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***Eunotia pottieziana*, a new diatom (Eunotiaceae, Bacillariophyta) species found in a tropical aquarium**

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Freshwater diatoms in tropical aquaria have been studied for almost a century, although published records are relatively scarce. A century ago, Krasske (1923) described *Achnanthes exigua* var. *heterovalva* Krasske (1923: 193), now transferred to the genus *Gogorevia* as *G. heterovalva* (Krasske) Tseplik & Chudaev (in Sokolova et al. 2023: 152), and *Cocconeis hustedtii* Krasske (1923: 193), now known as *Platessa hustedtii* (Krasske) Lange-Bertalot (in Krammer & Lange-Bertalot 2004: 445). Apart from these new species, Krasske reported several other species including for instance *Eunotia monodon* Ehrenberg (1843: 414) from the glass walls of a school aquarium. All species seemed to form stable populations as Krasske (1923: 193) reported "trotz ofterer Reinigung stets in Massen" [despite regular cleaning always in abundance]. Monnier *et al.* (2001, 2003a, b) also studied the diatom flora in tropical freshwater aquarium and reported not only several of Krasske's species (although differently and most likely erroneously identified, Van de Vijver, unpubl. res.) but also described a new species, *Nupela exotica* Monnier *et al.* (2003b: 278).

A regular survey of the diatom flora in a tropical aquarium in the author's residence, showed the constant presence of several diatom species forming stable populations, including *Gogorevia heterovalva*, *Platessa hustedtii* and *Nupela exotica*. But the most dominant taxon in the aquarium with almost 90% of the total diatom community, was an *Eunotia* taxon that could not be identified using the currently available literature (Furey *et al.* 2011, Lange-Bertalot *et al.* 2011, Costa *et al.* 2017, and references therein). Following the comparison of its morphology with a large number of similar *Eunotia* species worldwide, the species is described as new: *Eunotia pottieziana* Van de Vijver *sp. nov*.

New species description

Eunotia pottieziana Van de Vijver sp. nov. (Figs 1–15 LM, 16–23 SEM)

Frustules rectangular, connected to each other to form short chains of up to 10 cells (Figs 1–3, 16–17). Girdle composed of at least 5 broad open, perforated bands (Fig. 17). Valves clearly dorsiventral with a slightly convex dorsal and an almost straight to weakly concave ventral margin (Figs 4–15). Longer valves with almost parallel dorsal and ventral margins (Figs 4–7). Dorsal margin with irregular series of elongated, very low ridges (Fig. 19). Apices clearly set off, distinctly protracted, elongated, subcapitate, obtusely rounded. Terminal nodules very conspicuous at the apices, visible as black spots. Valve dimensions (n=50): valve length 8–70 µm, width 5–7 µm. Mantle rather deep. Raphe branches curved on the mantle towards the mantle edge (Figs 3, 17–18), almost at the apices with terminal raphe fissures curving about halfway onto the valve face (Figs 20–21). At both raphe ends, pores indistinct. Broad hyaline area bordering the raphe branches on the abvalvar side (Fig. 17). Three to six rows of small areolae located between raphe branches and mantle edge (Fig. 17). Striae uniseriate, 14–16 in 10 µm, on the valve face almost parallel, clearly sunken between weakly raised, irregularly wide virgae, composed of moderately large, rounded areolae with sunken individual hymenate coverings (Figs 19, 21). Areola density 35–40 in 10 µm. On the dorsal margin, short striae set between the normal striation pattern, composed of only 3–4 areolae (Fig. 19). At the apices, striae much denser with smaller areolae (Figs 17–18). Internally, distinct terminal helictoglossae present (Figs 22–23). One rimoportula per valve, located almost on the dorsal margin (Fig. 23). Small pseudosepta present on each apex (Fig. 23).

Type:—BELGIUM. Tropical fresh water aquarium, coll. date 15.x.2023, leg. B. Van de Vijver (holotype slide BR-4816= Fig. 4, isotype slide 432 in Collection University of Antwerp, Belgium).

Registration:— http://phycobank.org/104192

Etymology:—The species is named after Mrs Margaux Pottiez, master student of the author in recognition of her contributions to our knowledge of epizoic diatoms on sea turtles.

Ecology and associated flora: —The new species was observed living on plants and macroalgae in a 250l warm (T= 26.4°C) tropical freshwater aquarium, planted with mostly *Leptochilus pteropus* (Blume 1828) Fraser-Jenkins (2008: 62) (Java fern), *Vallisneria spiralis* L. (1753: 1015) (Eel grass), *Echinodorus* cf. *paniculatus*, *Cryptocoryne* sp. and *Salvinia sp.*

(Floating fern). The leaves and wood structures in the aquarium are regularly colonized by *Audouinella* sp. (Black algae). pH of the aquarium water was 4.2 and conductivity was 1050 µS/cm. The fish population includes several South American species such as *Moenkhausia pittieri* Eigenmann 1920, *Corydoras delphax* Nijssen & Isbrücker 1983, *Platydoras costatus* L. 1758, and *Ancistrus* sp. The diatom community is almost entirely dominated by *Eunotia pottieziana*. Other species in the community include *Gogorevia heterovalva*, *Nupela exotica*, *N. lesothensis* (Schoeman 1973: 221) Lange-Bertalot (in Rumrich *et al.* 2000: 213), and several small-celled *Sellaphora* species.

Observations of small living *Eunotia* colonies showed that these were loosely attached to the substrate without being connected to plants of ornaments in the aquarium (Fig. 24). Curiously, a lot of, usually solitary valves, seemed to be incorporated on the tests of *Centropyxis* sp., a further unidentified rhizopod living abundantly in the sapropelium of the filter of the aquarium. As the *Eunotia* frustules were observed having their chloroplasts, it can be assumed that they were living on the tests (Fig. 25, arrows).

Taxonomic comments: —As Krasske (1923) did not illustrate his record of *E. monodon* in the aquarium he studied, it is impossible to verify whether the species he observed on the glass walls of the aquarium is conspecific with *E. pottieziana* or not. It is actually unclear what *E. monodon* really is. Lange-Bertalot *et al.* (2011) discussed the typification and possible identity of *E. monodon*, choosing a drawing as iconotype showing a length of 33 µm and a valve width of 6.6 µm. Unfortunately, as valves have not been observed in the lectotype material, it is impossible to know what the correct identity of the species is. Most likely *Eunotia maior* (W.Smith 1856: 14) Rabenhorst (1864: 72) is meant by Krasske, a large, robust species (length 40–200 µm, width 10–13 µm) that could not be confused with the new species (Lange-Bertalot *et al.* 2011). There are, however, a few *Eunotia* species that show some resemblance to *E. pottieziana*, some of them described from Southeastern Brazil (Costa et al. 2017). *Eunotia gustavoi* L.F.Costa in Costa *et al.* (2017: 25) has a similar valve outline, similar stria density and pattern, comparable valve length but usually wider valves (up to 12 µm versus max. 7 µm in *E. pottieziana*). On the other hand, *E. gustavoi* has very short raphe branches, almost only half of the branch length in *E. pottieziana*, and a rimoportula that is located more towards the ventral side (and not dorsal as in *E. pottieziana*). *Eunotia intricans* Lange-Bertalot & Metzeltin (2009: 141), described from Panama, also has a similar valve outline, but a much lower stria density (11–3 in 10µm, a lower vale width (4–5 µm) and a rimoportula situated halfway between the dorsal and ventral margins (see Costa *et al.* 2017, plate 30, fig. 7). *Eunotia novaisiae* Lange-Bertalot & Ector (in Lange-Bertalot *et al.* 2011: 179) has narrower valves (3.7–5.9 µm), its rimoportula is more located near the ventral margin, and its terminal raphe fissures are shorter (Lange-Bertalot et al. 2011, plate 53, fig. 2). Another tropical species that could be confused with *E. pottieziana* is *Eunotia inspectabilis* Metzeltin & Lange-Bertalot (1998: 63), described from Guyana. Both species can be separated by the shape of the apices, short and broad in *E. inspectabilis*, more elongated and more slender in *E. pottieziana*. According to the original description (Metzeltin & Lange-Bertalot 1998, p. 64), *E. inspectabilis* can be wider (up to 8.5 µm versus maximum 7.0 µm in *E. pottieziana*) and has a lower stria density (13–14 in 10 µm, versus 14–16 in 10 µm in *E. pottieziana*). Finally, the terminal raphe fissures in *E. inspectabilis* are shorter as indicated in the original description.

Eunotia gustavoi and *E. macroglossa* Furey *et al*. (2009: 276) both show comparable distinct terminal nodules at their apices, clearly visible in LM as black dots. The differences with *E. gustavoi* have already been highlighted but also *E. macroglossa*, described from the Great Smokey Mountains (USA) can be distinguished by the position of its rimoportula (at the ventral margin, close to the helictoglossa, see Furey *et al.* 2009, fig. 25), a higher stria density (16–18 in 10 µm at the apices versus 14–16 in 10 µm in *E. pottieziana*) and the solitary lifeform whereas E. pottieziana forms short chains (Furey *et al.* 2009).

Eunotia pottieziana can also be confused with the *Eunotia minor*/*pectinalis* group. The type material of *E. minor* (Kützing 1844: 39) Grunow (in Van Heurck 1881: pl. 33: figs 20, 21) is not well known and the generally accepted concept of *E. minor* is very broad encompassing a large number of populations worldwide with very broad ecological tolerances, making it unlikely that they represent all the same species. Lange-Bertalot *et al.* (2011, pp. 158–159) discuss the taxonomy of this species without, however unfortunately, providing a solution. All illustrated populations in Lange-Bertalot *et al.* (2011, plates 160–163) show differences in position of the rimoportula, areola pattern around the raphe branches, shorter terminal raphe fissures and less elongated valve apices, to exclude conspecificity. The type material of *Eunotia pectinalis* (Kützing 1844: 39) Rabenhorst (1864: 73) was studied almost two decades ago by Tuji & Williams (2005) showing that the valves have a clear gibbous central part and very straight, weakly dorsiventral valves, different from the valve outline of *E. pottieziana* that lacks the central gibbosity.

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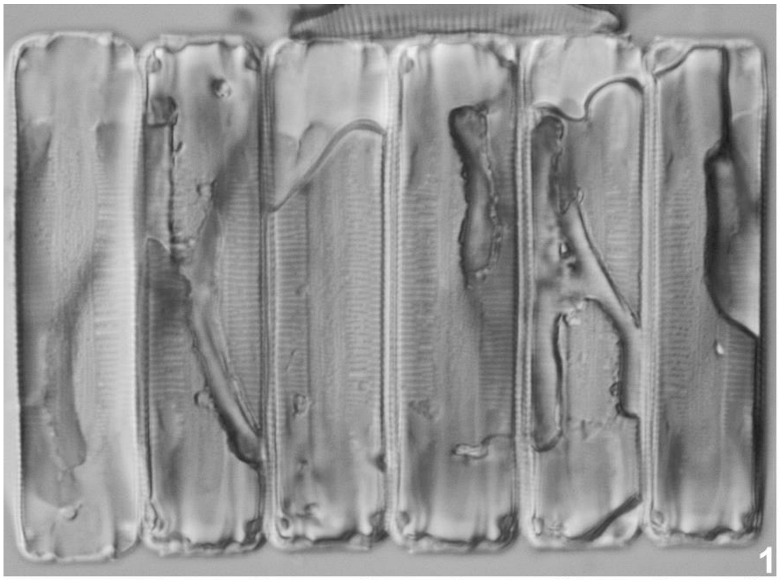
Figure captions

Figures 1–15. *Eunotia pottieziana* Van de Vijver sp. nov. LM images of specimens taken from the holotype sample (BR-4816, tropical freshwater aquarium, Belgium). 1–2. LM views of two short chains in girdle view observed in untreated material. 3. LM view of the ventral side of a frustule showing the raphe branches. 4–15. LM valve views of specimens of the type population arranged in decreasing length. Scale bar = 10 µm.

Figures 16–23. *Eunotia pottieziana* Van de Vijver sp. nov. SEM images taken from the holotype sample (BR-4816, tropical freshwater aquarium, Belgium). 16. SEM view of a short chain showing 3 connected frustules. 17. SEM external detail of the apices of a frustule, showing the shape of the raphe branches and the girdle bands. 18. SEM external view of the ventral side of an entire frustule. 19. SEM externa detail of the dorsal valve face/mantle junction showing the presence of short, low ridges. 20. SEM external view of two valves. 21. SEM external detail of a valve apex showing the terminal raphe fissures and the external rimoportula opening (arrow). 22. SEM internal view of an entire valve. The arrow shows the position of the internal rimoportula structure. 23. SEM internal detail of a valve apex with the rimoportula (apex) and the pseudoseptum. Scale bars represent 10 µm, except for Figs 19, 21 & 23 where scale bar = 1 µm.

Figures 24–25. *Eunotia pottieziana* Van de Vijver sp. nov. LM images of specimens taken from the holotype sample (BR-4816, tropical freshwater aquarium, Belgium). 24. LM view of several living cells, loosely attached to the substrate. 25. LM view of two Centropyxis tests covered with living Eunotia frustules (arrows). Scale bar =20 µm (Fig. 24) and 50 µm (Fig. 25).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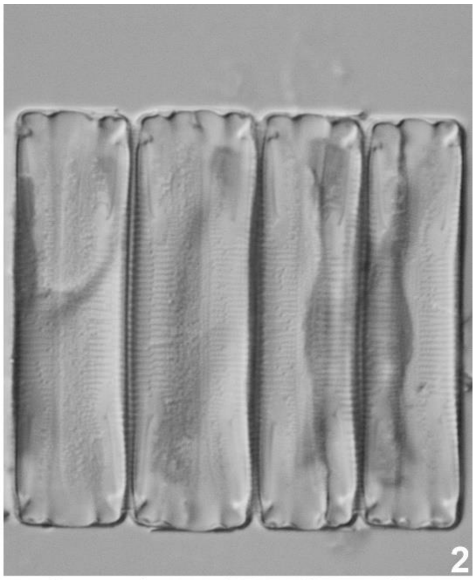
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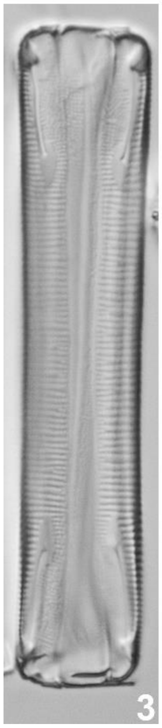
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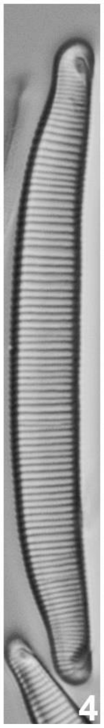
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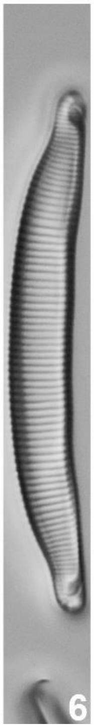
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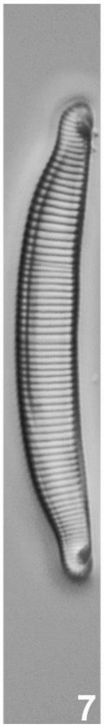
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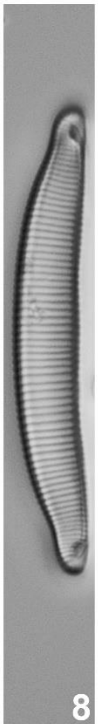
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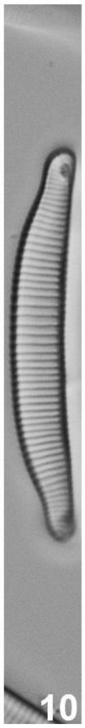
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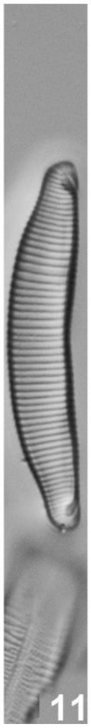
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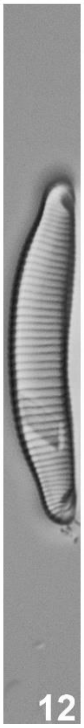
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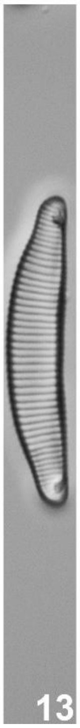
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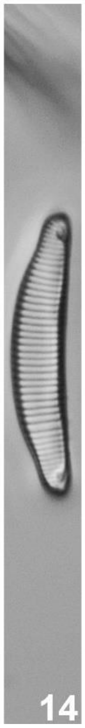
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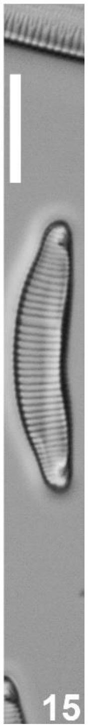
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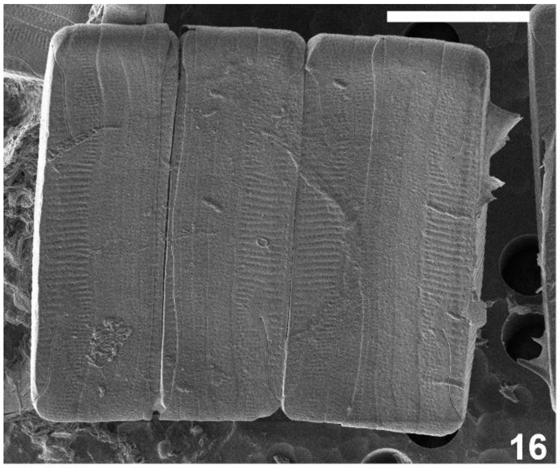
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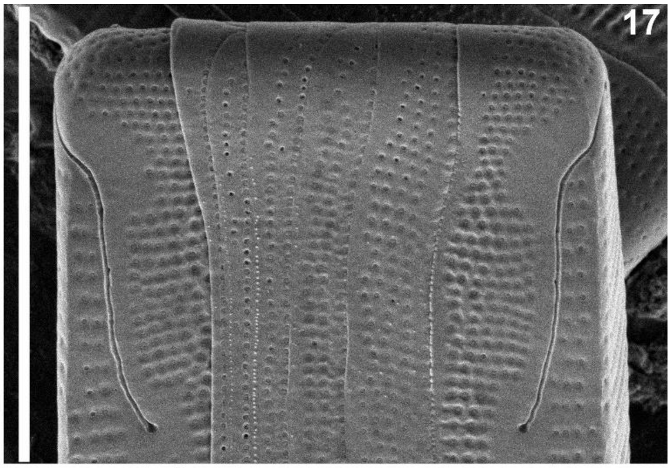
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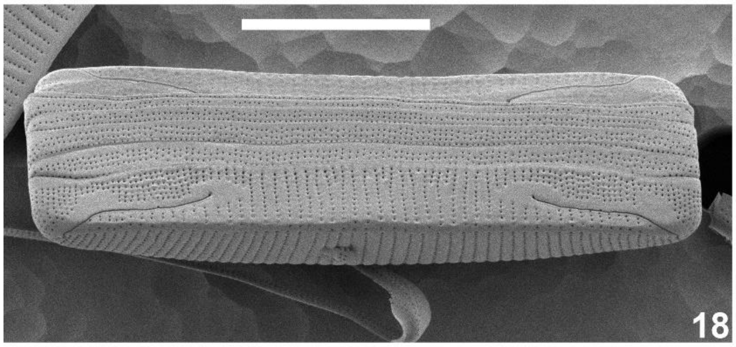
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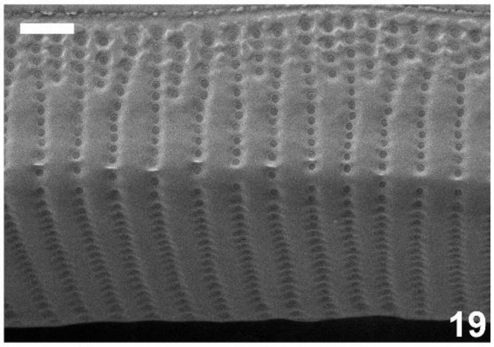
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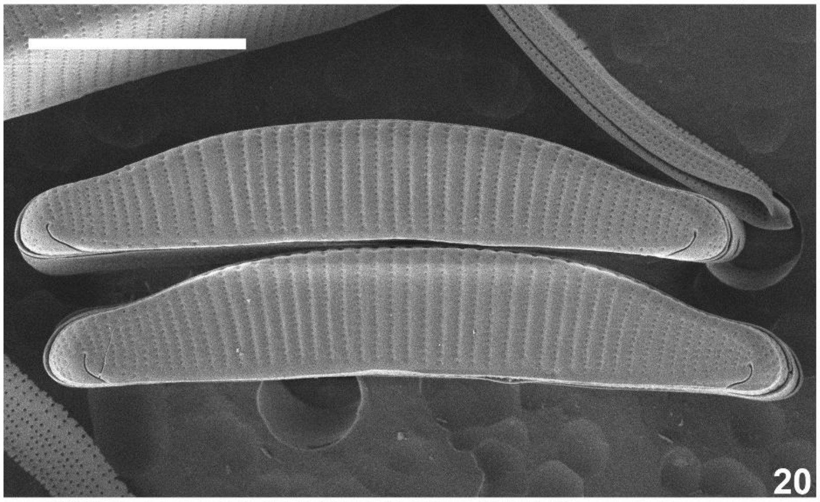
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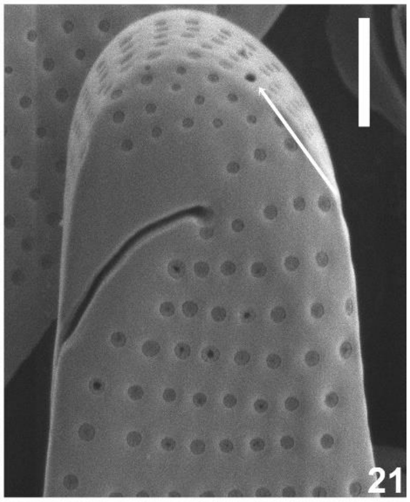
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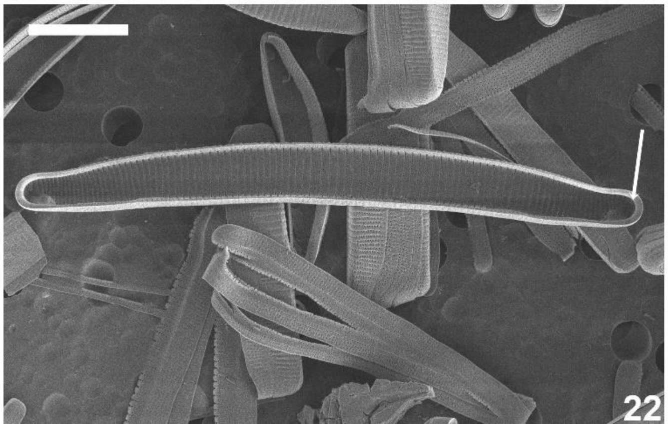
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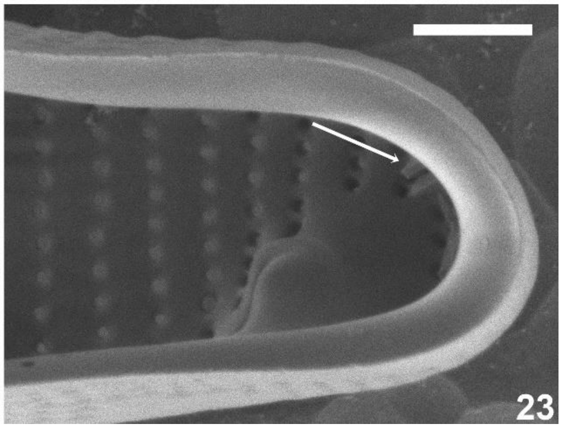
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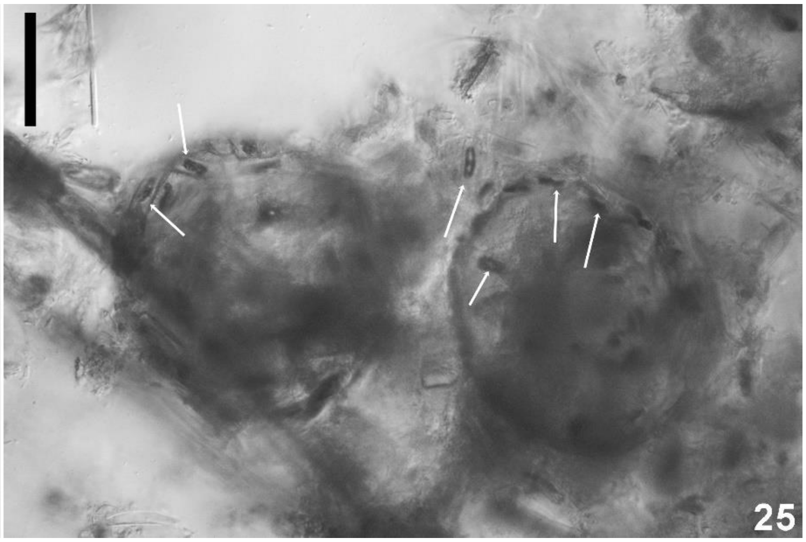
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