
Lectotype designation for *Anthophysa vegetans* (O.F.Müller) F.Stein (Ochromonadales, Chrysophyceae)

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This paper deals with the lectotypification of *Anthophysa vegetans* (O.F.Müller) F.Stein (Chromulinaceae, Chrysophyceae) (basonym: *Volvox vegetans* O.F.Müller), the nomenclaturally correct name (as defined in the ICN glossary) for the type species of *Anthophysa* Bory (1822: 427, as *Anthophysis*). Historical background information on both the species and genus names is also provided, beginning with the account of O.F. Müller (1786). The Articles of *The International Code of Nomenclature* (ICN) cited are those in the *Melbourne Code* (McNeill & al. 2012). The citation of authors of scientific names follows the International Plant Names Index (<http://www.ipni.org>).

O.F. Müller (1786, pp. 12-23) provided accounts of 12 species that he found in Denmark and ascribed to *Volvox* (Volvocaceae, Chlorophyceae); five were previously described (Linnaeus 1758, O.F.Müller 1773), and seven were newly described. Amongst the latter was *Volvox vegetans* O.F.Müller (*op. cit.*, p. 22, pl. 3, figs 22-25), known today as *Anthophysa vegetans* (O.F.Müller) F.Stein.

O.F. Müller did not describe individual cell features of *A. vegetans*, but, he described and illustrated the attached stage with branched filaments bearing terminal cell clusters and the free-swimming cell clusters or colonies that had broken free from the filaments (see Fig. 1 below). O.F. Müller found the alga in a stream during November in 1779 and 1780 but did not indicate how many collections he had. He did not designate a nomenclatural type (ICN, Art. 7.2), and no specimens are deposited in the Natural History Museum of Denmark (Dr Nina Lundholm and Dr Martin Vinther Sørensen, Curators, pers. comm.). Additional data on O.F. Müller and his collections are given in Stafleu & Cowan (1981, pp.650-651) and in Nakhaev & al. (2015: 51-53). O.F. Müller's original figures subsequently were reproduced in Bruguère (1791: pl. 2, upper part, figs 16-19; legends are in the text on p. 5 in French and Latin), and they also are reproduced here as Fig. 1.

Roth (1806, p.180) apparently observed the same organism, which he independently named *Conferva divergens* Roth. Roth reported "granular fruiting bodies" at the tips of filament branches, but he stated that these "fruiting bodies" were not distinctly observed. Roth did not provide illustrations or designate a nomenclatural type, and he did not mention O.F.Müller (1786).

Subsequently, J.B.G.M. Bory de Saint-Vincent (as Bory hereafter; 1822: 427, 597) concluded that the taxon described by O.F.Müller (1786) and by Roth (1806) involved a single species that was generically distinct from *Volvox* and *Conferva*, and consequently Bory (*op. cit.*) transferred it to his new validly published genus *Anthophysis* (now *Anthophysa*, orth. cons.; see below).

Within *Anthophysa*, Bory (1822: 427) recognized two new species: *A. mulleri* Bory (not 'mülleri' and not 'muelleri') and *A. dichotoma* Bory. *Volvox vegetans* O.F.Müller (1786) was listed as synonym of *A. mulleri*. Bory (1822: 427) cited both the protologue and figures of O.F.Müller (1786) and the reproductions of these in Bruguère (1791). Bory also suggested that *Conferva divergens* Roth represented elongated remains (empty stalks—see Ehrenberg 1838: 285) of *Anthophysa mulleri*. Bory did not designate nomenclatural types for his genus or for his two species. Bory used the spelling 'mulleri' (no umlaut), and this original spelling is to be retained (Art. 60.1).

Nomenclaturally, *Anthophysa dichotoma* and *Volvox vegetans* are validly published, legitimate names (see ICN glossary & Art. 6.5), but *A. mulleri*, although validly published, is illegitimate because it is superfluous for *Volvox vegetans* (Art. 52.1). Illegitimate names are to be rejected (Art. 52.1) and such a name is not to be used (ICN glossary). Moreover, the correct name of a species has to be a legitimate name (Art. 6.6), and thus the name *Anthophysa mulleri* cannot serve as the correct name of the nomenclatural type of *Anthophysa*.

Ehrenberg (1832: 95) transferred *Volvox vegetans* into *Epistylis*, a genus of ciliate protozoans (Lynn 2008), and recognized it as a distinct species, namely *E. vegetans* (O.F.Müller) Ehrenberg. Subsequently, however, Ehrenberg (1838: 285, pl. 27: fig. 5) expressed some taxonomic doubt about his generic assignment, adding a question mark after the generic name. Ehrenberg's placement was never widely accepted.

The current spelling, *Anthophysa*, was introduced by Dujardin (1841: 278, 302). Dujardin's spelling *Anthophysa* became widely used in preference to Bory's spelling *Anthophysis*, eventually prompting Silva (1980: 123) to propose conservation of the Dujardin orthography. Silva's proposal was accepted with a final and binding vote at the Nomenclature Section of the Fourteenth International Botanical Congress, Berlin, July-August 1987 and incorporated into Appendix III of the Berlin Code (Greuter *et al.* 1988) as well as all subsequent Codes.

Pfeiffer (1873: 215) apparently was the first author to designate an eligible species “(*Volvox vegetans* O.F.Müller)” as the (lecto-)type species of *Anthophysa*. Even though Bory treated *V. vegetans* as a synonym of *A. mulleri*, and even though Pfeiffer did not explicitly propose a new combination, Pfeiffer's choice is in accord with ICN Art. 10.3 and thus cannot be superseded except as specified in ICN Art 10.5 and 14.9. Pfeiffer's type citation is also indirect: he did not use the word type in his entry for *Anthophysa*. Instead, Pfeiffer included a blanket statement (*op.cit.*, unnumbered second page of Preface) stating that species names only were mentioned when they serve as the types of new genera or sections (see also Stafleu & Cowan 1983: 224). Pfeiffer (*op.cit.*) did not designate a type specimen for the type species. Because Bory (1822) did not designate a type species from amongst those included in the protologue account of *Anthophysa*, Pfeiffer's choice must be treated as a lectotype (Art. 9.2). The nomenclaturally correct name for *Volvox vegetans* when treated as a species of *Anthophysa* is *A. vegetans* (O.F.Müller) F.Stein (1878: 36, legend to Tafel V and figs 1-17). F. Stein apparently was the first author to validly publish the combination *Anthophysa vegetans*.

To our knowledge, a nomenclatural type has not previously been designated for *Anthophysa vegetans* (O.F.Müller) F.Stein. Lectotype designations are governed by ICN Art. 9.12, in which a hierarchical sequence is set out for the choosing process. In the absence of any known original specimens, the lectotype must be chosen amongst cited and uncited illustrations that comprise the remaining original material (as defined in ICN Art 9.3). **Therefore, we here designate O.F. Müller's 1786 fig. 23 as the lectotype of *Anthophysa vegetans*.** This figure was used as part of Müller's original description, and it illustrates a specimen with branched stalks that have the living colonial flagellates at the terminus of each branch (see Fig. 1). This does not imply that *Anthophysa vegetans* (O.F.Müller) F.Stein must have colonies at each branch terminus because over 200 years ago, O.F.Müller also described how the colonies were released and he illustrated an example in his Fig. 24.

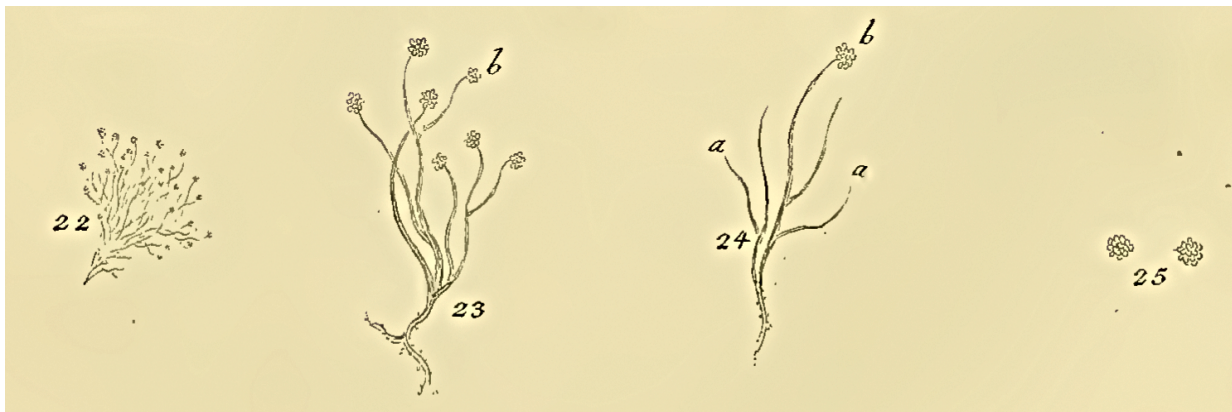


Fig. 1. Reproduction of Müller's (1786) drawings of *Volvox vegetans*. [Müller's original legend (translated). Fig. 22. *V. vegetans*, increased in size. Fig. 23. Greatly increased. Fig. 24. Another branch. a. Abandoned. b. Terminal rosette. Fig. 25. Free rosettes, by themselves.]

There have been many additional observations of *Anthophysa* and *Anthophysa*-like organisms; we briefly mention other species that have been ascribed to *Anthophysis*. Bory (1822: 427) described *A. dichotoma* Bory and later *A. solitaria* Bory (Bory 1824: 67). Kent (1871: 264) gave accounts of *A. laxa* Kent and *A. bennettii* Kent, but neither of these organisms resembles *A. vegetans*. Fromentel (1874: 212) described *Pycnobryon socialis* Fromentel, which does resemble *A. vegetans*, and this species was transferred into *Anthophysa* as *A. socialis* (Fromentel) Kent (Kent 1880-1881: 272). Stokes (1887: 141) reported *A. stagnatilis* A.C.Stokes.

Senn (1900: 133) described *A. steinii* Senn for a species that possessed an eyespot. Subsequently, Pringsheim (1946: 314) considered *A. steinii* to be conspecific with *A. vegetans*, and Pringsheim (*op. cit.*) explicitly implied that the original *A. vegetans* (i.e., *A. vegetans* var. *vegetans*; see ICN Art. 26.1) did not possess an eyespot, and O.F.Müller (1786) made no mention of an eyespot in the protologue of *A. vegetans*. Pringsheim (*op. cit.*) then published the name *A. vegetans* var. *sennii* for individuals that lacked an eyespot. As a result, the name *A. vegetans* var. *sennii* is a superfluous name for *A. vegetans* var. *vegetans* and thus is illegitimate and to be rejected (ICN Art. 52.1).

Further investigations are required to determine the taxonomic status of the above names, a task beyond the scope of the present study.

We thank Dr. Nina Lundholm and Dr Martin Vinther Sørensen, Natural History Museum of Denmark, for searching their collections for O.F. Müller type material or other collected specimens of *Volvox vegetans*.

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