

## NOTES ON SPHACELARIALES (PHAEOPHYCEAE) II

### On the identity of *Cladostephus setaceus* Suhr and remarks on European *Cladostephus*

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#### SUMMARY

In the herbarium in Kiel type material of *Cladostephus setaceus* Suhr was located. From comparison with type material of *Cladostephus hedwigioides* Bory it became evident that they are conspecific. The type of *C. setaceus* originated from Greece, not from Chile. *Cladostephus hedwigioides* is tentatively included in *C. spongiosus* as a forma. All other European material of *Cladostephus* also consist of forms of *C. spongiosus*.

#### CLADOSTEPHUS SETACEUS

In 1836 J. N. von Suhr described a new species in the genus *Cladostephus*. This species, *C. setaceus*, was said to be found in Chile and no further information of the locality was given. The description (p. 347) is quite clear, and the figures give a good impression of the species.

In later literature the name of this species is sometimes mentioned, but most authors apparently have seen no examples of it. Reinke (1891, p. 19) who certainly studied the type, made *C. setaceus* a synonym of *C. spongiosus* (Huds.) C. Ag.

De-Toni (1895, p. 512) followed Reinke, but with some uncertainty, while Sauvageau (1914, p. 487) placed *C. setaceus* in the *species inquirendae*.

Skottsberg (1907, p. 58) mentioned material of *Cladostephus setaceus* he collected during the Swedish Antarctic Expedition in the years 1901—1903. He gave more information about specimens from Fuegia and the Straits of Magellan in another publication (1921, p. 44). It is not certain, however, that his specimens are conspecific with the type-material of *C. setaceus*.

#### CLADOSTEPHUS HEDWIGIOIDES

Four years before von Suhr, Bory (1832, p. 330) described two new species of *Cladostephus*. One of these, *C. hedwigioides*, 'Croît en touffes noirâtres, fournies, un peu dures au toucher, dans le petit bassin que forme, au sortir des rochers, la source salée de Mili près d'Armyros, au-dessus des meules que cette source fait tourner', . . . .

According to the description it looked like closely packed *Hedwigia aquatica*, *Fontinalis*, or other aquatic Bryophytes. The figure shows a much branched and quite irregular *Cladostephus* with whorls of unbranched laterals. The other species described by Bory, *C. dubius*, proved to be a Rhodophyte.

## THE MATERIAL

J. M. Despréaux, who collected the type material of *C. hedwigioides*, seems to have found a large number of specimens, for the well-known French phycologist Lenormand sent many specimens to his correspondents, and so did Bory de St. Vincent. I have located material in BR (plate IIa) and many other herbaria. A specimen in CN had as synonym *Cladostephus setaceus* Suhr (written by Lenormand) and on a label in BM Bory had written '*Cladostephus dichotomus* von Suhr'. That there was some contact between von Suhr and Bory is proved by a label in PC reading:

'*Cladostephus dichotomus*' Von Suhr (scrips. von Suhr) = '*Cladostephus setaceus* Von Suhr' (scrips. Bory).

This label was found in a packet of *C. hedwigioides* in the collection of Bory in the Thuret herbarium in PC. In the Agardh herbarium in Lund (LD, *Ag. nr. 45674*) a specimen was found with on its label in von Suhr's hand a description in French of the locality in Greece and the name *Cladostephus dichotomus*.

So probably Bory and von Suhr did already know that *C. hedwigioides* and *C. setaceus* (= *C. dichotomus*) were conspecific, but they never published it.

In Kiel the folder inscribed '*Cladostephus setaceus*' contains several sheets. On one of these three specimens are present (one specimen is shown in plate II b); on another sheet a printed figure is pasted together with a description of *C. dichotomus* in von Suhr's hand. The printed figure is the one published in *Flora* in 1836. The name *Cladostephus dichotomus* has never been published. There is no original label with the specimens in the herbarium in Kiel; the label was written by Reinke. But it is almost certain that the label with the description of *C. dichotomus* was originally kept together with the specimens. The last sentence of this description reads: 'Vom Bory als Moos an Hornemann gegeben'. It is most probable that Bory sent some specimens to Hornemann for advice (just as Bory sent specimens to Lyngbye according to Sauvageau, 1914, p. 592; material in C, not seen by myself). Von Suhr (who may have got some material from Hornemann and perhaps also from Bory or Lenormand) obviously returned some material with the name *Cladostephus dichotomus* on it. The label by Bory may have said 'Mili' and von Suhr may have read 'Chili'.

Comparison of type specimens (plate II a and b) shows *C. hedwigioides* and *C. setaceus* to be conspecific. The name *Cladostephus hedwigioides* takes precedence, having been published first.

## THE HABITAT

The habitat of *Cladostephus hedwigioides* is not well known. Some labels give more information, saying 'Mili près d'Armyros' (or Armiros) is located 'dans la Laconie, côte de Magne, près de Sparta'. In a letter Dr. K. Anagnostidis explained to me that 'Mili' (better Myloi) means 'the Mills' and is a common name of many villages in Greece. 'Armyros' (better Almyros) means 'Salty place' and is also used as a name of many villages. Additional information in the publication of Bory made clear to Dr. Anagnostidis that Armyros is located near the town Katamai on the Peloponnesus.

And the 'source salée', was it brackish or as salt as the sea? Sauvageau (1914, p. 592) asked Dr. H. Peragallo to study the diatoms on the thallus of the *Cladostephus* in the Thuret herbarium. All diatoms Peragallo found were more or less euryhaline forms, but no typical marine diatoms were found. For that reason Sauvageau was sure the salinity of the 'source', was below the normal salinity of sea water.

In Caen I found a large amount of roughly dried, unprepared *Cladostephus hedwigioides* (probably the stock-collection of Lenormand). Amongst this material many Amphipods (*Crustacea*) were present. I sent some specimens to the Zoological Museum in Amsterdam, where Drs. S. Pinkster identified the animals as *Chaetogammarus olivii*. This species is rather common in the Mediterranean basin in the littoral zone of cobble beaches. But also in poikilohaline waters, as estuaries of small, non-permanent streams and lagoons (Stock, 1968). So it is plausible to think that *Cladostephus hedwigioides* lives in some poikilohaline waters in Greece.

The status of this taxon is not clear. For reasons mentioned below I propose to consider these algae as a form of *C. spongiosus*. I have not seen any living example of this form, and as all *Cladostephus* grow in culture too slowly for experiments with water of varying salinity, it was not possible to detect whether a poikilohaline habitat promotes *hedwigioides*-like growth.

#### OTHER TAXA OF CLADOSTEPHUS

Sauvageau (1914, p. 601—604) mentioned besides *C. setaceus* and *C. hedwigioides* five other species for the genus *Cladostephus*, viz. *C. verticillatus* Lyngbye, *C. spongiosus* C. Ag., *C. australis* Kütz. non C. Ag., *C. harioti* Sauv., and *C. antarcticus* Kütz. He placed the last mentioned species together with *C. setaceus* in the *species inquirendae*. In accordance with the rules in the International Code of Botanical Nomenclature, the names *C. verticillatus* and *C. australis* cannot be maintained. The commonly used name *C. verticillatus* (Lightf.) Lyngbye is a later homonym of *C. verticillatus* (Roth) Ag. When C. A. Agardh (1817, p. XXVI) made this new combination he used as type the description by Roth of a red alga (*Halurus*).

The name *Cladostephus australis* C. Ag. was published some years before *C. australis* Kütz. The former species is a red alga, and for the latter no new names have been suggested until now.

*Fucus hirsutus* L., described in 1767, is commonly placed in synonymy under *Cladostephus spongiosus* (Huds.) C. Ag. The type material of the former species made it clear that this is not the typical *C. spongiosus*, but a fertile specimen of the verticillate *Cladostephus*. If these taxa are retained as separate species, the verticillate *Cladostephus* should bear the epithet *hirsutus*.

#### CLADOSTEPHUS SPONGIOSUS

Most authors have divided the European material of *Cladostephus* into two species: *C. verticillatus* (sometimes as *C. myriophyllum*) and *C. spongiosus*. But usually they express doubts about their distinctness.

According to Reinke (1891, p. 19) the only clear difference is 'dass bei *C. verticillatus* deutliche Internodien zwischen den Blattwirteln hervortreten, bei *C. spongiosus* aber nicht'. Sauvageau (1914) mentioned many differences (Table 1).

All the differences given in table 1 are gradual and no major feature can be isolated. Probably most of the differences are caused by external factors and especially by tidal movements. *Spongiosus*-like specimens always grow at a much higher level on the shore than verticillate specimens do. In places without tidal movements (the Mediterranean especially) only verticillate specimens are to be found. But perhaps other unfavourable factors may also promote *spongiosus*-like specimens. All *Sphacelariales* show proliferation

TABLE 1: Differences between two species of *Cladostephus* according to Sauvageau (1914).

<i>Cladostephus verticillatus</i>	<i>Cladostephus spongiosus</i>
Large basal disk	Small basal disk
Basal disk uncovered	Basal disk covered by sandy silt
Many upright branches (5—100)	Not so many upright branches (5—20)
Till 25 cm high (average 15 cm)	4—10 cm high
Axes thick and straight	Axes not so thick and flexuose
Verticillation very clear	Verticillation only visible in younger parts in spring
Axes denudated in winter	Axes not much denudated
Determinate laterals mostly branched and piliferous	Determinate laterals partly unbranched and bare, partly branched and piliferous
Fructification in distinctly marked zones	Zones not distinct
Wall of unilocular zoidangia persistent	Wall of unilocular zoidangia not persistent
Few zoidangia on every special determinate lateral	More zoidangia on every special determinate lateral

of many cells in unfavourable culture conditions and it is the same proliferation that suppresses the visibility of the internodal parts of the axes in *C. spongiosus*. More information about experiments regarding this problem will be published in the revision of European *Sphacelariales* I am preparing, together with further observations.

Since the differences between *C. spongiosus* and *C. verticillatus* are not at all absolute, uniting these entities into one species is a logical result. They are, however, in most cases easily recognized in the field, and for that reason I like to keep them separate as forms.

#### OTHER FORMS IN CLADOSTEPHUS SPONGIOSUS

In 1824, C. A. Agardh (p. 169) described *Cladostephus laxus* based on a specimen taken from Lyngbye. Earlier, Lyngbye (1819, p. 102) had described this specimen and identified it as *Cladostephus verticillatus*. Later C. A. Agardh (1828, p. 14) denominated it as *C. spongiosus* var. *laxus*, while Sauvageau (1906, p. 31) called it *C. verticillatus* var. *patentissimus*.

This plant is a loose-lying form with whorls of only 8—12 determinate laterals (*C. spongiosus* has normally 24 laterals in a whorl). It is to be found in fields of *Zostera marina*, especially in Scandinavia where it maintains itself by vegetative propagation. When *Cladostephus spongiosus* is grown free-floating in culture, it does not assume the appearance of the loose specimens found in nature. I distinguish the loose *Cladostephus* from *Zostera*-fields as a separate forma.

Summaryzing, the taxa of the European *Cladostephus* are:

#### *Cladostephus spongiosus* (Huds.) C. Ag.

1. **f. spongiosus.** — *Conferva spongiosa* Hudson (1762) 480; Lightfoot (1778) 983; Dillwyn (1804) t. 42. — *Cladostephus spongiosus* C. A. Agardh (1817) XXVI; Reinke (1890) 211; De-Toni (1895) 512; Sauvageau (1906) 30; (1914) 602. — *Cladostephus verticillatus* var. *spongiosus* Farlow (1881) 78. — Type: Ed. Forster's herbarium, Hudson's sale, *sine coll. et loco* (BM, lecto).

2. **f. verticillatus** (Lightf.) P. v. R., *comb. et stat. nov.* — *Conferva verticillata* Lightfoot (1778) 984, *non* Roth (1797); Dillwyn (1805) t. 55. — *Cladostephus verticillatus* Lyngbye (1819) 102, *pro parte, excl. syn., non* (Roth) C. A. Agardh (1817); W. J. Hooker (1821) 89; Reinke (1890) 211; (1891) 272; De-Toni (1895) 513; Sauvageau (1906) 31; (1914) 601. — *Conferva myriophyllum* Roth (1801) 335, *nom. nov. pro Conferva verticillata.* — *Cladostephus*

*myriophyllum* C. A. Agardh (1817) XXVI. — T y p e: Lightfoot collection, *sine coll. et loco* (K, lecto, now in BM).

*Fucus hirsutus* Linnaeus (1767 a) 717; (1767 b) 134, *excl. syn., non* (1771). — T y p e: Linnaeus herbarium no. 1274-18, *sine coll. et loco* (LINN, holo).

3. **f. laxus** (C. Ag.) Areschoug (1850) 388. — *Cladostephus laxus* C. A. Agardh (1824) 169, *excl. syn.* — *Cladostephus spongiosus*  $\beta$  *laxus* C. A. Agardh (1828) 13. — T y p e: Denmark, Fionia, Lyngbye *s.n.* (*cum Cladostephus verticillatus*, Agardh herbarium no 45625, LD, holo).

*Cladostephus verticillatus* Lyngbye (1819) 102, t. 30 f. B, *pro parte, excl. syn., non* (Roth) C. A. Agardh (1817). — *Cladostephus verticillatus* var. *patentissimus* Sauvageau (1906) 31; (1914) 602. — T y p e: Denmark, Hofmangave, Dec. 1815, Lyngbye *s.n.* (*cum Cladostephus verticillatus* in C, lecto; PC).

4. **f. hedwigioides** (Bory) P. v. R., *comb. et stat. nov.* — *Cladostephus hedwigioides* Bory de St. Vincent (1832) 330; Sauvageau (1914) 603. — T y p e: Greece, Mili près d'Armyros, Despréaux *s.n.* (BM; BR; CN; L; LD; MPU; PC, lecto in herb. Thuret; TCD).

*Cladostephus setaceus* Suhr (1836) 347; Sauvageau (1914) 487, *spec. inquir.*; Skottsberg (1907) 58 (?); (1921) 44 (?). — T y p e: *ex. herb.* Suhr, *sine coll. et loco* (KIEL, lecto).

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