

Typification and observations on *Triceratium exiguum* W.Smith and its elevation to species level in the genus *Staurosira* (*Staurosiraceae*, *Bacillariophyta*)

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The Reverend William Smith (1808–1857) described *Triceratium exiguum* W.Smith, a somewhat curious-looking, triangular freshwater diatom in the second volume of his *Synopsis of the British Diatomaceae* (Smith 1856: 87). The original description (“Cellules circular; angles produced into linear and truncated processes. Distance between the angles .0005". v.v.”) clearly stressed the odd shape of this diatom making its identification straightforward, although the species was not illustrated by a line drawing, as was the case for many of his new species (Smith 1853, 1856). Smith himself was surprised by this species as he added after the description “This beautiful little form is remarkable as being the only freshwater species of the genus.” Currently, the genus *Triceratium* is generally regarded as being exclusively marine (e.g. Round & al. 1990), suggesting that the placement of the Smith’s species in *Triceratium* is incorrect. A single collection from Ormesby, Norfolk, England is mentioned, collected by a Mr. Bridgman in August 1853. “Ormesby” probably refers to Ormesby Broad, a freshwater lake system in Norfolk.

Brightwell (1856: 274) listed the species as *T. exiguum* in his contribution on the genus *Triceratium* and illustrated four valves (Brightwell 1856 pl. XVII: fig. 1 a–d) stating that it was found in fresh water near Ormesby and Horning (also in Norfolk) where it was “not uncommon.”

Despite its unusual form, the triangular freshwater species long remained unnoticed although in the Grunow collection in the Natural History Museum (**W**) in Vienna several drawings of the species were found, all made based on Grunow sample 2637 (Ormesby, Norfolk, based on Walker Arnott samples 914, 915 and 916 kept in **BR**) (Van de Vijver, pers. obs.). Grunow, however, named the taxon *Fragilaria parasitica* var. *trigona* Grunow (in Van Heurck 1883: pl. CXVI: fig. 14), adding that it was the same as *Triceratium exiguum* W.Smith.

In 1908, Lemmermann transferred the species to the genus *Fragilaria* as *F. exigua* (W.Smith) Lemmermann, but the name is illegitimate [priority for *Fragilaria exigua* Grunow (in Van Heurck 1882: pl. XLIV [44]: fig. 6, as ‘*F. (virescens* var.) *exigua*’]. The name *Fragilaria exigua* first appeared in Cleve & Möller (1879: exsiccatae Nos 59 and 144), but was not accompanied by a validating description or reference to a description. Schulz (1920: 750, figs 9–16) treated the taxon as *Fragilaria construens* var. *exigua* (W.Smith) Schulz, a combination also introduced later by Hustedt (1921: 137). Krammer & Lange-Bertalot (2000: 585) transferred the taxon to the genus *Staurosira* as *Staurosira construens* var. *exigua* (W.Smith) Krammer & Lange-Bertalot, a combination also introduced by Mayama & al. (2002: 90).

Following an analysis of its morphology, we propose that this taxon should no longer be considered a variety of *Staurosira construens* Ehrenberg but should be treated as a distinct species. Kulikovskiy & al. (2011: 364) proposed, without explanation, the name *Staurosira triangexigua* Kulikovskiy & Genkal for *Triceratium exiguum* W.Smith, but this name is superfluous and illegitimate as it included in synonymy a valid and legitimate name.

During a survey of the genus *Staurosira*, several samples in the William Smith collection, conserved in the Van Heurck collection (**BR**, Meise Botanic Garden, Belgium), from Ormesby were discovered. The Van Heurck collection includes original William Smith material consisting of unmounted samples (Hoover 1976). Two of these samples were collected by Mr. Bridgman in April and October 1853 at Ormesby. Both samples contained a large population of *Triceratium exiguum*. Although the sampling date mentioned in Smith (1856: 87) of “Aug. 1853” does not correspond with these samples, the material can be considered representing the type of *Triceratium exiguum*. The stated date may have been a *lapsus* for April, or there may have been a third collection.

Here, we detail observations on specimens of *T. exiguum* based on slides prepared from both the Ormesby samples, using light and scanning electron microscopy. As the April material is quite eroded, the material from October 10th, 1853 is **here designated as lectotype** of *Triceratium exiguum* and the taxon is here referred to the genus *Staurosira*.

Staurosira exigua (W.Smith) Van de Vijver & Guiry, *comb. nov.* (Figs 1–24)

Basionym: *Triceratium exiguum* W.Smith, *Synopsis of the British Diatomaceae*, p. 87, no fig., 1856.

Lectotype (here designated): **BR-4721**, slide prepared from a W.Smith sample from Ormesby, Norfolk, October 10, 1853, leg. Mr Bridgman, original material present in the Van Heurck collection (**BR**). The lectotype is represented by Fig. 6.

Registration (of recombination): <http://phycobank.org/103164>

Registration (of lectotypification): <http://phycobank.org/103165>

Synonyms: *Fragilaria parasitica* var. *trigona* Grunow (in Van Heurck) 1882, *Fragilaria exigua* (W.Smith) Lemmermann 1908, *nom. illeg.*, *F. exigua* var. *concava* Lemmermann 1908, *Staurosira construens* var. *exigua* (W.Smith) Krammer & Lange-Bertalot 2000, *Staurosira construens* var. *exigua* (W.Smith) H.Kobayashi in Mayama & al. 2002, *Staurosira triangexigua* Kulikovskiy & Genkal 2011, *nom. illeg.*

Description: Frustules solitary. Ribbon-like colonies not known. Valves triradiate with elongated apices in longer valves. Valves becoming triangular in shorter specimens. Valve dimensions (n=25): length from apex to centre of valve 4–7 µm. Central area distinctly present extending as sternum into each of the three apices. Striae uniseriate, composed of single rows of small rounded to transapically elongated areolae, clearly depressed between raised virgae, 14–16 in 10 µm. Short, acute marginal spines present on the virgae between the striae. Rimoportulae absent. Very small, reduced apical pore fields present on each of the three elongated apices, composed of maximum 8 small, rounded pores. Internally, valve face flat with areolae located in deep grooved, internally occluded by individual volae. Apical pore fields not discernible internally.

Many thanks to David M. Williams for his usual insights and helpful comments.

Brightwell, T. (1853). On the genus *Triceratium*, with descriptions and figures of the species. *Quarterly Journal of Microscopical Science* 1: 245–52.

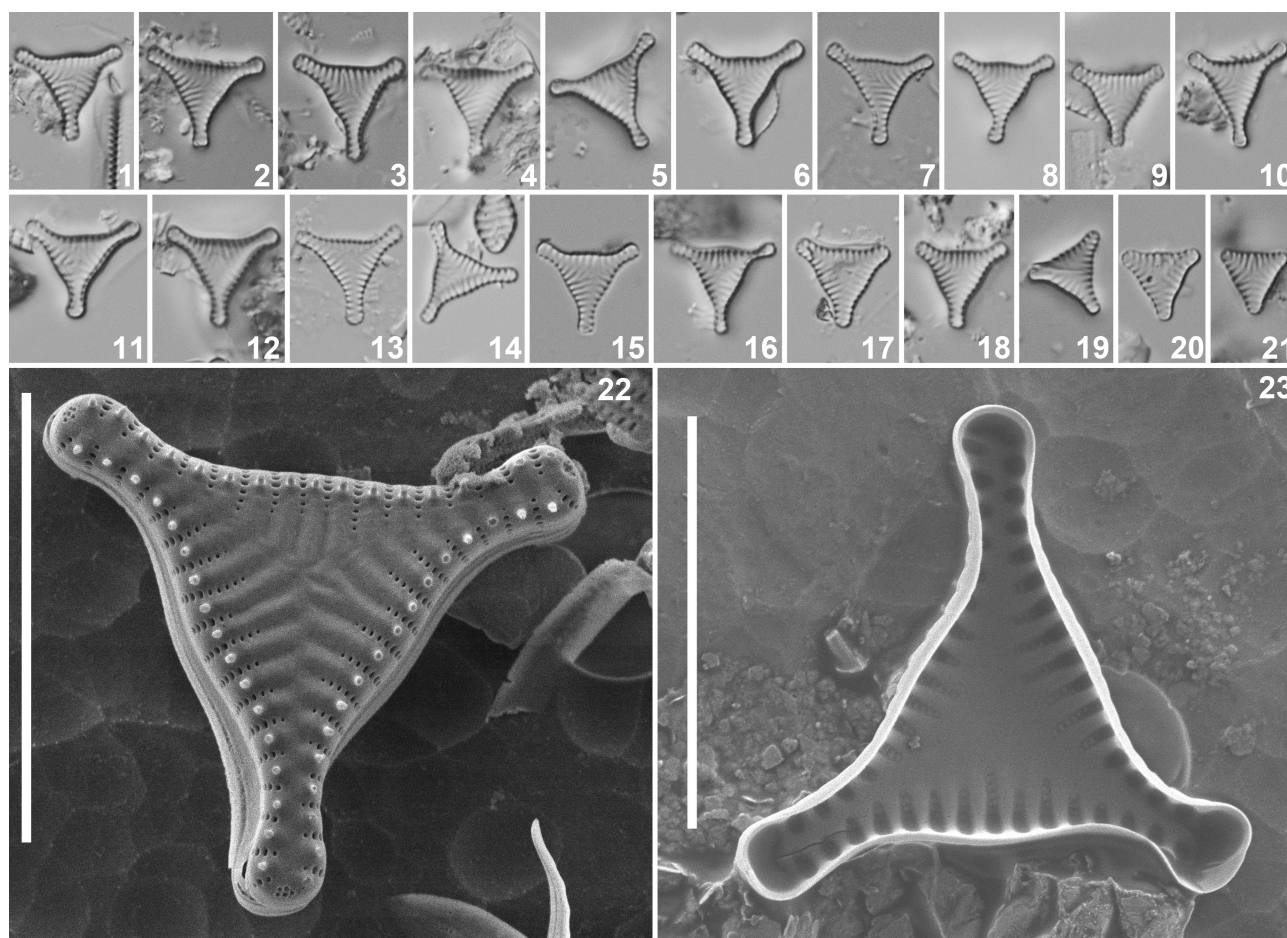
Cleve, P.T. & J.D. Möller. (1879). Diatoms, Parts II & III, no. 49–108 & 109–168. Upsala: Esatas Edquists Boktryckeri.

Hoover, R.B. (1976). *Inventory of the original typical collection of the Reverend William Smith (1808–1857). Types du Synopsis of British Diatomaceae*. pp. [i]–xlv, 1–106, 11 pls. Antwerp: Koninklijke Maatschappij voor Dierkunde van Antwerpen met de medewerking van de Koninklijke Albert 1 en het Stadsbestuur van Antwerpen.

Hustedt, F. (1921). Bacillariales. In: (B. Schröder, ed.) *Zellpflanzen Ostafrikas, gesammelt auf der Akademischen Studienfahrt 1910. Hedwigia* 63: 117–173.



- Krammer, K. & Lange-Bertalot, H. (2000). *Bacillariophyceae, 3. Teil: Centrales, Fragilariaceae, Eunotiaceae*. In: *Süßwasserflora von Mitteleuropa. Band 2/3 (ed. 2)*. (Ettl, H., Gerloff, J., Heynig, H. & Mollenhauer, D. Eds), pp. 1–599. Heidelberg: Spektrum Akademischer Verlag.
- Kulikovskiy, M.S., Genkal, S.I. & Mikheyeva, T.M. (2011). New data on the Bacillariophyta of Belarussia. 2. Fam. Fragilariaceae (Kütz.) De Tony, Diatomaceae Dumont. and Tabellariaceae F. Schütt. *Algologia* 21: 357–373 [in Russian].
- Lemmermann, E. (1908). Beiträge zur Kenntnis der Planktonalgen. XXIII–XXV. *Archiv für Hydrobiologie und Planktonkunde, Stuttgart* 3: 349–410.
- Mayama, S., Idei, M., Osada, K. & Nagumo, T. (2002). Nomenclatural changes for 20 diatom taxa occurring in Japan. *Diatom. The Japanese Journal of Diatomology* 18: 89–91.
- Schulz, P. (1920). *Fragilaria exigua* (W.Sm.) Lemm., ein Beitrag zum Variabilitätsvermögen der Bacillariaceen. *Archiv für Hydrobiologie* 10: 751–755.
- Smith, W. (1853). *A synopsis of the British Diatomaceae*; with remarks on their structure, functions and distribution; and instructions for collecting and preserving specimens. The plates by Tuffen West. In two volumes. Vol. 1. pp. [i]–xxxiii, 1–89, pls I–XXXI. London: John van Voorst, Paternoster Row.
- Smith, W. (1856). *A synopsis of the British Diatomaceae*; with remarks on their structure, functions and distribution; and instructions for collecting and preserving specimens. Vol. 2 pp. [i–vi] – xxix, 1–107, pls 32–60, 61–62, A–E. London: John van Voorst.
- Van Heurck, H. (1883). *Synopsis des Diatomées de Belgique. Atlas* pls LXXVIII–CXXXII [78–132 and supplementary pls 22 bis, 82bis, 83bis, 83ter, 95bis], tables genres. Anvers: Ducaju et Cie.



Figs 1–24. *Staurosira exigua* (W.Smith) Van de Vijver & Guiry, *comb. nov.* LM and SEM pictures taken from the **lectotype** material (**BR-4721**, Ormesby, Norfolk, October 10th, 1853, leg. Mr. Bridgman). **Figs 1–22.** LM pictures of valves in decreasing length series. **Fig. 23.** SEM external view of an entire valve. **Fig. 24.** SEM internal view of an entire valve. Scale bars = 10 µm.