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TYPIFICATION AND TAXONOMY OF GYROSIGMA FASCIOLA (EHRENBERG) J. W. GRIFFITH ET HENFREY

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**TYPIFICATION AND TAXONOMY OF
GYROSIGMA FASCIOLA (EHRENBERG)
J. W. GRIFFITH ET HENFREY**

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Based on typification in Ehrenberg's original material, the nomenclature and taxonomy of *Gyrosigma fasciola* (Ehrenberg) J.W. Griffith et Henfrey are discussed. This diatom is compared to two morphologically similar taxa, *Gyrosigma sulcatum* (Grunow in Cleve & Grunow) Frenguelli and *Gyrosigma arcuatum* (Donkin) Sterrenburg, which is here recombined on the basis of a type study. It showed that taxonomic continuity has been ensured for Ehrenberg's species for more than 150 years.

INTRODUCTION

Ehrenberg (1839) established the genus *Ceratoneis* from a marine habitat and included two taxa: *C. closterium* and *C. fasciola*. The nomenclatural and taxonomic history of *Ceratoneis* and its subsequently added taxa are very confusing (see the papers by Jahn & Kusber 2005, Bixby & Jahn 2005). However, *C. fasciola* was soon transferred by Smith (1852) to his new genus *Pleurosigma* and subsequently by Griffith & Henfrey (1856) to *Gyrosigma*. Since Cleve's (1894) redefinition of *Pleurosigma* (3-system striation) and *Gyrosigma* (2-system perpendicular striation) the taxon has been included in the latter genus. Ehrenberg's specimen from the original material has never been re-examined and photographed (see also Reid 2004) and therefore we do it here and discuss its historical and current taxonomic concept in comparison to two similar taxa which for some time had been assigned varietal status of *G. fasciola*.

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MATERIAL AND METHODS

From the Ehrenberg Collection at the Museum für Naturkunde, Berlin (BHUPM) the following material was investigated: Taxonomic Preparations No. 540032–3 [*Ceratoneis closterium*] and No. 540032–4 [*Ceratoneis fasciola*]. Both mica preparations were made from the same sample of one bucket full of North Sea water taken during the rising tide near the German harbor of Cuxhaven on 21 September 1839 (Ehrenberg 1839, p. 155; and Ehrenberg unpubl.). The corresponding drawing sheet No. 237, reproduced here as Fig. 1, was also consulted. The Taxonomic Preparations, also called “Troddenpräparate II Polygastrica” are sandwiched mica slides with dried material in between; no Canada Balsam has been used as a mountant.

Photomicrographs from the Ehrenberg Collection were taken with an Olympus BX 51 light microscope with a digital camera Olympus DP 50. The objectives used were Olympus SPlan 80x/N.A.0.75 and UPlan FI40x/N.A.0.75.

Gyrosigma arcuatum was examined from Donkin’s original material, Creswell, July 1857, BM 12071, from the Natural History Museum, London (BM).

OBSERVATIONS AND DISCUSSION

Original material

Gyrosigma fasciola (Ehrenb.) J.W. Griffith et Henfrey

In The Micrographic Dictionary, John Van Voorst, Paternoster Row, London, 1st Ed. 1856, p. 303, fig. 11/21.

Basionym: *Ceratoneis fasciola* Ehrenb. in Ber. Bekanntm. Verh. Königl. Preuss. Akad. Wiss. Berlin 1839: p. 157. 1839.

≡ *Pleurosigma fasciola* (Ehrenberg) W. Smith, in Ann. Mag. Nat. Hist. Ser. 2, 9: p. 9, fig. 2/6. Jan. 1852.

Ehrenberg’s diagnosis reads (1839, p. 157): “*C. Fasciola*, forma sigmoide, lineari-lanceolata.” One year later Ehrenberg (1840) gave the length as 1/36 Paris lines which corresponds to 62.7 μm . For Ehrenberg’s additional description, translated by FASS, see Stidoph (1994, p. 220).

Lectotype (designated here): Taxonomic Preparation No. 540032–4 in BHUPM. The cell, representing the lectotype is at the centre of the red ring (Fig. 2), another cell is at the margin of the red ring showing the remnants of chloroplasts (Fig. 3).

Locus typicus: North Sea, Cuxhaven. (water of the rising tide, Lat: 53' 52" N, Long: 8' 42" E, Germany). Sampling date 21 September 1839 (see handwriting on drawing sheet No. 237, reproduced here as Fig. 1).

The dimensions of the valves on the lectotype preparation are 104.4 μm x 12.6 μm and 96.6 μm x 13.2 μm respectively. The size range of all the specimens in Ehrenberg’s preparations 540032–3 and 540032–4 is: Length: 96.6–118.2 μm ; mean = 103.7 μm (5 valves); breadth: 12.0–14.4 μm ; mean = 13.2 μm (7 valves). Striation was barely visible (see Fig. 4).

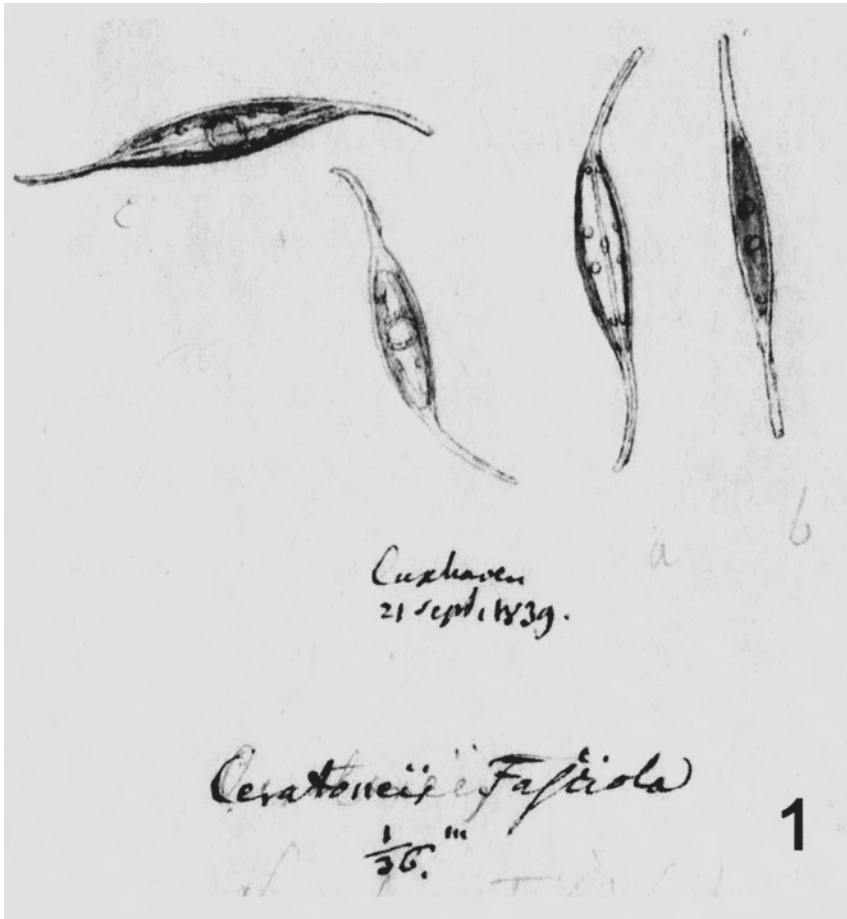


Fig. 1. Part of Ehrenberg's drawing sheet No. 237.

TAXONOMY

The taxonomic issue to be determined is whether there has been continuity of identification from *Ceratonieis fasciola* (sensu Ehrenberg) via *Pleurosigma fasciola* (sensu W. Smith) to *Gyrosigma fasciola* (sensu Cleve). Griffith & Henfrey (1856) is **nomenclaturally** but not **taxonomically** important because it is evident that these authors refer to W. Smith's taxon. Neither W. Smith, Cleve nor any later diatomist (e.g. Stidolph 1994, Reid 2004) were able to examine Ehrenberg's original material (Ehrenberg did not distribute his materials), and it might therefore be possible that they observed a species similar to, yet different from, Ehrenberg's organism.

G. fasciola has a general valve shape that is rather unusual for the genus, with narrow and oppositely curved apical extensions of the valve. There are two candidates for taxonomic confusion, *Pleurosigma arcuatum* Donkin (1858, p. 25, pl. 3/10) and *Pleurosigma (fasciola var.?) sulcatum* Grunow (in Cleve & Grunow 1880, p. 55, pl. IV, fig. 75). Both belong to *Gyrosigma* sensu Cleve (1894, p. 116) as the protolog clearly mentions a 2-system striation. Grunow's taxon was assigned specific status and was recombined as *Gyrosigma sulcatum* (Grunow in Cleve & Grunow) Frenguelli (1938, p. 294). Donkin's taxon was recombined with *Gyrosigma fasciola* as a variety; but is herewith assigned specific status.



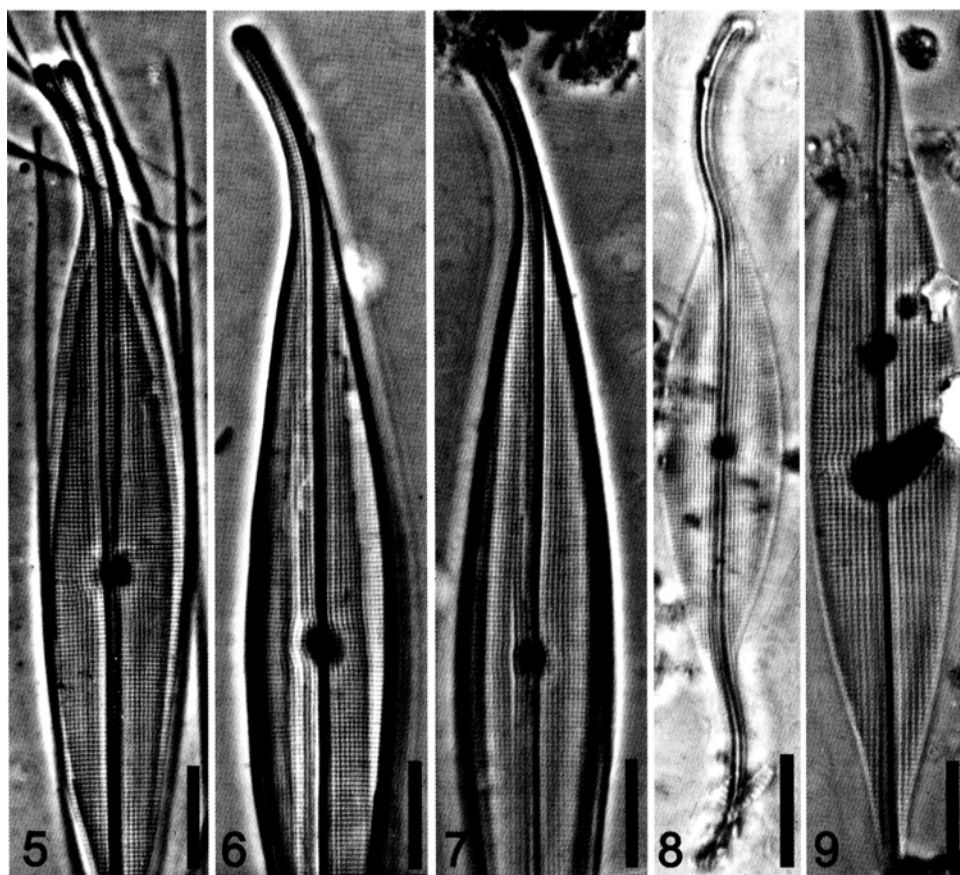
Figs 2–4. *Gyrosigma fasciola*. Ehrenberg's Taxonomic Preparations. **Fig. 2.** Cell on preparation No. 540032–4 (Lectotype) at centre of red ring. **Fig. 3.** Cell on preparation No. 540032–4 at the margin of red ring showing remnants of chloroplasts. **Fig. 4.** Specimen from original material (preparation No. 540032–3). Detail of the valve showing barely visible striation. Scale bar = 10 μ m.

Gyrosigma arcuatum (Donkin) Sterrenburg, comb. nov.

Basionym: *Pleurosigma arcuatum* Donkin in Transactions of the microscopical Society of London, New Series, 6, p. 25, pl. 3/10. 1858.

Synonym: *Gyrosigma fasciola* var. *arcuatum* (Donkin) Cleve

Lectotype (designated here): Creswell, July 1857, BM 12071.



Figs 5–9. LM. **Figs 5–7.** Specimens of *Gyrosigma fasciola*. **Fig. 5.** W. Smith material “Poole Bay, 1850”. **Fig. 6.** New Zealand specimen collected by S.R. Stidolph, see Stidolph 1994. **Fig. 7.** Morston Holt, UK, leg. Hamond 1993. **Fig. 8.** Specimen matching Donkin’s protolog for *Gyrosigma arcuatum* (Donkin) Sterrenburg from the North Sea (Zeeland Province, The Netherlands). **Fig. 9.** Specimen matching Grunow’s protolog of *Gyrosigma sulcatum* (Grunow in Cleve & Grunow) Frenguelli, from the North Sea (Zeeland Province, The Netherlands). Scale bars = 10 μ m.

The valves of *G. arcuatum* in the type material are 80–110 μ m long and 12–15 μ m wide. The curvature of the apical extensions is variable, probably because the thin extensions are flexible. This is not a good criterion for differentiation from *G. fasciola*. However, the much finer striation of *G. arcuatum* (circa 27 striae in 10 μ m as against 22 in 10 μ m for *G. fasciola*) permits separation and is here regarded as a specific rather than varietal character. Fig. 8 shows a specimen from the North Sea that matches Donkin’s taxon type. This finding is in agreement with the data in Donkin 1858 and Cleve 1894.

One must, therefore, also exclude the possibility that Grunow’s *G. sulcatum* (= *P. fasciola* var.?) *sulcatum*) corresponds to Ehrenberg’s *Ceratoneis fasciola*. Grunow’s protolog clearly mentions much coarser longitudinal (15 in 10 μ m) than transverse (19 in 10 μ m) striae. This places it in the section *Attenuati sensu* Peragallo, instead of the *Acuminati* as is the case for both *G. fasciola* and *G. arcuatum*. In view of the discontinuity in striation pattern Frenguelli’s (1938, p. 294) assignment of specific status to Grunow’s taxon therefore appears to be fully justified.

The next question is whether W. Smith's *P. fasciola* corresponds to Cleve's *G. fasciola*. According to W. Smith's data, his concept of *P. fasciola* includes equally fine transverse and longitudinal striae, circa 22 in 10 μm . Fig. 5 shows such a specimen, from the Poole Bay material, 1850, mentioned in W. Smith (1852). Stidolph (1994) verified with one of us (FASS) that his specimens from New Zealand (Fig. 6) correspond to W. Smith's concept. Cleve's data for *G. fasciola* correspond exactly to those of W. Smith for *P. fasciola*; therefore continuity is ensured in that case.

Only now it remains to demonstrate that W. Smith's taxon corresponds to Ehrenberg's type specimen as regards to stria density and here we encounter a problem. Ehrenberg's preparation consists of a mica slide carrying the material mounted "dry" and then covered with another mica slide. For physical-optical reasons it is impossible to obtain satisfactory images from such a preparation. In some of Ehrenberg's specimens, vestiges of striation are barely visible (Fig. 4). Exact measurement is not possible but the much finer striation of *G. arcuatum* would not be visible under these conditions, whilst the much coarser striation of *G. sulcatum* would be markedly more evident. Fig. 9 shows a specimen from the North Sea matching Grunow's protolog of *Gyrosigma sulcatum*. Therefore, we conclude that continuity of identification from Ehrenberg to W. Smith has been assured.

A favouring circumstance is the fact that according to our own observations *G. fasciola* (Figs 1–7) is more frequently encountered in the marine littoral of the Atlantic and North Sea than *G. arcuatum* (Fig. 8) or *G. sulcatum* (Fig. 9). *G. fasciola* is also common in the Baltic Sea (Kuylenstierna & Snoeijs 1996). Other records of this taxon have been published from the Atlantic and Pacific coasts of the USA (Patrick & Reimer 1966), from the Caribbean, from New Zealand and even from Arctic waters. Specimens identified as *G. fasciola* have been documented by light microscopy in several floras such as Krammer & Lange-Bertalot (1986) for the North Sea, and by Kuylenstierna & Snoeijs (1996) for the Baltic Sea; the most recent SEM documentation and some autecological information is given in Reid (2004). This diatom is a typical inhabitant of intertidal mudflats. It remains to be verified whether individual records of *G. fasciola* are indeed that taxon, or *G. arcuatum*.

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