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THE GENERIC NAME *HORMIDIUM* AS APPLIED TO GREEN ALGAE*

Paul C. Silva¹, Karl R. Mattox², and Will H. Blackwell, Jr.²

Summary

Hormidium Kützing 1843 (non Lindley ex Heynhold 1840, Orchidaceae) is shown to have been lectotypified with *H. velutinum*, a schizogoniaceous alga. *Hormidium* sensu Klebs 1896 comprises ulotrichaceous algae. Although intended to apply to ulotrichaceous algae, *Chlorhormidium* Fott 1960 can be associated only with schizogoniaceous algae inasmuch as the name was proposed as a substitute for *Hormidium* Kützing. Klebs's concept of *Hormidium* is therefore described as a new genus, for which the name *Klebsormidium* is proposed.

Considerable confusion is apparent in phycological literature as to the application of the generic name *Hormidium*. In recent years, moreover, the prior use of this name in the orchids has been brought to the attention of phycologists, necessitating a reconsideration of the taxonomy and nomenclature of the algae in question.

Hormidium was first used as a valid algal name by Kützing in his *Phycologia generalis* (1843b: 244), where it was applied to a new genus of filamentous green algae comprising three species: *H. moniliforme*, a new species growing among other filamentous algae near Nordhausen, Kützing's home; *H. velutinum*, a new species growing on bare earth near Trieste; and *Conferva flacca* Dillwyn 1805, for which the combination *H. flaccum* was made. (A synopsis of the taxonomic arrangement of Kützing's *Phycologia generalis* was published earlier the same year in the journal *Linnaea*; in the absence of descriptions, however, new names contained therein are not valid.) It is difficult to determine what Kützing had in mind when he conceived *Hormidium*. The Latin diagnoses and German discussion in the systematic portion of the *Phycologia generalis* are heavily laden with a special terminology that is explained (but not always lucidly) in the physiological-organographic portion of the book and partially illustrated. Some degree of clarification can be achieved by referring to Kützing's *Phycologia germanica* (1845), which follows essentially the taxonomic system of the earlier work and is written in German, with meaningful statements rather than abstruse characterizations. From a study of these two works there emerges the picture: Kützing perceived in these three green filamentous species certain characters which on the one hand linked them with a small number of other filamentous algae, both green and red, and on the other hand distinguished them from the majority of green filamentous algae.

Using *Hormidium* as a cornerstone, Kützing erected the family Hormi-

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dieae, its members characterized as having filaments formed of short "Vollzellen" (cells that apparently lack central vacuoles), the contents of each of which may develop into a single gonidium. Alongside *Hormidium*, Kützing arranged five other newly conceived genera (*Goniotrichum*, *Allogonium*, *Gloeotila*, *Schizogonium*, and *Schizomeris*) in addition to *Bangia* Lyngbye 1819. A second family, Ulotricheae, was erected to receive *Ulothrix*, first proposed by Kützing in 1833, and the new genus *Stygeoclonium* (the spelling being later changed by Kützing to *Stigeoclonium*, the form that has been officially conserved). Members of the Ulotricheae were characterized as having filaments formed "Hohlzellen" (cells with apparent central vacuoles), each with a green girdle-like "Amylidzelle" (chloroplast), the cell contents eventually dividing into four (and more) "Scheinsamen" (reproductive cells, now known to be gametes or zoospores). Kützing's knowledge of *Ulothrix* was based on his own careful observations of its life history, illustrated as pl. 80 in the *Phycologia generalis*. The disposition of the remaining green filamentous algae does not concern us here; it is sufficient to say that *Draparnaldia* was set apart in its own family, the conjugating forms were placed in the Zygnemeae, while the bulk of the species now referred to such genera as *Oedogonium*, *Bulbochaete*, *Chaetomorpha*, *Rhizoclonium*, *Cladophora*, *Urospora*, *Microspora*, and *Tribonema*, were placed in the Conferveae, whose members were characterized by having filaments formed from vacuolate cells with conspicuous, often starch-rich chloroplasts, and either with reproductive structures as in *Oedogonium* (only oogonia were known at this time) or with reproduction as yet unknown or uncertain.

While Kützing in his *Phycologia germanica* (1845) generally followed the innovative taxonomic system of his *Phycologia generalis* (1843b), there was some shuffling of old species and description of new species with regard to *Hormidium* (as well as many other genera). *Conferva flacca* Dillwyn was removed from *Hormidium* and placed in *Hormiscia* E. M. Fries 1835, which Kützing renamed *Hormotrichum* because of the existence of *Hormiscium* Kunze 1817 in the fungi and which subsequently has been officially rejected in favor of *Urospora* J. E. Areschoug 1866 (*nom. cons.*). To the remaining two original members of *Hormidium*, Kützing added eight new species and transferred three species from other genera. The resulting 13 species were distributed into two groups: aquatic and terrestrial.

Major changes of concept were introduced by Kützing in his *Species algarum* (1849). The families Hormidieae and Draparnaldieae were both merged with the Ulotricheae and the distinction between *Hormidium* and *Ulothrix* disappeared in the mind of Kützing, who transferred 12 of the 13 species recognized in 1845 to *Ulothrix* (*H. ericetorum* being inexplicably omitted in the *Species algarum*). Of the original species of *Hormidium*, *H. moniliforme* was listed as a fresh-water species of *Ulothrix* and *H. velutinum* as one of those species of *Ulothrix* that occur on bare earth. The latter group of species was headed "*In terra nuda* (Hormidium)", despite the fact that of the three original species, only *H. velutinum* is terrestrial. It may be mentioned that prior to Kützing's rejection of *Hormidium* as a genus, it had been accepted by Römer (1845), Rabenhorst (1847), Nägeli (1847), Trevisan (1848), and Jessen (1848).

Following Kützing's rejection of *Hormidium* as a genus, it was nonetheless recognized as such by Braun (1851: 140 adnot.) and by Rabenhorst (1863: 265) in approximately the same circumscription as *Ulothrix* sect. *Hormidium* of Kützing's *Species algarum*, that is, as a group of terrestrial *Ulothrix*-

like species. *Hormidium velutinum*, the only original species of the genus that remained in *Ulothrix* sect. *Hormidium*, was not treated by Rabenhorst, who soon afterward (1868) returned this group of species to *Ulothrix*.

For many years prior to this time, there had been a growing suspicion and belief that these terrestrial filamentous green algae were phylogenetically if not genetically related to *Schizogonium* and *Prasiola*. It is beyond the scope of this paper to recount the history of this movement, which is an integral part of a much larger picture – the theory of metamorphosis – itself a manifestation of Naturphilosophie. It was Gay (1888) who first transferred to *Schizogonium* certain of the terrestrial species which Kützing had placed in *Ulothrix*. Gay dealt only with those species in which he could demonstrate the cellular structure characteristic of the Schizogoniales: a stellate chloroplast with a central pyrenoid, first observed in *Schizogonium* and *Prasiola* by Schmitz (1882: 18). *Hormidium velutinum*, the only one of the three original species of the genus that is terrestrial, was not studied by Gay. Immediately afterward, Hansgirg (1888) reviewed the situation in light of Gay's work and concluded that *Hormidium* should be applied to a genus comprising the uniseriate filamentous Schizogoniales. It is important to note that Hansgirg attributed the genus to Kützing as of the *Phycologia generalis* but excluded two of the three original species, thus lectotypifying it with the third, *H. velutinum*, which he considered a variety of *H. parietinum* (Vauch.) Kütz. This lectotypification takes priority over Mattox's proposal (1968) of *H. flaccum* (Dillw.) Kütz. De Toni (1889) adopted Hansgirg's treatment, but placed *Hormidium* and *Schizogonium* in the Ulotrichaceae while aligning *Prasiola* with the Ulvaceae. Wille (1890: 84) merged *Schizogonium* with *Hormidium*, but otherwise followed De Toni's treatment. Later, however, Wille (1909: 74) considered *Hormidium* and *Schizogonium* as separate sections of *Prasiola*, which he then referred to its own family, Blastosporaceae. These sectional distinctions were abandoned by Printz (1927: 181).

Thus ends one line in the history of *Hormidium* Kützing: that as applied to a schizogoniaceous alga. However, the name continued to be used for certain filamentous green algae with parietal chloroplasts (i.e., ulotrichaceous algae) by Klebs (1896: 326-345, 393), who, although continuing to accredit the name to Kützing, circumscribed the genus in such a way as to exclude all of the original species and hence effectively created a new genus. As defined by Klebs in the results of his careful experimental studies, members of *Hormidium* are filamentous but lacking a basal cell; each cell has a plate-like chloroplast with a pyrenoid; reproduction is by fragmentation of the filament into small pieces or individual cells and (in one species) by biflagellate zoospores produced singly within a cell. The two species investigated by Klebs, in culture, were "*H. nitens* Meneghini" and "*H. flaccidum* (Kg.) Braun". *Hormidium nitens* was the manuscript name under which Meneghini sent a specimen to Kützing, who published it as *Ulothrix nitens* (1849: 349); it was later transferred into *Hormidium* by Rabenhorst (1863: 265). The material assigned by Klebs to this species was considered to be distinct from true *H. nitens* by G. M. Smith (1933: 385), who named it *H. klebsii*, but without giving any distinguishing character or indicating whether the type specimen of *H. nitens* had been examined. Through the kindness of Dr. W. F. Prud'homme van Reine of the Rijksherbarium, Leiden, we were able to examine the type specimen of *Ulothrix nitens* (L 939 67 828): in our opinion this material is referable to *Hormidium* sensu Klebs but more similar to *H.*

flaccidum than to the alga described by Klebs as *H. nitens*. Although no specimen or culture of *H. nitens* attributable to Klebs has been found, the shorter filaments and smaller cells indicated by Klebs clearly distinguish the organism he had in hand from true *H. nitens*. Smith was thus justified in recognizing Klebs's material as a new species. We consider *H. nitens*, as to type, conspecific with *H. flaccidum*, the second species studied by Klebs. *Hormidium flaccidum* was originally described as *Ulothrix flaccida* by Kützing (1849: 349) on the basis of material sent by Braun from Strasbourg. An examination of the type specimen (L 939 67 905) reveals that Klebs's identification of his material was apparently correct. Subsequent authors who applied *Hormidium* to ulotrichaceous algae more or less in the sense of Klebs include the following: Oltmanns (1904: 203); Chodat (1913: 138), who attributed authorship of the genus to "(Kützing p.p.) Klebs"; Heering (1914: 41), who accredited Klebs directly; Printz (1927: 166), as "(Klebs) Heering"; West & Fritsch (1927: 154), as "Kützing p.p. emend. Klebs"; Smith (1933: 385); Fritsch (1935: 205); Smith (1950: 146); Prescott (1951: 97); Mattox & Bold (1962); Printz (1964: 22); and Ramanathan (1964: 77), who chose *H. flaccidum* as lectotype of "*Hormidium* Kützing emend. Klebs".

In the meanwhile, the existence of *Hormidium* Lindley ex Heynhold 1840, a genus of tropical American orchids related to *Epidendrum* (cf. Brieger & Hunt, 1969), came to the attention of Fott (1960), who proposed a new name, *Chlorhormidium*, as a substitute for *Hormidium* Kützing. Although Fott intended to propose a new name for Klebs's emended genus and accordingly made the combination *C. flaccidum* (Kütz.) Fott, his citation of *Hormidium* Kützing 1843 as "basionym" means that *Chlorhormidium* is unequivocally a synonym of that generic name and would be the correct name for this genus of schizogoniaceous plants should anyone wish to adopt Hansgirg's treatment.

There remains the problem of selecting a name for *Hormidium* sensu Klebs¹. *Hormococcus* R. Chodat (1902), based on *Ulothrix flaccida* Kütz., would be available were it not for the fact that it is a later homonym of *Hormococcus* Preuss (1853) in the fungi. *Pseudulothrix* Pascher (1907) is a possibility. This name was proposed to accommodate *Ulothrix*-like plants with biflagellate rather than quadriflagellate zoospores, and insofar as this characterization goes, it does not exclude *Hormidium* sensu Klebs. Unfortunately, Pascher did not describe, illustrate, or cite a particular species, so that the application of the name remains clouded. The uncertainty is increased by a consideration of Heering's treatment (1914), the first subsequent use of the name and one that has been adopted by Printz (1927, 1964). Heering reduced Pascher's genus to the status of a section of *Hormidium*. From an examination of his key to species and of the descriptions of the three included species [*H. subtile* (Kütz.?) Heering, *H. fluitans* (Gay) Heering, and *H. rivulare* Kütz.], a more precise definition of the genus can be obtained, but there is no assurance that Heering's concept is the same as Pascher's. Neither of the two original species of Klebs's circumscription of *Hormidium* was included in sect. *Pseudulothrix*. Inasmuch as Heering characterized *Pseudulothrix* as comprising aquatic species, *H. flaccidum* was placed in sect. *Eu-*

1. '*Hormidium* Klebs 1896' was proposed for conservation against *Hormidium* Kützing 1843 by Mattox (1968) in the belief that *Hormidium* Lindley ex Heynhold 1840 was not validly published. After having been shown that the latter was indeed validly published, Mattox withdrew his proposal.

hormidium alongside other terrestrial species. *Hormidium nitens* was included in a special group compared solely on the basis of attributes demonstrated in culture. Under the circumstances, it seems best to treat *Pseudulothrix* Pascher as a generic name of uncertain application and to describe *Hormidium* sensu Klebs as a new genus:

Klebsormidium Silva, Mattox et Blackwell, gen. nov.

Fila non ramosa; cellulae uninucleatae unaquaeque cum chloroplasto uno qui lumen cellulae incomplete cingit et unam pyrenoidem distinctam continet; margines longitudinales chloroplasti non lobatae; zoosporae biflagellatae astigmaticaeque non producentes haptera quum germinent.²

Species typica: *Klebsormidium flaccidum* (Kütz.) Silva, Mattox et Blackwell (*Ulothrix flaccida* Kützing).

The following synopsis distinguishes *Klebsormidium* from closely related genera of the Ulotrichaceae:

Ulothrix: Cells with plastids which nearly, or completely, encircle the cell lumen; incompletely encircling plastids lobed along longitudinal margins; plastids typically with more than one pyrenoid; zoospores quadriflagellate and stigmatic, germinating to produce holdfasts.

Klebsormidium: Cells with plastids always incompletely encircling the cell lumen; each plastid with one pyrenoid; plastid margin not lobed; zoospores biflagellate and astigmatic, producing no holdfasts on germination.

Stichococcus: Cells with plastids always incompletely encircling the cell lumen; pyrenoids and motile cells lacking.

The following species may be placed in *Klebsormidium* at the present time:

Klebsormidium flaccidum (Kütz.) Silva, Mattox et Blackwell, comb. nov.

Ulothrix flaccida Kützing (1849: 349. Type: L 939 67 905). *Hormidium flaccidum* (Kütz.) Braun in Rabenhorst (1876: no. 2480). *Hormiscia flaccida* (Kütz.) Lagerheim (1888: 62). *Stichococcus flaccidus* (Kütz.) Gay (1891: 79, pl. XI: figs. 101-106). *Hormococcus flaccidus* (Kütz.) R. Chodat (1902: 269). *Chlorhormidium flaccidum* (Kütz.) Fott (1960: 149).

Ulothrix nitens Kützing (1849: 349. Type: L 939 67 828). *Hormidium nitens* (Kütz.) Rabenhorst (1863: 265). *Ulothrix flaccida* var. *nitens* (Kütz.) Hansgirg (1885: 386). *Hormiscia flaccida* var. *nitens* (Kütz.) Hansgirg (1888: 265). *Hormococcus flaccidus* var. *nitens* (Kütz.) R. Chodat (1902: 269). *Chlorhormidium flaccidum* var. *nitens* (Kütz.) Farooqui (1969: 4).

Klebsormidium klebsii (G. M. Smith) Silva, Mattox et Blackwell, comb. nov.

Hormidium klebsii G. M. Smith (1933: 385, fig. 257). *H. nitens* sensu Klebs (1896: 328, pl. II: figs. 25-29). Type: no material attributable either to Klebs or to Smith has been found. The species, therefore, is presently defined solely on the basis of Klebs's published treatment.

Klebsormidium marinum (Deason) Silva, Mattox et Blackwell, comb. nov.

Hormidium marinum Deason (1969: 244, figs. 5, 6, 17. Type: no type material extant. Neotype herein designated: MU 31022, selected from culture sent by T. R. Deason to the authors; duplicate at F).

Klebsormidium sterile (Deason et Bold) Silva, Mattox et Blackwell, comb. nov.

Hormidium sterile Deason et Bold (1960: 36, figs. 54, 55, 112. Lectotype: F 1001948).

2. The Latin translation of the diagnosis was kindly provided by Dr. R. J. Whittman of the Classics Department, Miami University.

Klebsormidium subtilissimum (Rabenhorst) Silva, Mattox et Blackwell, comb. nov.

Ulothrix subtilissima Rabenhorst (1857: no. 656. Lectotype: Rabenhorst, Die Algen Sachsens no. 656 in NY). *U. subtilis* var. *subtilissima* (Rabenh.) Rabenhorst (1868: 365). *U. subtilis* ssp. *subtilissima* (Rabenh.) Hansgirg (1886: 59). *Hormiscia subtilis* var. *subtilissima* (Rabenh.) Hansgirg (1890: 106). *Hormidium subtilissimum* (Rabenh.) Mattox et Bold (1962: 32, fig. 43).

It is possible that additional species will be transferred into *Klebsormidium* when their morphological relationships become more certain.

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