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NOTES ON AMERICAN CLADONIAS.

BY BRUCE FINK.

Since our western hemisphere surpasses the eastern in number of species and varieties of Cladonias and in forms peculiar to the hemisphere, the genus should have a special interest for the American student of lichens. Nevertheless our American descriptions have been for the most part quite inadequate and many of our determinations consequently incorrect. Cladonias are the most variable of all our higher lichens and therefore the most difficult to describe definitely. The most variable characters are those which may be studied with the eye or with a good hand lens, yet the most careful observation, the best possible descriptions, and comparison with authentic specimens are all necessary to enable one to determine these plants with any degree of certainty. Size, form, color, lobing and branching and the presence or absence of cortex and soredia must be constantly kept in mind in the consideration of the horizontal thallus, and yet more in the study of the podetia.

In actual determinations of Cladonias, the microscope need scarcely be used, except in instances where it is necessary to examine the thallus structure or the spores to make certain that one has not some species of such closely related genera as *Baeomyces*, *Stereocaulon* or *Piloporus* rather than a *Cladonia*. It is true that E. Wainio in his excellent Monograph, has seen fit to give a minute description of each species, even including the minute anatomy of the thallus of each species in great detail, but our investigations indicate that these characters of minute morphology are so constant, in the Cladonias, as to be only

(15)

very rarely of actual use in determinations. The so-called hypothallus is seldom seen and is of no use in the determination of Cladonias, while those doubtful structures, the spermagones and the spermatia, may be likewise neglected. As to chemical tests, it is extremely doubtful whether they are of diagnostic value in any lichens; and in the Cladonias, even the spore characters are so constant that they may be neglected. Here is a condition favorable to the work on the Cladonias, and it must be added that there is not another lichen genus in which microscopic characters may be largely neglected in determinations. However, the Cladonias are a comparatively recent evolution, and the macroscopic characters are so extremely variable and the preserved connecting links so numerous that the determinations are extremely difficult. Indeed, instead of being able to trace anything like a continuous line of evolution or even an evolutionary tree, the best students see only an interminable network of forms.

With all due respect to the late, eminent American lichenist, Tuckerman, it must be apparent to all who have attempted to use his diagnoses of American Cladonias as aids in determinations, that they are too brief and indefinite. For instance, Tuckerman recognizes in his manual just two varieties of *Cladonia fimbriata*, disposes of the species in a half page, and gives not the slightest hint that the forms are extremely varied and difficult to understand. This view is, however, all that could be expected from one who was a pioneer in the study of American lichens, and much as Tuckerman has done for American lichenology, we can not afford to do otherwise than pass beyond his results as rapidly as may be done with some sufficient degree of certainty.

In a series of articles now appearing in the *Bryologist*, the present writer is attempting to give a more recent view of the Cladonias by means of adequate descriptions, illustrations and notes on distribution. However, this work is merely preliminary in nature and much remains to be done in way of actual examination of material in

various herbaria and further collections and studies in American Cladonias. If the series of articles is found helpful in contributing to this end, they will serve their purpose. In passing beyond the Tuckermanian view, we have been so fortunate as to have the aid of the eminent Cladoniologist, E. Wainio, of the University of Helsingfors, and we now have his view of more than two hundred specimens of American Cladonias, which the present writer has submitted to him from time to time.

Attention was directed to the extremely great amount of variation in forms of *Cladonia fimbriata* years ago in work in the field, and an especial effort was made to obtain all of the forms possible. But it was only by a careful study of the species, as viewed by Wainio, and set forth in great detail in one hundred and three pages of his monograph of the genus *Cladonia*, that the present writer began to realize something of the difficulties to be encountered in the attempt to gain anything like an adequate knowledge of the species. In Wainio's monograph, sixteen varieties and a very large number of subvarieties and forms are recognized. We have not been able to see the subvarietal distinctions in some instances even with specimens which have passed through Wainio's hands before us. However, though we may not be able to follow the specialist in the genus into all of the intricacies of the most minute and discriminating observations, we have tried to improve matters somewhat, and perhaps as much as is desirable, by giving brief and yet sufficiently definite descriptions of the twelve varieties which are well known to exist in North America.

After *Cladonia fimbriata*, perhaps *Cladonia furcata* and *Cladonia crispata* are as troublesome as any of the *Cladonia* species. However, Tuckerman, in his treatment of the various forms of these two species, came much nearer to a correct solution than he did with regard to *C. fimbriata*. Indeed, though *C. furcata crispata* of Tuckerman's "Synopsis" has seemed difficult to trace, and though *C. furcata pungens* has seemed hardly to belong with the

species, yet the disposition has been as a whole fairly satisfactory. Wainio has seen fit to remove the latter variety from the species, placing it with *Cladonia rangiformis*, and this appears surely to be an improvement. The former variety Wainio has also removed from the species under the name, *Cladonia crispata*. This species as viewed by Wainio seems to be well represented in Europe, where there are quite a number of varieties. However, in America, we have as yet only two of the varieties, and there is room for doubt as to whether it is best to consider these forms as distinct from *Cladonia furcata*. Indeed, our *Cladonia crispata infundibulifera* seems very near to *Cladonia furcata paradoxa*, and further study is necessary to decide whether Wainio's view is the best one. But though there may be some doubt as to the best disposition of the puzzling *Cladonia crispata*, the study of the Minnesota Cladonias has brought to light one new variety within the two species, two others not previously known in North America, and still another known only through a single specimen collected many years ago by Tuckerman.

We may now consider *Cladonia gracilis*. The species has been abused in being subjected to the "splitting process" by European workers, but Wainio has succeeded in bringing order out of the chaos of names, and one who has learned to use his Monograph finds comparatively little trouble in applying his revision to our American forms of the species. The present writer thought years ago that *Cladonia gracilis* was the most difficult of all our Cladonias, but further acquaintance with *Cladonia fimbriata* gives that species first place as a difficult one.

It now appears plainly enough that much of the difficulty with *Cladonia gracilis* was really due to an attempt to follow Tuckerman, who included *Cladonia verticillata* with the above species. Then, too, *Cladonia gracilis symphy carpia* has been parceled out by Wainio to *Cladonia cariosa* and *Cladonia subcariosa*. Tuckerman gave his variety this description, "cups obsolete and apothecia confluent," and this diagnosis was wholly inadequate so that no one could

FIG. 2. *Cladonia furcata*. X 1.

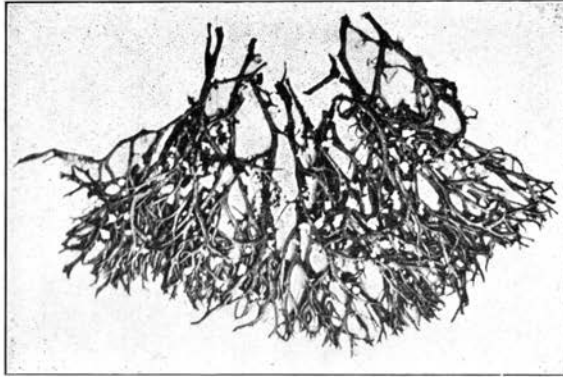


FIG. 1. *Cladonia fimbriata confocrea* (Fijk.) Wainio. X 2.

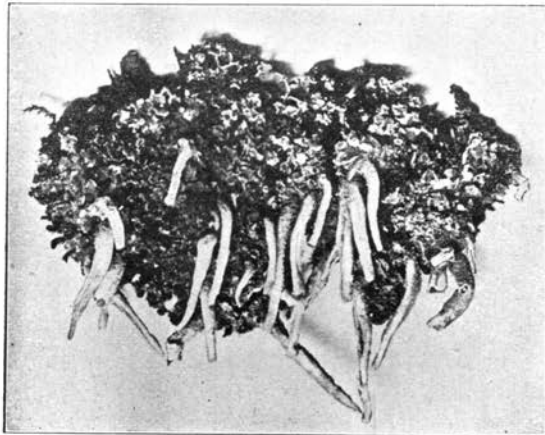


PLATE VI.

conceive what he meant without seeing the specimens. This Wainio has done and has no doubt placed the forms where they belong. Indeed, it is apparent enough after Wainio has done the work, that Tuckerman's diagnosis would apply to a form of *Cladonia cariosa* or to one of *Cladonia subcariosa* quite as well as to *Cladonia gracilis*.

Is it any wonder that we could never understand *Cladonia gracilis* while attempting to follow Tuckerman who placed forms of at least four species in one?

In treating *Cladonia gracilis*, the writer considers himself exceedingly fortunate in being able to see the specimens collected by Mr. G. K. Merrill, on Mount Washington, N. H., during the last summer. Indeed, but for the keen-eyed work of this collector in this best American collecting ground for the species, we could by no means give the presentation which appeared in a recent number of the *Bryologist*.

It should be stated regarding *Cladonia gracilis* that the eastern forms are as a rule longer and more slender than the western. This appeared plainly enough in comparing the plants collected by Mr. Merrill with those found by the present writer in Minnesota and in Iowa. Also, Dr. L. H. Pammel has collected a form of *Cladonia gracilis elongata* in Montana, which inclines to the shorter form, but still seems to be the variety. Also, Tuckerman states that the plants are paler in lower latitudes as in lower portions of Maine, Massachusetts and California. Our forms from Minnesota are paler than those of Merrill from New England, but it appears also that forms of *Cladonia amaurocraea*, quite elongated and cup-bearing, have frequently been placed under *Cladonia gracilis*.

As indicated above, there is some real difficulty in distinguishing between *Cladonia gracilis* and *Cladonia verticillata*. During the last summer, Dr. E. T. Harper collected and photographed lichens on Isle Royale, in Lake Superior, and the present writer is under obligations to him for the photographs from which the plate presented herewith was made. This plate shows forms of the two closely related

species. In *Cladonia gracilis* the squamules are to be looked for anywhere on the podetia, while in *Cladonia verticillata* they occur very rarely, and, when present, are found only at the bases of the podetia or on the margins of the cups. Also in the latter species, the proliferations are almost always from the center portions (or cavities) of the cups, while in the former they are almost always from the margins. Such are the "ear marks," while other differences are less marked, and are difficult to bring out even in descriptions.

In attempting, thus briefly, to give some view of the work that is being done on the American Cladonias, we have selected for discussion some of the species that have been treated more at length, with descriptions, in the series of articles by the present author and now appearing in the *Bryologist*. The descriptions can not be repeated herein, but may be seen by any who may be interested.

Besides E. Wainio, another European who has helped considerably in the work on American Cladonias, is Mr. L. Scriba, of Hochst, Germany. Mr. Scriba aided the present writer several years ago and is now examining specimens sent him by Mr. G. K. Merrill.

To the person who wants all rough places made smooth and all disagreement and all uncertainty removed, the study of Cladonias is an aggravation. But the one who will not quail before a task that seems so large and so uncertain that he may never hope to complete it, will find in the genus a good field for the most discriminating taxonomic effort.

Only twenty-four forms of Cladonias have been reported from Iowa, while more than sixty are recorded for Minnesota. Our flora is not so rich in these plants, but there is a great need of careful collecting, examination of all material in the various herbaria of the state, and final revision of the work.

Thanks are due to the *Bryologist* for the cuts from which the accompanying figures are reproduced.

PLATE VII.

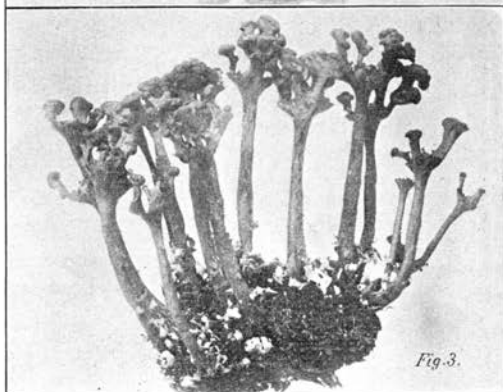
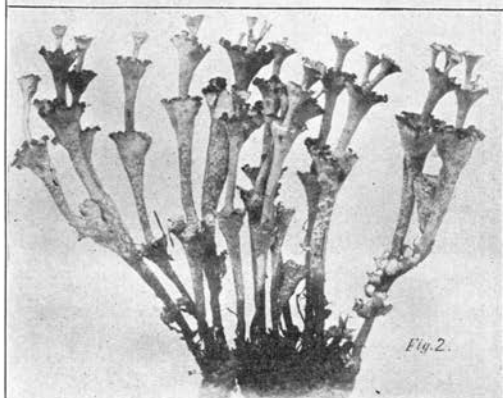
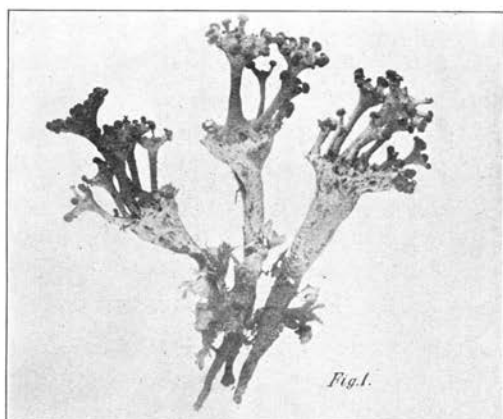


FIG. 1. *Cladonia verticillata*.
FIG. 2. *C. verticillata* var. *evoluta*.
FIG. 3. *C. gracilis* var. *dilatata*. X 1.