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# Examination of the type material of *Synedra rumpens* = *Fragilaria rumpens*, Bacillariophyceae

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## SUMMARY

*Fragilaria rumpens* (Kütz.) G. W. F. Carlson is assumed to be a cosmopolitan species, and is often reported from ponds and lakes. Nevertheless, this species is similar to both *Fragilaria capucina* Desm. and *Fragilaria vaucheriae* (Kütz.) J. B. Petersen and, as a consequence, the taxonomy of all three species has been confusing. In an attempt to solve the taxonomic problems within this group, we have examined the type material of *Synedra rumpens* and discuss the differences between it and some of those species said to be similar.

Key words: *Fragilaria rumpens*, morphology, nomenclature, *Synedra rumpens*, taxonomy.

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## INTRODUCTION

*Synedra rumpens* Kütz. was described by Kützing (1844) from 'Brackwasser der oldenburgschen Küste'. Carlson (1913) transferred this taxon to genus *Fragilaria*. Hustedt (1930) presented this taxon in his famous monograph. However, the form presented in this monograph was quite different from type individuals (see Krammer & Lange-Bertalot 1991 table 110, fig. 22). Patrick and Reimer (1986) also presented this taxon using the US material.

This taxon is presumed to be a cosmopolitan and common tycho planktonic-benthic species, reported from many freshwater lakes or ponds or slow-flowing streams (Patrick & Reimer 1986). Yet, the species is very similar to both *Fragilaria capucina* Desm. and *Fragilaria vaucheriae* (Kütz.) J. B. Petersen, and, hence, its taxonomy has been confusing. For example, Lange-Bertalot in Krammer and Lange-Bertalot (1991) examined the type materials of these taxa and considered *F. rumpens* to be part of the *F. capucina* complex, which at that time was composed of 14 'Sippen'. Although the new combination '*Fragilaria capucina* var. *rumpens* (Kützing) Lange-Bertalot' was proposed, it is not validly published as no basionym was cited. Later, Lange-Bertalot (1993) proposed a different combination, *Fragilaria capucina* ssp. *rumpens* (Kütz.) Lange-

Bert. and, later still, Lange-Bertalot, in the revised edition of Krammer and Lange-Bertalot (1991, 2000), used the specific name *Fragilaria rumpens* (Kütz.) Carlson for this taxon.

Nomenclature aside, the morphological variation of *F. rumpens* was thought to be very large (Krammer & Lange-Bertalot 1991), although it was acknowledged that ecologic difference between *F. rumpens* and *F. capucina* existed: *F. rumpens* is a tycho planktonic-attached species, whereas *F. capucina* is attached. Therefore, it is important to be able to distinguish these species if they are significant for ecologic studies.

In the present paper, we report and document the morphology of *F. rumpens* as understood from the type material. We also discuss the differences between it and similar, presumably related, taxa.

## MATERIALS AND METHODS

Two samples were examined:

- 1 Original type material (isotype) from the labeled packet 194 in the Kützing collection in the Dr Henri Van Heurck Museum, Antwerpen (AWM) and the Department of Botany, the Natural History Museum, London (BM).
- 2 Slide BM 18357 prepared from material in Kützing packet 194.

## RESULTS

*Fragilaria rumpens* (Kütz.) G. W. F. Carlson (1913).

Basionym: *Synedra rumpens* Kütz., *Bacill.* 69. pl. 16. f. VI. 4, 5.

Synonyms:

*Fragilaria capucina* var. *rumpens* (Kütz.) Lange-Bertalot in Krammer et Lange-Bertalot (1991) (nom. invalid).

*Fragilaria capucina* ssp. *rumpens* (Kütz.) Lange-Bertalot (1993).

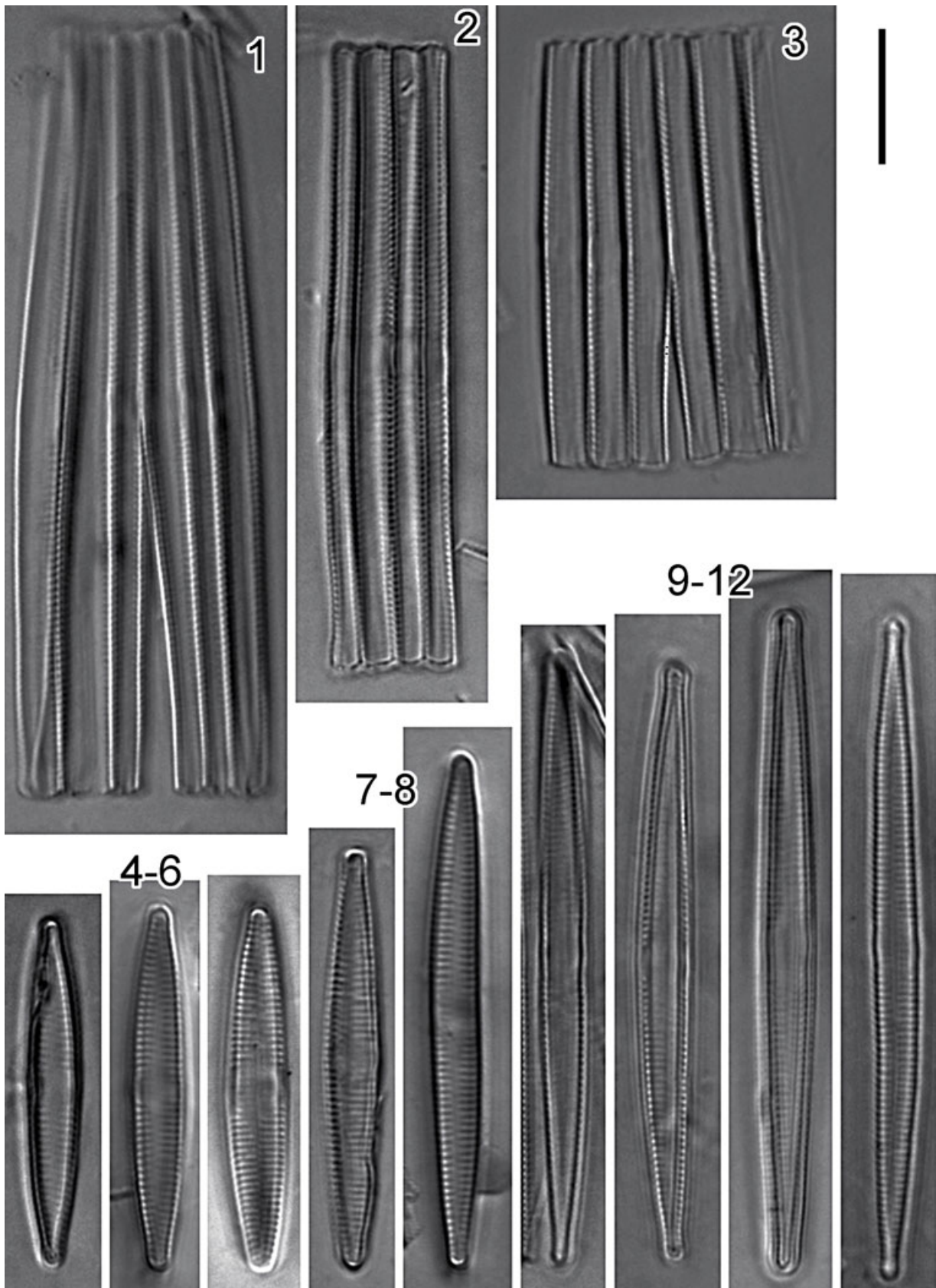
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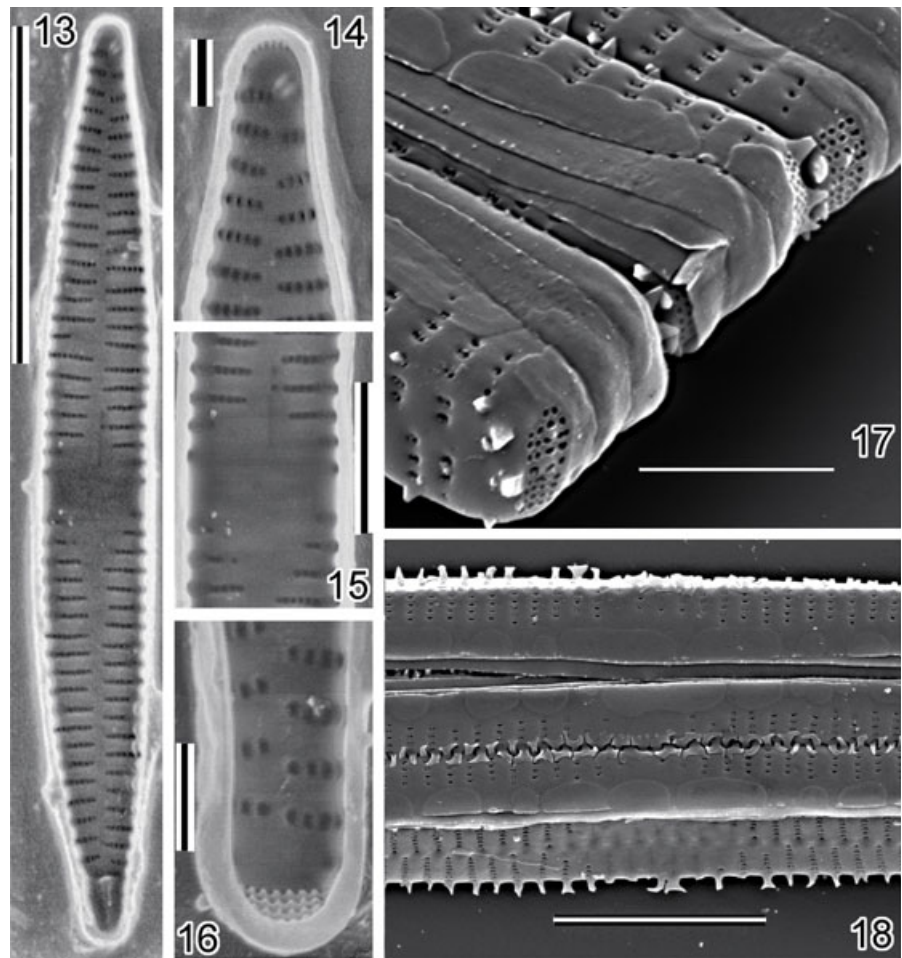
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**Figs 1–12.** *Fragilaria rumpens* (Kütz.) G. W. F. Carlson. Light microscopy. Bar = 10  $\mu$ m. 10–12. Girdle view. 1–9. Valve view. 1,2,4–12. Slide BM18357 in Department of Botany, The Natural History Museum, London (BM) from Kützing packet 194 in BM (isotype material). 3. Slide TNS-AL-55563sa in TNS from Kützing packet 194 in the Dr Henri Van Heurck Museum, Antwerpen (isotype material).

**Figs 13–18.** *Fragilaria rumpens* (Kütz.) G. W. F. Carlson. Kützing packet 194 in BM (isotype material of *Synedra rumpens* Kütz.). Scanning electron microscopy. 15. Interior of a valve. Bar = 5  $\mu\text{m}$ . 16–18. Details of internal view of valves. Bar = 1  $\mu\text{m}$ . Note the presence of a single rimoportula at one end of the valve (Fig. 16) and its absence at the other end of the valve (Fig. 18). 17. Central area. 13, 14. The spines and girdle bands of the valve. 13. Bar = 2  $\mu\text{m}$ . 14. Bar = 5  $\mu\text{m}$ .



Holotype: Kützing packet 194 in AWH.

Isotype slide: Slide BM18357 in BM from Kützing packet 194 in BM (isotype material).

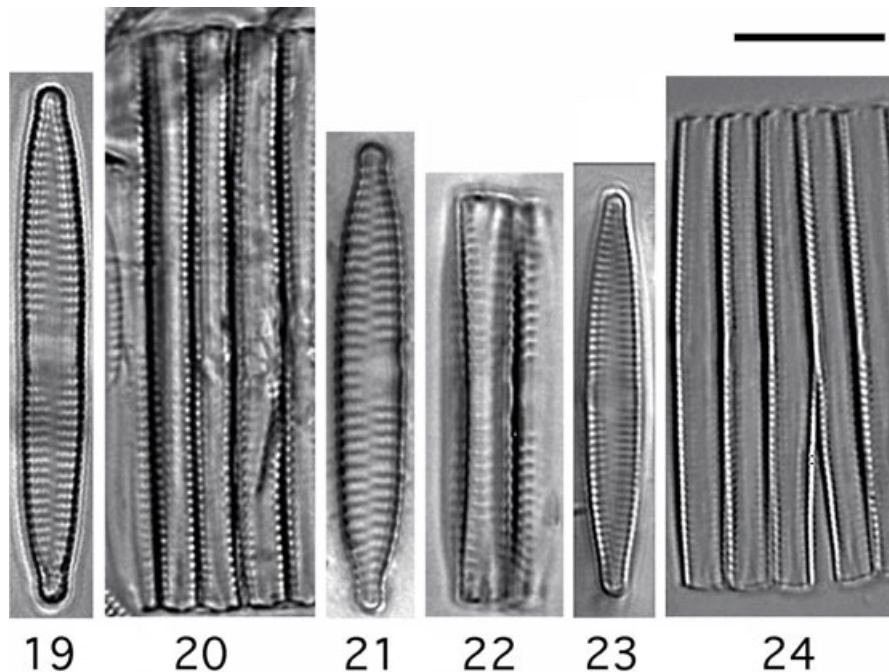
TNS-AL-55563sa in TNS from Kützing packet 194 in AWH (isotype material).

Type locality: Im Brackwasser der Oldenburgschen Küste (Germany).

Valves lanceolate, fusiform, sometimes irregularly curved, poles rostrate. Length, 25–63  $\mu\text{m}$ ; breadth 3–4  $\mu\text{m}$ . Central area a wide transverse fascia, sometimes unilaterally or bilaterally gibbous. Striae parallel throughout (Figs 1–9), 18–20 per 10  $\mu\text{m}$ . Colonies ribbon-like, adhering by their valve faces (Figs 10–12). Pervalver axis thick at the central area and thin at the ends, cells sometimes separated from each other at the poles (Figs 10–12). Spines irregular, located on the costae, at mantle-face junction, often deformed and rectangular at central area, very small and triangular at valve poles. Girdle of three open bands with punctum (Figs 13, 14). Rimoportulae exist eccentric, adjacent to sternum, one per valve; apical pore fields rectangular (Figs 15–18).

## DISCUSSION

*Fragilaria vaucheriae* is easily distinguished from *F. rumpens* and *F. capucina* by its form and coast striae (Figs 19–24). There are also several differences between *F. rumpens* and *F. capucina*. Although the differences in striae structure are not altogether significant, *F. rumpens* has striae (18–20 striae per 10  $\mu\text{m}$ ) that are denser than *F. capucina* (15–16 striae per 10  $\mu\text{m}$ ) or *F. vaucheriae* (9–14 striae per 10  $\mu\text{m}$ ). Valve poles in *F. capucina* are not as rostrate as those in *F. rumpens*. Although Krammer and Lange-Bertalot (1991, 2000) include the rhombic form of valves with rostrate ends in *F. rumpens*, the rhombic forms are most probably a different taxon. Similarly, the morphological variation observed for *F. capucina* is likely not as diverse as presented by Krammer and Lange-Bertalot (1991) (Tuji & Williams, 2006). *F. capucina* has two small rimoportulae, one at each pole (Tuji & Williams, 2006), whereas *F. rumpens* (Figs 15–18) and *F. vaucheriae* (Tuji and Williams, pers. obs., 2005) have only one. Rimoportulae can be observed by light



**Figs 19–24.** Comparison of *Fragilaria capucina* Desm., *Fragilaria vaucheriae* (Kütz.) J. B. Petersen and *Fragilaria rumpens* (Kütz.) G. W. F. Carlson. Bar = 10  $\mu$ m. 19,20. *F. capucina*. 19. TNS-AL-53974sa in the Department of Botany, The National Science Museum, from isotype material in BM. 20. Slide BM 81302 in BM (isotype). 21. TNS-AL-55562sa in TNS from Kützing packet 185 (isotype) in the Dr Henri Van Heurck Museum, Antwerpen. 22. Slide BM78023 in BM (isotype). 23,24. Slide BM18357 in BM (isotype). 19,21,23. valve view. 20,22,24. girdle view.

microscopy (LM) and easily verified using scanning electron microscopy. The simplest way to distinguish *F. rumpens* from both *F. capucina* and *F. vaucheriae* is in girdle view, because the frustules of *F. rumpens* are much thicker at the center than at the poles, and the frustules of *F. rumpens* are sometimes separated from each other at their ends in colonies (Figs 10–12,24), similar to the related species *Fragilaria crotonensis* Kitton. Both *F. crotonensis* and *F. rumpens* are planktonic species. Colonies of *F. capucina* and *F. vaucheriae* differ from *F. rumpens*; the depth of the frustules in the former two taxa is equal at both the central area and poles, and adjacent valves are completely attached by linking spines, from pole to pole (Figs 20,22). This morphological character can be easily observed by LM using unprocessed material or burn mounts.

Because type specimen of this taxon came from blackish water, this taxon is usually seen in freshwater lakes or ponds or slow-flowing streams (Patrick & Reimer 1986). It can be transported from upper stream.

*Fragilaria rumpens* has also been reported from the periphyton (Tuji 1995). These populations do not form ribbon-like colonies and might indeed be yet another taxon.

Many varieties have been described for *F. rumpens* (VanLandingham 1978). Most are not found in the plankton but as periphyton. These varieties do not form ribbon-like colonies but occur as either single cells and/or in rosette-like colonies; it is most probable that these

taxa should not be named as varieties of *F. rumpens* and will require further study to clarify their taxonomy.

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