



Observations on the type material and typification of two sigmoid brackish *Nitzschia* species of the section *Obtusae* (*Bacillariaceae*, *Bacillariophyceae*)

Bart Van de Vijver¹, Margaux Pottiez² & Michael. D. Guiry³

¹Meise Botanic Garden, Research Department, Nieuwelaan 38, 1860 Meise, Belgium & University of Antwerp, Department of Biology – ECOSPHERE, Universiteitsplein 1, B-2610 Wilrijk, Belgium (correspondence: bart.vandevijver@plantentuinmeise.be)

²Meise Botanic Garden, Research Department, Nieuwelaan 38, 1860 Meise, Belgium

³AlgaeBase, Ryan Institute, University of Galway, Galway, H91 TK33, Ireland.

Diatom scientists in the nineteenth century described several brackish *Nitzschia* Hassall, 1845, *nom. cons.*, species presenting a more or less sigmoid valve outline. Examples include *Nitzschia obtusa* W.Smith (1853: 39, pl. XIII [13]: fig. 109), *N. nana* Grunow (in Van Heurck 1881: LXVII [67]: fig. 3), *N. brevissima* Grunow (in Van Heurck 1881: pl. LXVII [67]: fig. 4) and *N. clausii* Hantzsch (1860: 40, expl. pl. VI [6]: fig. 7). Originally, Grunow (1862: 559) placed several of these species (*N. obtusa* and *N. clausii*) in his subgenus or section *Sigmoidea* in which he included sigmoid *Nitzschia* species and included the genus *Sigmatella* Kützinger, 1833, *nom. rejic.* in parentheses. Later, Grunow (in Cleve & Grunow 1880: 91–92) further subdivided the genus *Nitzschia* into “Gruppe” splitting off the *Obtusae* (as “Gruppe *Obtusae*”) from the *Sigmoidea* to accommodate a small group of predominantly sigmoid species characterised by valves with obtusely rounded valve apices, an eccentric raphe system, a slight central (often asymmetrical) constriction and central fibulae that are more widely spaced. In Cleve & Grunow (1880: 90–91), the *Obtusae* initially comprised seven taxa, mostly infraspecific taxa of *Nitzschia obtusa* (Cleve & Grunow 1880: 91–92). Van Heurck (1885: 180) included *N. brevissima* and *N. nana* (as *N. obtusa* var. *nana* Grunow) in the *Obtusae*. Despite its early recognition, the *Obtusae* received relatively little taxonomic attention for more than a century, and its species composition and diagnostic characters remained largely unchanged. Hustedt (1930: 421) confirmed the *Obtusae*, again referring to it as a “Gruppe”, refining its description and also placing *N. filiformis* W.Smith in it, but placing *N. clausii* in his *Sigmoidea*. Krammer & Lange-Bertalot (1988: 9, 23–32) referred to the *Obtusae* as a section (“*Sektionen*”) and added further taxa, including *N. clausii* and *N. terrestris* (J.B.Petersen) Hustedt (1934: 396). More recently, Hamsher & al. (2021) published a comprehensive revision of *Nitzschia obtusa* and some of its varieties, based on an integrative approach combining light and scanning electron microscopy. In their paper, the authors included a table listing all *Nitzschia* species in the section *Obtusae* recognised by Cleve & Grunow (1880) and Krammer & Lange-Bertalot (1988). While Grunow (in Cleve & Grunow 1880: 91–92) did not specifically assign the *Obtusae* to a subgenus or section, as “first revisers” Krammer & Lange-Bertalot (1988: 9, 23–32) advertently or inadvertently chose the level of section rather than subgenus particularly as they separately refer to the “*Untergattung*” *Nitzschia* in their key and employ the term “*Sektionen*” for the *Obtusae*, which still should be attributed to Grunow.

Hamsher & al. (2021: 247) also determined the morphological differences with the other sigmoid section of the genus *Nitzschia* the section *Nitzschia* (as section *Sigmoidea*)* that includes the generitype of *Nitzschia*: *N. sigmoidea* (Nitzsch) W.Smith. Differences between the sections include: the lack of a conopeum in the section *Obtusae*, strongly deflected and elongated external central raphe endings, and a different position of the raphe. One of the features they did not mention was the typical organisation of the first rows of areolae on the valve face bordering the raphe. Some of the species possess a distinct, longitudinally running, incomplete groove composed of larger areolae

* As the generitype of the genus *Nitzschia*, *Nitzschia elongata* Hassall, *nom. illeg.* [$\equiv$ *Nitzschia sigmoidea* (Nitzsch) W.Smith] is included in this section, the autonym, section *Nitzschia*, is required to be employed (ICN Art. 22.1).

(e.g. *N. filiformis* W.Smith) or a longitudinal series of elongated areolae along the raphe branches, separated from the raphe by a series of very small areolae (e.g. *N. nana* Grunow).

It is, however, unclear whether the type populations of several other *Nitzschia* section *Obtusae* species possess a similar areola structure on their valve faces. Two such species are *N. brevissima* and *N. clausii*. A literature search did not reveal any indication of the types of these two names. Krammer & Lange-Bertalot (1988, pl. 22: figs. 1–6) show some LM illustrations of *N. brevissima* based upon Van Heurck's *Type du Synopsis* exsiccata slide n° 400, but SEM observations are lacking. Similarly, they also showed six LM pictures of *N. clausii* (Krammer & Lange-Bertalot 1988, pl. 19: figs. 1–6, 6A) again without SEM observations, and lacking even an indication of the origin of the pictures.

Nitzschia clausii was described in 1860 by the German botanist Carl August Hantzsch (1825–1886). The original description was limited to a figure legend in Hantzsch (1860: 40, expl. pl. VI [6]: fig. 7) accompanied by five line drawings of some frustules (as indicated by the fibulae on both sides of the valves). Hantzsch (1860: expl. pl. VI [6]: fig. 7) named the original material: “*Vergl[eich] Algen Mitteleurop[as] Nr. (=Rabenhorst) 944*”. Although a species description is lacking, the name is validated under ICN Art. 38.9 by the provision of a diagnostic illustration. The accompanying label of Rabenhorst exsiccata sample 944 (Decas 95–96) in the series *Die Algen Europa's, Fortsetzung der Algen Sachsens, resp. Mittel-Europa's* (Rabenhorst 1860) under the name “*Nitzschia clausii* Ha. (n. sp.)”, reads as follows: “*In der Grösse etwa der N. parvula gleich; Haupt- und Nebenseiten schwach sigmoidisch, die Enden des Hantseiten Kopfförmig erweitert; Knoten deutlich* [Approximately the same size as the *N. parvula*; main and side margins weakly sigmoid, the ends of the valves head-shaped; nodes distinct]”. According to the label, the sample was “*gefunden von Claus*” in September 1859 in a small brook near Tharandt (Sachsen) and communicated by Hantzsch. Later authors such as Grunow (1862: 573) and Rabenhorst (1863: 48), included the species in their monographs with Rabenhorst (1863: 48) adding morphological details: “*1/43–1/37 " lang, die Enden der Haupts(eite) kopff(örmig)* [52–60 µm long, the apices of the valves capitate]”. Later, Rabenhorst (1864: 156) redescribed the species as *N. curvula* var. *subcapitata* Rabenhorst, referring to *N. clausii* and the material in Rabenhorst sample 944 and recorded a smaller size (50–51 µm, [0.0020]). It is not clear why Rabenhorst redescribed it.

The second species, *Navicula brevissima* Grunow (in Van Heurck 1881: pl. LXVII [67]: fig. 4, as ‘*N. (obtusae var.) brevissima*’), is based on three drawings in Van Heurck's *Types du Synopsis des Diatomées de Belgique Atlas*. These drawings were made from a sample that Henri Van Heurck probably collected near Antwerp (Belgium) as the label on the flask containing the cleaned material for slide Van Heurck Types n° 400, reads ‘*Pilotis de L'Escaut – Nitzschia*’. The annotated version of Van Heurck's Atlas, conserved in the Grunow collection in Vienna (W, Austria) mentions the same locality without an official Grunow sample number and this absence makes the Van Heurck sample undoubtedly the type material. It is, however, unclear what Van Heurck meant by ‘Pilotis’, although it is likely that he was referring to a locality close to the river pilots’ building in the harbour at Antwerp, but an exact explanation could not be found in the literature.

De Toni (1892: 534) considered the original publication of the taxon as a variety of *N. obtusa*, although Grunow deliberately put the variety between brackets. The name *Nitzschia brevissima* Grunow (in Van Heurck 1881: pl. LXVII [67]: fig. 4) is correctly treated as a species name, despite its original designation as “*Nitzschia (obtusae var.) brevissima* Grunow”. The rank of a name is determined from the place of its original publication (ICN Art. 37, Turland & al. 2025), and the parenthetical reference to “*obtusae var.*” does not in itself constitute an indication of varietal rank. Thus, *Nitzschia obtusa* var. *brevissima* (Grunow) Van Heurck is a subsequent name at varietal rank, rather than the original name (Art. 6.10, 41). It should be noted that this type of parenthetical notation was historically used by authors to indicate an affinity or relationship to another taxon, without necessarily indicating the formal rank of the name.

Van Heurck (1881: pl. 67: fig. 4) links in his figure legend *N. brevissima* to *Nitzschia parvula*, in this case a taxon presumably described by Francis West Lewis (1825–1902) but not by William Smith (“*nec W. Smith*”). However, none of the papers published by Lewis included a species named *N. parvula*. *Nitzschia parvula* was originally described by Smith (1853: 41) and represents a very different taxon (hence Van Heurck’s addition “*nec W. Smith*”). *Nitzschia parvula* F.W.Lewis later appeared in Schmidt’s *Atlas* (Hustedt in Schmidt 1921: pl. 336; figs. 12–16) with a brief comment “*Eine Verbindung mit N. obtusa halte ich nicht für zulässig* [I do not consider a connection with *N. obtusa* to be permissible.]” Whether this can be considered a validation of the taxon by means of this, though brief, comment is unclear but if valid, the name would be an illegitimate later homonym of Smith’s species. Krammer & Lange-Bertalot (1988: 30) indicate Lewis (1862) as source for this name, but the name does not appear there. De Toni (1892: 534) mentioned the name *N. parvula* F.W.Lewis (“*nec alior*”) only as a synonym for *Nitzschia (obtusum) brevissima*. Van Heurck (1885: 180), however, listed *N. obtusum* var. *brevissima* Grunow in his *Synopsis Texte* but this should be considered as a younger synonym, *N. obtusum* var. *brevissima* (Grunow) Van Heurck. Curiously, Hustedt (1930: 421, fig. 816) lists and illustrates the species as *N. parvula* F.W.Lewis but as there is no indication of a valid description of the latter illegitimate name, this should be corrected to *N. brevissima*.

The original material for both *N. clausii* and *N. brevissima* was retrieved from the Van Heurck collection, part of the herbarium of Meise Botanic Garden (BR, Belgium), allowing both a light and scanning electron microscopy analysis of these species. Here we discuss and illustrate the morphology of *N. brevissima* and *N. clausii* based on this original material and formally lectotypify the original material and slide.

Nitzschia brevissima Grunow (Figs 1–17).

Lectotype (here designated): BR-4954 (Fig. 5 represents best the lectotype), slide prepared from original Van Heurck material, *Types du Synopsis*, exsiccata set, sample n° 400, Pilotis de l’Escaut, Anvers, Belgium, Van Heurck collection (BR).

Registration: <http://phycobank.org/107598>

Homotypic synonym: *Nitzschia obtusum* var. *brevissima* (Grunow) Van Heurck

Heterotypic synonym: *Nitzschia parvula* F.W.Lewis, *nom. illeg.*

Description: Valves rather compact, broadly linear, sigmoid in outline. Margins constricted near the valve middle. Apices clearly protracted, rostrate to weakly subcapitate, turned into opposite directions. Valve dimensions (n=50); length 15–55 µm, width (at central constriction) 5.0–6.0 µm. Raphe keel eccentric, not positioned on the margin, but slightly off (Fig. 16). Raphe branches curved, with central raphe endings shortly curving inwards onto valve face. Second row of areolae bordering the raphe branches clearly enlarged, transapically elongated, running from apex to apex, interrupted at the central raphe endings (Fig. 16). Striae uniseriate, composed of small, weakly transapically elliptical to rounded areolae, 38–42 in 10 µm, only weakly discernible (but not countable) in LM. Areolae internally closed by perforated hymenes (Fig. 17). Fibulae distinct, broad, very irregular in size and distribution, 7–9 in 10 µm. Prominent central nodule present, central fibulae typically more spaced than others (Fig. 17).

Nitzschia clausii Hantzsch (Figs 18–40).

Lectotype (here designated): BR-4955 (Fig. 23), slide prepared of original Rabenhorst material, *Algen Sachsens & Europa’s*, exsiccata, sample nr. 944, “in einem Bach bei Tharandt” (Sachsen), Germany (coll. date September 1859), present in the Van Heurck collection (BR).

Registration: <http://phycobank.org/107600>

Homotypic synonym: *Nitzschia sigma* var. *clausii* (Hantzsch) Grunow 1878

Heterotypic synonym: *Nitzschia curvula* var. *subcapitata* Rabenhorst 1864

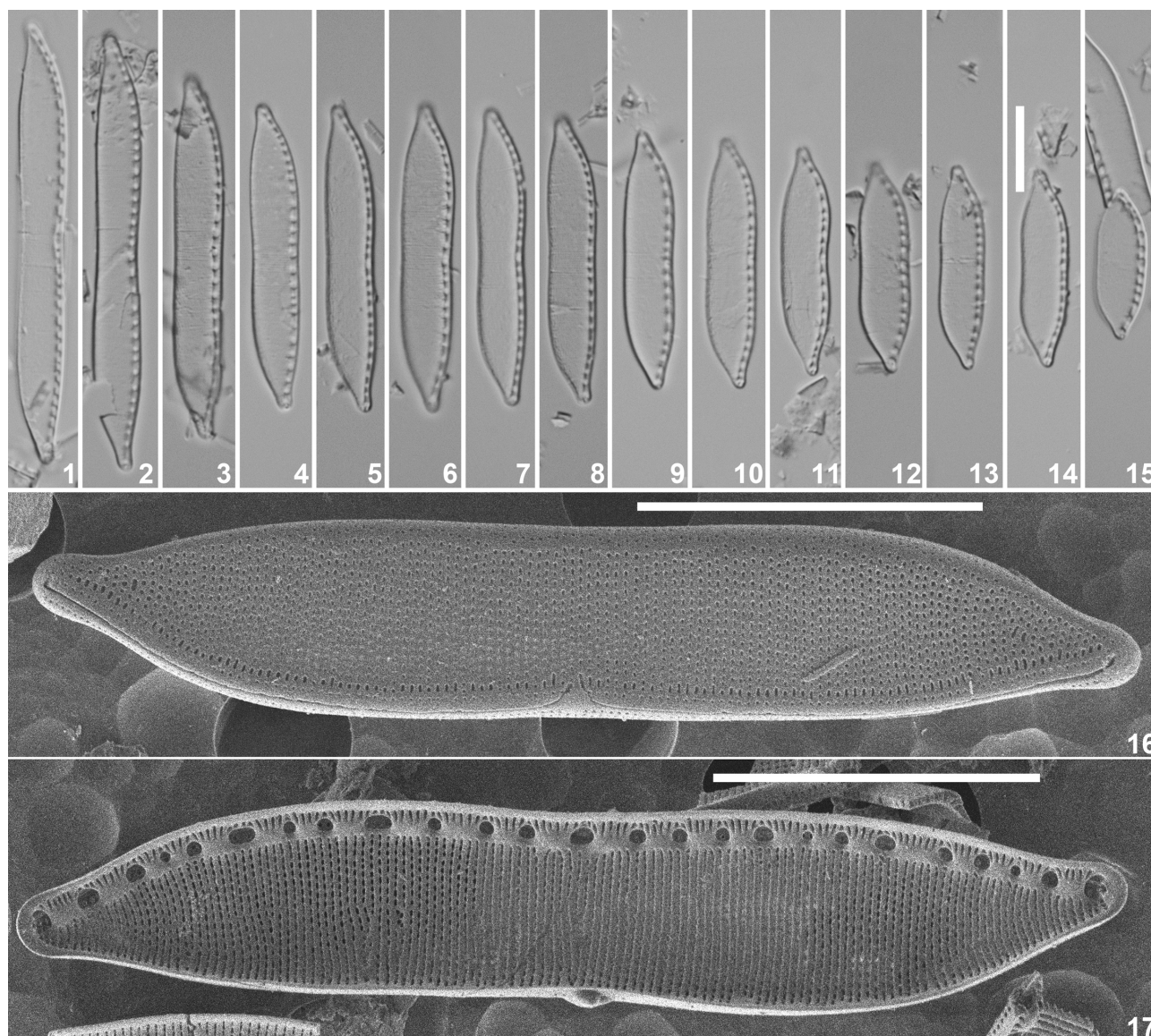
Description: Frustules in girdle view clearly sigmoid (Fig. 18). Valves elongated, linear, clearly sigmoid in outline. Margins very weakly constricted near the valve middle. Apices clearly protracted, rostrate to weakly subcapitate, turned into opposite directions. Valve dimensions (n=40); length 35–50 µm, width (at central constriction) 3.5–4.0 µm. Raphe keel eccentric, on most of its length positioned on the margin, at the valve centre slightly off (Fig. 37). Raphe branches curved, undulating, with central raphe endings distinctly curving inwards onto valve face, connected to the striae (Fig. 38). Second row of areolae bordering the raphe branches clearly enlarged, transapically elongated, running from apex to apex, interrupted at the central raphe endings (Figs 37–39). Striae uniseriate, composed of small, mostly rounded areolae, ca. 45 in 10 µm, not discernible in LM. Areolae internally closed by perforated hymenes (Fig. 40). Fibulae distinct, relatively broad, very irregular in size and distribution, 11–14 in 10 µm. Prominent central nodule present, central fibulae typically more spaced than others (Fig. 40).

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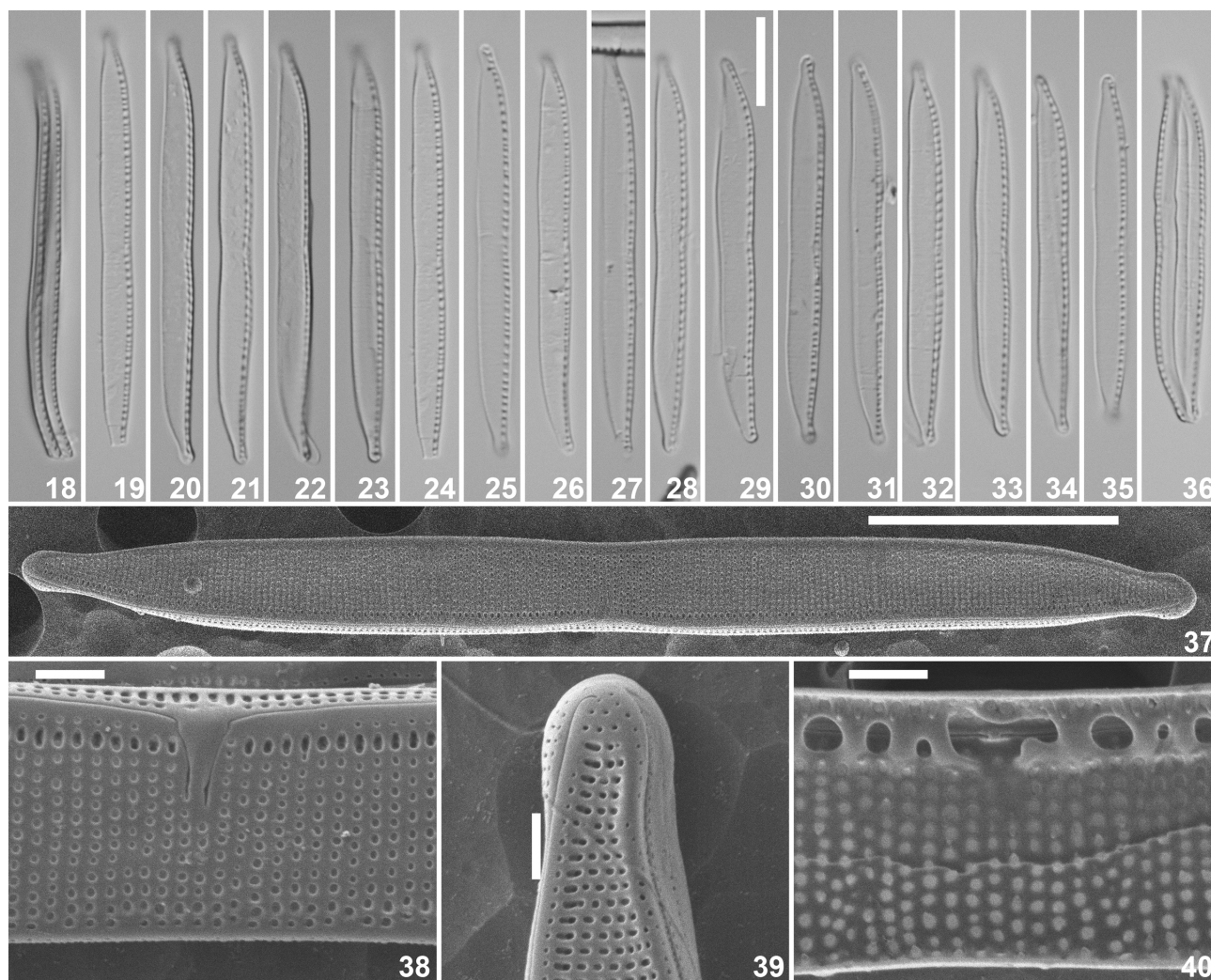
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Figs 1–17. *Nitzschia brevisissima* Grunow. LM and SEM pictures taken from the lectotype sample (BR-4954, Pilotis de l’Escaut, Belgium). Figs 1–15. LM pictures showing valves in decreasing length. Fig. 16. SEM external view of an entire valve. Fig. 17. SEM internal view of an entire view. Scale bars = 10 μ m.



Figs 18–40. *Nitzschia clausii* Hantzsch. LM and SEM pictures taken from the lectotype sample (BR-4955, Tharandt, Saxony, Germany). Fig. 18. Two frustules in girdle view. Figs 19–36. LM pictures showing valves in decreasing length. Fig. 37. SEM external view of an entire valve showing all discriminating features such as the elongated central raphe endings. Fig. 38. SEM external detail of the central area showing the mantle areolae, the central raphe endings and a detailed view of the areolae. Fig. 39. SEM external detail of a valve apex showing the continuation of the groove as a series of transapically elongated areolae. Fig. 40. SEM internal detail of the central raphe endings and the central nodule. Note the fibulae and the internal areola hymenes. Scale bar = 10 μ m, except for Figs 38–40 where scale bar = 1 μ m.