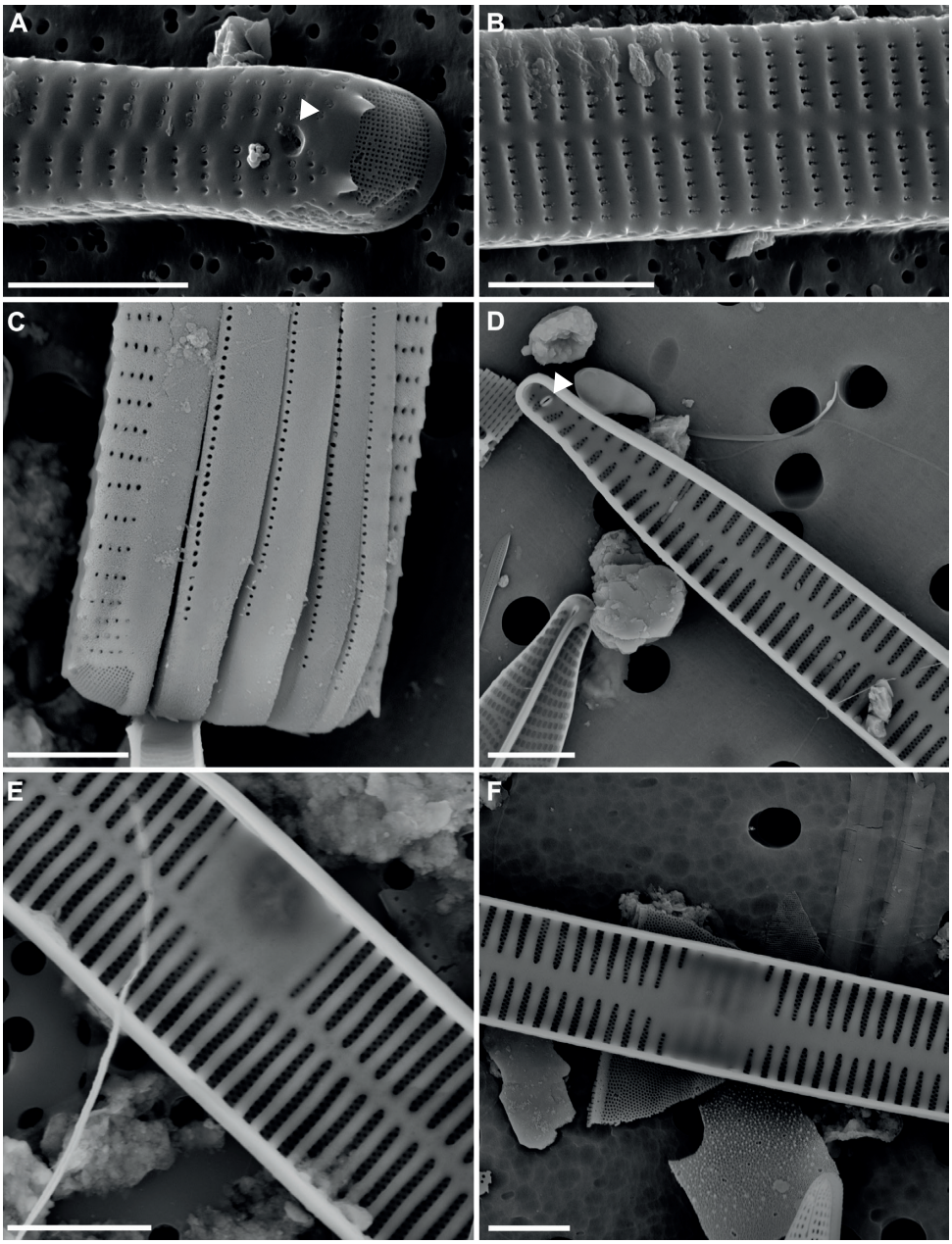


Fig. 53. *Ulnaria* spp. **A-F.** SEM. **A-B.** External view of valve**. A.** Cell apex, note apical pore field and rimoportula (arrow). **C.** External girdle view. **D-F.** Internal view of valve. **D.** Cell apex with internal opening of rimoportula (arrow). **E-F.** Central area, varies in size and may reach both valve margins. Scale bars = 5 µm (A-F).

Tabellaria (Ehrenberg) Kützing 1844

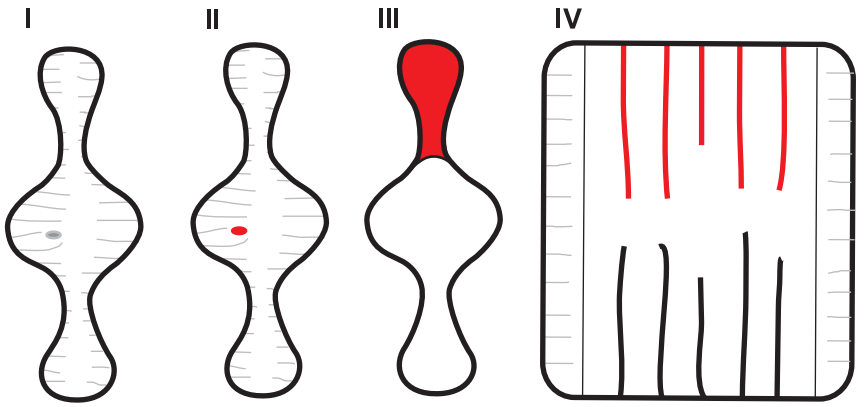
Type species: *Tabellaria flocculosa* (Roth) Kützing

Characteristics – Cells **araphid** with swollen mid-valve and apices. Parallel striae through the length of the valve, areolae fine, not easily observed under LM (Fig. 54: C, E-F). **Axial area** very narrow, a reduced central area may be present. **Rimoportula** (labiate or lipped processes) present mid-valve (II), positioned slightly eccentrically. Apical pore fields at both poles (Fig. 55: A). Numerous girdle bands or **copulae** bear **septa** (III), visible in both valve view (III) and girdle view (IV) (Fig. 54: D; Fig. 55: B, E). Spines may be present at the junction of the valve face and mantle (Fig. 55: A).

Plastid structure – Cells with numerous discoid plastids (Fig. 54: A-B).

Identification of species – Species can be identified by cell size (length), cell shape, presence of a central area, presence of spines as well as the height of complete frustules in girdle view.

Ecology – Cells colonial, joined at the apices of the cells by mucilage pads forming zigzag colonies (Fig. 54: A-B). Found in the benthos of slightly acidic oligotrophic waters with low conductivities, may be re-suspended in the phytoplankton.



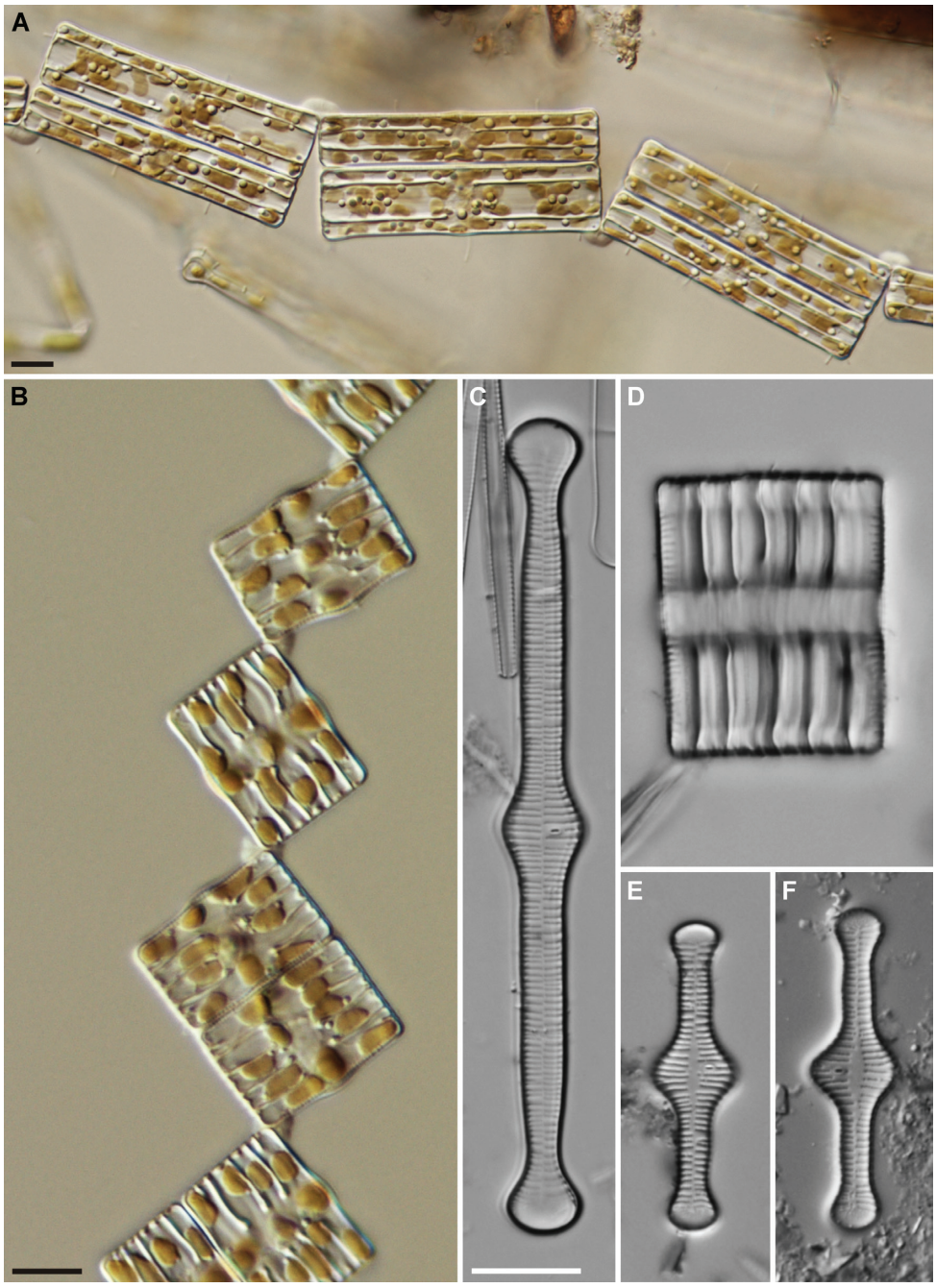


Fig. 54. *Tabellaria* spp. **A-F.** LM. **A-B.** Living cells forming zigzag colonies. **C-F.** Cleaned cells. **C, E-F.** Valve views. **D.** Girdle view. **A, C.** *T. fenestrata* (Lyngbye) Kützing. **B, D, F.** *T. flocculosa.*
Scale bars = 10 µm .

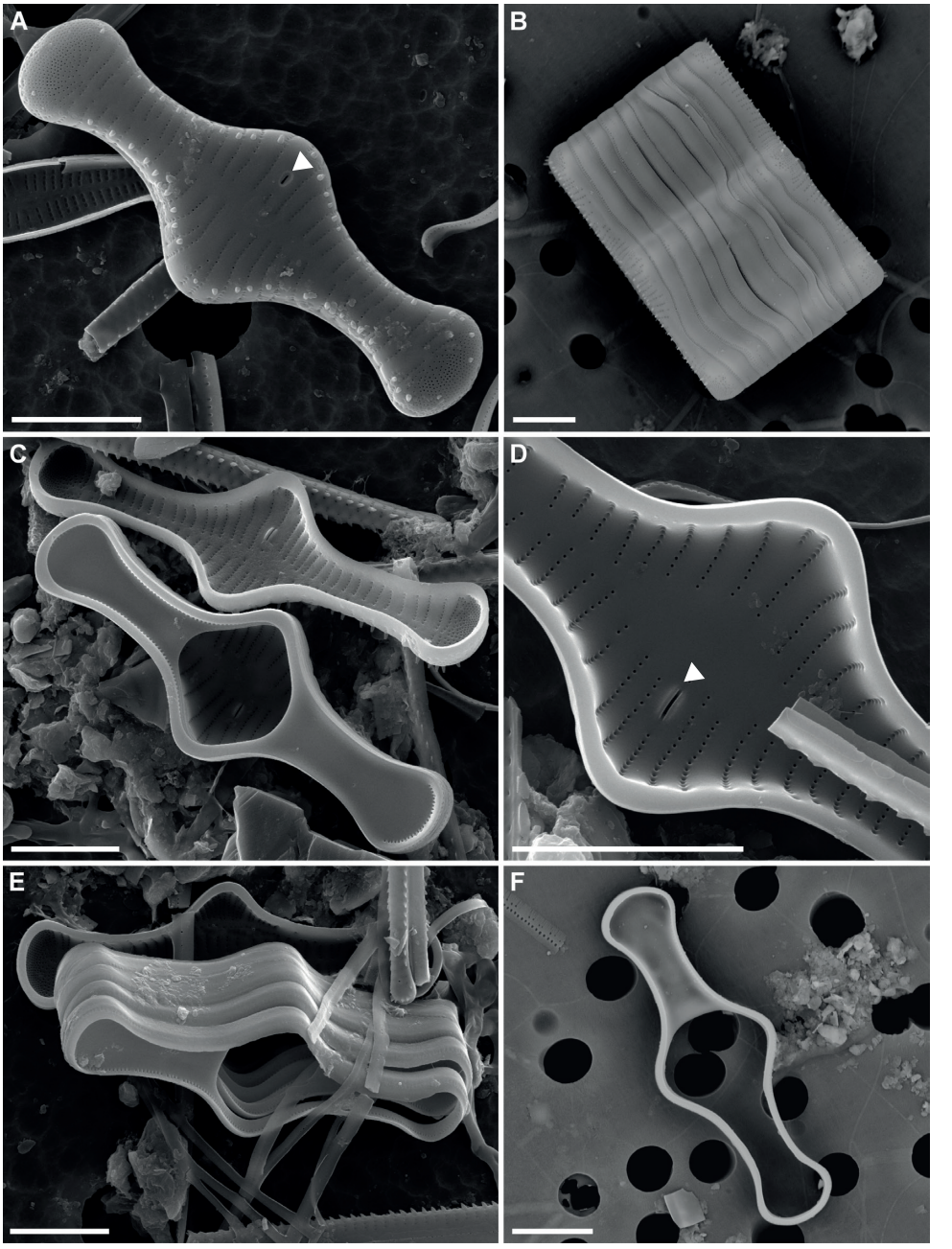


Fig. 55. *Tabellaria flocculosa*. **A-F.** SEM. **A.** External view of valve, note position of the rimoportula (arrow). **B.** Girdle view. **C, E-F.** Internal view of valve showing the septa. **D.** Internal view of valve, note internal opening of rimoportula (arrow).
Scale bars = 5 µm .

Actinella F.W. Lewis 1864

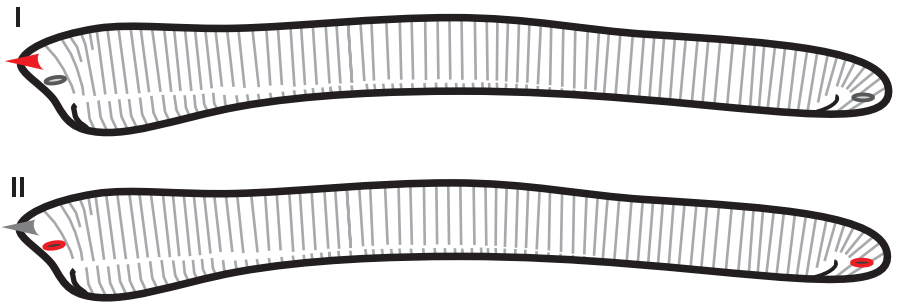
Type species: *Actinella punctata* F.W. Lewis

Characteristics – Cells raphid, usually strongly **heteropolar** (head pole differs in size and shape from foot pole) and this is the chief character differentiating this genus from *Eunotia*. The cell margins have **spines** and the head or larger pole (Fig. 57: F) as well as the foot pole (Fig. 57: G) may carry a single isolated **spine** (I). The raphe is very short on the valve face (comparable to *Eunotia*) with the majority of the length being found on the **valve mantle** (Fig. 57). In girdle view cells have a pronounced wedge shape (Fig. 57: B). A single **rimoportula** (labiate or lipped process) is present at each apex which may be rather difficult to see in LM (II, Fig. 57: A).

Plastid structure – Cell occupied by a single large chloroplast the lobes of which are apressed under each valve and connected centrally by a bridge (Fig. 56: D).

Identification of species – Species and varieties in this genus are distinguished based on cell size and shape and importantly the shape of the apices.

Ecology – Cells solitary. Found in acidic oligotrophic waters.



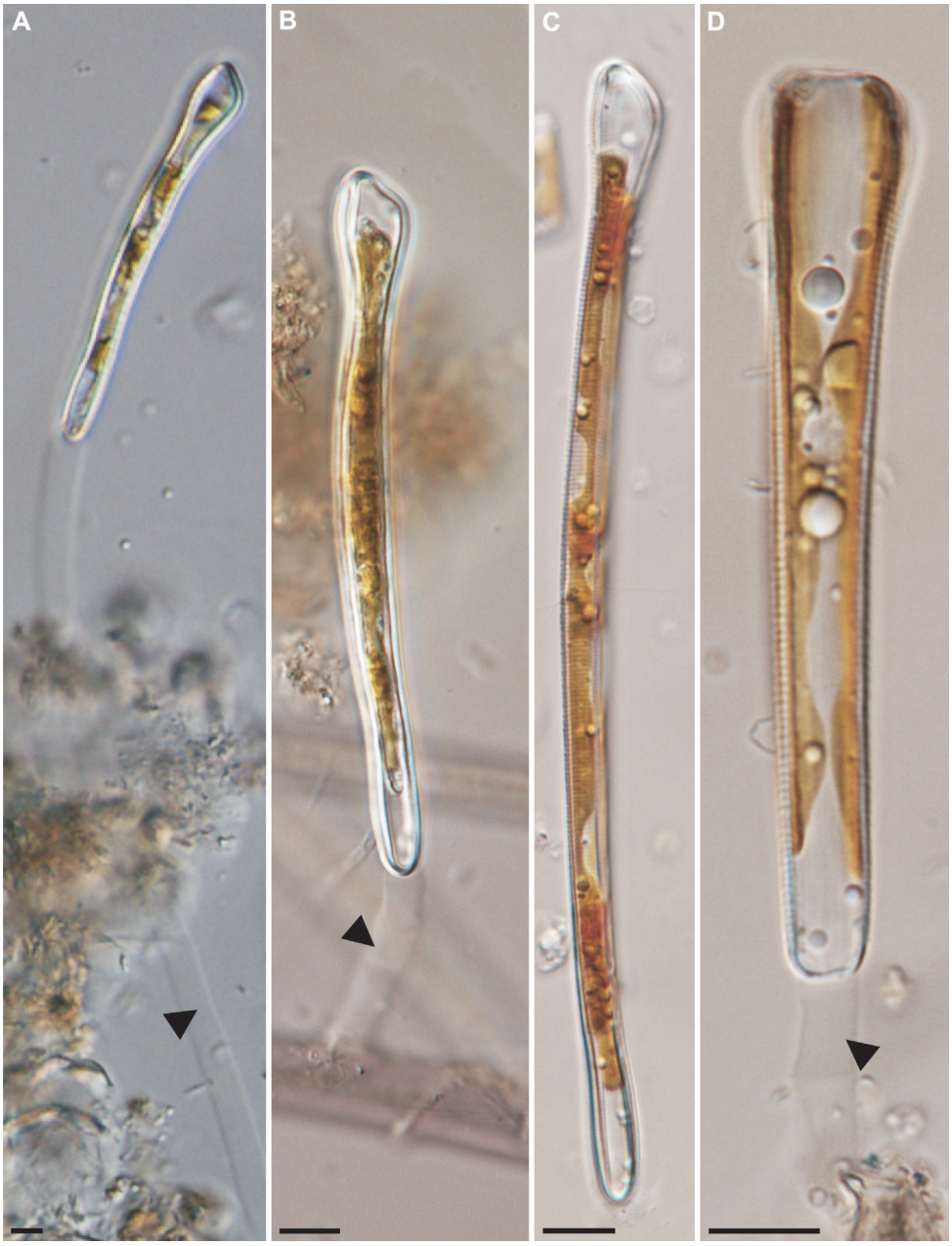


Fig. 56. *Actinella* spp. **A-D**. LM, living cells. **A-C.** *Actinella brasiliensis* Grunow valve view. **D**. *A. brasiliensi*s girdle view.
Scale bars = 10 µm (A-D).

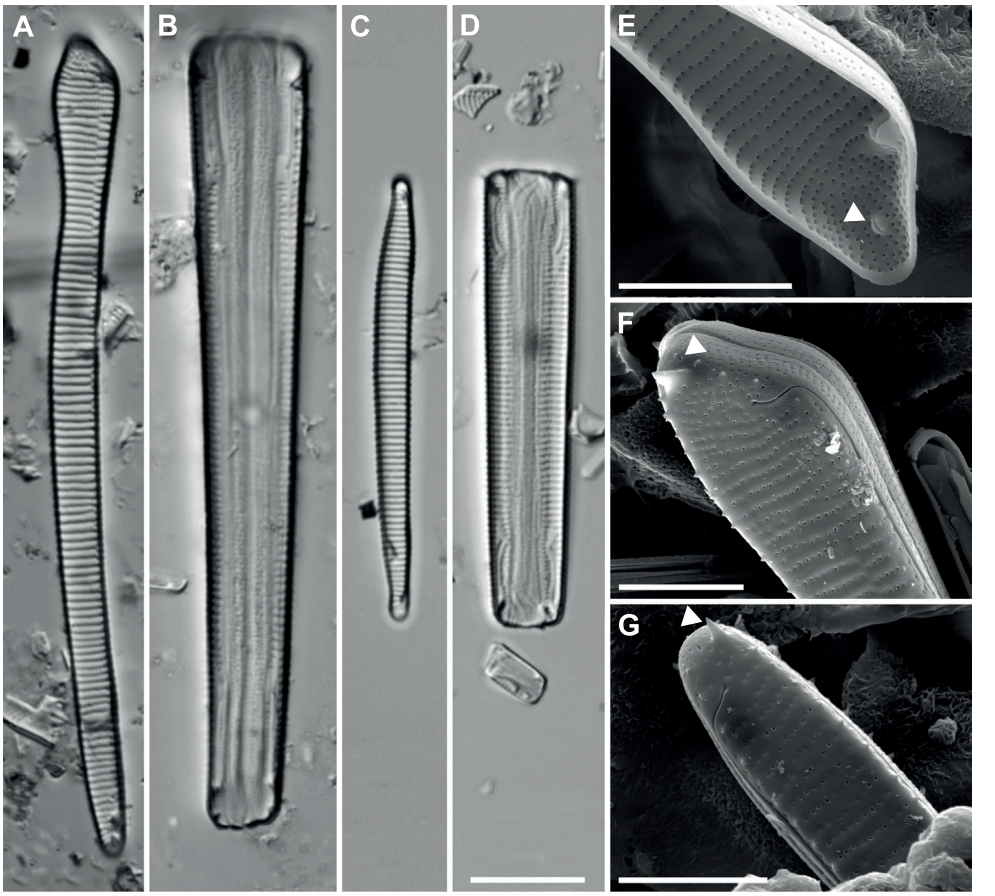


Fig. 57. *Actinella* spp. **A-D**. LM. **A**. *Actinella brasiliensis* valve view. **B**. *A. brasiliensis* girdle view. **C**. *Actinella* sp. valve view. **D**. *Actinella* sp. girdle view. **E-G**. SEM. **E**. Internal view of valve showing rimoportula near head pole (arrow). **F**. Head pole, note position of external opening of rimoportula (arrow). **G**. External view of foot pole, note the single large spine near the apex (arrow). Scale bars = 10 µm (A-D), 5 µm (E-G).

Actinellopsis J.C. Taylor, B. Karthick & Kociolek 2014

Type species: *Actinellopsis murphyi* J.C. Taylor, B. Karthick & Kociolek

SYNONYM:

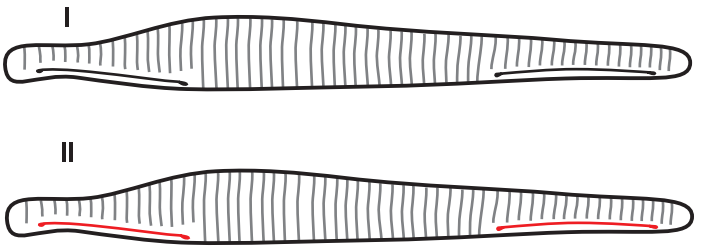
Actinella F. W. Lewis 1864 pro parte

Characteristics – Cells raphid, **heteropolar** (head pole differs in size and shape from foot pole) as well as being **dorsiventral** with a rounded dorsal and flattened ventral margin (I). Complete raphe system located on the valve face alone and does not extend onto the valve mantle (II). Only two species are known thus far for the genus (one recent, one fossil); both small with rather indistinct striae which are difficult to resolve under LM. No spines are present. In girdle view cells have a pronounced wedge shape (Fig. 58: D). A single **rimoportula** (labiate or lipped process; Fig. 58: D) is present on either the head or the foot pole which can only be seen in SEM (Fig. 58: I).

Plastid structure – Plastid structure is unknown at this time.

Identification of species – Species and varieties in this genus are distinguished based on cell size and shape and importantly the shape of the apices.

Ecology – Cells probably solitary. Found in acidic oligotrophic waters.



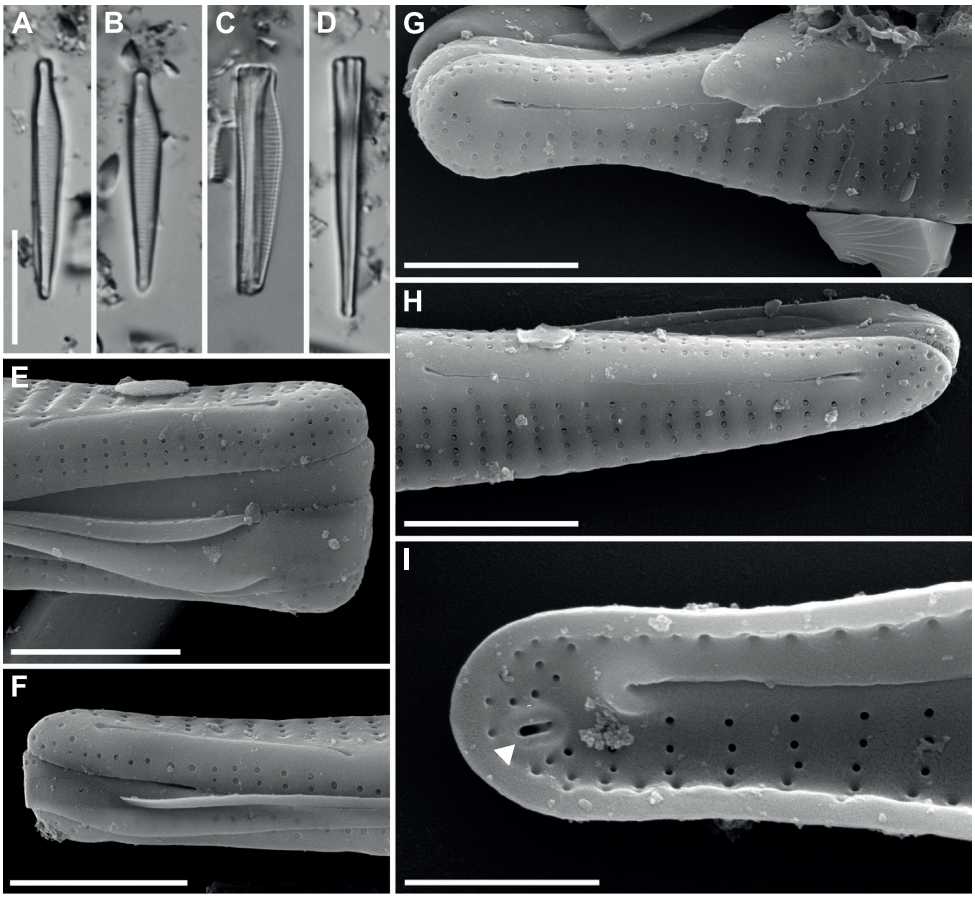


Fig. 58. *Actinellopsis murphyi*. **A-D**. LM. **A-B**. Valve view of cleaned material. **C**. Oblique view showing both valve face and girdle. **D**. Girdle view. **E-I**. SEM. **E.** Head pole, girdle view. **F**. Foot pole, girdle view. **E-F**. Showing the raphe does not extend onto the mantle. **G**. Head pole, external valve face. **H**. Foot pole, external valve face. **I**. Internal view of the head pole showing weakly developed rimoportula (arrow).
Scale bars = 10 µm (A-D), 2 µm (E-H), 1 µm (I).

Desmogonium Ehrenberg 1848

Type species: *Desmogonium guianense* Ehrenberg

SYNONYM:
Eunotia Ehrenberg 1837 pro parte

Characteristics – Cells **raphid**, dorsiventral, slightly **lunate** and large. Striae coarse and easily discernable interrupted near the ventral valve margin forming a narrow longitudinal line running from apex to apex (I). Raphe branches on the valve face are very short and curved with the majority of the raphe structure found on the mantle (Fig. 60: G). Cells always have spines at the junction of the valve face and mantle; these may be more or less visible depending of focal depth (II, Fig. 60: A-H; Fig. 61: A, B).

Plastid structure – Cells with 2 elongate plastids lying on the ventral side of the cell and extending under the valve faces (similar to *Eunotia*) (Fig. 59: D).

Identification of species – Species can be identified by cell size, cell shape, shape of the apices and structure and density of the striae.

Ecology – Cells solitary and motile, or forming colonies and then cells connected at both poles. Found in the benthos of acidic oligotrophic waters with low conductivity.

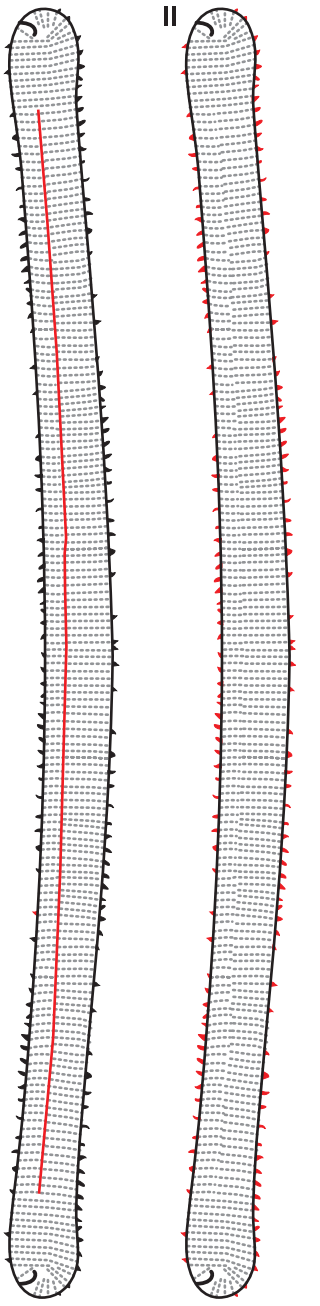


Fig. 59. *Desmogonium* spp. **A-D**. LM, living cells. **A-C**. Cells forming colonies, connected at both apices. **D**. Solitary cell, girdle view.
Scale bars = 10 µm.

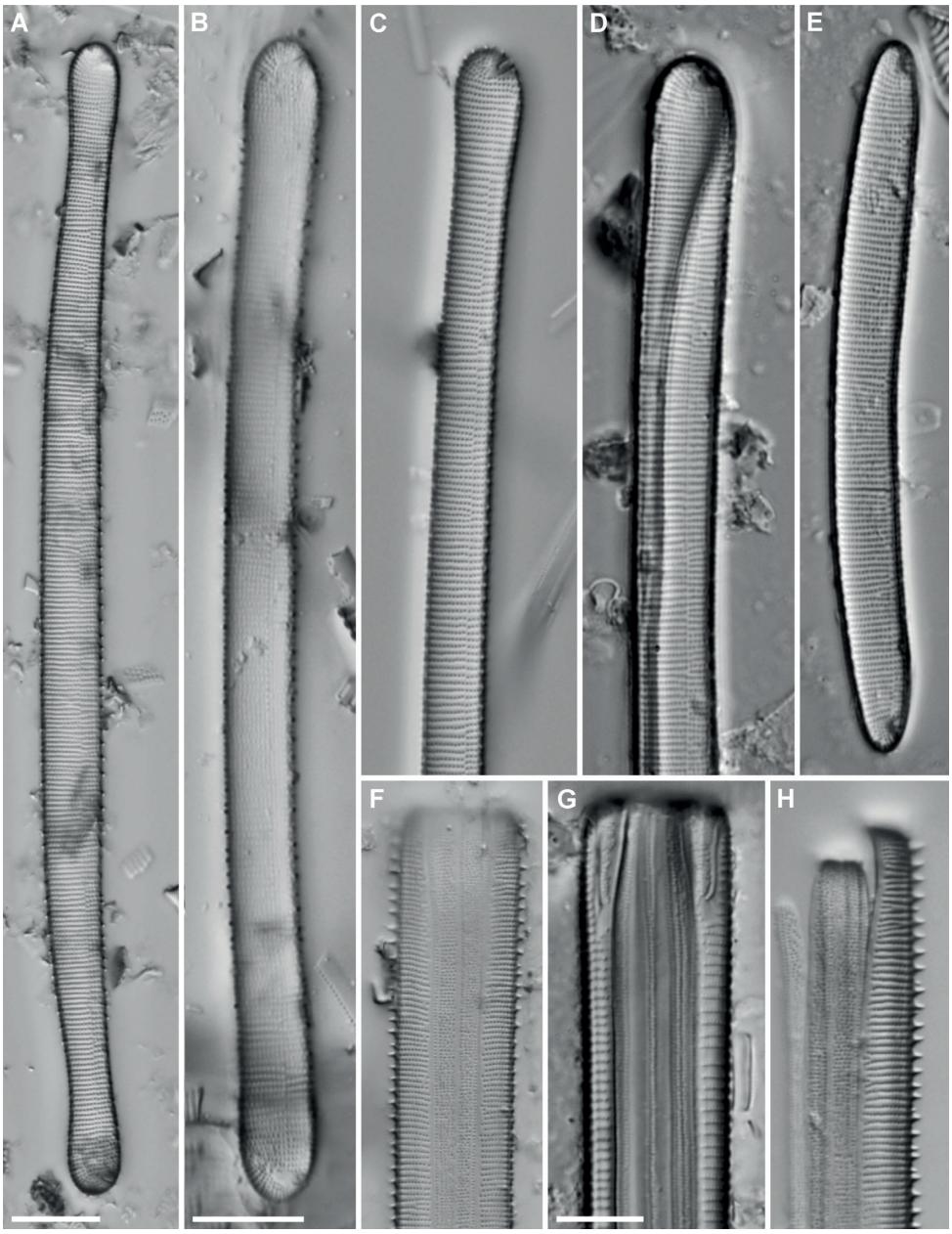


Fig. 60. *Desmogonium* spp. **A-H**. LM. **A-E**. Valve views of cleaned material. **F-H**. Girdle views of cleaned material, note marginal spines. Scale bars = 10 µm.

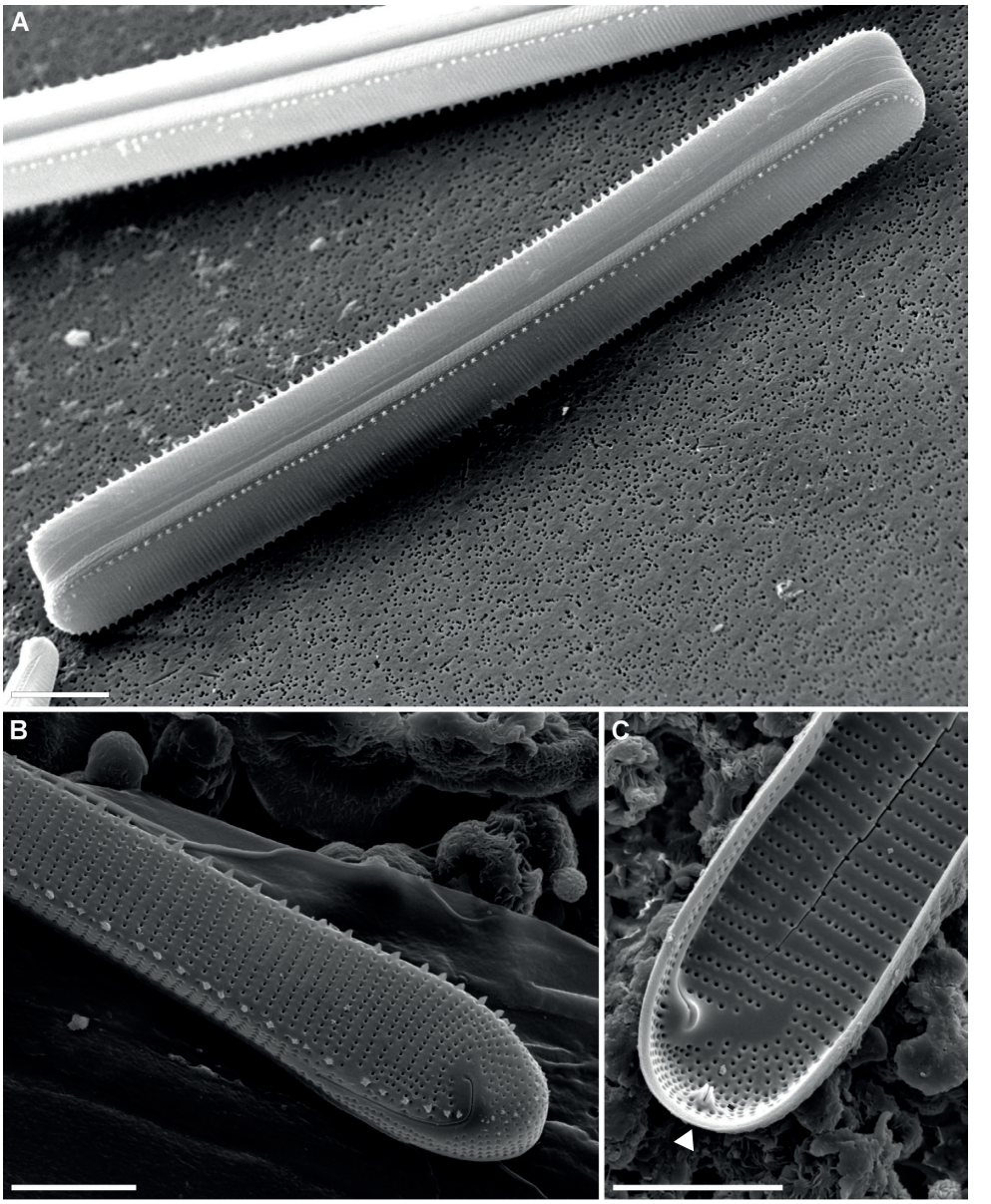


Fig. 61. *Desmogonium* spp. **A-C**. SEM. **A**. Oblique view of whole cell. **B**. External view of valve apex showing raphe ending and marginal spines. **C**. Internal view of valve showing raphe ending and rimoportula (arrow).
Scale bars = 10 µm (A), 5 µm (B-C).

Eunotia Ehrenberg 1837

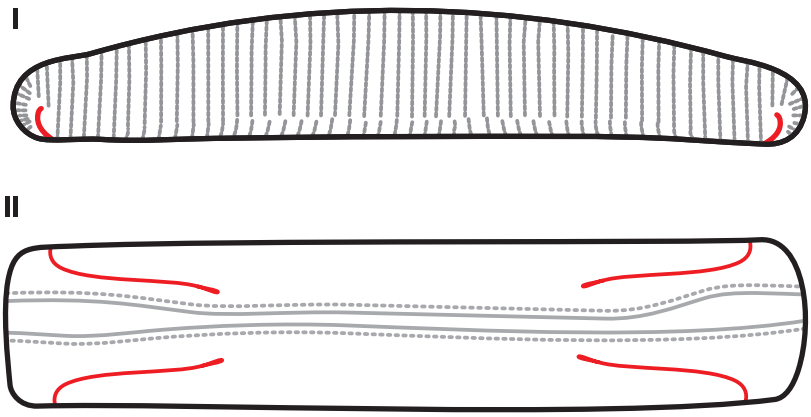
Type species: *Eunotia arcus* Ehrenberg

Characteristics – Cells **raphid**, **dorsiventral**, **lunate** and highly variable in size. Raphe branches on the valve are very short and curved (I) with the majority of the raphe structure found on the valve mantle (II, Fig. 65: C). Cells rarely have spines at the junction of the valve face and valve mantle, apical spine may be present. Areolae often visible.

Plastid structure – Variable, some species with 2 elongate plastids lying on the ventral side of the cell and extending under the valve faces (Fig. 62: C), others with many granular plastids (Fig. 63: C) .

Identification of species – Species can be identified by cell size, cell shape, shape of the apices and structure and density of the striae and areolae, position of the raphe as well as the degree to which the cell is curved. Number of undulations on the dorsal margin are sometimes, but not always, a good character to distinguish species.

Ecology – Cells solitary and motile, also colonial and linked face to face to form ribbon-like colonies (Fig. 63: A-B) or linked corner to corner (Fig. 63: D) or grouped, joined at the base of the cells (Fig. 63: E). Found in the benthos of acidic oligotrophic waters with low conductivity, some species may be found in waters with higher trophic levels.



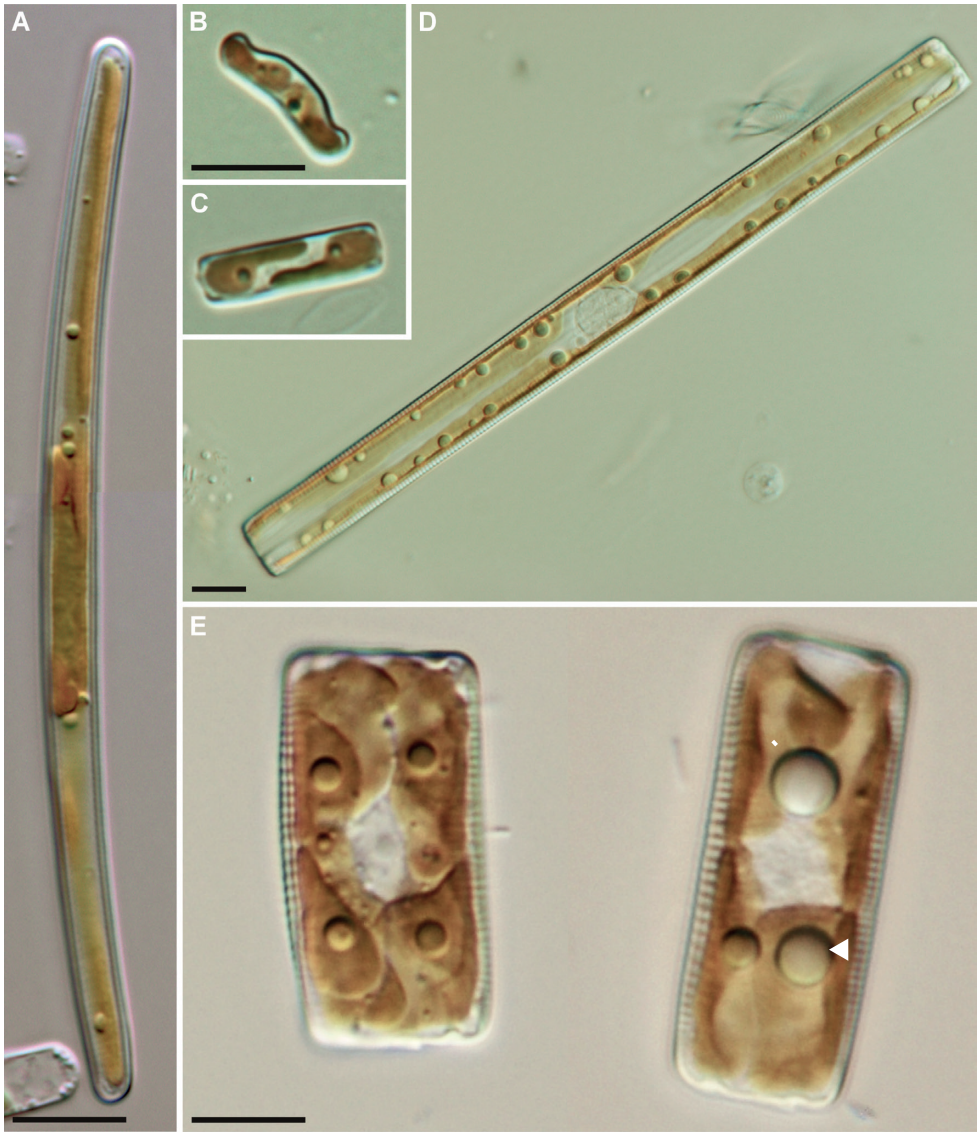


Fig. 62. *Eunotia spp*. **A-E**. LM, living cells. **A**. Valve view. **B-C**. *Eunotia exigua* (Brébisson ex Kützing) Rabenhorst, valve view (**B**), girdle view (**C**). **D-E**. Girdle views of *Eunotia* sp., note large lipid droplets (arrow).
Scale bars = 10 µm (A-E).

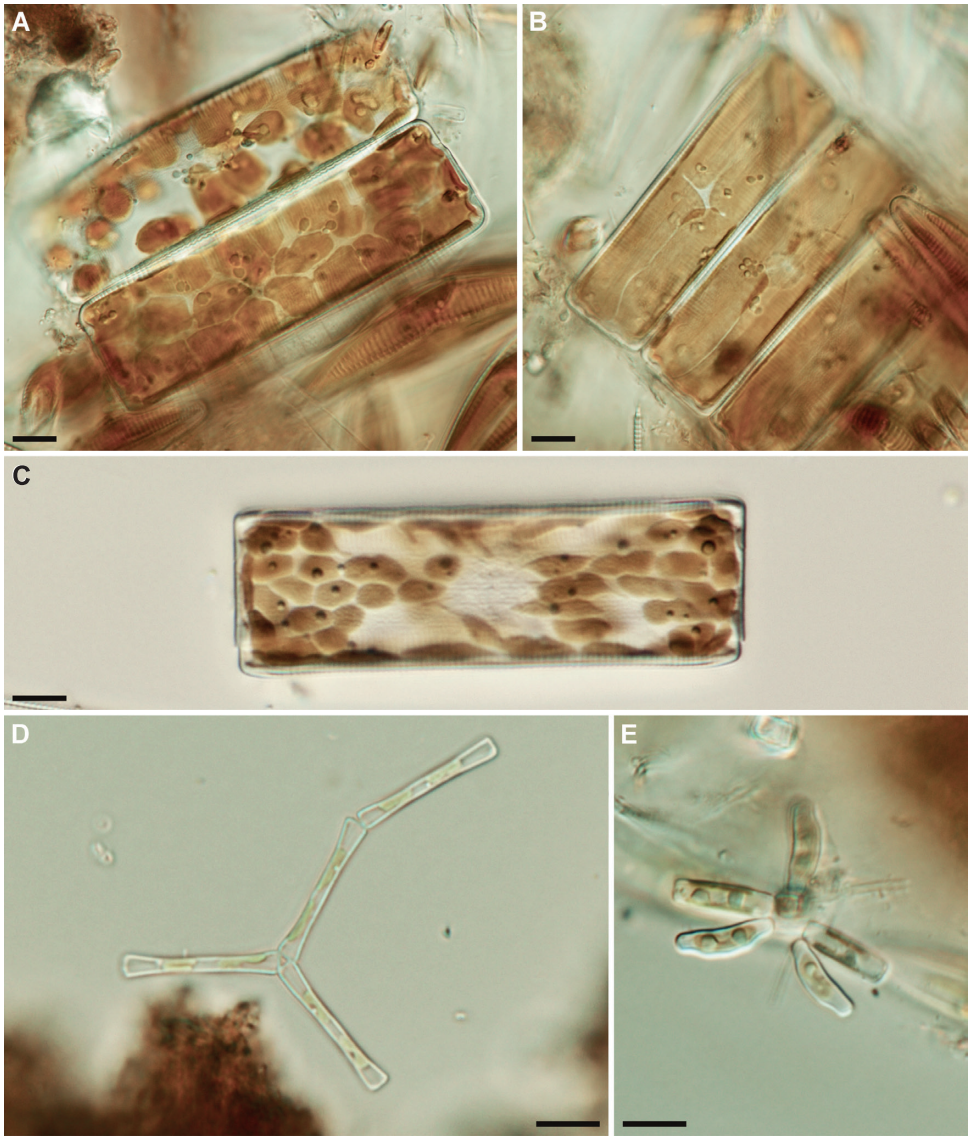


Fig. 63. *Eunotia* spp. **A-E**. LM, living cells. **A-B**. Large chain forming cells. **C**. Girdle view showing many small granular plastids. **D**. Cells linked at the corners to form colony. **E**. Cells united on a single mucilage pad and forming a colony. Scale bars = 10 µm (A-E).

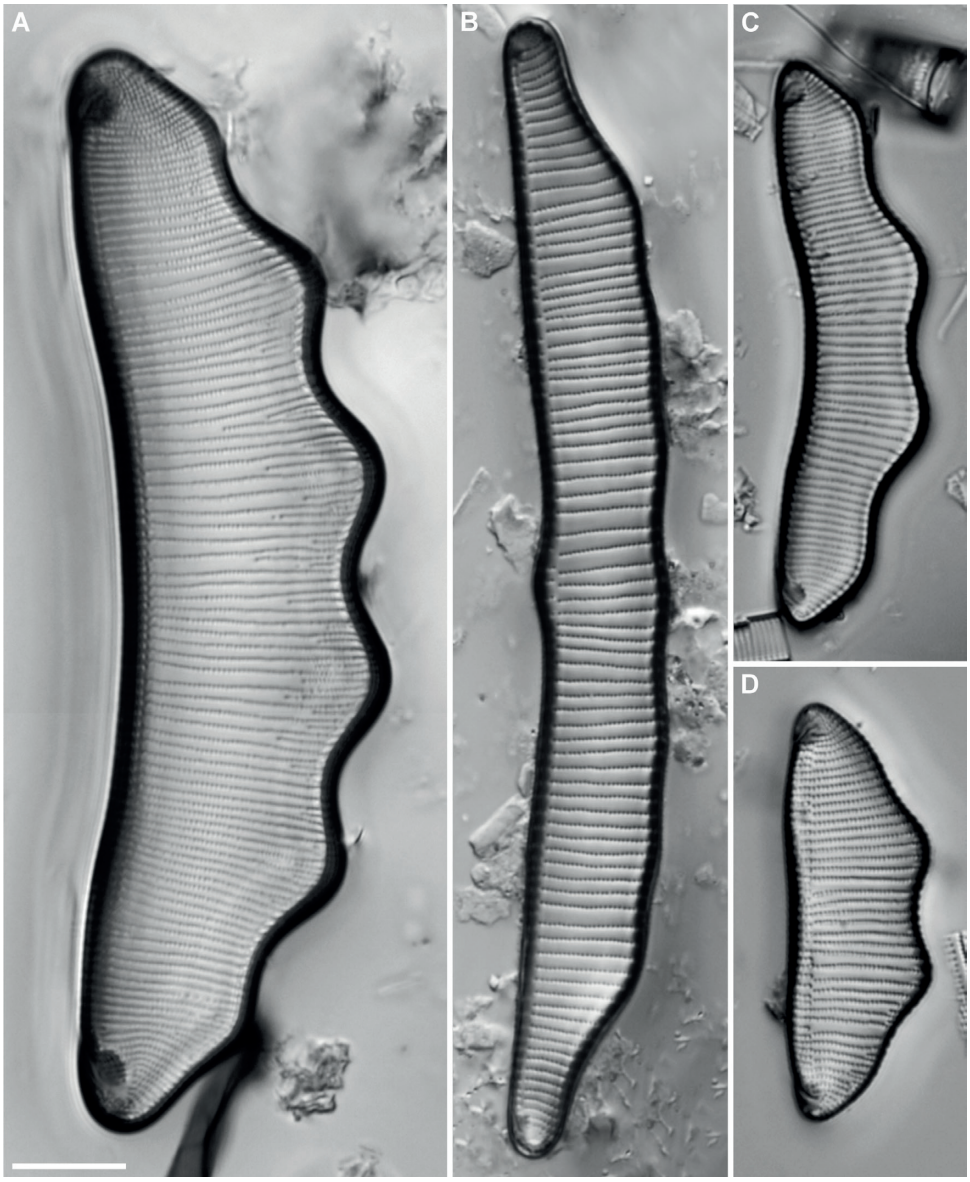


Fig. 64. *Eunotia* spp. **A-D**. LM, cleaned material of large-celled *Eunotia* spp. **B**. *Eunotia pectinalis* (Kützing) Rabenhorst. **C**. *E. zygodon* Ehrenberg. Scale bar = 10 µm.

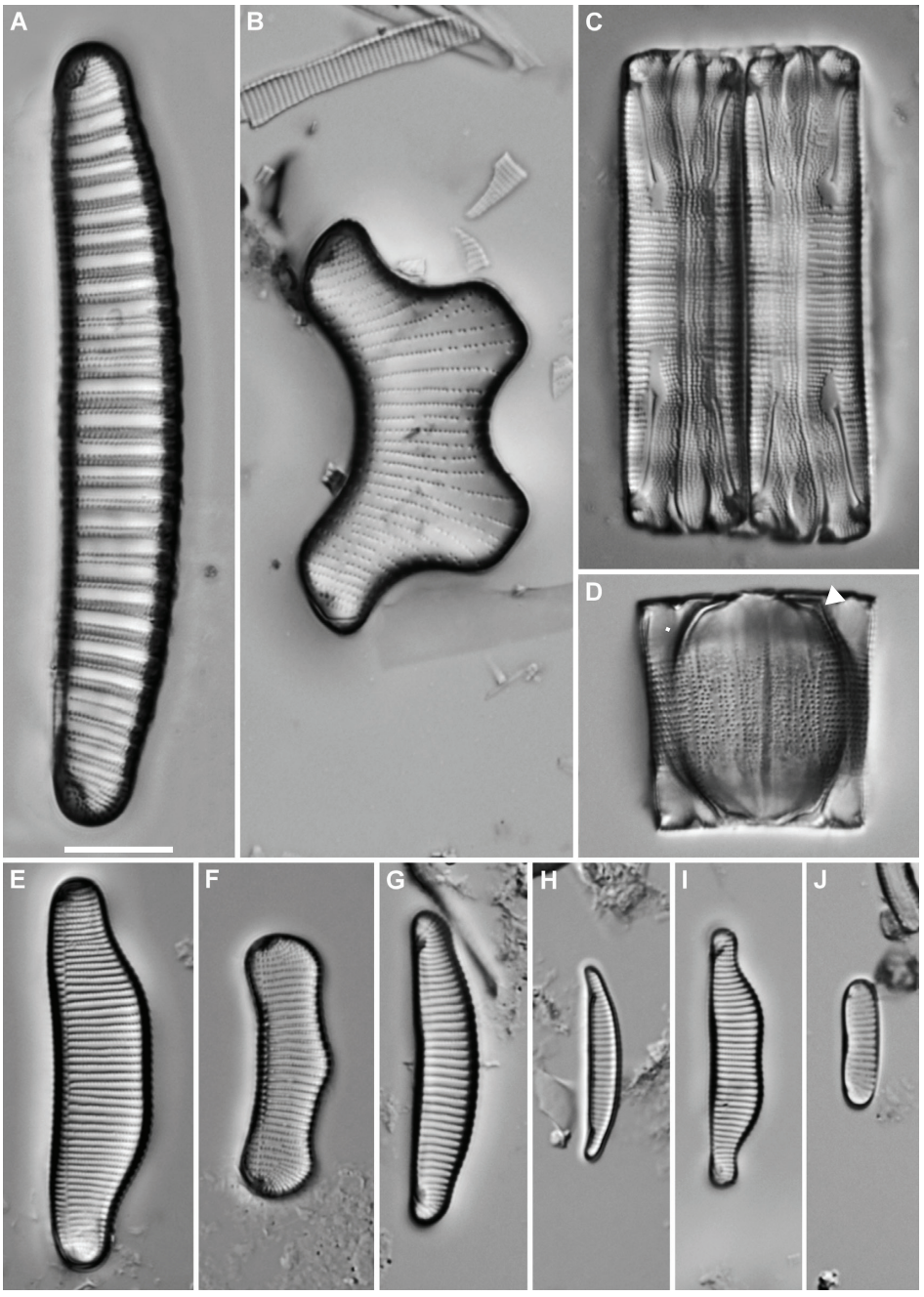


Fig. 65. *Eunotia* spp. **A-J**. LM, cleaned material. **A**. *Eunotia epithemioides* Hustedt. **C**. Ventral girdle view of two cells immediately post cell division. **D**. Girdle view, double thecae or internal septa (arrow), produced during resting spore formation. **F**. *E. rabenhorstii* Cleve & Grunow. Scale bar = 10 µm.

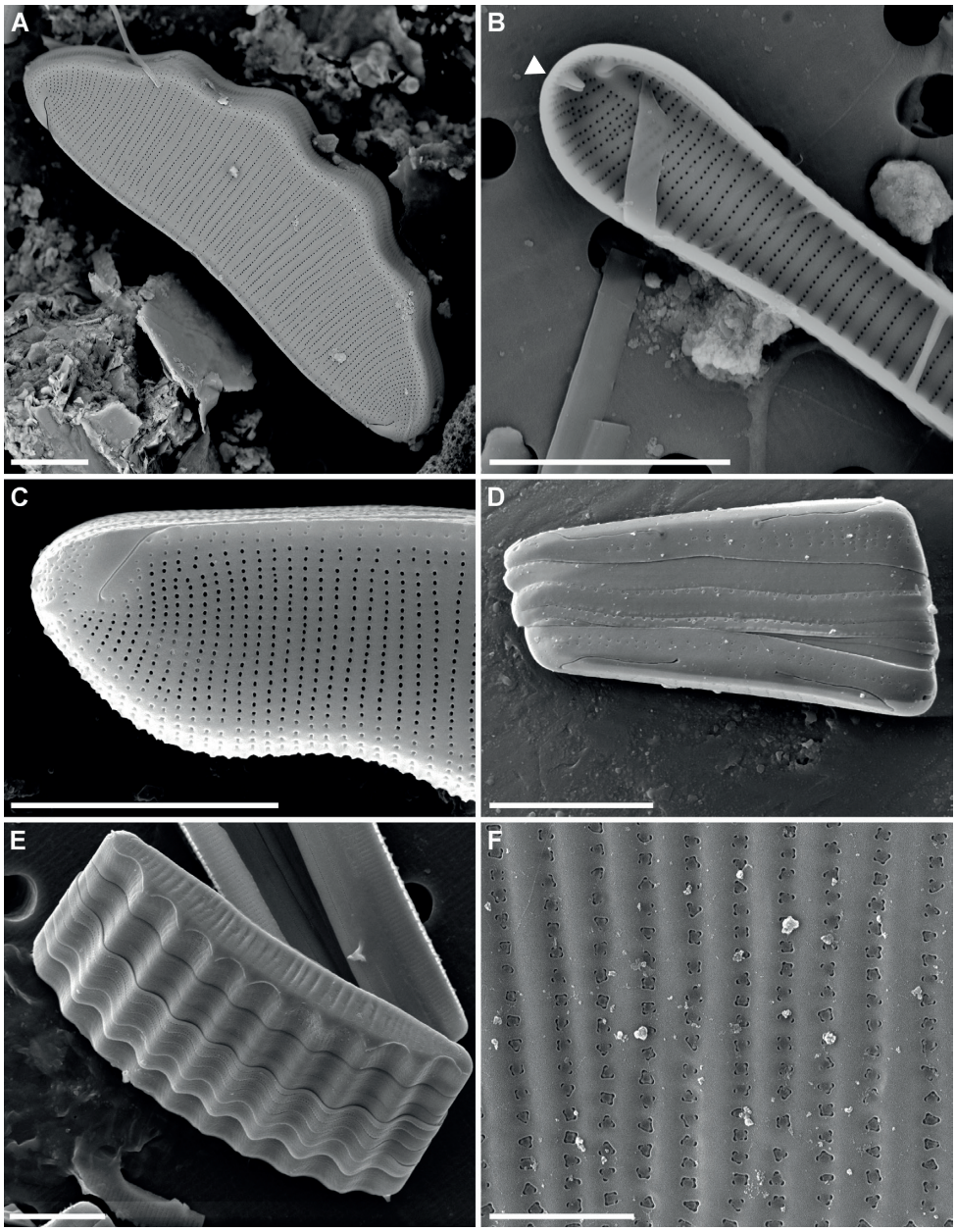


Fig. 66. *Eunotia* spp. **A-F**. SEM. **A**. External view of valve. **B**. Internal view of valve, note position of rimoportula (arrow). **C**. External view of apex of *E. zygodon*. **D**. Girdle view. **E**. Oblique view showing dorsal copulae. **F**. External view of areolae.
Scale bars = 10 µm (A-E), 2 µm (F).

Mastogloia (Thwaites) W. Smith 1856

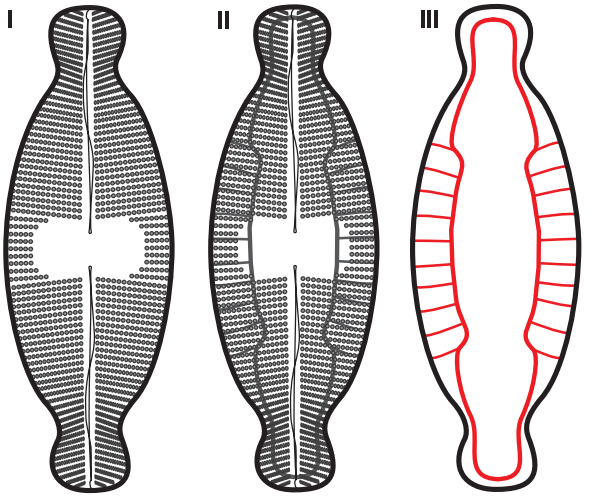
Type species: *Mastogloia dansei* (Thwaites) Thwaites ex W. Smith

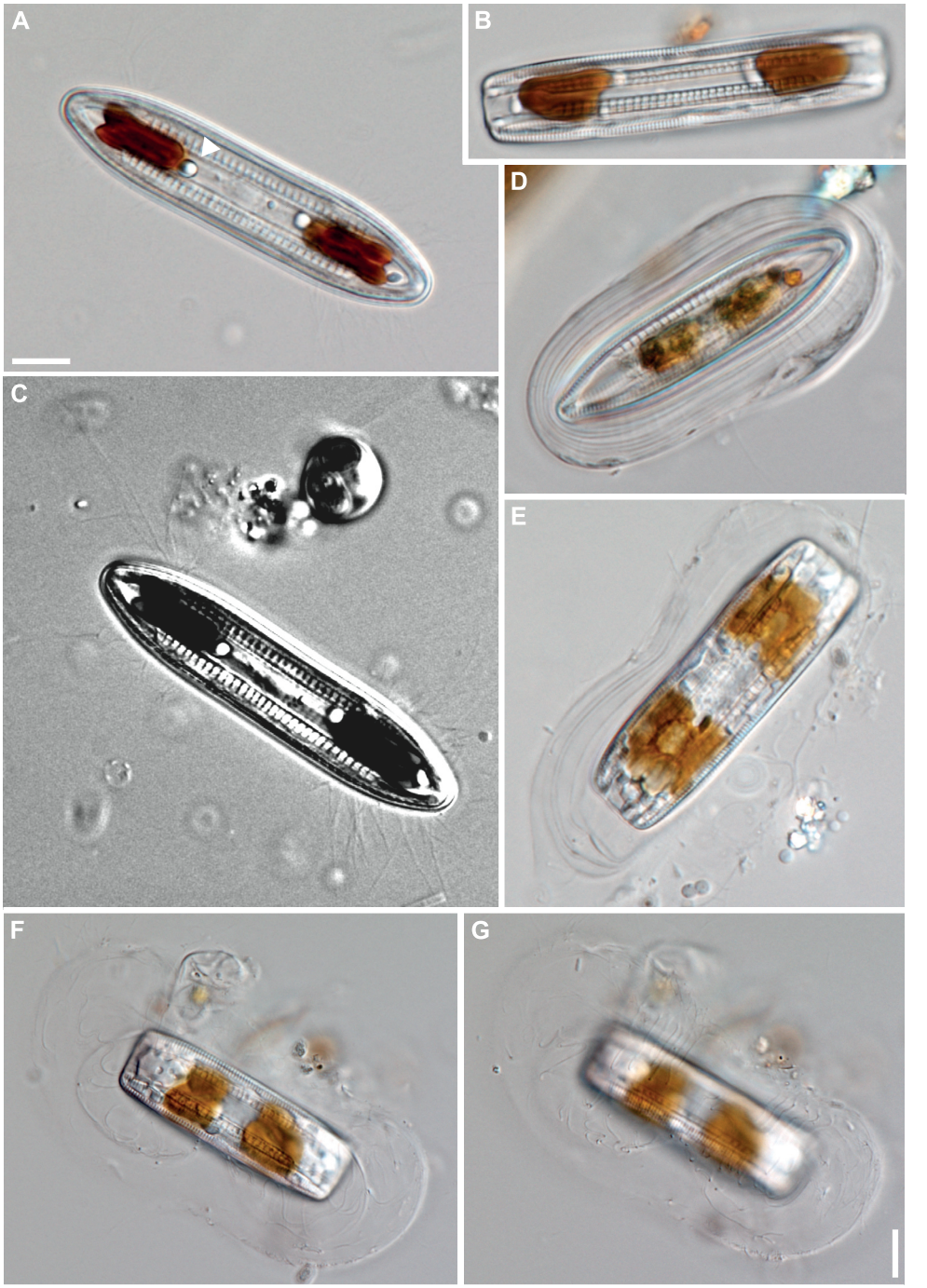
Characteristics – This genus is most noticeably distinguished in light microscopy by the **partecta** or chambers (III, Fig. 68: B, D-F) associated with the first girdle band or **valvocopula**. When seen from the girdle in SEM the large perforations extending into the **partecta** are clearly visible (Fig. 68: G). The raphe usually appears highly sinuous and complex. Areolae are large and clearly visible in LM. In living cells mucilage threads are exuded from the **parteca** (Fig. 67: C), this mucilage often encapsulates the entire cell (as illustrated in Fig. 67: D-G) and may play some role in allowing these cells to survive dessication and other unfavorable circumstances such as shifts in osmotic pressure.

Plastid structure – There are two small double lobed plastids found at each end of the cell (Fig. 67: A, B) with a pyrenoid between the two lobes of each plastid (Fig. 67: E). Usually two lipid droplets are present (Fig. 67: A).

Identification of species – Species in this genus are distinguished based on cell size and shape as well as the shape of the apices. Striae density and orientation are also of importance as well as the size of the areolae.

Ecology – Cells solitary, motile or encased in mucilage. The majority of species are brackish or marine but some are also found in fresh waters of higher electrolyte content and calcium rich waters.




A
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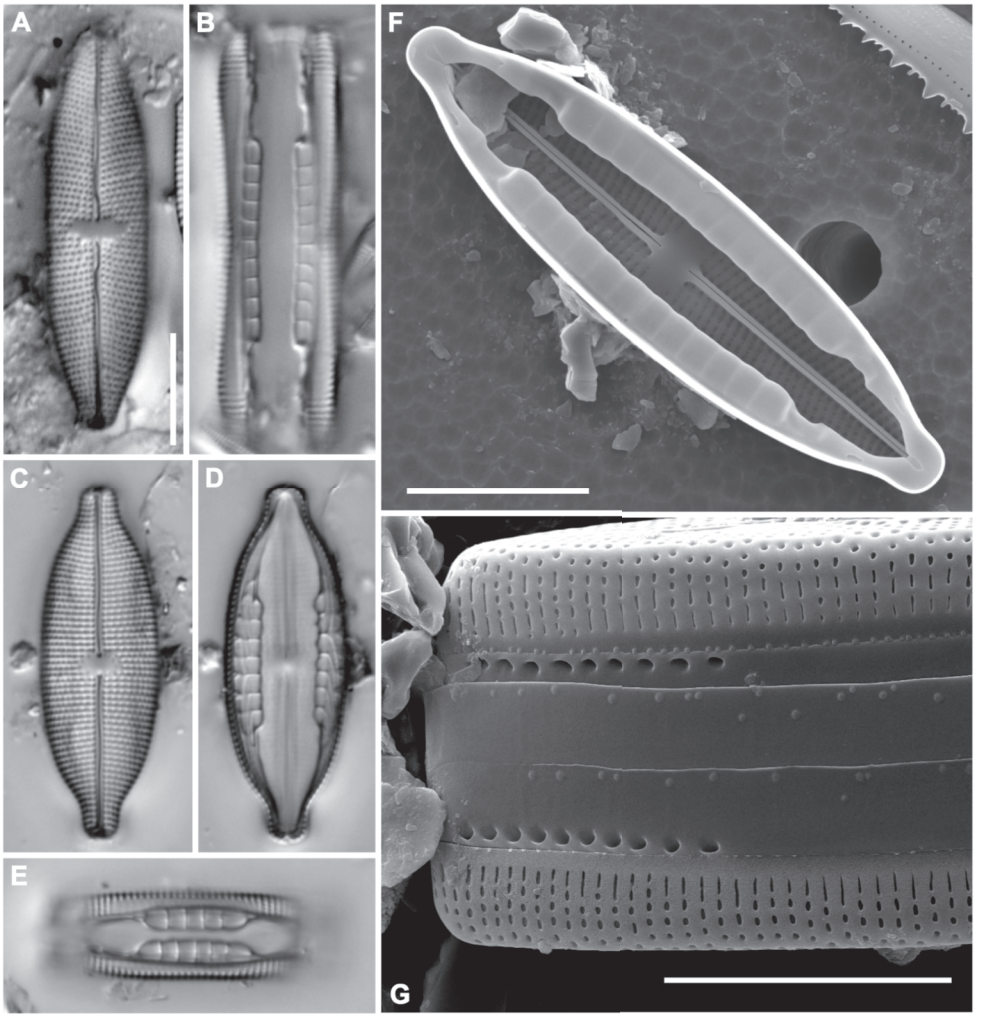

Fig. 68. *Mastogloia* spp. **A-E**. LM of cleaned material. **A, C.** Valve view. **B, E.** Girdle view. **D**. Detail of the valvocopula. **F-G**. SEM. **F**. Internal view of valvocopula showing the partecta. **G**. Girdle view, note external openings of the partecta through which the mucilage is exuded.
Scale bars = 10 µm (A-F), 3 µm (G).

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Fig. 67. *Mastogloia* spp. **A-G**. LM, living cells. **A**. Valve view, note the lipid droplets associated with each plastid (arrow). **B**. Girdle view. **C**. Living cell (high contrast), mucilage threads protruding from the partecta. **D-G**. Living cells encapsulated in mucilage, note threads protruding from partecta.
Scale bars = 10 µm (A-G).

Rhoicosphenia Grunow 1860

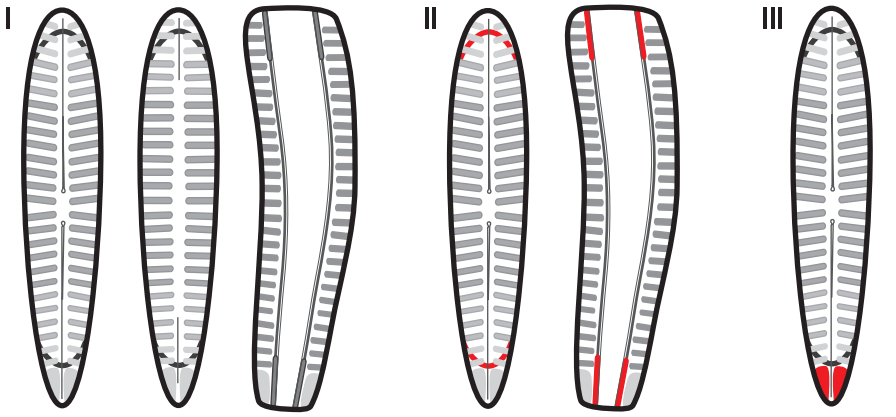
Type species: *Rhoicosphenia curvata* (Kützing) Grunow

Characteristics – Cells **biraphid**, **heterovalvar**, **heteropolar** and curved in girdle view (one valve convex the other concave). Broadly rounded head pole and narrowly rounded foot pole. Striae robust, composed of single rows of elongate areolae. **Pseudosepta** (II, Fig. 69: I) are present at both poles, **apical pore field** (III) present at the base pole. Convex valve bears a full length raphe (Fig. 69: A, F) while the concave valve bears shortened or rudimentary raphe branches near the apices (Fig. 69: B, E).

Plastid structure – Single H-shaped lobed plastid with central narrow pyrenoid.

Identification of species – Up till now only one species known from tropical Africa: *Rhoicosphenia abbreviata* (C. Agardh) Lange-Bertalot (a homonym of *Rhoicosphenia curvata*).

Ecology – Cells solitary or in pairs, attached to substrate by short mucilage stalks, may be re-suspended in the plankton. Found in the benthos of eutrophic waters with moderate conductivities.



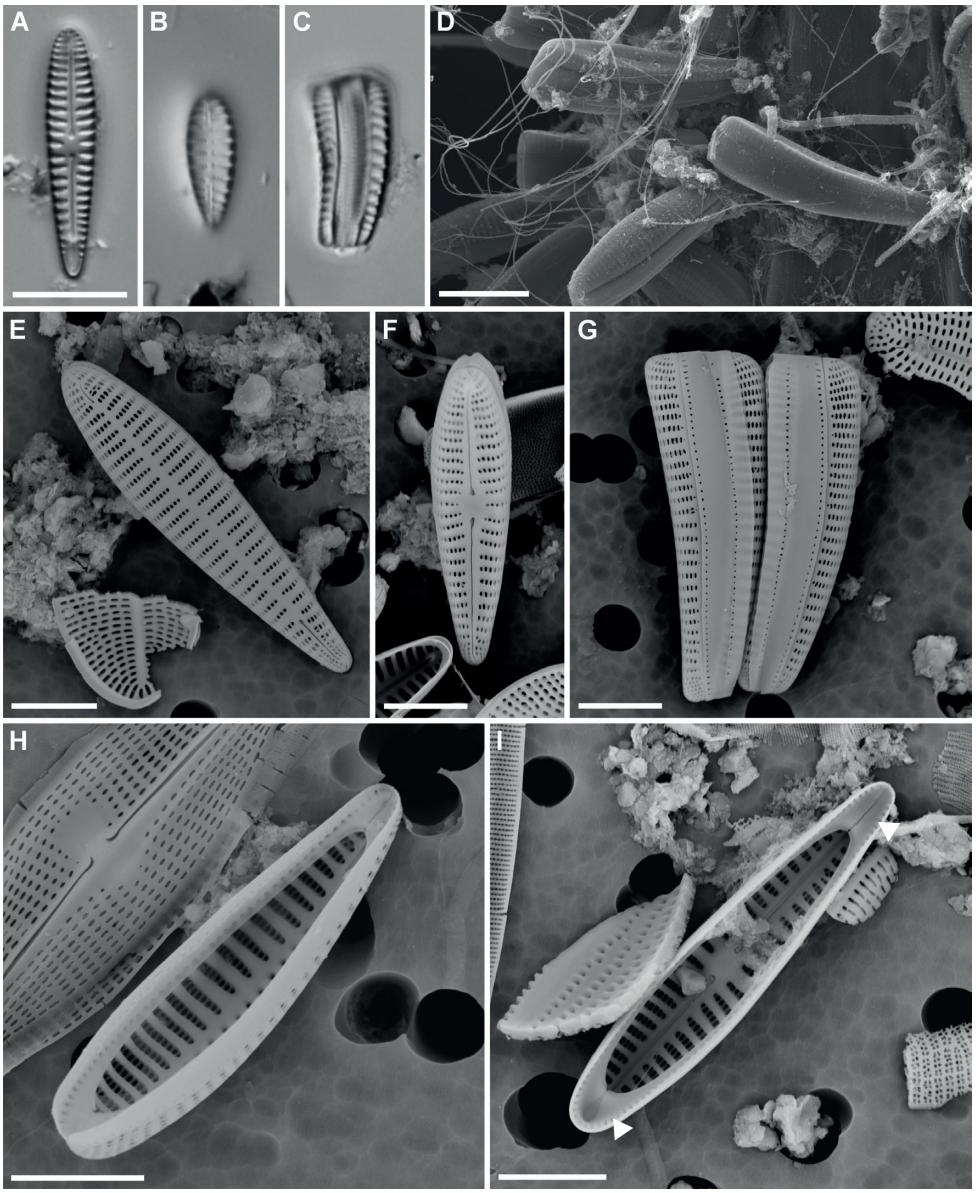


Fig. 69. *Rhoicosphenia abbreviata*. **A-C**. LM. **A-B.** Valve view. **C.** Girdle view. **D-I.** SEM. **D.** Cells of biofilm. **E**. External view of concave valve, note shortened rudimentary raphe. **F.** External view of convexe valve. **G.** Girdle view. **H.** Internal view of concave valve with shortened raphe. **I.** Internal view of convexe valve, note pseudosepta (arrows).
Scale bars = 10 µm (A-D), 5 µm (E-I).

Anomoeoneis Pfitzer 1871

Type species: *Anomoeoneis sphaerophora* Pfitzer

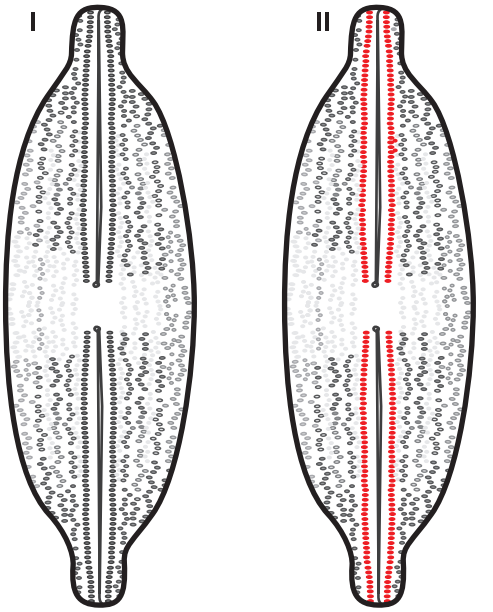
SYNONYM:
Brachysira Kützing 1836 pro parte

Characteristics – This genus is most noticeably distinguished in light microscopy by the scattered areolae on the valve face forming uneven **transapical lines** (I; Fig. 70: D-F). A number of '**ghost areolae**' (pictured as light grey dots - I, II) are found on the valve face and are especially visible in the **central area (**Fig. 70: H), these areolae do not perforate the **valve face**.

Plastid structure – The single plastid is large and occupies most of the cell (Fig. 70: A, B), it has two lobes, one appressed to each valve face forming a H-shape when seen from the girdle (Fig. 70: C). One large pyrenoid is found adjacent to the cell margin. The plastid arrangement is similar to that of *Cymbella* and *Gomphonema*, hence its placement in the order Cymbellales.

Identification of species – Species and varieties in this genus are distinguished based on cell size and shape as well as the shape of the apices.

Ecology – Cells solitary, motile. Commonly found in waters of higher electrolyte content.



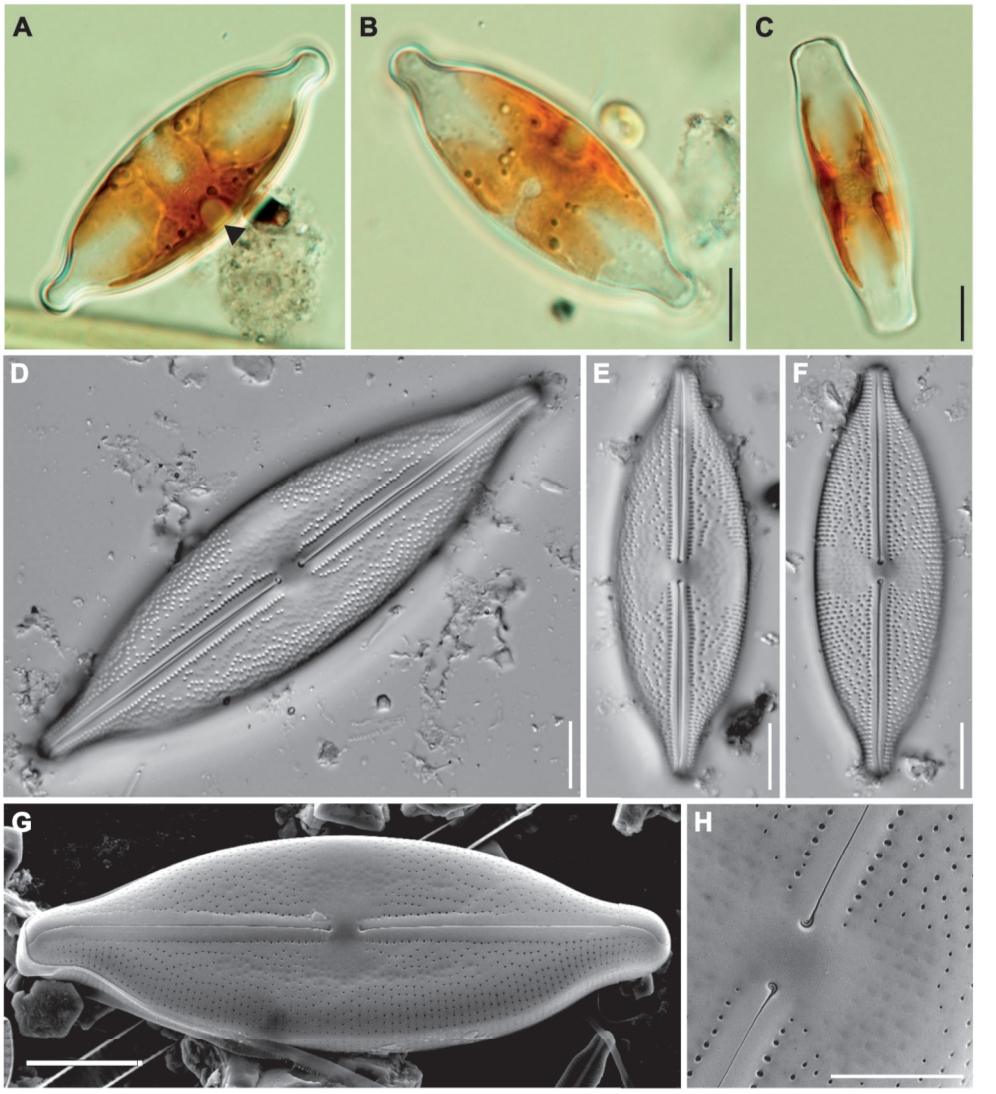


Fig. 70. *Anomoeoneis sphaerophora*. **A-F**. LM. **A**. Living cell, note pyrenoid (arrow) next to the cell margin. **B**. Living cell, note H-shaped plastid. **C**. Living cell, girdle view, note bridge between the two plates of the plastid. **D-F**. Cleaned valves, note the feint ghost areolae in the central area. **G-H.** SEM. **G.** Valve view of complete valve. **H**. Detail of central raphe endings.
Scale bars = 10 µm (A-G), 5 µm (H).