

**A SYNOPSIS OF THE NORTH
AMERICAN LICHENS: PART I.,
COMPRISING THE PARMELIACEI,
CLADONIEI, AND COENOLOGONIE**

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A synopsis of the North American lichens: part I., comprising the parmeliacei, cladonie, and coenogonie by Edward Tuckerman

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EDWARD TUCKERMAN

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A
SYNOPSIS
OF THE
NORTH AMERICAN
LICHENS:
PART I,
COMPRISING THE
PARMELIACEI, CLADONIEI, AND CÆNOGONIEI;

BY

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

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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.

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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 Algaë. 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 shown 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 hyphæ 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 characteristic 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 thal-line 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*.