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The nomenclatural history of *Didymosphenia geminata* (Lyngbye) M. Schmidt in Schmidt *et al.* (Bacillariophyta) and related taxa

La historia nomenclatural de Didymosphenia geminata *(Lyngbye) M. Schmidt* et al. *(Bacillariophyta) y taxones relacionados*

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The diatom genus *Didymosphenia* was erected by M. Schmidt in Schmidt *et al.* [36], although the question whether *Didymosphenia* was proposed as a genus or as a subgenus of *Gomphonema* remained unclear [13][40] and was only settled by the conservation of the genus name *Didymosphenia* M. Schmidt [22]. This genus originally comprised three species: (1) *Didymosphenia sibirica* (Grunow) M. Schmidt in Schmidt *et al.* ≡ *Gomphonema geminatum* var. *sibiricum* ("*sibericum*") Grunow ≡ *Gomphonema sibiricum* ("*siberica*") (Grunow) Mills *non Gomphonema sibiricum* ("*sibirica*") Skvortzow & K.I. Meyer, (2) *Didymosphenia curvirostra* ("*curvirostrum*") (Tempère & Brun) M. Schmidt ≡ *Gomphonema geminatum* var. *curvirostra* ("*curvirostrum*") (Tempère & Brun) Cleve ≡ *Gomphonema curvirostra* ("*curvirostrum*") Tempère & Brun, and (3) *Didymosphenia geminata* (Lyngb.) M. Schmidt ≡ *Echinella geminata* Lyngb. ≡ *Gomphonema geminatum* (Lyngb.) C. Agardh. However, no generitype was designated until the Special Committee for Bacillariophyta [39] designated *Didymosphenia geminata* (Lyngb.) M. Schmidt as type of the genus. This type is conserved since *Didymosphenia* is conserved against its nomenclatural (homotypic) synonym *Dendrella* Bory and its taxonomic synonym *Diomphala* Ehrenb. [22]. *Gomphonema geminatum* is also the type species designated and conserved by the former ICBN [23] for the genus *Gomphonema* C. Agardh (rejected *versus Gomphonema* Ehrenb., *nom. cons.*) with *Gomphonema acuminatum* Ehrenb. as its conserved type [22][23].

Currently, Fourtanier & Kociolek [14] list a total of 10 species validly described in or transferred to *Didymosphenia* : (1) *Didymosphenia clavaherculis* (Ehrenb.) Metzeltin & Lange-Bert. ≡ *Diomphala clavaherculis* Ehrenb., (2) *Didymosphenia curvata* (Skvortzow & Meyer) Metzeltin & Lange-Bert. ≡ *Didymosphenia geminata* var. *baicalensis* f. *curvata* Skvortzow & K.I. Meyer, (3) *Didymosphenia curvirostra* (Tempère & Brun) M. Schmidt ("*curvirostrum*") (see above); (4) *Didymosphenia dentata* (Dorogostaisky) Skvortzow & K.I. Meyer ≡ *Gomphonema dentatum* Dorogostaisky, (5) *Didymosphenia fossilis* Horikawa & Okuno, (6) *Didymosphenia geminata* (Lyngb.) M. Schmidt, (7) *Didymosphenia lineata* Skabichevskii, (8) *Didymosphenia pumila* Metzeltin & Lange-Bert., (9) *Didymosphenia sibirica* (Grunow) M. Schmidt, and (10) *Didymosphenia sublinearis* Shirshov (actually absent in Shirshov [37], possibly a *nomen nudum*). Munda [28] also mentions "*Didymosphenia borealis*", but this name does not seem to appear anywhere else, it is a *nomen nudum* or a mistake. Finally, a new species, *Didymosphenia tatrensis* Mrozińska, Czerwik-Marcinkowska & Gradziński has been described from the Western Carpathians [27]. With respect to *Diomphala clavaherculis*, Metzeltin & Lange-Bertalot [25] and Jahn & Kusber [20] treated this taxon as a clearly defined species not conspecific with *Echinella geminata*.

Adding to *Gomphonema geminatum* and *Echinella geminata*, *Dendrella geminata* (Lyngb.) Bory and *Lyngbyea pulvinata* var. *geminata* (Lyngb.) Sommerfelt have been identified as nomenclatural synonyms of *Didymosphenia geminata*. Kützing [21] provided the following list of taxonomic or nomenclatural synonyms: *Gomphonema herculeanum* Ehrenb., *Gomphonema pyriferum* Suhr, *Gomphonema intricatum* Suhr, *Gomphonema radicula* Suhr, *Gomphonema ampullaceum* Grev. ≡ *Echinella ampullacea* Carmichael (*nomen* in Greville [16]) (also synonymized by Ralfs [34], Smith [38], Rabenhorst [33], Brun [37] and VanLandingham [43]), *Gomphonema geminatum* Grev., *Crystalia* ("*Crystallia*") *pulvinata* Sommerfelt in Agardh (also synonymized by Rabenhorst [32], but Prollius [31] did not accept the synonymy), *Dendrella lyngbyei* Bory (also synonymized by Bory [6][7] and Drapiez [12]), *Dendrella geminata* (Lyngb.) Bory, and *Vorticella pyraria* O. Müll. ≡ *Gomphonema pyrarium* (O. Müll.) Ehrenb. (also synonymized by Agardh [1][2], Greville [15] and Dawson [10]). Rabenhorst [32] additionally considered *Dendrella styllarioides* Bory and *Gomphonella olivacea* Rabenh. as synonyms of *Gomphonema geminatum* (see the discussion about genus *Gomphonella* Rabenh. in Fourtanier & Kociolek [13]). *Gomphonema herculeanum* was later rejected as a synonym of *Gomphonema geminatum* and combined with *Gomphoneis* Cleve by Cleve in 1894 [13]. Concerning Suhr's species, Kützing [21] seems to be the only one to have seen these diatoms, all later authors always citing Suhr "teste Kützing"; since these names are always cited as synonyms, they are not validly published and should be ignored. *Gomphonema ampullaceum* is regarded as an independent taxon by Harvey [18]. *Vorticella pyraria* is considered as synonym of *Dendrella geminella* Bory (and possibly of *Dendrella styllarioides*), but not of *Echinella geminata* in Bory [6][7] and Drapiez [12], and as a former synonym of *Gomphonema truncatum* Ehrenb. by

Pritchard [30], opinion followed by many other authors. Guiry & Guiry [17] regard *Gomphonema vulgare* Bréb. in Brébisson & Godey as a synonym of *Didymosphenia geminata*. Lawson [24] mentions "*Gomphonema coquedense* Lang" (*nomen nudum*) as a possible synonym of *Gomphonema geminatum*. Finally, Antoine & Benson-Evans [3] presented an emended diagnosis of the generitype.

The tracking of diatom synonyms back to the XIX century is obscured by the lack of the precise descriptions and/or accurate illustrations available through modern microscopic techniques; e.g., *Vorticella* O. Müll. was treated as an animal in several early monographs (e.g., Pritchard [29][30], Deshayes & Edwards [11]), and is currently recognized as a genus of ciliates. *Echinella* Lyngb. (*non* O. Müll.) was also established for many forms that were not diatoms [43]. Moreover, in several cases the type material of these taxa has been lost or remains unavailable, which leaves their assignation as taxonomic synonyms *in suspenso*. In many cases, they could be considered only as synonyms *pro parte*.

Additionally, up to 26 infraspecific taxa have been validly described within *Didymosphenia geminata* [5], mainly published in the works of Skvortzow and Meyer about the lake Baikal. Metzeltin & Lange-Bertalot [25] rearrange all these into five species, accommodating many of the previously described varieties and forms into three different "morphotypes" of *D. geminata* ("*geminata*", "*capitata*" and "*subcapitata*"). However, this classification, followed by few subsequent authors, is based on recent samples and original descriptions (and not on type materials), and thus might be not definitive [26]. The following taxa, originally described as varieties of *Gomphonema geminatum*, are not considered in detail in this monograph and deserve further comments:

Gomphonema geminatum var. *hybridum* ("*hybrida*") Grunow in Van Heurck (Fig. 1A): this taxon lacks description, and only a single drawing is provided by Grunow in Van Heurck's Atlas [42]. Dawson [10] suggested a connection with *D. sibirica*, but Metzeltin & Lange-Bertalot [25] did not cite *G. geminatum* var. *hybridum* in their list of synonyms, but they did it in that of *D. curvata*, with the addition of a question mark. This variety seems to represent a transitional form between *D. sibirica* and *D. curvata* according to the figures provided in Metzeltin & Lange-Bertalot [25]. Until the morphological variability of this taxon can be resolved with new findings, the combination of this taxon under *Didymosphenia curvata* is not recommended at this stage.

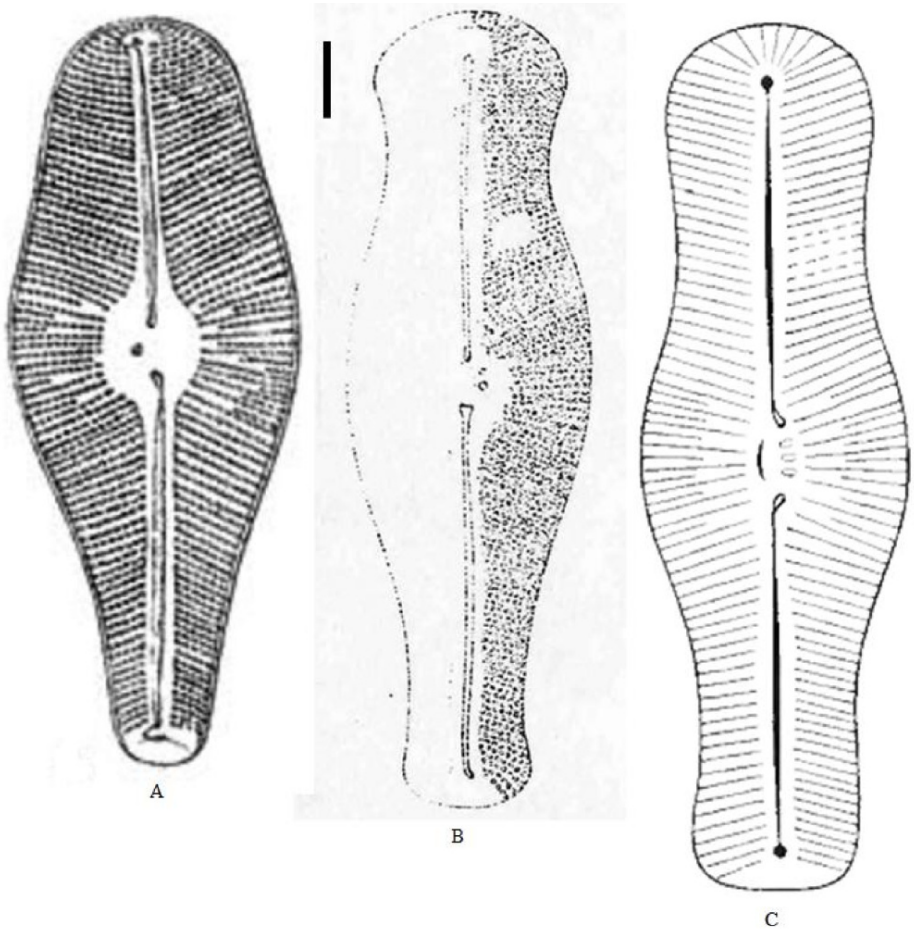

Figure 1: A. *Gomphonema geminatum* var. *hybridum*. Iconotype [42]. **B.** *Gomphonema geminatum* var. *bipunctatum*. Iconotype [35]. **C.** *Gomphonema geminatum* var. *norvegicum*. Iconotype [19]. Scale bar: 10 µm.

Gomphonema geminatum var. *bipunctatum* ("*bipunctata*") Rattray (Fig. 1B): Dawson [10] hypothesized the conspecifity of this variety and "*Didymosphenia fossilis*", a taxon presumably described in Barnard & Welch [4], although this short paper actually does not deal with gomphonemoid species. In any case, the micrograph of the lectotype of *Didymosphenia fossilis* Horikawa & Okuno [41] clearly shows a different taxon. Rattray [35] presents a detailed description of *G. geminatum* var. *bipunctatum*, evidencing a number of differences with respect to the nominal variety as illustrated in Smith [38]. The low stria density reported for this variety (6 in 10 µm) cannot be found in any of the taxa analyzed in Metzeltin & Lange-Bertalot [25], supporting therefore its status as an independent taxon. No further references were found in

the literature of this taxon, considered "rare" in Rattray's type material (diatomite from Loch Osabath, Isle of Lewis, Outer Hebrides).

Gomphonema geminatum var. *norvegicum* ("*norvegica*") Holmboe [25] (Fig. 1C): the iconotype of this variety fits well with characteristic features of *Didymosphenia*, although the shape clearly differs from any other taxon described within this genus. In particular, the broad foot pole, giving the entire valve an isopolar outline, seems to be typical for this variety. According to the author, *G. geminatum* var. *norvegicum* exhibits a consistent morphology throughout all populations examined (five samples from Mjøsa and Grudbrandsdalen, Norway), so that it cannot be regarded as a "pseudo-taxon" *sensu* Metzeltin & Lange-Bertalot [25]. However, no more information was found in the bibliography advising against an eventual transfer to genus *Didymosphenia*.

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