Observations on the types of *Nitzschia tubicola* and *N. gandersheimiensis* (*Bacillariaceae, Bacillariophyceae*)

Bart Van de Vijver[1,2] & Tanja M. Schuster[3]

[1]*Meise Botanic Garden, Research Department, Nieuwelaan 38, 1860 Meise, Belgium* (correspondence: bart.vandevijver@plantentuinmeise.be)
[2]*University of Antwerp, Department of Biology – ECOSPHERE, Universiteitsplein 1, B-2610 Wilrijk, Belgium*
[3]*Natural History Museum, Department of Botany, Herbarium, Burgring 7, 1010 Vienna, Austria* (correspondence: tanja.schuster@nhm-wien.ac.at)

Krammer & Lange-Bertalot (1988: 90–92) placed *Nitzschia adamata* Hustedt (1957: 342) and *N. gandersheimiensis* Krasske (1927: 272) in synonymy with *N tubicola* Grunow (in Cleve & Grunow 1880: 97), as the earliest available name. However, each species was described from ecologically different conditions. The original material of *Nitzschia tubicola* was described (Cleve & Grunow 1880: 97) as a marine species occurring in large quantities in the sheath ("Scheide") of *Schizonema grevillei* C.Agardh [currently *Libellus grevillei* (C.Agardh) Cleve] collected near Sonderburg, today the Danish city of Sønderborg. Krasske (1927: 254) described *N. gandersheimiensis* from Herzog-Wilhelmsquelle near Bad Gandersheim (a brine spring in Lower Saxony, Germany) and classified it as a mesohalobe species. *Nitzschia adamata* was found in several localities near Bremen in the rivers Lesum and Wumme (Hustedt 1957: 343) and, according to the author, it should be classified as pH-indifferent, oligohalobe, and meso-oxybiont. However, Krammer & Lange-Bertalot (1988) expressed doubt ("*nicht zweifelsfrei*") as to whether *N. tubicola* and *N. gandersheimiensis* should be considered conspecific.

Alternatively, in an earlier work, Lange-Bertalot & Simonsen (1978: 28) concluded that *N. gandersheimiensis* belonged to a group including *N. capitellata* Hustedt and *N. frequens*, contradicting an earlier statement by Cleve-Euler (1952: 86) that *N. gandersheimiensis* "…might only be a 'local variation' of *N. intermedia* Hantzsch." This suggested conspecificity was later rejected and Krammer & Lange-Bertalot (1988: 91, see discussion there) urged a revision of all taxa added as synonyms of *N. gandersheimiensis* in Lange-Bertalot & Simonsen (1978: 28). The confusion around *N. tubicola* was exacerbated by separating at least six different 'Sippen' within *N. tubicola* such as the '*tubicola*-Sippen', the '*gandersheimiensis*-Sippen,' and the '*adamata*-Sippen' in addition to three further unidentified taxa from the North Atlantic and Pacific, the North Sea, and several unnamed rivers.

The first edition of Krammer & Lange-Bertalot (1988) was issued as a second edition in 1997 with the addition of further taxonomic comments on various species of *Nitzschia* (Krammer & Lange-Bertalot 1997: 587–600). Although the authors were still not convinced that the holotype specimens of *N. adamata* differed from *N. tubicola*, they acknowledged the presence of a eutrophic species of *Nitzschia* in rivers with moderate electrolyte contents like Hustedt's *N. adamata*. Later, Lange-Bertalot & al. (2017) formally separated these populations from *N. tubicola* as *N. adamata*. This resolved the matter of *N. adamata* but *N. gandersheimiensis* is still considered a junior, heterotypic synonym of *N. tubicola*, which will be treated here.

During analysis of type material of several species of *Nitzschia* from the Grunow collection, kept in the herbarium of the Naturhistorisches Museum Wien (**W**, Vienna, Austria), the original slide (*Grunow 1065*, Sonderburg, slide W0164900) containing the type of *N. tubicola* was documented photographically. Unmounted material is no longer available, so only LM observations were possible. In addition, the slide with the type of *N. gandersheimiensis* (Krasske slide A III 30, sample n° 1205, Herzog-Wilhelmsquelle, Bad Gandersheim) from the Krasske collection, conserved in the Naturkundemuseum im Ottoneum (**KASSEL**, Germany), was also analysed.

Here we detail observations on specimens of *Nitzschia tubicola* (W0164900) and *N. gandersheimiensis* (Krasske slide A III 30) using light microscopy on the original material to analyse their presumed conspecificity. Both species were previously lectotypified by Lange-Bertalot (1976: 270 for *N. tubicola*) and Lange-Bertalot & Simonson (1978: 29 for *N. gandersheimiensis*). The latter was lectotypified a second time in Lange-Bertalot & al. (1996: 161) using slide A III 27 from Hessen, but the second lectotypification is superfluous and thus invalid.

Despite the lower mounting quality (air mount, but still preserving information about colony formation) of the *N. tubicola* type slide, it was possible to make observations highlighting morphological differences between both species that in our opinion support treating them as separate. Figures 1–19 show specimens from the type population of *N. gandersheimiensis*. The valves are more elongated (meaning, longer for same width), compared to the type population of *N. tubicola* (Figs 20–30) that shows more sturdy, shorter valves. Both species differ in valve length (44–75 µm for *N. gandersheimiensis* versus 24–44 µm for *N. tubicola*), whereas valve width shows no difference (both 4.0–4.5 µm). The linear to narrowly lanceolate valve outline in *N. gandersheimiensis* shows a clear (often asymmetrical) constriction near the central area, contrary to the strictly lanceolate outline of *N. tubicola* where a similar constriction has not been observed so far. The striation pattern in *N. gandersheimiensis* is clearly discernible in LM with ca. 35 striae in 10 µm. The striae in *N. tubicola*, on the other hand, are not at all resolvable in LM, which may however be a consequence of the lower quality of the slide. Finally, the specific epithet '*tubicola*' was chosen because this species lived within the mucilaginous tubes of *Libellus grevillei*, clearly observable in the type slide (Figs 21, 22). *Nitzschia gandersheimiensis* has not been found to live in such tubes. These morphological differences and the difference in ecological preferences (marine versus inland, albeit briny water) also suggest a lack of conspecificity.

To summarise, the morphological analysis, in combination with the diverse ecological preferences of the two investigated taxa, shows that both taxa should be kept as separate species: *Nitzschia tubicola* Grunow and *Nitzschia gandersheimiensis* Krasske.

Dr Peter Mansfeld (Ottoneum Kassel, Germany) is thanked for finding the Krasske type slide of *N. gandersheimiensis*. Wolf-Henning Kusber (Botanischer Garten und Botanisches Museum Berlin, Freie Universität Berlin, Germany) is acknowledged for advice regarding the lectotype of *N. gandersheimiensis*.

Cleve, P.T. & Grunow, A. (1880). Beiträge zur Kenntniss der arctischen Diatomeen. *Kongliga Svenska Vetenskaps-Akademiens Handlingar* 17(2): 1–121.

Cleve-Euler, A. (1952). Die Diatomeen von Schweden und Finnland. Teil V. (Schluss.). *Kungliga Svenska Vetenskapsakademiens Handlingar, ser. IV* 3(3): 1–153.

Hustedt, F. (1957). Die Diatomeenflora des Fluß-systems der Weser im Gebiet der Hansestadt Bremen. *Abhandlungen des Naturwissenschaftlichen Vereins zu Bremen* 34(3): 181–440.

Krammer, K. & Lange-Bertalot, H. (1988). Bacillariophyceae. 2 Teil: Bacillariaceae, Epithemiaceae, Surirellaceae. Süsswasserflora von Mitteleuropa 2/2, Begründet von A. Pascher. Herausgegeben von H. Ettl, J. Gerloff, H. Heynig, D. Mollenhauer. Band 2/2, pp. [i]–x, [1]–596, Jena: Gustav Fischer.

Krammer, K. & Lange-Bertalot, H. (1997). Bacillariophyceae. 2 Teil: Bacillariaceae, Epithemiaceae, Surirellaceae. Süsswasserflora von Mitteleuropa 2/2, Begründet von A. Pascher. Herausgegeben von H. Ettl, J. Gerloff, H. Heynig, D. Mollenhauer. Band 2/2, pp. [i]–x, [1]–611, Spectrum Akademischer Verlag.

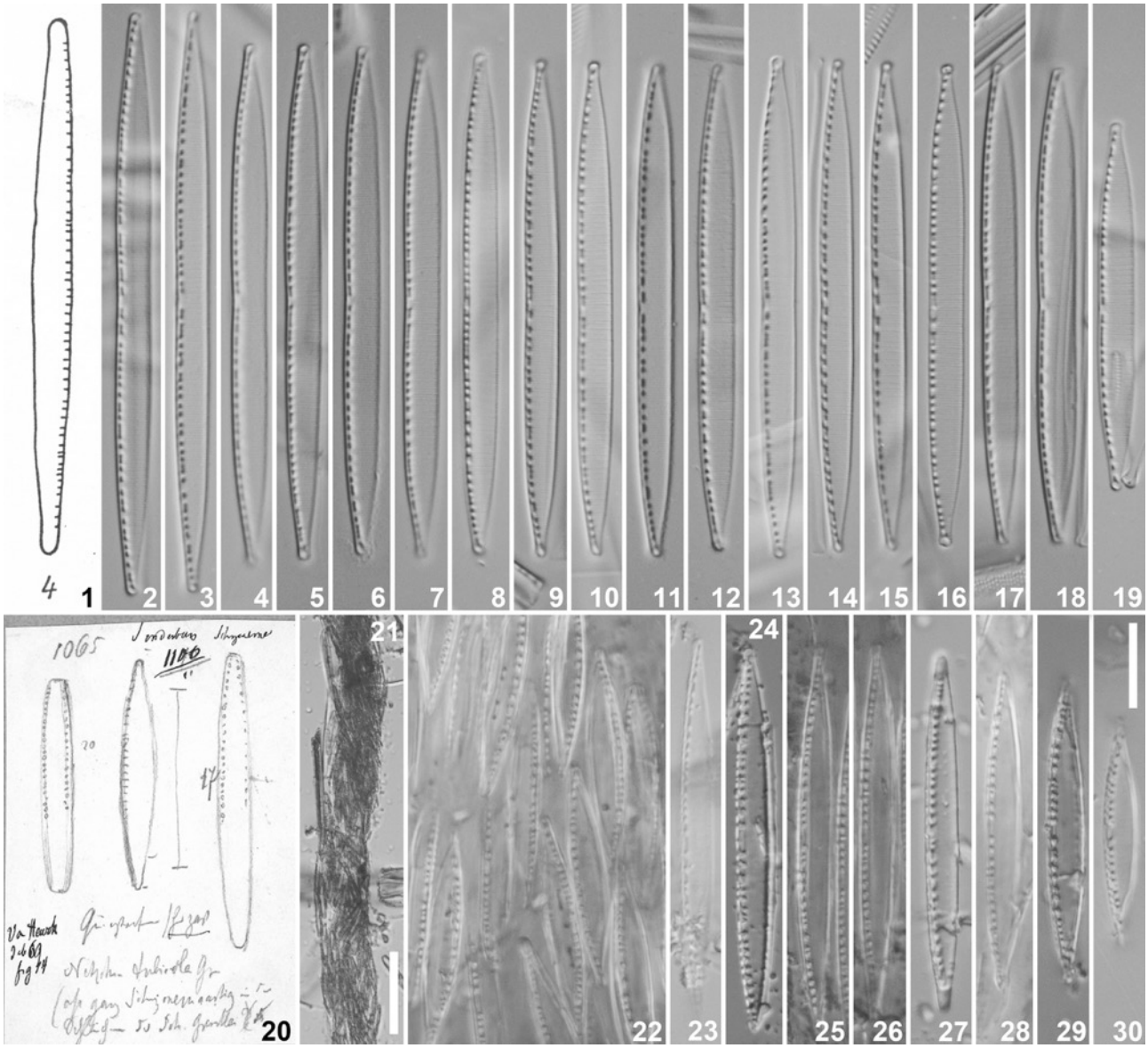
Krasske, G. (1927). Diatomeen deutscher Solquellen und Gradierwerke. *Archiv für Hydrobiologie* 18: 252–272.

Lange-Bertalot, H. (1976). Eine Revision zur Taxonomie der *Nitzschiae Lanceolatae* Grunow. Die "klassischen" bis 1930 beschriebenen Süsswasserarten Europas. *Nova Hedwigia* 28: 253–307.

Lange-Bertalot, H. & Simonsen, R. (1978). A taxonomic revision of the *Nitzschiae Lanceolatae* Grunow. 2. European and related extra-European freshwater and brackish water taxa. *Bacillaria* 1: 11–111.

Lange-Bertalot, H., Külbs, K., Lauser, T., Nörpel-Schempp, M. & Willmann, M. (1996). Diatom taxa introduced by Georg Krasske. Documentation and revision. Dokumentation und Revision der von Georg Krasske beschriebenen Diatomeen-Taxa. *Iconographia Diatomologica* 3: 2–358.

Lange-Bertalot, H., Hofmann, G., Werum, M. & Cantonati, M. (2017). Freshwater benthic diatoms of Central Europe: over 800 common species used in ecological assessments. English edition with updated taxonomy and added species (Cantonati, M. & al. eds). pp. 1–942, 135 pls. Schmitten-Oberreifenberg: Koeltz Botanical Books.



Figs 1–30. *Nitzschia gandersheimiensis* Krasske (Figs 1–19) and *N. tubicola* Grunow (Figs 20–30). All LM pictures taken of the lectotype material of each taxon: *N. gandersheimiensis* = Wilhelmsquelle, Bad Gandersheim, Krasske slide A III 30 (sample 1205), *N. tubicola* = Sonderburg, Grunow sample 1065, slide: W0164900. **Fig. 1.** One of the original drawings in Krasske (1927, plate 10, fig. 4). **Figs 2–19.** LM valve face views showing a cell diminution series. **Fig. 20.** Original Grunow drawing in the Grunow collection in **W** with the annotations Grunow added indicating the sample's origin. **Fig. 21**. LM overview of hundreds of *N. tubicola* frustules colonising a mucilaginous tube. **Fig. 22.** Detail of a group of *N. tubicola* frustules in the type slide. **Figs 23–30.** LM valve face views showing a cell diminution series. Scale bar represents 10 µm except for Fig. 21 where scale bar = 20 µm.