

**On the taxonomic position of *Navicula jakovljevicii* Hustedt (*Naviculaceae*, *Bacillariophyceae*)**Erwin Reichardt¹¹*Bubenheim 136, 91757 Treuchtlingen, Germany* (correspondence: erwin.reichardt@freenet.de)

Navicula jakovljevicii was described by Hustedt (1945: 931, pl. 40: figs 17, 18) from several localities in the Balkans. It has a peculiar feature: longitudinal lines on either side of the valve, which are unusual in the genus. Reichardt (1992) showed that these lines are caused by siliceous lamina (axial plate) partly covering the alveoli on the valve inside. *Gandhia* Kulikovskiy & al., (2023: 3), was proposed for naviculoid diatoms with such lamina, and *Navicula jakovljevicii* was transferred to this genus by Kulikovskiy & al. (2023: 7). However, a thorough examination shows notable differences from the type species *Gandhia obtecta* (Jüttner & E.J.Cox) Kulikovskiy & al., indicating that *N. jakovljevicii* is more closely related to another group of naviculoid diatoms that contains *Navicula oppugnata* Hustedt (1945: 925, pl. 42: fig. 1) and *N. striolata* (Grunow) Lange-Bertalot (in Krammer & Lange-Bertalot 1985: 96, pl. 16: figs 4–6). As previously mentioned in Reichardt (2018: 180), these species differ in the formation of internal lamina. *Navicula oppugnata* seemingly lacks them, and in *N. striolata* the alveoli in the mantle are covered, and *N. jakovljevicii* has an axial plate. There is a gradual development of internal lamina within these species, otherwise their morphology is identical. The most important features separating the species from *G. obtecta* include:

- External central raphe endings penetrated by strongly developed silicate tongues (ligulae) giving the impression of forked central pores (figs 10–12). Similar, though less-developed structures are present in *Navicula tripunctata* (O.F.Müller) Bory (generitype of the genus *Navicula*) but not in *Gandhia obtecta* (generitype of the genus *Gandhia*), possessing elongate teardrop-shaped central pores with very small ligulae.
- Terminal raphe fissures showing externally a pore-like dilation near the end of the valve face from which the fissures continue over the polar valve mantle and finally bend to the secondary side (figs 7–9). *Gandhia obtecta* shows simple terminal raphe fissures, hooked first to the primary side near the valve ends before they recurve.
- One to three small, more or less slit like foramina at the apices (figs 7–9), seemingly connected to an internal cavity.
- The sternum internally running straight to the apices where it merges into the silicate masses of the polar valve mantle (figs 4–6). In *Gandhia obtecta* the distal sternum is clearly shifted to the secondary side. The position of the helictoglossae is different, too.
- The presence of a hole or cavity at the ends of the valve interior (figs 4–6). *Gandhia obtecta* lacks such structures.

Alveoli partly covered by siliceous lamina can be found in many groups of diatoms, even in araphid ones. Closed alveoli in the mantle occur more often than expected. However, these are not visible in LM and even in SEM suitably fractured valves are necessary to distinguish them. The development of axial plates can vary, too. The best examples can be found in *Pinnularia*, where species with well-developed axial plates exist amongst others with weakly, partly or not at all developed lamina even in closely related taxa (see, for example, pls 259–63 in Reichardt 2018). Examples in *Gomphonema* corresponding to *N. striolata* and *N. jakovljevicii* are *Gomphonema moresbyanum* E.Reichardt (Reichardt 2005: 121, pl. 3: figs 1–11) and *Gomphonema makaluense* E.Reichardt, Jüttner & E.J.Cox (in Jüttner & al. 2004: 247, figs 45–54); the first with covered alveoli in the mantle, the second with an additional axial plate. Hence, partly covered alveoli alone seem to be of secondary importance in diatom taxonomy. In the case of *N. jakovljevicii* the features matching *N.*



oppugnata and *N. striolata* but differing from *Gandhia obtecta* are certainly of higher significance than just the development of an axial plate. Thus *Navicula jakovljevicii* is best retained within *Navicula* until suitable methods inform the real relationships.

Hustedt, F. (1945). Diatomeen aus Seen und Quellgebieten der Balkanhalbinsel. *Archiv für Hydrobiologie* 40: 867–973, pls 31–43.

Jüttner, I., Reichardt, E., & Cox, E.J. (2004). Taxonomy and ecology of some new *Gomphonema* species common in Himalayan streams. *Diatom Research* 19: 235–264.

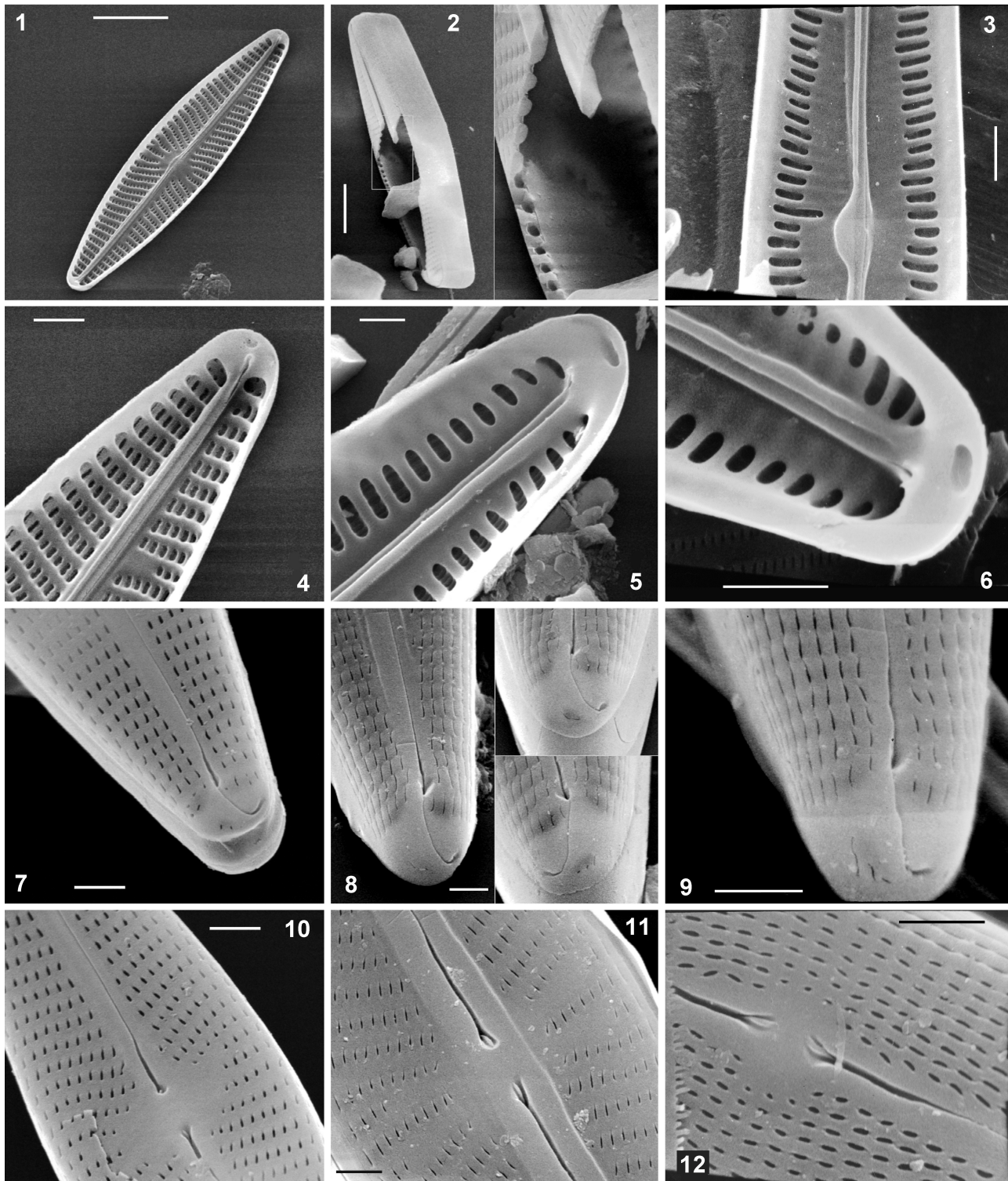
Krammer, K. & Lange-Bertalot, H. (1985). Naviculaceae. Neue und wenig bekannte Taxa, neue Kombinationen und Synonyme sowie Bemerkungen zu einigen Gattungen. *Bibliotheca Diatomologica* 9: 1–230.

Kulikovskiy, M.S., Thacker, M., Glushchenko, A.M., Kuznetsova, I.V., Iurmanov, A.A., Karthick, B. & Kociolek, J.P. (2023). *Gandhia* gen. nov.—A new diatom genus with unusual morphology split off from the genus *Navicula* Bory. *Plants* 12(3941): 1–13, 4 figs, 1 table.

Reichardt, E. (1992): *Navicula jakovljevicii* Hust. (Bacillariophyceae): Morphologie und taxonomische Überlegungen. *Diatom Research* 7(2): 293–301, 19 figs.

Reichardt, E. (2005). Die Identität von *Gomphonema entolejum* Østrup (Bacillariophyceae) sowie Revision ähnlicher Arten mit weiter Axialarea. *Nova Hedwigia* 81: 115–144.

Reichardt, E. (2018). *Die Diatomeen im Gebiet der Stadt Treuchtlingen*. pp. [1]–576 (Bd 1); 579–1184 (Bd 2), incl 451 pls. München: Bayerische Botanische Gesellschaft [Selbstverlag der Gesellschaft].



Figs 1–12. SEM images of morphological details of *Navicula oppugnata*, *N. striolata* and *N. jakovljevicii* differing from *Gandhia oblecta* (except Fig 3). **Figs 1, 4, 7, 10 (left row).** *N. oppugnata*. **Figs 2, 5, 8, 11 (middle row).** *N. striolata*. **Figs 3, 6, 9, 12 (right row).** *N. jakovljevicii*. **Fig 1.** Valve inside with open alveoli. **Fig 2.** Frustule with fractured part showing occluded alveoli in the valve mantle (detail $\times 4$). **Fig 3.** Valve inside with axial plate as in *Gandhia*. **Figs 4–6.** Internal views of valve-ends with straight sternum and a hole/cavity near the apex. **Figs 7–9.** External views of valve-ends; terminal raphe fissures with a pore-like dilation and small foramina at the apex. **Figs 10–12.** External views of valve centre with “forked” proximal raphe endings. Scale bars = 10 μm (Figs 1, 2), = 2 μm (Figs 3–12).