

Typification and transfer of *Fragilaria undulata* C.E.Cramer to the genus *Pseudostaurosira* (*Staurosiraceae*, *Bacillariophyta*) with some notes on the diatom species described by Carl E. Cramer

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Carl Eduard Cramer (1831–1901), a Swiss biologist and former director of the Botanical Garden of Zürich, only described a handful of new diatom species during his life. In 1862, a new species was described as *Cocconema variabile* C.E.Cramer in Rabenhorst (1862: 1246) from a brook near Zürich, Switzerland. A year later, he reported two new species from the same sample, collected “*Aus einem Bache kaum hundert Schritt von der Sennerei unterhalb Casaccio auf der Südseite des Lukmanier. 2 Juli 1862* [from a brook barely a hundred paces from the alpine dairy farm below Casaccio on the south side of the Lukmanier] (border between the cantons of Graubünden and Ticino)”. The first species Cramer described in the genus *Cymbella* as *Cymbella elegans* C.E.Cramer (Cramer 1863: 65), but the rather sparse description and the lack of an illustration does not allow an unambiguous identification as the sample contains several *Cymbella* taxa (Van de Vijver, pers. obs.). Cleve (1894: 162) previously stated that it was impossible to identify this new species due to the lack of an illustration (“*As no description or figure of C. elegans is given, it is impossible to determine what form the name denotes.*”). Moreover, the species is an illegitimate name since already used in 1860 by the Polish naturalist Felicjan Sypniewski (1822–1877) (Sypniewski 1860: 517, pl. 1: fig. 16). The second Cramer new species, *Fragilaria undulata* C.E.Cramer was illustrated by Cramer combined with a very short description (Figs 1, 2) indicating that the species was 17–27 µm long and extremely delicate, lacking striae (Cramer 1863, 62, fig. 7). Cramer indicated in his publication the sample he used to describe the new species: Zu Nr. 1441 der Decaden, referring to sample 1441 in Rabenhorst’s exsiccata ‘*Die Algen Sachsens & Europa’s*’ (Rabenhorst, Decade 45, February 1863). The sample was also used in 1863 by Wartmann & Schenk as sample 233 in their exsiccata ‘*Schweizerische Kryptogamen*’ (Wartmann & Schenk 1862–1882). In the latter, a slightly more extended description was added “*Ungemein zart. Hauptseiten rectangular, 17–27 Mik. Mill. breit, bis 5mal kurzer als breit. Nebenseiten streifenlos, mit einer Einschnürung in der Mitte und je einer starken Anschwellung zu beiden Seiten der Mitte*” [Extremely delicate. Main sides rectangular, 17–27 mic. Mill. wide, up to 5 times shorter than wide. Adjacent sides without striae, with a constriction in the middle and a strong swelling on both sides of the middle.]. Material for both samples was retrieved from the Van Heurck collection, part of the Meise Botanic Garden collection (**BR**) and prepared for the current paper.

To complete the list of species Cramer described, three more taxa should be mentioned. In the above-mentioned Wartmann & Schenck exsiccata, three other Cramer species can be found, all collected by Cramer near Sankt Gallen (Switzerland). The first species was recorded in exsiccata sample 332 (Quarry near Sankt Gallen) and was named *Epithemia recta* C.E.Cramer. *Synedra wartmannii* C.E.Cramer (‘*wartmanni*’) was described based on exsiccata sample 335, recorded in a sample collected in April 1862 from a fountain at the Foreign Hospital of Sankt Gallen (Switzerland). Preliminary analysis of the sample showed that this taxon is referable to the genus *Nitzschia* (Van de Vijver, unpubl. res.). Both mentioned species were briefly discussed in Wartmann & Schenk 1864). Finally, in sample 536, the name *Denticula subtilissima* C.E.Cramer was introduced from a sample collected in a swamp near Sankt Gallen [*In einem kleinen Sumpfe zwischen Flawil und Gossau (St. Gallen)*]. Unfortunately, apart from the description added by Wartmann to the exsiccata sheet of the latter taxon, we have not been able to trace more information in the literature.

A last species, *Epithemia manipulifera* C.E.Cramer (1868: 8, pl. 2: fig. 22 a–c) was described in 1868 from a Sahara sand sample; but apart from the short description in Cramer (1868) and the small drawings, it has not been possible to find more information regarding this taxon (D.M. Williams, pers. comm.).

Fragilaria undulata was later only very occasionally mentioned by other authors, most likely because De Toni (1892: 689) considered *F. undulata* C.E.Cramer to be a synonym of *Fragilaria construens* var. *binodis* (Ehrenberg) Grunow.

In 1951, Pierre Fusey (1921–1999) described a small-celled araphid taxon as *Fragilaria construens* [var. *binodis*] f. *robusta* Fusey (Fusey 1951: 34, pl. 1: fig. 2) from a small pond (Étang du Pellinec) near the commune of Corlay, Côtes-d'Armor Département, Brittany, France. The taxon was first raised to species level by Manguin as *Fragilaria robusta* (Fusey) Manguin (Manguin 1954: 14, pl. 1: fig. 6) and later transferred to the genus *Pseudostaurosira* as *P. robusta* (Fusey) D.M. Williams & Round (1987: 278). Although the original Fusey material was not examined for the current study, from a comparison of the drawing in Fusey (1951: pl. 1: fig. 2) with the *F. undulata* valves in Rabenhorst sample 1441, it is clear that both taxa are conspecific, making the former a junior heterotypic synonym of *F. undulata* C.E.Cramer.

However, although validly published, Cramer's *F. undulata* is an illegitimate name as in 1835, another species bearing the name *Fragilaria undulata* was described by August K.J. Corda (1809–1849), a Czech mycologist and botanist working as curator of the Zoology division at the Czech National Museum. *Fragilaria undulata* Corda (Corda 1835: 207, pl. IV: figs, 39, 40) described a colony-forming diatom species from a sample collected in the thermal waters of Carlsbad (Karlovy Vary, Czech Republic). Attempts to find the Corda material were unsuccessful (O. Šída, Herbarium, National Museum Prague, pers. comm.). Judging from the drawing in Corda (1835) it is clear that both taxa are not even congeneric. Also, Ehrenberg (1854: 108) included the name *F. undulata* but this is considered a *nomen nudum* since only a name was mentioned lacking a description or an illustration (Art. 38.1).

Despite this illegitimate name, it is possible to validly and legitimately transfer *F. undulata* C.E.Cramer to the genus *Pseudostaurosira* as a replacement name (Art. 6.11) as *P. undulata* Van de Vijver & Kusber, *nom. nov.* The slide made from Rabenhorst sample 1441, kept in **BR** (Meise Botanic Garden, Belgium) is designated as lectotype for *P. undulata*.

Pseudostaurosira undulata* Van de Vijver & Kusber, *nom. nov.

Replaced synonym: *Fragilaria undulata* C.E.Cramer in *Hedwigia* 11: 65, pl. XII: fig. 7. 1863, *nom. illeg.*, non *Fragilaria undulata* Corda (Corda 1835: 207, pl. IV: figs, 39, 40) nec “*Fragilaria undulata* Ehrenberg” (Ehrenberg 1854: 108), *nom. nud.*

Lectotype (here designated): **BR**-4683, slide prepared from Rabenhorst sample 1441 (exsiccata *Algen Sachens & Europa's*) in **BR** (Meise Botanic Garden, Belgium). The lectotype is represented here by Fig. 6. Duplicates of the Rabenhorst material No. 1441 and Wartmann & Schenk as sample 233 are found in numerous herbaria (e.g., Stafleu & Cowan 1983: 465; 1988: 93).

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Synonyms: *Fragilaria pseudoconstruens* var. *bigibba* Marciniak (Marciniak 1982), *Staurosira robusta* (Fusey) Lange-Bertalot (in Krammer & Lange-Bertalot 2000), *Pseudostaurosira robusta* (Fusey) D.M. Williams & Round (Williams & Round 1987), *Fragilaria construens* [var. *binodis*] f. *robusta* Fusey (1951, 34, pl. 1: fig. 2)

Description: Frustules rectangular in girdle view, connected to each other forming ribbon-like colonies using spatulate linking spines (Figs 3, 16). Valves linear, bigibbous with a clear central

constriction. Apices protracted, rostrate. Valve dimensions (n=30): length 10–19 μm , width (largest width at undulations) 4–5 μm , width (at constriction) 2.5–3.0 μm . Sternum broad, linear to linear lanceolate. Central area absent. Striae uniseriate, composed of 1–3 large, rounded to transapically elongated, marginal areolae, internally closed by volae, 16–17 in 10 μm (Figs 18, 19, 20). Rimoportulae absent. Apical pore field small, composed of a few small pores at the apices (Fig. 18). Mantle plaques clearly visible at the mantle edge (Fig. 16). Girdle bands very narrow, plain (Figs 16, 21). Occasionally, deformed valves present in the population showing apical asymmetry (Figs 14, 15).

The discrepancy in valve length between the observed value (10–19 μm) and the reported length in Cramer (1863) is striking. However, analysis of the original material revealed no valves combining the morphology and the given measurement, indicating that the observed length range most likely is the correct one.

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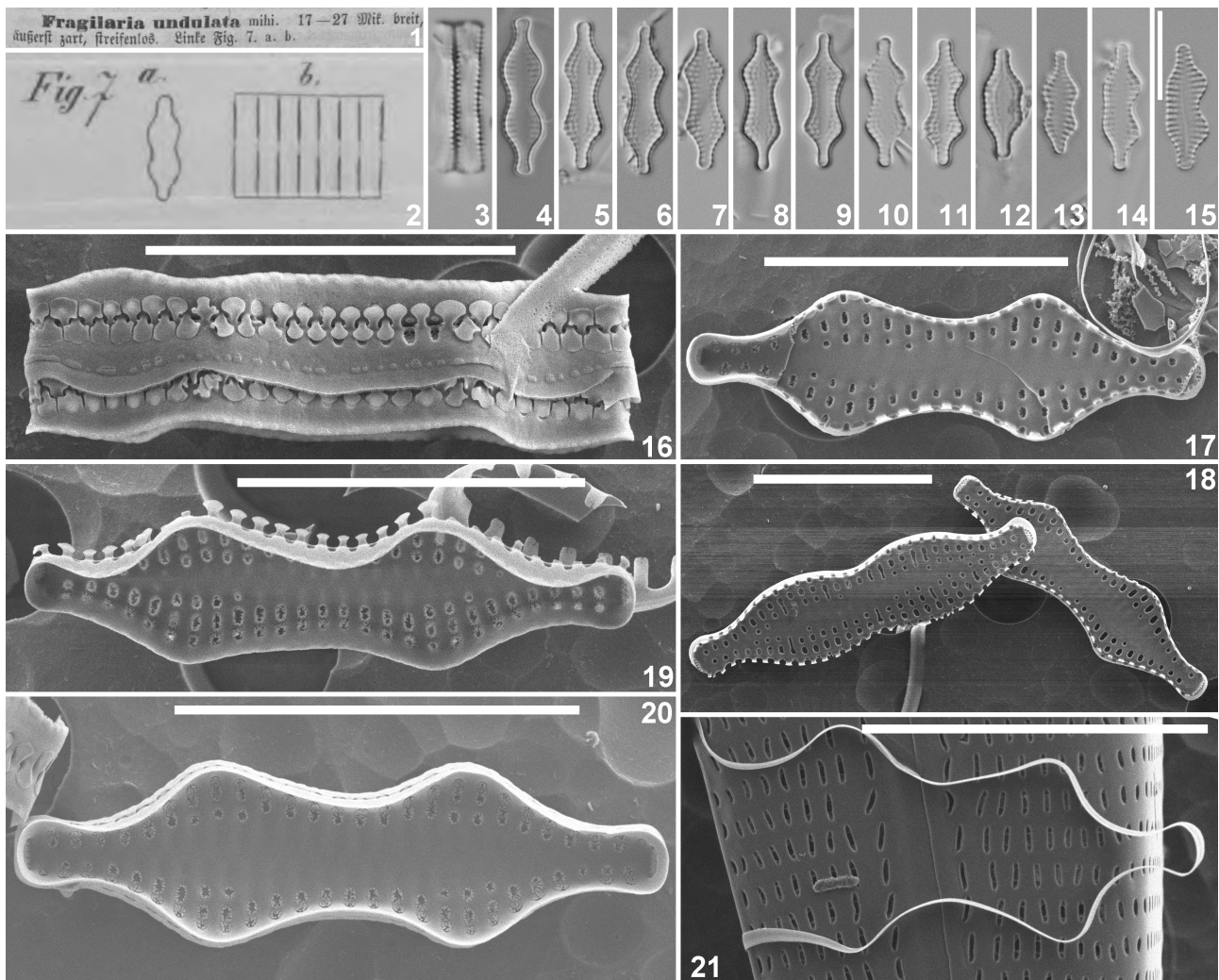


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Figs 1–4. *Pseudostaurosira undulata* Van de Vijver & Kusber, *nom. nov.* LM and SEM pictures taken from lectotype material (BR-4683, Rabenhorst sample 1441). **Fig. 1.** Original description of *Fragilaria undulata* in Cramer (1863: 65). **Fig. 2.** Original drawings of *Fragilaria undulata* in Cramer (1863, fig. 7). **Figs 3–15.** Several valves showing part of the entire cell cycle. Note the deformed valves in figs 14 & 15. Fig. 3. shows two frustules connected to each other forming a ribbon-like colony. **Fig. 16.** SEM view of several valves connected to each other using spatulate linking spines. **Fig. 17.** SEM external view of an entire valve. **Fig. 18.** SEM external view of two valves showing their apical pore field. **Fig. 19.** SEM internal view in oblique view showing the spatulate spines. **Fig. 20.** SEM internal view of an entire valve showing the internal volae. **Fig. 21.** Girdle band. Scale bars represent 10 µm.