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Remarks on Sphacelaria radicans, Harv., and Sphacelaria olivacea, J. Ag. By E. M. HOLMES, F.L.S.

The plant alluded to by Mr G. W. Traill, in the above paper, under the name of *Sphacelaria olivacea*, J. Ag., does not appear to have been well understood by any of the preceding algologists who have described it, except Dillwyn.

Agardh, in his *Species, Genera, et Ordines Algarum*, p. 31, mentions *S. olivacea*, and a variety *radicans*, distinguished by its rather firmer filaments rooting from the upper portion, but does not remark that it has a different habit of growth. This rooting character, however, is figured by Kützing, under *S. olivacea* !

In *English Botany*, two figures are given, one of which, tab. 2430, represents *S. olivacea*, as having a more flaccid character than *S. radicans*, tab. 2429. In the description of the species there given, the author remarks that *S. olivacea* approaches so nearly to *S. radicans*, that the creeping habit of the latter seems to constitute the only real difference. *S. radicans* is described as growing on sand-covered rocks, and *S. olivacea* on rocks and larger algæ.

It would thus seem that both the plants of *English Botany* grow under water, one being rather more rigid than the other.

Harvey, in the *Phycologia Britannica*, combines these two under the name of *Sphacelaria radicans*. He remarks that *S. olivacea* of British authors is less disposed to throw out radicles than the other, but that the *S. olivacea* of Lyngbye may be a different plant. I cannot find, however, that Lyngbye describes a species under this name. He doubtfully identifies his *S. cæspitula* with Dillwyn's *S. olivacea* (*Dillw. Int.*, p. 57, suppl. tab. c.).

More recent authors* follow Harvey in uniting the above two forms under the name of *S. radicans*. The difference in habit of the *S. olivacea* of Dillwyn from that of *S. radicans*, Harv., is very marked. As I have seen *S. olivacea*, Dillwyn, growing in caves at Berwick, it forms a dense coat on the walls of the cave like velvet plush, of a fine brown colour,

* Farlow, *Marine Algæ of New England*, p. 76 ; Hauck, *Meeresalgen der Deutschland*, p. 343.

extending for many feet, alternating or mixed with *Callithamnion Rothii*. With a knife it can be cut off like turf. This I have never seen to be the case with Harvey's *S. radicans*, of which it would be impossible to obtain a felted piece an inch square. This difference appears to arise from the fact that in the former plant the radicles and ramuli are densely felted together, which is not the case in the latter. I have never met with this plant in the south of England.

With respect to the fructification, the specimens of the felted plant (*S. olivacea*, Dillwyn) sent me by Mr Traill have the sporangia distinctly stalked; while those received from him of the low-water plant exactly correspond with Harvey's figure of *S. radicans*, Harv., in having sessile bodies resembling unilocular sporangia. I have, however, found specimens of the latter plant at Falmouth with the fructification sessile above, and stalked lower down on the filaments; and in *English Botany* the fruits of *S. radicans* are described as "sessile or stalked." Moreover, Agardh describes them as oval, long-stalked, situated on the upper ramuli singly, or a few together ("subsingulis").

So far as I have observed in Mr Traill's *S. olivacea*, Dillw., the unilocular sporangia are invariably stalked, and more distinctly so, *i.e.*, on longer pedicels, than in my Falmouth specimens of *S. radicans*, Harv.

Unfortunately, the length of the joints in *S. olivacea* and *S. cirrhosa*, and Mr Traill's felted plant, are so nearly alike, that the habit of growth and the angle at which the branches arise, and the distinct localities at which they grow, are almost the only characters by which to distinguish these plants. (The same is the case with *S. racemosa*, which Mr Batters was so fortunate as to find last month at Berwick-on-Tweed in good fructification. This species has, I believe, been only once or twice previously found—first, by Sir John Richardson, near Granton, in 1821; and next, by the late Mr Hennedy, in the Clyde, according to Harvey, many years subsequently.* In this species the joints are about as long as broad, resembling in this respect the above-mentioned species. The plant is, however, taller, and grows

* I have seen Hennedy's specimens, but could find no fruit on them, and doubt if they belong to *Sphacelaria racemosa*. I should refer them to *Sphacelaria radicans*, Harv.

in scattered tufts. In *Sphacelaria tribuloides*, however, which I met with at Dunbar, the joints are twice as long as broad.) The felted mode of growth of *S. olivacea*, Dillw., and the diameter of the filaments, which is only about half of that of *S. radicans*, Dillw., and the growth in small isolated tufts of *S. racemosa*, and the racemose fruits, are the best modes of distinguishing the species from *S. radicans*, Dillw.

Pringsheim (*Morphol. Differenzirung in der Sphacelarien-Reihe*, Berlin, 1873, p. 165) has given the best description yet published of the fructification of *S. olivacea*.* He figures the following reproductive organs:—

1. Unilocular sporangia, of an elliptical or oval form, terminal on pedicels, consisting of about three joints.
2. Globular sporangia, on longer stalks, consisting of about nine joints. (These appear to be plurilocular sporangia.)
3. Propagula, or deciduous special branches, like those found in *S. cirrhosa*.
4. Gemmæ (Brutzellen), formed out of lateral segments of the joints, which may either develop into ordinary or into fruit-bearing ramuli, or subdivide and form a conglomeration of cells on the branch.

The sessile bodies, figured in the *Phycologia Britannica* as the fructification of *S. radicans*, are considered by Pringsheim to be probably a parasite, similar in character to, but different from, *Chytridium*.

With respect to the time of fructification, he remarks that the germination of the zoöspores often takes place very slowly, since he has found sporangia in July and August, with spores but little advanced in development (I have found them in August). The plurilocular sporangia were also met with in July and August.

The deciduous special ramuli, or propagula, he found of rare occurrence, except in a solitary tuft, which was remarkable for the abundance of hairs it bore.

On the cæspitose form of the plant the propagula appeared to be extremely rare, and they were developed out of the gemmæ above alluded to.

Pringsheim's statement concerning the sessile fructification

* Pringsheim recognises four varieties of *S. olivacea*, Dillw., viz., *cæspitosa*, *radicans*, *solitaria*, and *elatia*.

of *S. radicans*, Harv., figured in the *Phycologia Britannica*, seems to require further confirmation; and as, at this time of the year, as Mr Traill has shown, the fructification is in its best condition, I hope that the subject will not be allowed to rest until the doubtful points are cleared up by careful microscopical investigation. The fact that both kinds of sporangia may occur on the same plant, or even on the same branch, in this family of Algæ (*e.g.*, *Ectocarpus hyemalis*), should be borne in mind. It seems probable that the plurilocular sporangia may afford characters in their position or shape by which to distinguish the closely allied *S. cirrhosa*, *S. radicans*, and *S. racemosa*, the joints of which are almost equal in length. A comparison of the sections of the stems might also reveal some differences.

Dillwyn describes *S. olivacea* as having joints equal in length and breadth, and *S. radicans* as having them about half as long as broad.

I cannot close these remarks without paying a willing tribute to the perseverance and careful observations of Mr Traill. I know of no other algologist who has kept such a careful record of the times of fructification and duration of growth of various species as this gentleman, and only wish that he could be induced to publish in detail his algological diary.

In conclusion, I may add that, as Dillwyn does not describe the fructification of *S. olivacea*, Mr Traill's discovery of it adds one more fact to our knowledge of this group of plants.

The Indigenous Flora of Madeira, in special relation to its Peculiar Plants. By FRANCIS M. NORMAN, Commander R.N.*

(Read 12th May 1887.)

From time to time, before the year 1857, fragmentary and intermittent notices of the flora of the island of Madeira, and lists of some of its plants, were published both in England and Germany, but no serious attempt to produce a

* Herbarium specimens of most of the plants mentioned, and many not noticed in this paper, were exhibited by the author.