livid-ash-coloured becoming dark-olivaceous;) apothecia terminal; smallish to middling-sized; heaped and confluent; or dilated. Spores acicular, 4-locular, $\frac{20\text{-}36}{2\text{-}3}$ mic.——*Schær. Enum. p.* 178. *Tuck. Lich. exs. n.* 113 (*rupicolis excl.*). *Koerb. Syst. p.* 13. *Th. Fr. Scand. p.* 52.

On the earth in gravelly soil on the coast of Massachusetts, *Tuckerman* Syn. N. E. 1848.

7. *S. pileatum*, Ach.; podetia short, erect, sparingly, but at length fastigiately branched above; smooth; phyllocladia glaucous and ash-coloured, verruculose, passing into corallinoid branchlets, with all the summits now sorediiferous; crowded at the base of the podetia into a horizontal crust; (cephalodia as in the last;) apothecia terminal; middling-sized; pileate. Spores obtusely fusiform, 4-locular, $\frac{20\text{-}32}{3\frac{1}{2}\text{-}4\frac{1}{2}}$ mic.——*Lich. Univ. p.* 582. *Th. Fr. Scand. p.* 51. *S. cereolus, Schær. Enum. p.* 178. *S. cereolinum, Koerb. Syst. p.* 14. *S. condensatum pro p. Fr. L.*

E. p. 203, *Tuck. Syn. N. E. p.* 46; *Exs. n.* 113, *pr. p. Nyl. Syn. p.* 250 *.

Granitic rocks in the mountains of New England, *Tuckerman* Syn. N. E. 1848. Grand Menan, Maine, *Willey.*

8. *S. nanodes*, Tuckerm.; podetia short and slender, cæspitose-conglomerate; divergently branched from below and more or less fastigiately divided above; smooth; phyllocladia glaucous becoming ash-coloured, globular often powdery, but confluent above into squamiform extensions lending a sub-foliaceous character to the commonly flattened podetia; (cephalodia much as those of the last;) apothecia terminal; dilated. Spores staff-shaped and acicular, 4-locular, $\frac{25\text{-}40}{2\frac{1}{2}\text{-}3}$ mic.——*Suppl.* 2, *l. c. p.* 201. *Nyl. Syn. p.* 251.

Rocks along streams. White Mountains, *Tuckerman l. c.* 1848.

9. *S. albicans* (Th. Fr.) Nyl.; podetia small, very slender, softish, and fragile, cæspitose; sparingly fastigiate-branched; delicately tomentose; white, but blackening below; phyllocladia glaucous-white, minute, rounded, dull, soon powdery, scattered, mostly toward the summits; apothecia unknown.——*Nyl. Syn. p.* 252. *S. tenellum, Tuck. in Bot. Wilkes Voy., p.* 123, *t.* 2, *f.* 2.

Rocky Mountains in Colorado, *Brandegee*, comm. Sprague. Guadalupe Island, Lower California, *Palmer*, comm. Willey. ——Representing here S. *nanum* of Europe; and like that apparently always an imperfect organism.

* * *Phyllocaulon. Phyllocladia obsolete.*

10. *S. Wrightii*, Tuckerm.; podetia short, densly cæspitose, ascendant; sparingly branched from the blackening base; dilated above into cut-crenate, lobe-like, greenish segments with inflexed, crisped, white margins; tomentose on the under side; (cephalodia conspicuous, pulvinate, granulose, olivaceous, and blackening;) apothecia unknown.——*Suppl.* 2, *l. c. p.* 202.

Rocks; islands of Behring's Straits, *Mr. Wright.* Very marked as are the features of this lichen, the development of the summits is in fact not ill comparable with the final condition of those of *S. nanodes*. The gonimia of the cephalodia occur in nodules, from rounded-oblong at length difform-elongated, resembling those of *S. Colensoi*, as exhibited in Nyl. *Syn. t. VII., f.* 8.

XL.—PILOPHORUS, Th. Fr.

Apothecia cephaloid; solid; black. Spores ellipsoid; simple; colourless. Spermatia staff-shaped; on sub-simple sterigmas. Podetia simple or but little branched; originally solid; clothed with wart-like granules (phyllocladia) which are collected also into a crust at the base.——The distinctness of this type is manifest; as is its very close affinity to *Stereocaulon*.

P. cereolus (Ach.); podetia erect, rigid, sub-cylindrical, for the most part simple; phyllocladia minute, roundish becoming flattened and squamiform, from green at length ash-coloured; (cephalodia from sub-globose at length flattened; wrinkled, and granulate; and from livid reddish-brown, and darkening;) apothecia terminal. Spores $\frac{16\text{-}23}{5\text{-}8}$ mic.——*P. acicularis*, *Tuck. Gen. p.* 146.

a. Fibula, Tuck.; podetia solid, from very short, and even obsolete, at length equalling those of *c*, simple; (cephalodia at length explanate, and finely granulate, olivaceous-brown;) apothecia globose-depressed.——*Stereocaulon Cereolus*, *Ach. Meth. p.* 316; *L. U. p.* 582. *Borr. in E. Bot. Suppl. t.* 2667, *fide Taylor herb.! S. Fibula*, *Tuck. Syn. N. E. p.* 46. *Pilophoron*, *Tuck. Suppl.* 1, *p.* 42. *Nyl. Syn.* 1, *p.* 229. *Pilophorus*, *Th. Fr. Mon. Ster. p.* 71; *t.* 10, *f.* 5. *P. robustus*, *v. Cereolus*, *Th. Fr. Scand. p.* 55.

b. Hallii, Tuck.; podetia solid, short and stout; the apothecia elongated and pestle-shaped (2-4$^{mm.}$ long, 0, 5$^{mm.}$–1$^{mm.}$ wide).——*Obs. Lich.* 4, *l. c. p.* 177.

c. acicularis, Tuck.; podetia sub-fistulous, rather elongated; simple or scarcely now branched; (cephalodia sub-globose, bullate, from pale-livid becoming reddish and brown;) apothecia soon sub-conical.——*Bæomyces*, *dein Cenomyce*, *Ach. Meth. p.* 328, *t.* 8, *f.* 4; *L. U. p.* 567. *Stereocaulon*, *Tuck. Syn. N. E. p.* 47. *Pilophoron*, *Tuck. Suppl.* 1, *p.* 427. *Nyl. Syn.* 1, *p.* 229, *t.* 7, *f.* 6. *Pilophorus*, *Th. Fr. Mon. Ster. p.* 70, *t.* 10, *f.* 4.

d. robustus, Tuck.; podetia sub-fistulous, at length rather elongated, and stout; branching above into somewhat corymbose summits; (cephalodia as in *c*, becoming ample;) apothecia depressed-globular.——*P. robustus*, *Th. Fr. Mon. Ster. p.* 69, *t.*

10, *f.* 3. *Pilophoron, Nyl. Syn. p.* 228, *t.* 7, *f.* 4. *P. polycarpum, Tuck. Suppl.* 1, *l. c. p.* 427.

Rocks, bordering water courses. *a*, White Mountains, *Tuckerman l. c.* 1848. Adirondack Mountains, New York (ill-distinguishable from *c*, and in the cephalodia not at all, in the specimens), *Peck.* The lichen is better exhibited here than in Europe, and is not likely to be confused with *Stereocaulon pileatum.*——*b*, Cascade Mountains, Oregon, *E. Hall.* A stouter plant than *a*; and, in the specimens, dark-ash-coloured: the cephalodia not seen.——*c*, Pacific Coast, *Menzies*, *Douglass*, *Hall*, etc.; as in the Rocky Mountains, *Herb. Hook.*——*d*, Islands of Behring's Straits, *Wright*; as also in Norway, Th. Fr. *l. c.*

XLI.—CLADONIA, Hoffm.

Apothecia for the most part soon inflated and cephaloid; hollow within; variously coloured (not black). Spores ovoid-oblong; simple; colourless. Spermatia staff-shaped; on sub-simple sterigmas. Podetia fistulous; cartilagineous; cup-shaped; or funnel-shaped; or at length shrub-like, and very much branched; rarely club-shaped; the horizontal thallus squamulose; or very rarely granulose (n. 13), now deficient.——The spores of *Cladonia* are small, and differ but little in dimensions; the extremes of those given by Nylander (*Syn.*) being 7-17$^{mmm.}$ by 3-5$^{mmm.}$.——For the anatomy, see Tulasne *Mém. sur. les Lich.* (*Ann. Sci. Nat.* 3, 17) *pp.* 24, 36, 171, *t.* 10, *f.* 6–11, *t.* 11, *f.* 11–17; *& Schwendener Untersuch. l. c.* 2, *p.* 168, *t.* 6, *f.* 23–27.——The chief, recent arrangements of this genus have all started from that of Fries; and, except in terminology and other less important respects, have varied from it but little, nor then perhaps always with advantage. It is followed here, with some exceptions long since (Syn. N. E.) proposed and still adhered to by me;—*C. rangiferina* finding, I conceive, the most natural place next after *C. furcata*, in the *Fuscescentes*; and *C. uncialis* next after *C. amaurocræa*, in the *Ochroleucæ*. And this from the analogy of *C. cristatella*, and *C. leporina*. The former (a member of Acharius's section *Helopodium*)

exhibits what should, it might seem, have been a simple, cup-shaped podetium with the cup broken up into a cluster of (fertile) branchlets; but passes at length into a condition so thickly branched as to offer no little of the aspect of dwarfed *C. rangiferina* as occurring on dead wood. And *C. leporina*, fully comparable finally with *C. rangiferina*, takes on also an inflated, funnel-shaped, simple condition (compare here Fries's sufficiently pertinent observation on *C. rangiferina v. portentosa*, Duf., in L. E. p. 244) reminding us at once of ordinary forms of *C. cristatella*. Like this last (it is also a matter of interest) *C. leporina*, with all its associableness with *C. rangiferina*, offers horizontal squamules of a peculiar type, which are obsolete so far as appears, in the much-branched state. We may perhaps then assume the morphosis of *C. rangiferina*, and *C. uncialis* to be possibly explainable by that of the two species with which they are compared above; as even possibly more clearly by that of *C. furcata*; however stages in the development of the one set of lichens be less fully exhibited, or now deficient from the first, in the other. The position of *C. Papillaria* is the only remaining, important point in which the present arrangement of *Cladonia* differs from others now received. I conceive Floerke to have been quite right in associating this species with *C. delicata*; and that Fries favoured in fact the same view in allowing the first-named, however differently placed by him, to be really most closely allied (*L. E.* p. 245) to *C. turgida*. The horizontal thallus of *C. delicata* is, here at least, most commonly quite granulose; and that of *C. Papillaria*, if never to be called squamulose, assumes finally a squamaceous form, comparable certainly with some states of the thallus of *C. Ravenelii* of this work. And there is nothing else to keep *C. Papillaria* from the place thus assigned to it.

Ser. I. *Fuscæ. Apothecia brown. Podetia from greenish-gray passing into brownish.*

1. *Scyphiferæ. Podetia normally simple, or only proliferous-ramose; dilating above into a cup closed by an imperforate*

membrane: but the evolution of the cup now precluded from the first, and the podetia club-shaped.

a. Flavo-virentes. Thallus especially developed and ample; from glaucous- becoming yellowish-green. Podetia cup-shaped so far as known, but mostly infrequent, and ill-characterized (n. 1-3).

1. *C. endiviæfolia* (Dicks.) Floerk.; thallus prostrate; foliaceous; at length coriaceous; the elongated, flexuous divisions sinuately and somewhat pinnately cleft; glaucous passing soon into yellowish above; sulphureous-white beneath; podetia of the colour of the thallus, short, smooth, turbinate, the cups irregular; apothecia reddish-brown.——*Fr. L. E. p.* 212. *Schær. Enum. p.* 194. *Nyl. Syn.* 1, *p.* 189.

On dry sterile soils, especially of a calcareous nature, in the Mediterranean countries; as also in England, and even in the Baltic island Gothland. I possess a specimen ticketed Cartagena by Gaudichaud; but know not whether it be South American. A small specimen from Florida (Dr. Chapman) is possibly however referable here.

2. *C. alcicornis* (Lightf.) Floerk.; thallus ascendant; subfoliaceous; cartilagineous, but thinner than the last; the elongated divisions narrow and linear, more or less palmately cleft, and repand-dentate; pale-green; beneath creamy-white; beset here and there at the margins with tufts of blackening fibrils; podetia of the colour of the thallus; elongated-turbinate; smooth; the regular cups at length leafy, and proliferous; apothecia reddish-brown.——*Fr. L. E. p.* 213. *Schær. Enum. p.* 194. *Nyl. Syn.* 1, *p.* 190.

Sterile, sandy earth. North America, *Muhlenberg Catal.* 1818; Floerke *Clad.* 1828. Arctic America, *Hooker.* Sands, Cambridge, Mass., *Tuckerman.* Sterile fields, Weymouth, *Willey.*

3. *C. ceratophylla* (Sw.) Eschw.; thallus prostrate; subfoliaceous; of much the size and aspect of the last but rather thinner; the elongated, narrowed, deeply- and pinnately-cleft divisions crisped-crenate at the margins; pale- to yellowish-green; beneath white, sub-ciliate with finally blackening fibrils; podetia copiously arising from and characterizing the lobes, but always sterile; subulate; simple for the most part; as mostly

also decorticate, or beset only with isidioid granules.——*Eschw. Bras. p.* 280. *Nyl. Syn.* 1, *p.* 191. *Cenomyce, Ach. L. U. p.* 533, *& in Sw. Lich. Amer. t.* 12, *f.* 1.

A native of the forests of tropical America; in Jamaica, *Swartz*; and in Mexico, *Nylander*, *Syn.* 1858. It is also cited as occurring in the islands of Tristan d'Acunha, and Bourbon; and in the mountains of India, *Nyl.*

b. Fuscescentes. Thallus squamulose; only exceptionally macrophylline; from grayish-green becoming ash-coloured, and brownish. Podetia largely exhibited and at length richly-developed; either club-shaped, or cup-shaped.

† *Podetia club-shaped* (*n.* 4-7).

4. *C. symphycarpa*, Fr.; thallus squamulose, rather conspicuous, round-lobed, soon elongated, and becoming ample, and brownish-green; podetia short, but more elongated in the macrophylline state, in which they also pass above into several branchlets; smoothish; of the colour of the thallus; apothecia confluent, brown.——*Fr. Nov. Sched. crit. cit. Th. Fr. Scand. p.* 89; *Lich. Succ. exs. n.* 232. *C. pyxidata, v. symphycarpa, Fr. Summ. Nyl. Scand. p.* 50. *Th. Fr. l. c.*

b. epiphylla (Ach.) Nyl.; podetia excluded; the apothecia seated on the squamules.——*Nyl. Scand. p.* 50.

On the earth. Middle States, *Muhlenberg Catal.* 1818; *Peck*; *Austin*; etc.: Illinois, *Hall.* Wisconsin, and Minnesota, *Lapham.* Virginia, *Tuckerman.* South Carolina, *Ravenel.* Alabama, *Peters.* Louisiana, *Hale.* Texas, *Wright.*——Fries's later opinion that this *Cladonia* is to be taken for an abortive condition of *C. pyxidata*, has been generally accepted; but the plant deserves perhaps to stand alone quite as well as the next following numbers, which are now as generally received. It is better exhibited here (so far as appears) than in Europe.

5. *C. Mitrula*, Tuckerm.; thallus squamulose, the thick squamules small to minute, often glebous, rounded and subentire, but becoming at length somewhat extended and crenate-lobate, pale-green; podetia short, slender, almost always simple, granulate-verruculose; glaucescent; apothecia heaped and confluent; from flesh-coloured becoming pale-brown (now darker).——*Tuck. in Darlingt. Fl. Cestr. edit.* 3, *p.* 444. *Nyl. Syn. p.* 203. *C. imbricatula, Nyl. in Flora*, 1858, *p.* 378.

On the earth throughout the Southern States, *Ravenel*; *Hale*; etc., to Texas, *Wright*; also in Mexico, *Nylander l. c.*; and Cuba *Wright*. It is also found in the Western States, *Lesquereux*, *Hall*, etc., and occurs as well, but less characteristical, at least in colour, in New Jersey, *Austin*, and New England, *Tuckerman*; *Willey*.——The pale-fruited, southern specimens now well simulate some *Bæomyces*. It is not easy to refer this lichen, as an abnormal condition, to any cup-bearing species; and this suggests at once the keeping of *C. symphycarpa* by itself, as is proposed above.

6. *C. cariosa* (Ach.) Spreng.; thallus squamulose, much as in *C. pyxidata*; podetia acquiring the full size and stoutness of the same species; soon warty, and squamulose, and cancellate-carious above; where they pass into digitately divided, fastigiate branchlets; greenish-glaucescent; apothecia at length confluent, dark-brown.——*Cenomyce, Ach. L. U. p.* 567. *Cladonia, Nyl. Syn. p.* 194. *Th. Fr. Scand. p.* 90. *C. degenerans, b, Fr. L. E. p.* 221. *Tuck. Lich. exs. n.* 120.

On the earth. Northern and middle States, *Muhlenberg Catal.* 1818; etc. Arctic America, *Richardson* in herb. Hook. Colorado, *Wolf.* New Mexico, *Fendler.* Oregon, *Hall.* British Columbia, *Macoun.*

7. *C. decorticata*, Floerk.; thallus squamulose, much as in the last; podetia rather slender, cylindrical, at length elongated; the fertile ones mostly simple but the sterile becoming at length fastigiately branched and subulate; largely decorticate; the epidermis passing into scattered, conspicuous squamules and rounded granules; irregularly at length fistulous, greenish-ash-coloured (finally woody, and blackening) apothecia brown.——*Fl. Clad. p.* 10. *Tuckerm. Syn. N. E. p.* 50; *Lich. Amer. exs. n.* 124. *Nyl. Scand. p.* 53. *Th. Fr. Scand. p.* 91.

On the earth upon rocks. White Mountains, N. H., *Tuckerman l. c.* 1848.

† † *Podetia cup-shaped* (*n.* 8–11).

8. *C. pyxidata* (L.) Fr.; thallus squamulose, the ascendant squamules crenate-lobate, of middling size and thickness; rarely ample; podetia cartilagineous-corticate, becoming warty, and scurfy; turbinate; grayish-green and ash-coloured; the

cups dilated and cyathiform; apothecia brown.——*L. E. p.* 218. *Tuck. Lich. exs. n.* 25. *Nyl. Syn. p.* 192.

b. Pocillum, Ach.; thallus foliaceous, appressed, much thickened, finally olivaceous- or tawny-brown; podetia reduced in size.——*Fr. l. c. Nyl. l. c.*

On the earth, *a*, common everywhere, *Muhlenberg Catal.* 1818. Arctic America, *Giseke*; R. Br.; etc. Southern States, *Ravenel*; *Hale*; etc. California, *Bolander*. Oregon, *Hall.*——*b*, Bear Lake, Arctic America, *Richardson*. Islands of Behring's Straits, *Wright*.

9. *C. fimbriata* (L.) Fr.; thallus squamulose, much as in the last but smaller, and less abundant; podetia cylindrical and soon elongated; the mostly greenish, membranaceous epidermis dissolving into a fine, glaucous-white powder; the cups with erect margins; apothecia brown.——*L. E. p.* 222.

a. Podetia shortish, but often proliferous-extended; the cups sub-denticulate.——*Fr. l. c. Tuckerm. Lich. exs. n.* 121.

b. tubæformis, Fr.; podetia slender, elongated; the epidermis either as in *a*; or more or less persistent and pale-tawny-brown; now conspicuously beset with squamules; the cups reduced in size, and either toothed or entire; often proliferous-fimbriate; or not seldom abortive, and the podetia subulate; apothecia confluent.——*Fr.! l. c. C. pyx. f. Fibula, Fl.! Clad. p.* 63. *C. fimbriata f. tubæformis, & f. Fibula, Nyl. Scand. p.* 51; *& in Norrl. Lich. Fenn. n.* 59, 60. *C. adspersa, Mont.! & V. d. Bosch in Mont. Syll. p.* 336. *C. fimbriata, v. adspersa, Tuckerm. in Wright Lich. Cub. n.* 31, 32; *& Gen. p.* 147.

c. radiata, Fr.; much elongated, subulate; or the cups subulate-proliferous; or disappearing in radiate branchlets.——*Fr. l. c., & Auctt. Tuck. Lich. exs. n.* 122.

On the earth, and rotten logs, throughout North America. *a*, Arctic America (*Richardson*), Hooker *l. c.* 1823. New York, *Halsey*. New England, *Tuckerman*.——*b*, in the northern and middle States, common, as well on the coast as in the mountains, *Tuckerman*, etc. Southern States, *Curtis*; *Ravenel*; etc. Ohio, etc. *Lea*; *Hall*. New Mexico, *Fendler*. California, *Bolander*. Oregon, *Newberry*.——*c*, White Mountains, N. H., *Tuckerman* Syn. N. E. 1848. Canada, *Macoun*.——Studied in its entirety, the present species, however now approaching the

last preceding one, is seen to have a distinct development; and this to be well-marked by the diversity in the epidermis. There is little difference of opinion as to the three forms determined by Fries; but the second of these (f. *tubæformis*) may most readily be extended to include another lichen, which, unrecognized in Europe, fills a considerable place in the Lichen-Floras of both northern and equinoctial America. The interest of the study of Lichens lies in the resolution rather than the overestimation of differences. *C. adspersa*, Mont. & V. d. Bosch *l. c.* (*C. fimbriata*, v. *adspersa*, Tuckerm. *ll. cc.*) possesses, in the two cited diagnoses, no single character that should exclude it from the form we are now considering: the specimens in Wright *Lich. Cub.* n. 32 (though referred by Mr. Leighton to his *C. pyxidata*, v. *decorticata*) being inseparable from Montagne's lichen, and agreeing equally, as a subulate state, with the scyphiferous n. 31 (taken by Leighton for his *C. pyxidata*, v. *pityrea*) which is manifestly only an extension of Cuban specimens (unpublished) of what should as clearly be *a.*

10. *C. degenerans*, Floerk.; thallus squamulose, much as in the next, infrequent at the base and now wanting; podetia longish; cartilagineous-corticate; irregularly but at length luxuriantly proliferous-ramose; for the most part smooth but beset more or less with squamules; and now at length granulate-furfuraceous; glaucous-greenish, ash-coloured, and brown; but blackening, with white spots, at the base; cups irregular, cristate-lacerate; apothecia brown.——*Fl. Clad. p.* 41. *Fr. L. E. p.* 221 (*b. excl.*) *Tuckerm. Lich. exs. n.* 95. *Nyl. Scand. p.* 53.

On the earth. Northern and middle States, *Muhlenberg Catal.* 1818; *Halsey.* Canada, *Agassiz.* Arctic America, *Richardson*; *Wright.* Southward, Virginia, *Dillenius.*

11. *C. gracilis* (L.) Nyl.; thallus squamulose, middling-sized to now ample, but infrequent for the most part at the base, and now scarcely any; podetia soon elongated, and from slender very robust; cartilagineous-corticate; polished; from pale-greenish becoming pale- to finally dark-brown; cups rather flattened; apothecia brown.——*Nyl. Syn. p.* 196. *C. gracilis, max. p., Fr. L. E. p.* 218. *C. gracilis, & verticillata, Floerk. Clad. p.* 26, 30. *C. ecmocyna, Ach.*

a. verticillata, Fr.; podetia from shortish now rather elongated; all cup-bearing; the cups dilated and flattish, soon

proliferous, at length luxuriantly, from the centre.——*Fr. l. c. Nyl. l. c. Scyphophorus-verticillaris, Michx. Fl. Bor. Amer.*, 2, *p.* 328, *not of* (*Radd.*) *Mont.*

* *cervicornis*, Floerk.; thallus macrophylline, the lobed squamules elongated, ascendant.——*Fl. l. c. p.* 28. *Fr. l. c. Nyl. l. c.*

* * *symphycarpia*, Tuckerm.; cups obsolete from the first; apothecia confluent.——*Lich. Amer. exs. n.* 116.

b. hybrida, Schær.; podetia elongated; cylindrical; often beset with squamules; mostly cup-bearing; the dilated cups proliferous commonly from the margin.——*Fr. l. c. Tuckerm. Lich. exs. n.* 27.

c. elongata, Fr.; podetia much elongated; cylindrical; mostly subulate or forked; either stout and commonly pale (f. *macroceras*) or slender and commonly darker brown (f. *chordalis*), now beset here and there with squamules; the cups diminished, and somewhat concave.——*Fr. l. c. Tuckerm. Lich. exs. n.* 28, 117.

On the earth, to be especially studied in high mountains, but found, in one form or another, throughout our region; *Muhlenberg Catal.* 1818. *a*, reaching its height of development in the lower regions of the White Mountains, passes, at the south (South Carolina, *Ravenel*; Florida, *Chapman*; Louisiana, *Hale*) into a slender, smaller form, otherwise equally well-marked, which occurs, also in Cuba, and Venezuela.——*a*, * as respects what is here referred to it, is certainly a macrophylline state of the present species, and perhaps better referable to *a*, than to *b* (in which Fries also recognizes a macrophylline condition), but its greater robustness makes it less comparable with the European lichen, than with such American ones as the above-cited Lich. Amer. n. 27. It has only occurred to me in the lower region of the White Mountains.——*a*, * * is known only from the coast of Massachusetts, *Oakes*; *Willey*.——*b*, an intermediate form between *a*, and *c*, and not always readily determinable, is commonly found wherever *c* is, throughout our northern regions, as well Atlantic as Pacific; and is sent from Wisconsin (*E. L. Greene*) but I have not seen it from the south.——*c* is especially characteristical of arctic and alpine regions, but descends, at least in the paler form, to the coast of Massachusetts, *Oakes*; and of Maine, *Willey*; as of California, *Menzies*.

11(*b*). *C. cornuta* (L.) Fr.; thallus as in the last; podetia much elongated, cylindrical; mostly subulate; the epidermis persistent, smooth, and pale- to dark-brown below, but thinner above and dissolving there, more or less, into a fine white dust; cups much narrowed, as in *C. gracilis v. elongata*, from which this is now commonly taken to descend; apothecia as in that. ——*Fr. L. E. p.* 225. *Tuckerm. Lich. exs. n.* 123 (*the terricoline specimen*). *Nyl. Scand. p.* 52. *C. gracilis v. cornuta, Schær.*

On the earth, especially of burnt districts, in the White Mountains, *Tuckerman* Syn. N. E. 1848. Tamarack swamps, Wisconsin, *Lapham.* Canada, *Macoun.* British Columbia, *Lyall. Macoun.*

2. *Perviæ. Podetia not cup-bearing; and the simpler, more turgid states which correspond to the cup-lichens, though similarly dilated at the axils and summits, are normally open and funnel-shaped; or in the slender, much-branched states at least perforate.*——The truly fruticulose, dichotomously-branched forms of this division are well distinguishable from the correspondingly elongated but only proliferous ones of the *Scyphiferæ*; and the horizontal thallus, though far less abundant, in most of the species, and finally quite deficient, is yet marked, in the most, by a character of its own.

12. *C. turgida* (Ehrh.) Hoffm.; thallus foliaceous, sub-erect, membranaceous-cartilagineous, deeply and somewhat pinnately laciniate; podetia from shortish, turgid, and obconical, soon elongated; smooth; glaucous; the summits scyphiform but mostly perforate, proliferously at length much-branched; apothecia brown.——*Ach. Syn. p.* 272. *Fr. L. E. p.* 215. *Tuckerm. Lich. exs. n.* 124. *Nyl. Syn. p.* 205.

b. conspicua (Schær.) Nyl.; thallus disappearing; podetia much elongated, densely crowded together and fastigiately branched; now beset with squamules; ashy-green; the summits stellate-dentate.——*Nyl. l. c. C. turgida, v. grypea, Tuckerm. in Agass. Lake Sup., Append.*

On the earth, especially in fissures of rocks on mountains. Northern States, *Muhlenberg Catal.* 1818. Canada, *Agassiz.* Newfoundland, *Despreaux.* Arctic America, *Richardson.* North West Coast, *Herb. Hook.*——Best comparable with *C. cenotea*; as especially now with some of the forms of *C. furcata, a, cris-*

pata; and at length, as respects the ultimate ramification, with *C. uncialis, b.* This is the general view of Floerke, Schærer, and Nylander; and in fact, too, of Fries, though he assigns the lichen a different place.

13. *C. Papillaria* (Ehrh.) Hoffm.; thallus of minute, smooth, finally squamaceous and lobulate granules; podetia short; smooth or now granulate; either sub-simple, and from papillæform becoming club-shaped and cylindrical-ventricose (*a*) or much and fastigiately branched, growing in crowded clumps (*b. molariformis,* Hoffm.), the summits dividing irregularly into gibbous branchlets; glaucous, now a little yellowish; apothecia reddish-brown.——*Fl. Clad. p.* 5. *Fr. L. E. p.* 245. *Tuckerm. Lich. Exs. n.* 115. *Nyl. Syn. p.* 188.

Sandy and gravelly earth, *Tuckerman* Syn. N. E. 1848. *a,* on the coast of New England, *Bennett*; *Farlow*; etc.; as of New Jersey, *Austin.* Virginia, common, *Tuckerman.* North Carolina, *Curtis.* South Carolina, *Ravenel.*——*b,* alpine region of the White Mountains, *Tuckerman.*——Schærer, whose acquaintance with this species will scarcely be questioned, has plainly testified to gathering specimens of it 'furnished with a minute, narrowly lacinulate thallus' (*Enum.* p. 203), a description really bringing to mind the thallus of *C. Ravenelii* (described below) imperfect squamules of which may be compared with certain states of the granules of the present. And the true place of the lichen is also suggested by its resemblance not only to *C. turgida,* but to *C. Santensis.*

14. *C. Santensis,* Tuckerm.; thallus squamulose, small, thickish, elongated at length and laciniate, dentate-crenate; podetia thin and fragile, short, simple, turgid, and dilating, in the manner of the last species, into proliferous-fimbriate summits; or more cylindrical and a little branched; the epidermis passing more or less into smooth granules; glaucescent; apothecia reddish-brown.——*Suppl.* 1, *l. c. p.* 427.

b. Beaumontii; podetia elongated; cylindrical; very slender, dichotomously much-branched, and intricate; the summits cristate-ramulose.

On the earth, South Carolina (*Ravenel*), Tuckerman *l. c.* 1858. Texas, *Wright*; *Hall.*——*b,* North Carolina, *Curtis.* Alabama, *J. F. Beaumont.*——The granules afford a very characteristical

note of this species, but they finally disappear, when a rather stouter lichen of California (*Bolander*) comes near.

15. *C. œnotea* (Ach.) Schær.; thallus squamulose, for the most part ill-exhibited, but the squamules at length elongated and dissected, and the few scattering ones on the lower part of the podetia stalked and acanthiform; podetia longish; dividing dichotomously by repeated proliferation; the at first smooth, from pale-greenish at length dark-brown membranaceous epidermis soon scurfy below, and passing above into a fine whitish powder; the funnel-shaped axils and summits gaping, with incurved margins; apothecia sessile; from flesh-coloured becoming dark-brown.——*Fl. Clad. p.* 125. *Tuckerm. Lich. Exs. n.* 125. *Cenomyce, Ach. Syn. p.* 271. *Cladonia brachiata, Fr. L. E. p.* 228.

b. furcellata, Fr.; podetia much elongated, slender, fruticulose, the summits subulate and forked.——*Fr. l. c. Tuckerm. Lich. exs. n.* 126.

On rotten logs, and on the earth among mosses. White Mountains and coast of Massachusetts, *Tuckerman* Syn. N. E. 1848.——*b*, on the earth in old pastures, Massachusetts, etc.

16. *C. squamosa*, Hoffm.; thallus foliaceous-squamulose, soon elongated and much dissected; podetia longish; irregularly at length much branched; the soon granulate epidermis disappearing at length in crowded, ashy-green squamules; axils and summits either dilated and funnel-shaped (f. *ventricosa,* Fr.) or the slenderer podetia attenuate, with subulate summits (f. *attenuata,* Fr.); apothecia cymose, brown.——*Fr. L. E. p.* 231. *Tuckerm. Lich. exs. n.* 30. *Nyl. Scand. p.* 57.

On the earth, mossy rocks, and rotten logs, common in the northern mountains, *Tuckerman* Syn. N. E. 1848. New Jersey, *Austin.* Ohio, *Miss Biddlecome.* Illinois, *Hall.* Lake Superior shores, *Agassiz.* Lake Winnipeg, *Herb. Hook.* North West Coast, *Herb. Hook.*; etc. North Carolina, *Curtis.* South Carolina and Tennessee, *Ravenel.* Alabama, *Peters.* Louisiana, *Hale.*——The southern specimens inferior and less typical, except a small form (f. *botryoides*) sent from South Carolina and Georgia, *Ravenel*; and Louisiana, *Hale*; with smoother, scarcely squamulose podetia, and much of the look generally of *C. Botrytis*, for which it might be mistaken; but the apothecia are finally dark-brown.

16(*b*). *C. delicata* (Ehrh.) Fl.; small; the thallus associable primarily with reduced states of that of *C. squamosa*, but soon disappearing in crowded, white granules; podetia short; slender; simple for the most part, or only now branching above; soon decorticate; besprinkled with granules; apothecia heaped; becoming dark-brown.——*Nyl. Syn. p.* 210. *C. parasitica, Schær. Tuck. Syn. N. E. p.* 51; *Lich. Amer. exs. n.* 29. *C. squamosa, v. delicata, Fr. L. E.*

Decaying wood. Northern and middle States, *Muhlenberg Catal.* 1818. Ohio, *Miss Biddlecome.* Illinois, *Hall.* Indiana, *V. d. Bosch.* South Carolina, *Ravenel.* Alabama, *Peters.* Louisiana, *Hale.*

16(*c*). *C. cæspiticia* (Pers.) Fl.; thallus small but foliaceous, much elongated, erectish, with many-cleft, crisped divisions; compacted into a dense clump; pale-green; podetia very short; naked; or now wanting, and the brown apothecia sessile on the leaflets.——*Fl. Clad. p.* 8. *Tuck. Syn. N. E. p.* 48. *Nyl. Syn. p.* 210.

Old trunks of trees, and rocks. New York, as throughout the northern States, *Halsey* View 1823. Ohio, *Lesquereux.* Illinois, *Hall.* Virginia, *Curtis.* Tennessee, and South Carolina, *Ravenel.*——Thallus now much reduced.

17. *C. furcata* (Huds.) Fr.; thallus squamulose, small and sparse, but at length much like that of *C. squamosa* except in size; podetia dichotomously fruticulose; cartilagineous-corticate; polished; brownish-green; axils and fertile summits pervious; the fertile ones corymbose; apothecia brown.——*Fr. L. E. p.* 229. *Th. Fr. Scand. p.* 78.

a. crispata, Fl.; podetia at first short and scyphiform, often not unlike simple forms of *C. gracilis, a*, but pervious, and turgescent; soon elongated, and, by proliferation from the margin much branched; from pale-greenish at length brown; now squamulose; the axils and summits funnel-shaped (now also not seldom closed, and cup-shaped).——*Fl. Mon.* 148. *Fr. l. c. Tuck. Lich. exs. n.* 31.

b. racemosa, Fl.; podetia elongated; more or less inflated; and, together with the axils, here and there gaping; the branches spreading, and curved, and beset at length thickly with squamules; the sterile summits subulate; from pale-greenish at length brownish.——*Fl. Mon.* 152. *Fr. l. c. Tuckerm. Lich. exs. n.* 32.

c. subulata, Fl.; squamules rare or deficient; podetia slenderer, straighter, and much branched; more commonly darker; the axils slightly more or less perforate; the sterile summits subulate, and forked.——*Fl. Mon. p.* 143. *Fr. l. c. Tuckerm. Lich. exs. n.* 33.

d. pungens, Fr.; smallish; very slender and fragile; divaricately much branched; pale; growing in dense clumps.——*Fr. l. c. Nyl. l. c.*

On the earth, common. *a*, Northern States, *Tuckerman* Syn. N. E. 1848. Wisconsin, *E. L. Greene.* Newfoundland, *Despreaux.* Arctic America, *Richardson* in herb. Hook. Rocky Mountains, *Herb. Hook.*; *Hall.* British Columbia, *Macoun*, etc. California, *Bolander.*——*b*, range quite the same with that of the last, but probably also occurring in the southern States, at least in the mountains.——*c*, range the same, but fine at the south, as far as Florida, *Ravenel.*——*d*, White Mountains, in the alpine region, *Tuckerman.* Northern shore of Lake Superior, *Agassiz.* And probably southern; specimens possibly referable to it have been sent from Alabama, *Peters.* It is very fine, and now beautifully foliose in Cuba (Wright *Lich. Cub.* n. 33).

18. *C. rangiferina* (L.) Hoffm.; horizontal thallus deficient; podetia elongated; erect; fruticulose; variously roughish or mealy; trichotomously very much branched, the inbricate branches divaricated; axils sub-perforate; fertile summits cymose; apothecia brown.——*Fl. Clad. p.* 160. *Fr. L. E. p.* 243. *Nyl. Syn. p.* 211.

a. pale-ash-coloured; verruculose; the summits drooping. ——*Fr. l. c. Tuckerm. Lich. exs. n.* 127.

b. sylvatica, L.; pale-yellowish; perhaps rather more delicate, and more loosely branched; smoothish; the summits commonly straighter.——*Fr. l. c. Tuck. Lich. exs. n.* 128.

c. alpestris, L.; with the coloration of the last; softish; mealy or now as if tomentose; the branches and branchlets very densely thyrsoid-entangled.——*Fr. l. c. Tuckerm. Lich. exs. n.* 129.

On the earth, common everywhere; found also in degenerate states on dead wood. Pennsylvania, Virginia, and Carolina, *Dillenius*, Hist. Musc. 1741. Canada (*a*) and Carolina (*c*), *Michaux.* Arctic America, *Gieseke, Richardson*, etc. North

West Coast, *Herb. Hook.*; Hall; *Macoun*, etc.——*b* is found at the south in a delicate, well-coloured form; North Carolina, *Curtis*; South Carolina, *Ravenel*; Alabama, *Beaumont*; Florida, *Chapman*.——*c* is also more delicate at the extreme south; Florida, *Chapman*; and this is perhaps Michaux's v. *minor*, found by him in Carolina.

Ser. II. *Ochroleucæ. Apothecia pale flesh coloured, oftener becoming reddish-brown. Podetia pale sulphur coloured, or straw-coloured.*

19. *C. Botrytis* (Hag.) Hoffm.; thallus squamulose, minute, erose-crenate, at length lobate; podetia short; cylindrical; slender; cartilagineous-corticate; verruculose; pale-sulphur-coloured; dividing more or less above into sub-fastigiate branchlets which are crowned by the largish, pale, flesh-coloured at length brownish apothecia.——*Fr. L. E. p.* 234. *Nyl. Syn. p.* 202.

Rotten pine wood, British Columbia, *Macoun*. Growing mixed with these specimens is a cornute, always simple lichen, agreeing with similar (small) forms of *C. fimbriata* in general character, as in becoming powdery above, but with the colour of the present, to which it is difficult not to refer it.——According to Schærer (*Enum.* p. 192) the species is also a native of Virginia (Herb. Shuttleworth) and of Carolina (Herb. Moug.) but I have seen nothing resembling it from the Atlantic region except the small form of *C. squamosa* called here f. *botryoides*, which, though very like the first, has the coloration and the thallus, and belongs without doubt to the stock, of the other. Fries took the present for an abortive cup-lichen; a representative therefore in the present series of the club-shaped group of the preceding one.

20. *C. lepidota*, Fr.; thallus squamulose, minute, sub-entire, but becoming elongated and much-lobed; podetia shortish; cylindrical; cartilagineous-corticate; soon verrucose; sub-simple or sparingly branched; the scarcely dilated summits passing into erectish, fastigiate branchlets, which, are densely at length beset, as more or less also the lower portions, with rounded squamules; greenish-straw-coloured; apothecia from pale-brownish-flesh-coloured at length darker.——*Fries in litt. Tuckerm. Gen. p.* 148.

On the earth, Mexico (*Liebmann*), Tuckerman *Gen.* 1872. Coast of Massachusetts, *Oakes. Willey.* New Jersey, *Austin.* Aiken, South Carolina, *Ravenel.*——Most readily comparable with conditions of *C. degenerans*; but the scyphiferous type by no means as clear as in that.

21. *C. carneola*, Fr.; thallus squamulose, minute, crenate-lobate, greenish; podetia membranaceous-corticate soon becoming powdery; pale-sulphur-coloured; apothecia flesh-coloured, at length brownish.——*Fr. L. E. p.* 233. *Nyl. Syn. p.* 201.

a. podetia short, turbinate; all cup-bearing; simple, or proliferous.——*Fr. l. c.*

b. cyanipes, Sommerf.; podetia elongated; cylindrical; slender; fragile; from simple soon sparingly and irregularly short-branched; the cups disappearing in subulate branchlets.——*Nyl. l. c. Th. Fr. Scand. p.* 73. *C. Despreauxii* (*Bor.*) *Tuckerm. Syn. N. E. p.* 54.

On the earth, *a*, Greenland, *Fries l. c.* 1831. Cascade mountains, Oregon, *Hall.*——*b*, Newfoundland (*Despreaux*), Tuckerman *l. c.* 1848. Alpine region of the White Mountains.

22. *C. amaurocræa* (Fl.) Schær.; horizontal thallus deficient; podetia growing more or less loosely in clumps, elongated; slender; much curved-decumbent; irregularly branched; scyphiferous and repeatedly proliferous, or the cups obsolescent below, and the axils now open, or again largely obsolete above, and the tips subulate; straw-coloured with brown summits; the cups narrowed and concave, with cristate-dentate margins; apothecia flesh-coloured fuscescent.——*Fl. Clad. p.* 119. *Schær. Enum. p.* 197. *Tuckerm. Syn. N. E. p.* 53; *& Lich. Amer. exs. n.* 130. *Nyl. Syn. p.* 216.

On the earth in alpine districts. Arctic America, *Floerke l. c.* 1828; *Richardson*; *Wright*; etc. Newfoundland, *Despreaux.* Lake Superior, northern shores, *Agassiz.* White Mountains, *Tuckerman.*——Manifestly the analogue of *C. gracilis*, and when the normal, scyphiferous condition is well-marked it is impossible to confound the lichen with *C. uncialis*; subulate conditions are often more difficult, but perhaps not much more so than in the species first-named.

23. *C. uncialis* (L.) Fr.; horizontal thallus deficient; podetia growing in dense clumps, soon elongated; turgid-cylindrical;

dichotomously branched; either slender for the most part, and somewhat attenuate, with often imperforate axils, and subulate summits (*a.* Auct.) or turgid, with gaping axils, and fastigiately at length much-branched, radiate summits, with cristate-dentate tips (*b. adunca*, Auct.); fertile podetia incrassated above, cymose; apothecia brown.——*Fr. L. E. p.* 244. *Tuckerm. Lich. exs. n.* 34, 35. *Nyl. Syn. p.* 215. *C. stellata, Schær. Fl. Clad. p.* 172.

c. Caroliniana; podetia not unlike those of *b. adunca* in its most turgid forms, but bullate-ventricose, and the obconical branches terminating in sub-truncate, obtuse summits beset here and there with short, thorn-like branchlets of the same colour. ——*Dufourea, dein Cenomyce Caroliniana, Schwein. herb. Cladonia, Tuckerm. Suppl.* 1, *l. c. p.* 427. *Nyl. Syn. p.* 216 (*sub-sp.*).

On the earth, throughout North America. Canada, *Michaux Flora* 1803. Arctic countries, *Richardson*; *Vahl*; *Wright*, etc. Newfoundland, *Despreaux*. North West Coast, *Lyall*. Northern and Middle States, *Muhlenberg*. Southern States, *Curtis*; *Ravenel*.——*a* is often short, and well contrasts in size, as in other respects, with *b*; but, like the latter, becomes at length much elongated and inflated, without wholly losing its other distinctions.——*b* is finally very turgid (f. *turgescens*, Schær.) though not otherwise differing. Both these large forms belong to alpine and arctic regions. I cannot distinguish from the last-named the Newfoundland *C. Delisei*, Despreaux! in *herb. varr.*; nor at all refer it, as Nylander (*l. c.*) has done, to *C. Boryi*.——*c*, mountains of Georgia, and Tennessee, *Ravenel*; Alabama, on sandrocks, *Peters*.

23(*b*). *C. Boryi*, Tuckerm.; horizontal thallus deficient; podetia turgid, now much distended; elongated-turbinate; dividing above fastigiately; or now more narrowed and sub-cylindrical, dichotomously much-branched; reticulate-lacunose passing into cribrose; pale-straw-coloured; scyphiferous and repeatedly proliferous, as also proliferous-fimbriate; but the cups not uncommonly perforate, and disappearing at length in cristate-dentate extremities; apothecia brown.——*Syn. N. Eng. p.* 54; *Lich. Amer. exs. n.* 36. *C. uncialis, v. reticulata, Russell in Essex Journ. Nat. Hist. Cenomyce lacunosa, Bory fide sched. in Herb. Berol.* (*nomen.*).

On the earth near the sea, Newfoundland (*Despreaux*), Tuckerman l. c. 1848. Labrador, *Mr. W. A. Stearns*. Coast of Mas-

sachusetts, *Dr. Jacob Porter*; *Russell*; etc.; as of Rhode Island, *Mr. Bennett.*——It was found in Japan, by *Mr. Wright.*——A reduced, more or less incrassated, and glaucescent state (*Lich. Amer. exs.* n. 132) occurs in the alpine region of the White Mountains; and is scarcely different from *Hook. & Thoms. Herb. Ind. Or. n.* 2129, from the Himmalayah.——Podetia of the coast-lichen now eight lines in diameter, and five where the branches begin. The plant, which is too remarkable to be passed over, occurs now with much the habit, and the cups of *C. gracilis v. hybrida*; but these cups are very commonly more or less perforate, and pass at length into tips quite like those of *C. uncialis, b*, in its more turgid conditions. The herbarium-name first-given is credited also to Delise (*Herb.* Spreng.); I retain the name by which the lichen was first described.

Ser. III. *Coccineæ. Apothecia scarlet. Podetia from yellowish or greenish more or less finally gray.*

24. *C. Cornucopioides* (L.) Fr.; thallus squamulose, the squamules small to middling-sized and now ample, crenate-lobate; podetia long-turbinate; cartilagineous-corticate; smooth becoming warty, or now even squamulose (*a*) or very commonly more or less powdery above (*b. pleurota*, Schær.) from pale-yellowish most often ashy-greenish; the dilated cups cyathiform; apothecia scarlet; or now yellow (*c. ochrocarpia*).——*Fr. L. E. p.* 236. *Tuckerm. Lich. Amer. exs. n.* 37. *Nyl. Syn. p.* 220.

On the earth in sterile soils, *a*, & *b*, common. Northern and middle States, *Muhlenberg Catal.* 1818. Arctic America, *Richardson*; *Gieseke*; *Wright.* Canada and British Columbia, *Macoun.* Oregon, *Hall.* Along the mountains southward, as in North Carolina, and Georgia, *Ravenel.*——*c* is rare; South shore of Massachusetts, *Willey.*

25. *C. bellidiflora* (Ach.) Schær.; thallus squamulose, the squamules from smallish at the base becoming middling-sized above and irregularly much lobed; podetia elongated; ventricose-cylindrical; cartilagineous-corticate; smooth, clothed more or less densely and imbricated with squamules (*a*) or the squamules more or less entirely wanting (*b. Hookeri*, Nyl.) finally somewhat branched, and now subulate; ashy-greenish now yellowish; cups small; apothecia scarlet.——*Fl. Clad. p.* 95. *Fr. L. E. p.* 237. *Nyl. Syn. p.* 221.

On the earth, and on rocks, in alpine and arctic regions. Greenland, *Floerke* Clad. 1828. Labrador, *Wenck*, etc. Newfoundland, *Despreaux.* British Columbia, *Macoun.* Marin county, California, *Bolander.*——*b* (*C. Hookeri*, Tuck. Syn. N. E. 1848) Newfoundland, *Herb. Hook.*——A rock-lichen of the White Mountains, of the present series, with densely squamulose podetia, is, for the most part, scarcely distinguishable from the species last preceding; but notwithstanding offers now no differences at all from small forms of the present.

26. *C. deformis* (L.) Hoffm.; thallus squamulose, the squamules sparse and small, but at length more ample, rounded, and lobed; podetia elongated-cylindrical more or less ventricose; incrassated; simple becoming somewhat branched; membranaceous-corticate; ashy-greenish and smooth below, above finally sulphureous-powdery; cups cupulæform, and the erect, now proliferous margin crenate-dentate, but at length dilated and very irregularly torn-lobed; apothecia scarlet.——*Fr. L. E. p.* 239. *Tuckerm. Lich. exs. n.* 38. *Nyl. Syn. p.* 222.

On the earth in our highest New England mountains, and northward. Canada, *Michaux* Fl. 1803; *Agassiz.* Newfoundland, *Despreaux.* White Mountains, *Tuckerman.* Coast of Massachusetts, rare, *Oakes.* Rocky Mountains, alpine, *Hall.* British Columbia, *Herb. Hook.*; *Macoun.*——An ochrocarpious form occurs commonly in Sweden (Fr.) but has not been seen here.

27. *C. digitata* (L.) Hoffm.; thallus squamulose, the squamules becoming ample, round-lobed, and crenate; podetia cylindrical; membranaceous-corticate; smooth and yellowish-green below, finely white-powdery above; cups narrowed, with an incurved, entire margin, but at length dilated, and irregularly proliferous-palmate; apothecia scarlet.——*Fr. L. E. p.*240. *Tuckerm. Lich. exs. n.* 39. *Nyl. Syn. p.* 222.

On rotten wood, and on the earth, in the highest New England mountains, *Tuckerman* Syn. N. E. 1848. Canada, *A. T. Drummond.* Greenland, *J. Vahl.* Very rarely also on the coast of Massachusetts, *Oakes.*——Ochrocarpious states unknown here.

28. *C. macilenta* (Ehrh.) Hoffm.; thallus squamulose, minute, sparse, the squamules crenate-lobate; podetia cylindrical; slender; membranaceous-corticate; from simple at length irregu-

larly somewhat branched; below, like the squamules, pale-greenish, becoming above finely hoary-powdery; cups obsolete; apothecia conglomerate and confluent; scarlet (or now yellow, *b, ochrocarpia*).——*Fr. L. E. p.* 240. *Tuck. Syn. N. E. p.* 55; *& Lich. Amer. exs. n.* 134. *Nyl. Syn. p.* 223.

On rotten wood, as also on the earth, and rocks; northern and middle States, *Muhlenberg Catal.* 1818. Ohio, *Miss Biddlecome.* Illinois, *Hall.* Wisconsin, *Lapham.* South Carolina, *Ravenel.* Alabama, *Beaumont.*——*b*, White Mountains, *Tuckerman.*——A rock-form otherwise referable here has yet the character of the very uncertain *C. Floerkiana*, Fr.; but I cannot attempt to separate specifically from *C. macilenta* what only differs from it in the epidermis continuing throughout, for the most part, smooth and entire. Indeed Fries himself did not escape confounding the two;—his *Lich. Suec.* n. 52 (*C. macilenta*, Fr.) consisting, in my copy, all but wholly of *C. Floerkiana* —which it is admitted to be in part by Dr. Th. Fries (*Scand.* p. 66).

28(*b*). *C. pulchella*, Schwein.; thallus conspicuous, the squamules at length elongated and dissected; podetia short, slender, denudate, granulose; besprinkled and finally imbricated with pale-green, and glaucescent squamules; cups obsolete; apothecia as in the last preceding.——*Tuckerm. Suppl.* 1, *l. c. p.* 427.

Roots of trees, and decaying wood, North Carolina (*Schweinitz*), Tuckerman *l. c.* 1858. South Carolina, and Georgia, *Ravenel.* Florida, *Chapman.* Alabama, *Beaumont.* Louisiana, *Hale.* Texas, *Wright.*——Not a little resembling *C. bellidiflora* in miniature; but the more granulose states related, through *C. muscigena*, Eschw. (*Lich. Cub.* n. 42) to *C. macilenta.* Fries (*L. E.* p. 232) has indicated the analogy of the lichen to such forms as *C. delicata.*

29. *C. Ravenelii*, Tuckerm.; thallus sub-squamulose, the squamules very minute, from rounded and sub-entire becoming erose-lacinulate, or more commonly disappearing in granules, white; podetia small; short-turbinate; simple; smooth becoming granulate-verrucose, and granulose; from yellowish-green white; cups dilated, cyathiform, palmately proliferous; apothecia scarlet.

On dead wood, South Carolina, and Florida, *H. W. Ravenel, Esq.* Also in the island of Cuba, *Wright.*——Comparable, as

respects the thallus, to some extent, with *C. delicata*, but yet different, and exhibiting perhaps rather the ultimate if scarcely reached type of that of *C. Papillaria*. The granulate condition passes into a fine-powdery one; but the turbinate and cup-bearing podetia suggest resemblance to a minute *C. Cornucopioides*, rather than to any *C. macilenta*.

30. *C. cristatella*, Tuckerm.; thallus squamulose, the squamules minute, but at length rather elongated, cut, and crenate; podetia of middling size; cylindrical often ventricose and not rarely elongated; cartilagineous-corticate; smooth, warty, or wrinkled, or beset at length with squamules; not forming cups, but the dilated summits passing into fastigiate (fertile) branchlets: from yellowish- at length ashy-green; apothecia scarlet, or now yellow (*b, ochrocarpia*).——*Obs. Lich.* 2, *l. c. p.* 394. *C. Floerkiana, Tuck., pro p., Syn. N. E. p.* 55; *& Lich. Amer. Exs. n.* 133. *C. substraminea, Nyl. Syn. p.* 204.

c. ramosa, Tuckerm.; podetia spreading-branched more or less below, and dichotomously much-divided above.——*C. cristatella, Suppl.* 1, *l. c. p.* 428.

On the earth, dead wood, etc., common throughout the northern and middle States, *Tuckerman l. c.* 1858. Southward, Virginia, *Behrich*; North Carolina, *Curtis*; South Carolina and Georgia, *Ravenel.* Alabama, *Peters.* Texas, *Hall.*——*b*, White Mountains, and elsewhere.——*c*, White Mountains, *Tuckerman.* Illinois, *Hall.*——A state with densely squamulose podetia (f. *vestita*) now very like the southern *C. pulchella*, has occurred in Massachusetts, and New Jersey, *Miss Biddlecome.*——A reduced form, as I cannot but consider it, with conspicuously powdery squamules, and the short, simple apothecia now epiphylline (v. *paludicola*) inhabits Cypress, and other swamps; and corresponds closely with the European *C. Cornucopioides* v. *incrassata.*——Some small forms of the present species resemble greatly *C. Floerkiana*, Fr.; but the two lichens are quite distinct, and *C. cristatella* might rather be regarded as standing in the same relation to *C. Cornucopioides* as *C. symphycarpa* to *C. pyxidata.*——*C. substraminea*, Nyl. *Syn.* 1860, was founded on the ochrocarpious form of the present, with which the very distinct *C. lepidota* of the *Ochroleucæ*, was mistakenly joined.

31. *C. leporina*, Fr.; thallus squamulose, squamules minute, narrowed, erose-lacinulate, finally disappearing; podetia frutic-

ulose; more or less turgid; from smooth soon wrinkled; sending up now, from prostrate stems, inflated, sub-simple, turbinate branches soon divided radiately above; or now more slender, and divaricately very much branched in densely intertangled clumps; from yellowish- ashy-green; axils sub-perforate; apothecia scarlet.——*Fr. L. E. p.* 243. *Tuckerm. Suppl.* 1, *l. c. p.* 428; *& in Wright Lich. Cub. n.* 44. *Nyl. Syn. p.* 227.

On sand, in Pine barrens, southern States, *Fries l. c.* 1831. North Carolina, *Curtis.* South Carolina, and Georgia, *Ravenel.* Florida, *Chapman.* Alabama, *Peters.* Texas, *J. Drummond*, as also in the island of Cuba, *Wright.*——Analogous, in the present series, first to *C. furcata*, as well to the v. *crispata* as to the v. *racemosa*, etc.; and then to *C. rangiferina.*

XLII.—THAMNOLIA (Ach.) Mass.

Apothecia sub-globose-patellæform; immersed many together in cephalodium-like thalline receptacles opening by cribrose perforations; variously coloured (not black). Spores fusiform-ovoid; simple; colourless. Spermatia staff-shaped; on multi-articulate sterigmas. Podetia cylindrical; fistulous; coriaceous; subulate; the cortical layer continuous and persistent; horizontal thallus deficient.—— For the anatomy, see Nylander, *Syn. p.* 264, *t.* 8, *f.* 6. Schwendener *Untersuch.* 2, *p.* 167, *t.* 6, *f.* 21, 22. Minks *Monogr.* in *Flora*, 1874, *n.* 22, 23, *t.* 4.

T. vermicularis (Sw.) Schær.; podetia simple for the most part, or sparingly forked; smooth or at length wrinkled; very white; either slender and prostrate (*a. subuliformis*, Schær.) or ventricose, and erectish, becoming furrowed and branchy, and beset now here and there with cornute branchlets (*b. taurica*, Schær.); neither the spermogones, nor the apothecia observed as yet here.——*Nyl. Syn. p.* 265. *Koerb. Parerg. p.* 14. *Minks Monogr. l. c. Cladonia, Floerk. Clad. p.* 175. *C. gracilis, v. vermicularis, & taurica, Tuckerm. Syn. N. E. p.* 49; *& Lich. exs. n.* 118.

On the earth in alpine and arctic districts; Arctic America (*Richardson*), Hooker l. c. 1823. White Mountains, *Tuckerman.* Adirondack Mountains, *W. F. Macrae.* Rocky Mountains, *Macoun.*

Fam. 2.—CŒNOGONIEI.

Thallus horizontal; confervoid-filamentous.

The *Pannariei*, with all that the ultimate structure of the family associates with it, are here regarded as an unavoidable intercalation in the series of lichens which beginning with *Usneei* finds its completion in *Lecanorei* (*Gen. Lich.* p. 150) and *Cœnogonium* as conceivably filling a similar place in *Lecideacei*. Lecideine elements are indeed far from unknown in the very various differentiation of the *Pannariei*, etc.; and *Cœnogonium* found a place in this Parmeliaceous neighbourhood, with Montagne, as formerly with Fries. The same elements occur also in *Gyalecta*, the first section of which (as here taken) is so well comparable in the fruit with the genus now before us that when, in Cuban specimens, the two plants are found growing together, it might, without examination, be readily supposed that the apothecia of *Gyalecta lutea*, wandering over some Confervaceous plant, thus constituted *Cœnogonium*; and Nylander places the latter next before *Gyalecta*. It is not easy to follow him in reducing *Gyalecta* to *Lecidea*; but perhaps nothing better now offers than to regard *Cœnogonium* as Lecideaceous.

XLIII.—CŒNOGONIUM, Ehrenb.

Apothecia patellæform, pale. Spores (in narrowed thekes) fusiform-ellipsoid, simple and bilocular, colourless. Spermogones globular; spermatia fusiform, on simple sterigmas. Thallus composed of jointed filaments, loosely intertangled, forming a more or less determinate, and rounded web; each filament consisting of 1, a central row of larger, cylindrical cells with greenish content, taken to represent gonidia; and 2, of slender thread-cells resembling and answering to the ordinary lichen-filaments, which longitudinally band, or loosely surround the first.

The principal authority for this type is Nylander, *Obs. sur les Cœnog. in Ann. Sci. Nat.* 4, 16. p. 89, t. 12. Schwendener *Untersuch in Naeg. Beitr.* 4, p. 172, t. 23, f. 18–21, should also be consulted; and a note by Müller in *Flora*, 1881, p. 235.——The species belong all of them to the warmer regions of the earth.

1. *C. Linkii*, Ehrenb.; thallus orbicular, attached at the side in the manner of some *Polypori*, and with a similar stratiform growth; glaucous-green; apothecia from pale-yellowish becoming reddish. Spores fusiform-ellipsoid, simple and biocular, $\frac{6\text{-}10}{3\text{-}4}$ mic.——*Mont. Cuba, p.* 107.

On trees in tropical countries, Mexico.——*C. Linkii*, v. *Leprieurii*, Mont. *Guy.* in *Ann.* 3, 16, p. 47, can scarcely be kept apart by the given character. *C. Leprieurii*, Nyl. *Cœnog.*, founded apparently on the Guyana lichen, is yet differently distinguished by the greater slenderness of the filaments (11–16 mic. thick, according to Nylander, while the filaments of this author's *C. Linkii* are reckoned 20–30 mic. thick) and simple spores; but the latter difference is not to be depended on, and the former, so far as my specimens (averaging say 12–20 mic.) go, is equally uncertain.

2. *C. interpositum*, Nyl.; thallus irregularly effuse; of the colour of the preceding; apothecia pale. Spores oblong, simple and bilocular, $\frac{6\text{-}10}{3\text{-}4}$ mic.——*Obs. sur. les Cœnog. l. c. p.* 91.

Trees. Louisiana (*Hale*), Nylander *l. c.* 1861. Texas, *Hall.* Florida, *Austin.* As also in Cuba (determ. Nyl.), Wright Lich. Cub. n. 171.——Filaments from 14 mic., scarcely exceeding 20 mic., in thickness.——From this, Nylander *l. c.* has distinguished his *C. disjunctum* by coarser filaments (23–36 mic. thick, Nyl.) and larger spores ($\frac{11\text{-}15}{2\frac{1}{2}\text{-}3\frac{1}{2}}$ mic., Nyl.) which may possibly be represented here by a too small specimen from Mobile, Alabama, *Mohr*, in herb. Willey. The Cuban specimen of this *C. disjunctum* (Wright *Lich. Cub.* n. 170) which is accepted by Nylander, is a better developed plant than *C. interpositum*, and has much of the regularity of *C. Linkii.*

3. *C. moniliforme*, Tuckerm.; thallus effuse; thin; from yellowish- becoming olive-green; the short filaments moniliform; apothecia bright red. Spores oblong, bilocular, $\frac{8\text{-}12}{3\text{-}4}$ mic.——*Tuck. in litt., and in Wright Lich. Cub. n.* 172. *Nyl. Cœnog. l. c. p.* 92. *Tuck. Obs. Lich.* 2, *l. c. p.* 416.

Trees. Florida, *Austin.* As in Cuba, *Wright.*

XLIV.—CYSTOCOLEUS, Thwaites.

A sterile, confervoid plant, blackish-brown when dry, but shewing black-greenish when wet, and differing also from *Cœno-*

gonium in its erectish habit of growth, but agreeing with that generally in the axial cells, the greenish colour of the content of which is also supposed to be due to chlorophyll, as the cells therefore to correspond also with gonidia. But the thread-cells with colourless content which, as in *Cœnogonium*, surround the central ones, are few (4–6) in number, and dark-brown, and coalesce into a sheath. The only species is *C. rupestris* (Pers.) Rabenh. (*Racodium rupestre* (Pers.) Fr. *Cystocoleus ebeneus*, Thwaites *l. infra cit.*) which inhabits rocks, and has occurred in North Carolina, *M. A. Curtis*; in Pennsylvania, *Wolle*; and in Rhode Island, *Farlow*.

Besides Thwaites (Ann. Mag. Nat. Hist. 2, 3), De Bary (*Morph und Phys. der Pilze, etc.*, p. 270), and Schwendener (Untersuch in *Naeg. Beitr.* 4, p. 173) have described the plant.

ADDENDA.

P. 82, before Genus XIII., insert

OMPHALODIUM (Mey. & Flot.) Koerb.

Apothecia scutellæform, much as in *Parmelia*. Spores ellipsoid, simple, colourless. Spermatia short-acicular; on sub-simple sterigmas. Thallus sub-monophyllous and stellate-lobate, attached to the substrate at a single point, by a disk-like process, in the manner of *Umbilicaria*.

O. Arizonicum; thallus ample; coriaceous; becoming wrinkled, and ridged; greenish-yellowish; beneath black, reticulately ridged and thickly besprinkled with black tubercles, and the ridges passing also into ragged extensions; apothecia ample, a little elevated; disk dark-chestnut; the margin finally flexuous and sub-crenate. Spores (in 8^s, in ventricose thekes, among agglutinate paraphyses) ellipsoid, limbate, colourless, $\frac{8\text{-}14}{6\text{-}8}$ mic.

Upon rocks, Santa Rita Mountains, Arizona, *Mr. C. G. Pringle*; comm. Sprague. Thallus exceeding at length three inches across; and the apothecia from two reaching more than eight mic., in width.——*Omphalodium* (upon which the author's *Gen. Lich.* p. 28, may be compared) is a group constituted of a South African lichen — *O. Hottentottum* (Ach.) Flot., and a Peruvian *O. Pisacomense*, Flot. Our plant is very near to the former of these; differing especially in its wider lobation, and, so far as can be judged from the descriptions and specimens, the brighter colour of its thallus, the less entire apothecia, and the larger spores. The fibrils of the under side, and of the exciple, which are so marked a feature of *O. Hottentottum*, are indeed quite deficient in the American lichen, but they are wanting sometimes in the African (Delis. *Stict.* p. 136) and their place is taken in ours by tubercular processes exactly like a common anamorphosis of the fibrils in *Umbilicaria vellea*, and *U. Dillenii*.——The disappearance of the fibrils of one form in the processes just referred to of another, the passing of the ridges

into ragged extensions as in *Umbilicaria erosa*, and *U. Muhlenbergii*, the disk of attachment,—in short the whole under side of *Omphalodium*, with not a little of the general habit of the lichens brought together in it, is sufficiently significant of an Umbilicarieine rather than Parmelieine affinity.

P. 161, after *L. pulchellum*, add *L. hypotrachynum*, Müll. *Lich. Beitr.* in *Flora*, 1881, n. 6, Mexico, on trunks, Sumichrast; with a specimen of which I have been favoured by the author: but I cannot well separate it from the species first-named.

P. 229, after *Gyrostomum*, would correspond to the place chosen, for lack of a better, in the author's *Genera Lichenum*, for a plant of obscure affinity which is often taken for a lichen, and has not yet found any other place.

MYRIANGIUM, Mont. & Berk.

Apothecia lecanoroid; multilocular; each cell containing a single theke; paraphyses deficient. Spores in 8^s, oblong-ovoid; sub-muriform; commonly without colour. Spermogones deficient. Thallus wholly cellulose; orbiculate, with something of the aspect of some *Omphalariæ*, and the circumference becoming plicate-striate and effigurate; but friable; and gonimous cells deficient.

M. Duriæi (Mont. & Berk.) Tuckerm.; thallus apparently crustaceous-adnate, but the at length sub-lobulate circumference free; from dark-brown blackening, dull; apothecia at length a little elevated; of the colour of the thallus; the flat disk bordered by a stout but depressed, very entire margin. Spores $\frac{20\text{-}25}{7\text{-}1}$ mic. ——*Gen. Lich. p.* 140. *M. Duriæi, & M. Curtisii, Mont. & Berk. in Mont. Syll. p.* 380. *Nyl. Syn.* 1, *p.* 139, *t.* 4, *f.* 1–5.

Upon trees. North and South Carolina, *M. A. Curtis*; *Ravenel.* Alabama, *Beaumont.* And no less in Cuba, *Wright*; and New Granada, *Lindig.* It occurs also at the north; in Massachusetts, *Sprague*; Connecticut, *Wright*; Rhode Island, *Bennett*; Pennsylvania, *Michener.*

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