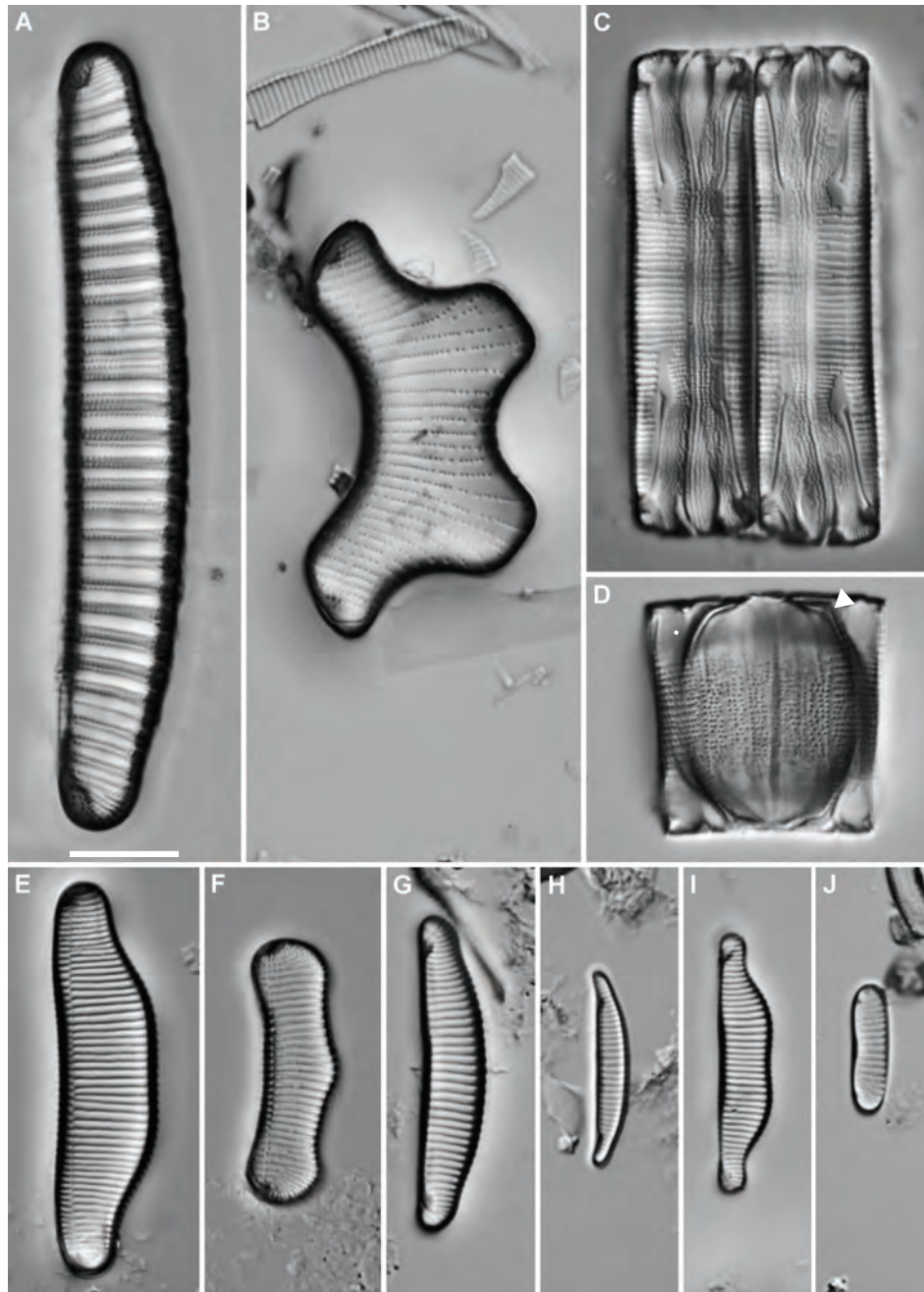
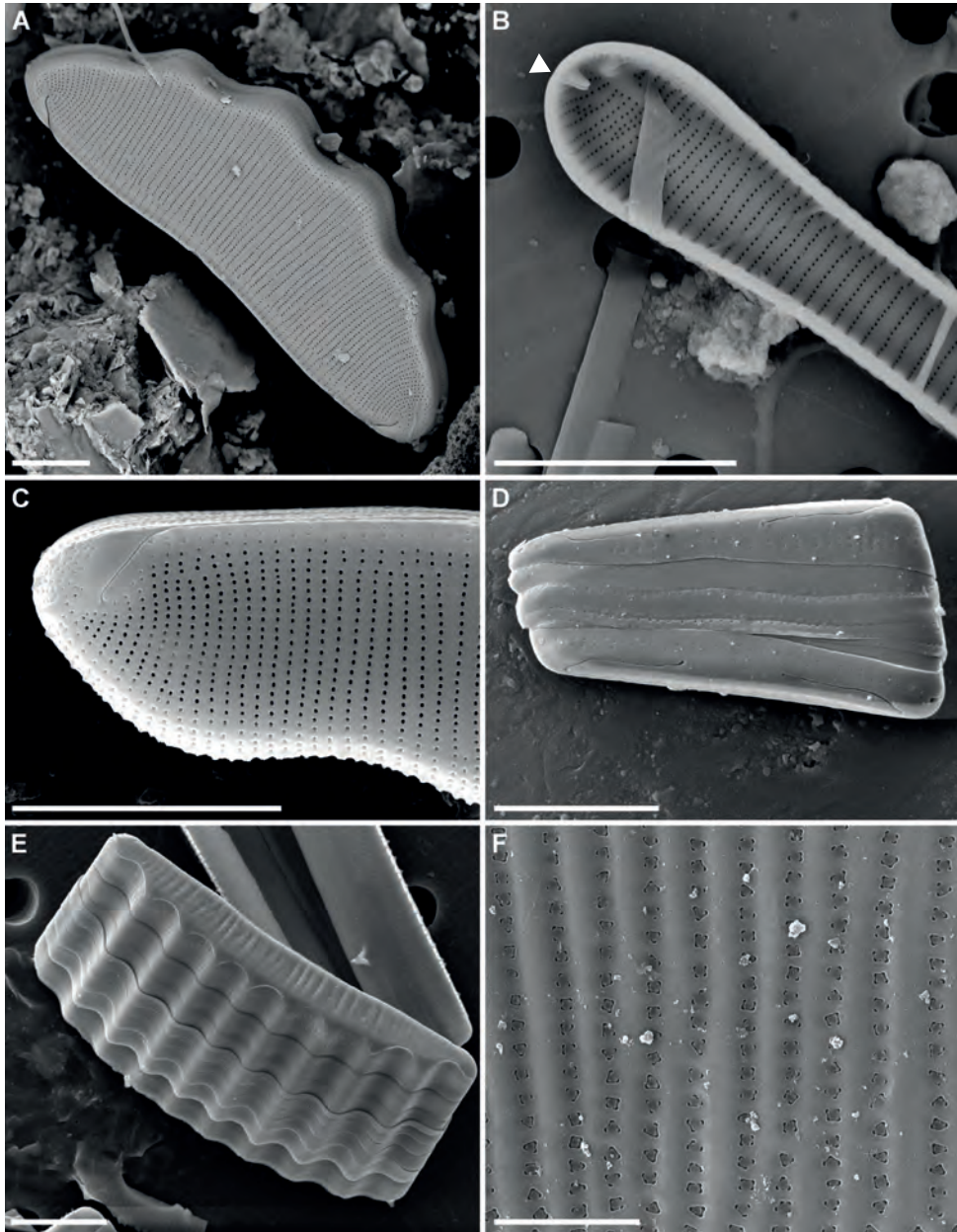


**Fig. 64.** *Eunotia* spp. **A-D.** LM, cleaned material of large-celled *Eunotia* spp. **B.** *Eunotia pectinalis* (Kützing) Rabenhorst. **C.** *E. zygodon* Ehrenberg.  
Scale bar = 10  $\mu$ m.



**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  $\mu$ m.



**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  $\mu$ m (A-E), 2  $\mu$ m (F).



## ***Mastogloia* (Thwaites) W. Smith 1856**

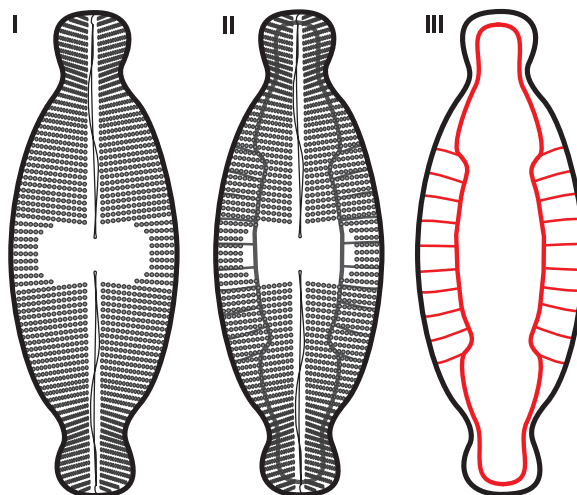
Type species: *Mastogloia dansei* (Thwaites) Thwaites ex W. Smith

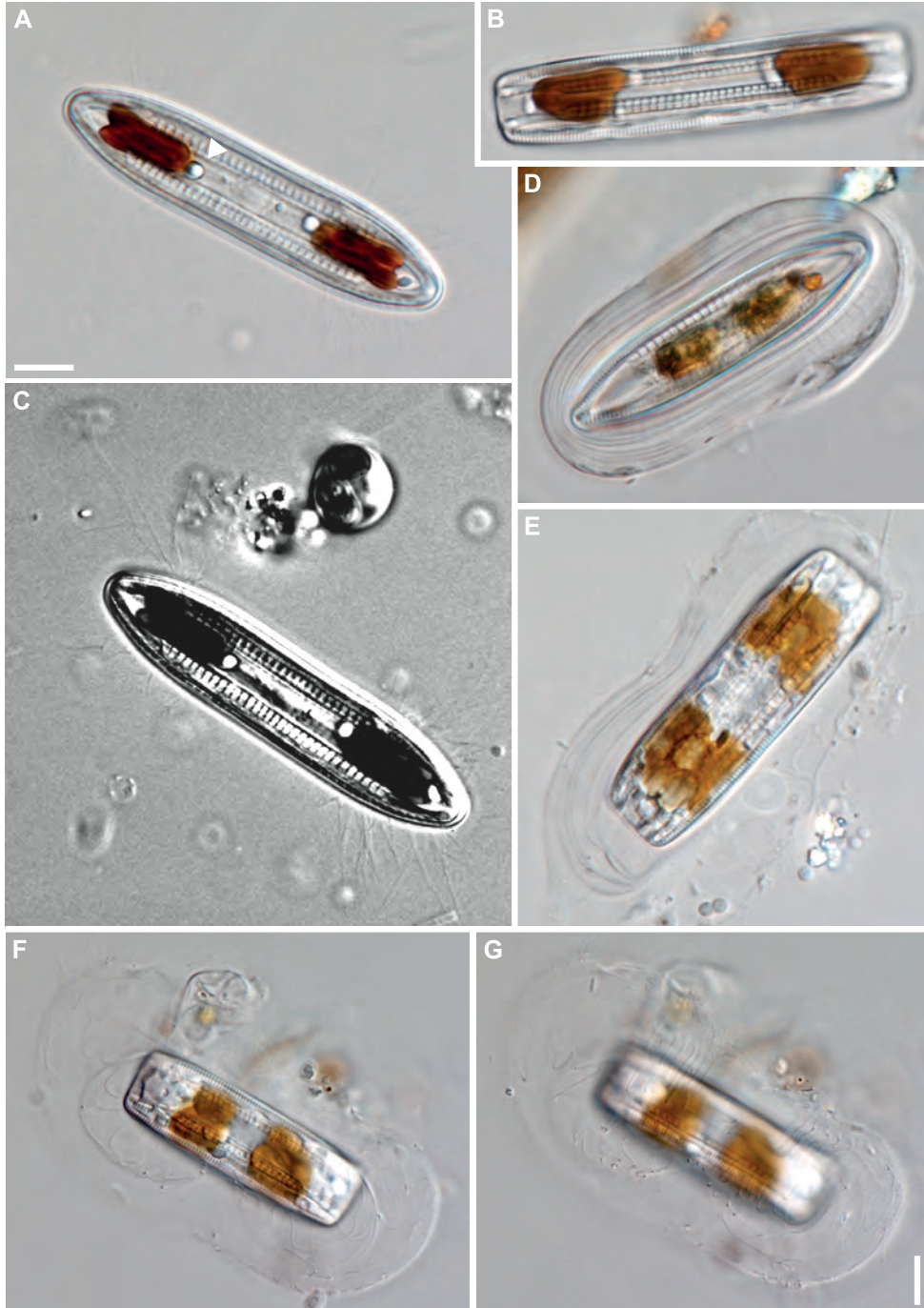
**Characteristics** – This genus is most noticeably distinguished in light microscopy by the **partecta** or chambers (III, Fig. 68: B, D-F) associated with the first girdle band or **valvocopula**. When seen from the girdle in SEM the large perforations extending into the **partecta** are clearly visible (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.

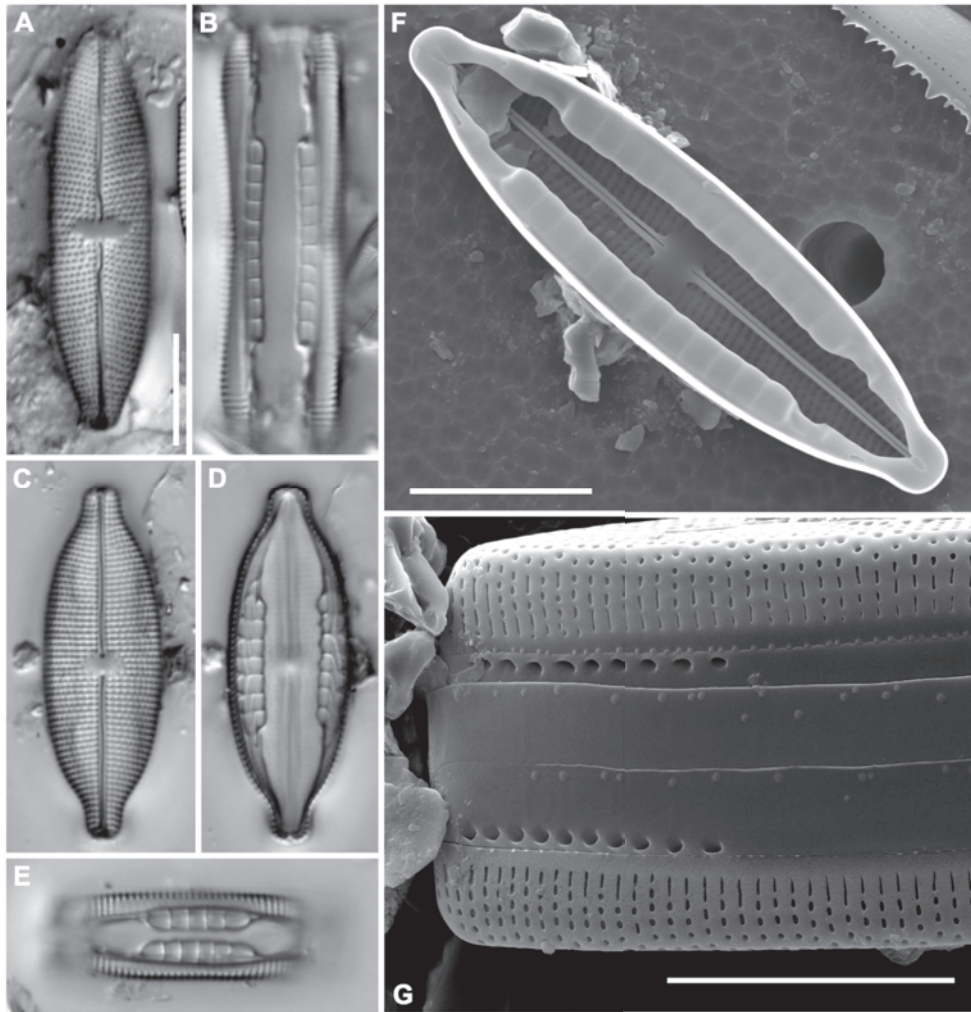
**Plastid structure** – There are two small double lobed plastids found at each end of the cell (Fig. 67: A, B) with a pyrenoid between the two lobes of each plastid (Fig. 67: E). Usually two lipid droplets are present (Fig. 67: A).

**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.







**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).

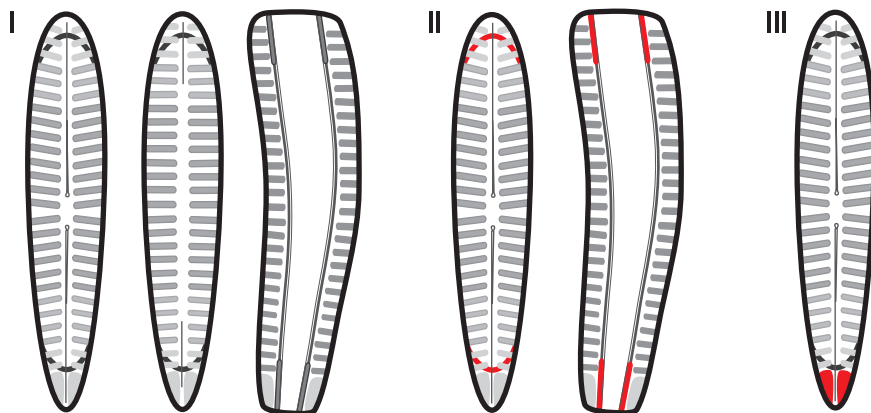
***Rhoicosphenia* Grunow 1860**Type species: *Rhoicosphenia curvata* (Kützing) Grunow

**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).

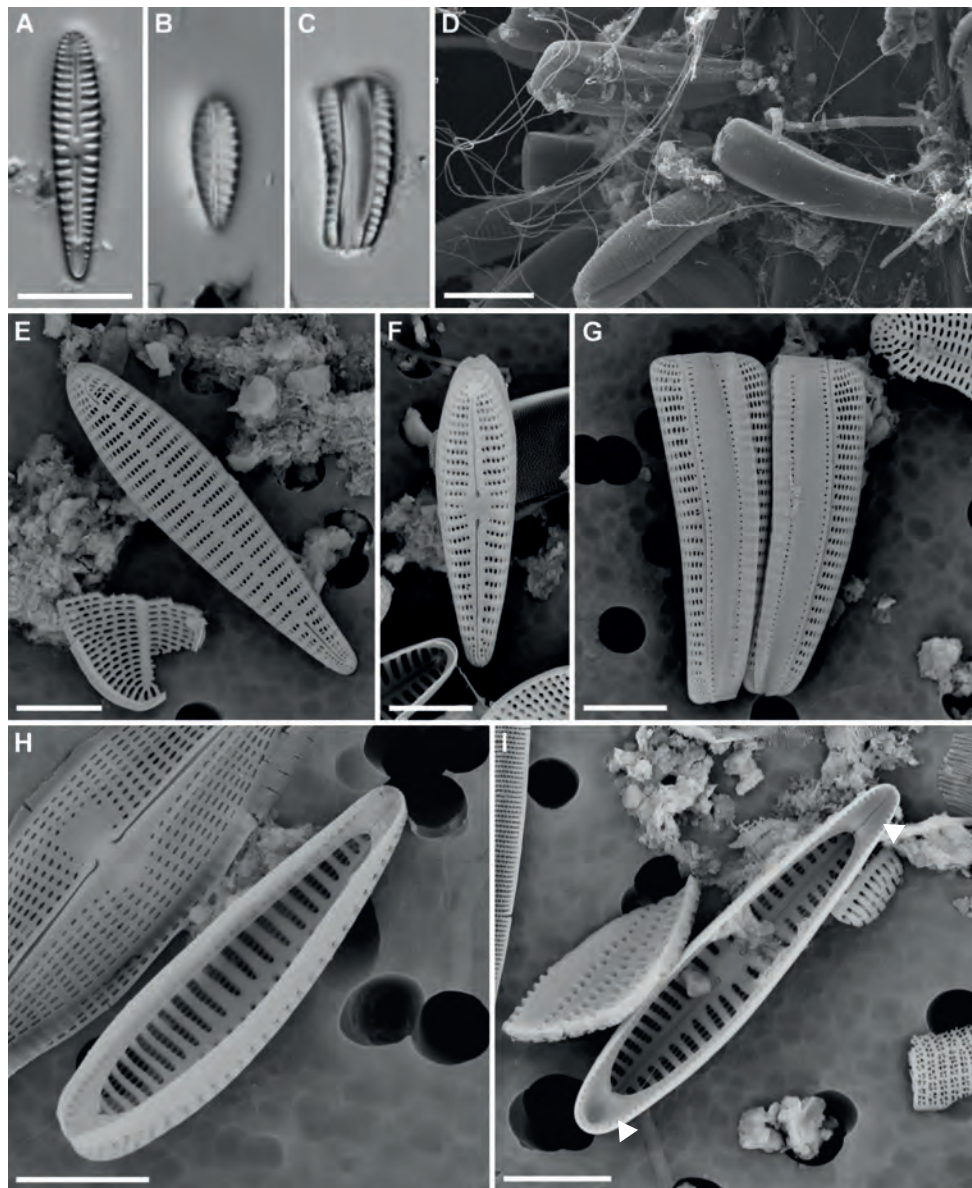
**Plastid structure** – Single H-shaped lobed plastid with central narrow pyrenoid.

**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 convex valve. **G.** Girdle view. **H.** Internal view of concave valve with shortened raphe. **I.** Internal view of convex valve, note pseudosepta (arrows).  
Scale bars = 10  $\mu\text{m}$  (A-D), 5  $\mu\text{m}$  (E-I).



***Anomoeoneis* Pfitzer 1871**

Type species: *Anomoeoneis sphaerophora* Pfitzer

SYNONYM:

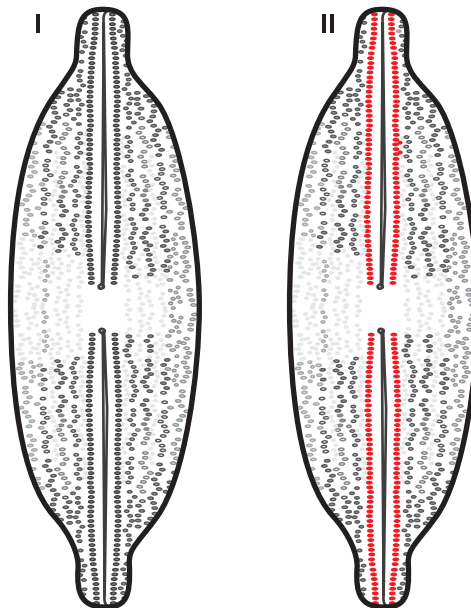
*Brachysira* Kützing 1836 pro parte

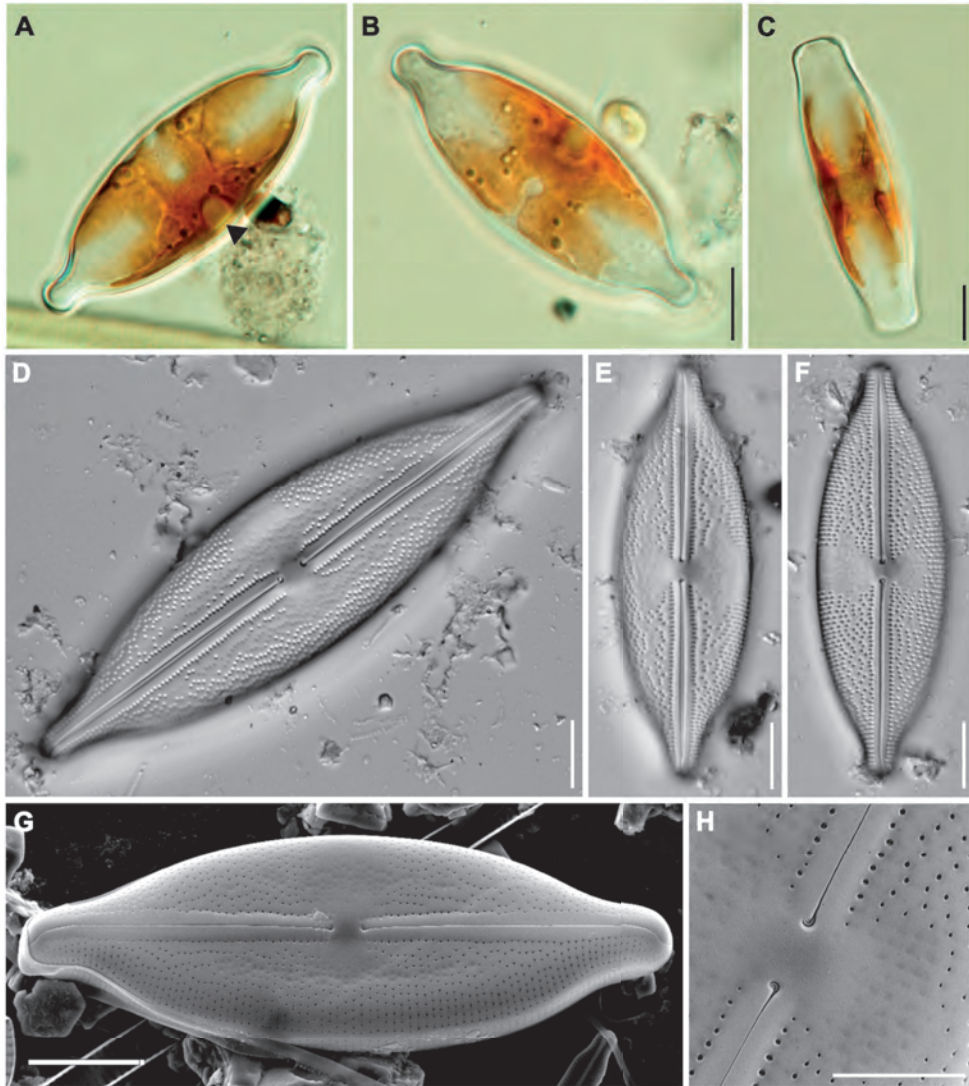
**Characteristics** – This genus is most noticeably distinguished in light microscopy by the scattered areolae on the valve face forming uneven **transapical lines** (I; Fig. 70: D-F). A number of ‘**ghost areolae**’ (pictured as light grey dots - I, II) are found on the valve face and are especially 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 faint ghost areolae in the central area. **G-H.** SEM. **G.** Valve view of complete valve. **H.** Detail of central raphe endings.

Scale bars = 10  $\mu$ m (A-G), 5  $\mu$ m (H).

***Afrocymbella*** Krammer 2003Type species: *Afrocymbella reichardtii* Krammer

SYNONYM:

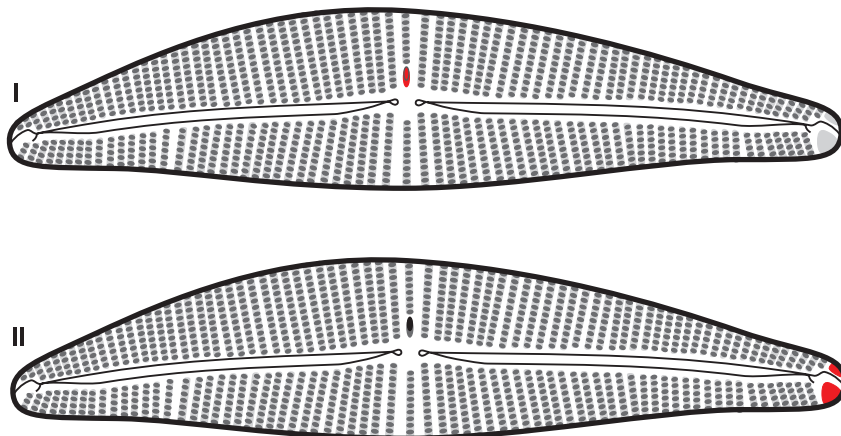
*Gomphocymbella* O. Müller 1905 pro parte

**Characteristics** – Cells **biraphid**, large and rather robust, valve shape **dorsiventral** and **heteropolar** (characteristics of both *Cymbella* and *Gomphonema*). Clearly visible elongate **stigma** on the dorsal side of the cell closely associated with the central striae (I, Fig. 72: B-C). Small apical pore field to the right and the left of the raphe on the foot pole (II, Fig. 71: B, Fig. 72: D).

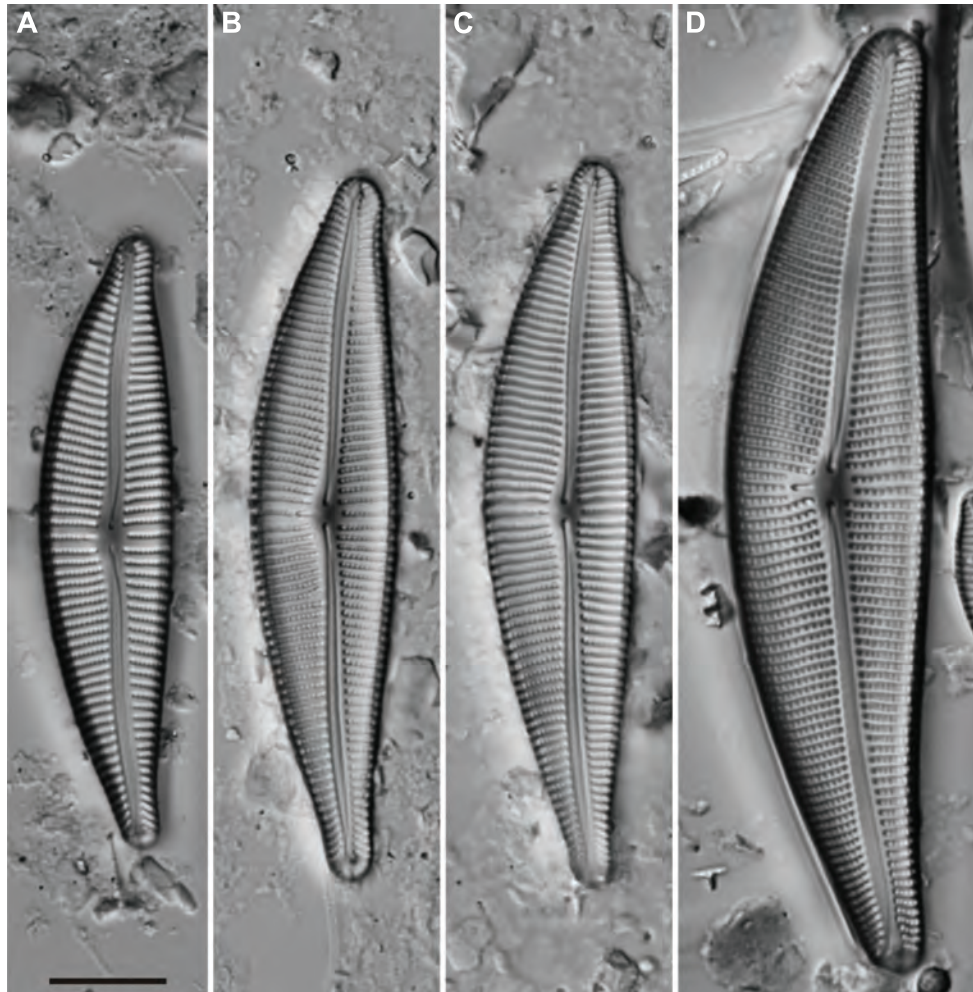
**Plastid structure** – Single plastid with 2 lobes connected by a bridge (H-shape) (Fig. 72: A). Large pyrenoid against one margin in the central area (see *Cymbella*), several lipid droplets scattered through the cell.

**Identification of species** – Species in this genus are distinguished based on cell size and shape and the shape of the apices. Striae density and angle relative to the **transapical axis** are also important characteristics to consider.

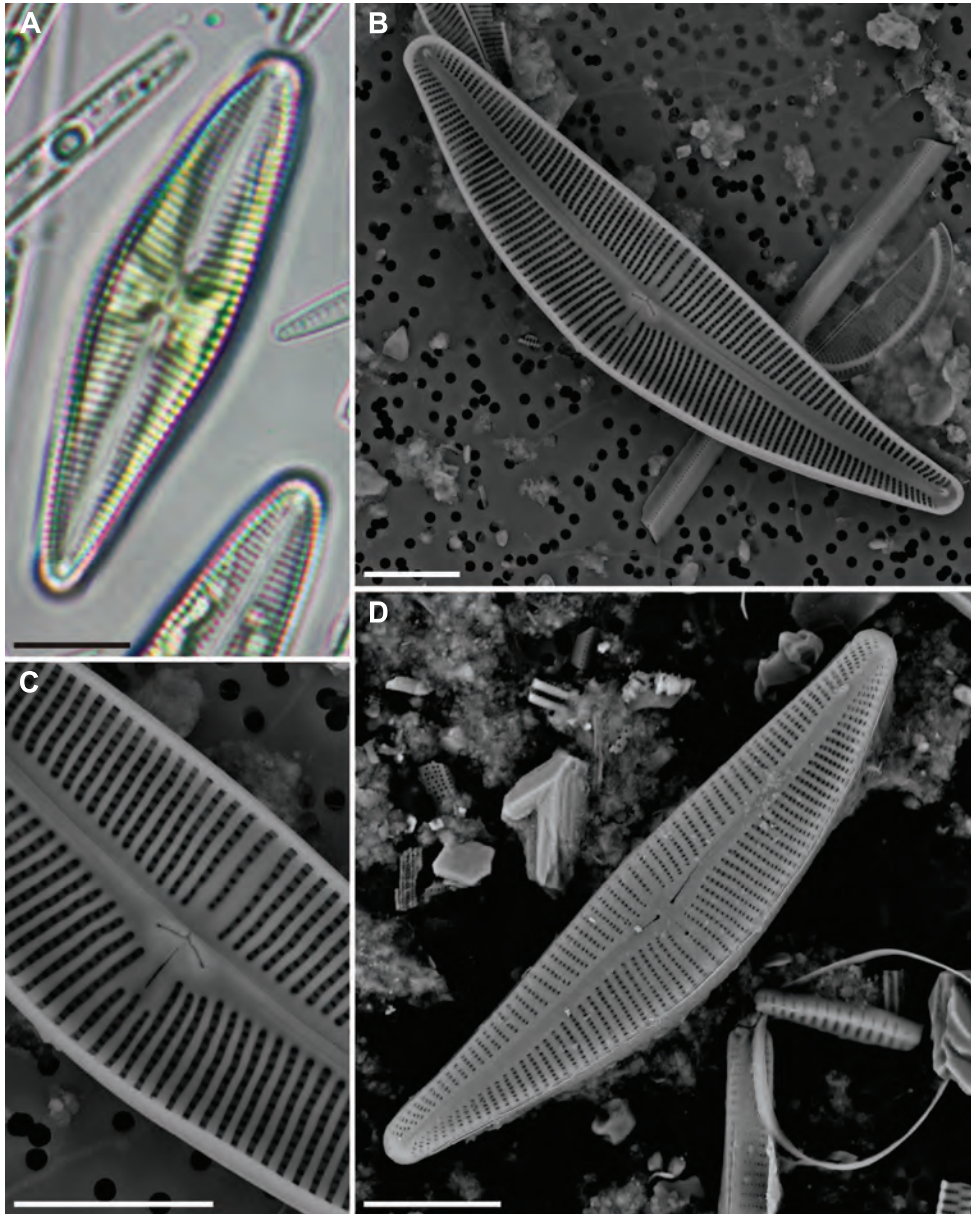
**Ecology** – Cells solitary, mostly observed free living occasionally attached. Found in tropical African alkaline oligotrophic waters in both planktonic and benthic habitats.







**Fig. 71.** *Afrocybella* spp. **A-D.** LM. **A-C.** Valve view of *Afrocybella beccarii* (Grunow) Krammer. **D.** Valve view of *A. reichardtii* var. *procera* Krammer. Scale bar = 10  $\mu$ m.



**Fig. 72.** *Afrocybella* spp. **A.** LM. Living cell of *Afrocybella barkeri* Cocquyt & Ryken, valve view . **B-D.** SEM. **B-C.** Internal view of valve of *A. beccarii*. **D.** External view of valve of *A. beccarii*.  
Scale bars = 10  $\mu\text{m}$  (A-C), 8  $\mu\text{m}$  (D).

## ***Cymbella*** C. Agardh 1830

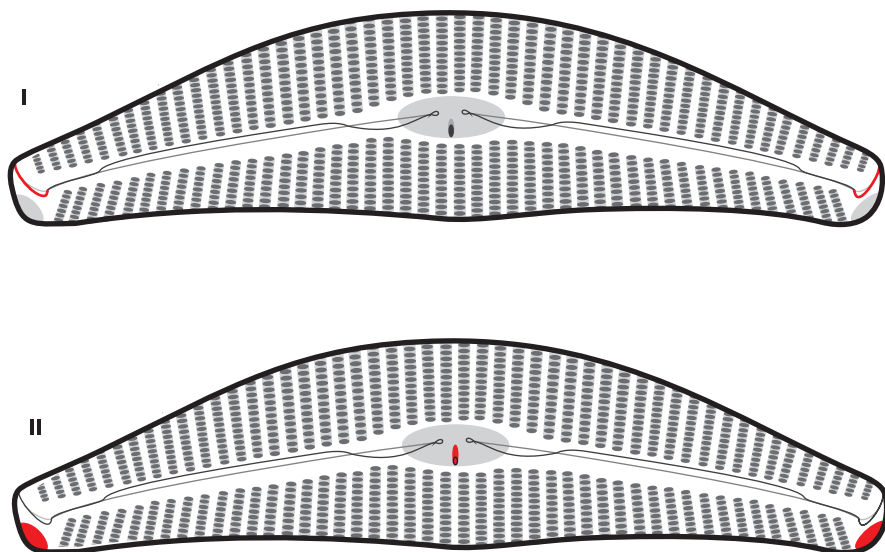
Type species: *Cymbella cymbiformis* C. Agardh

**Characteristics** – Cells **biraphid**, slightly to strongly **dorsiventral**, raphe complex, terminal raphe endings bent towards the dorsal side (I, Fig. 75: A-C). **Stigma(ta)** (II) in general present in the **central area** on the ventral side. Apical pore field found at the apices (II); may be difficult to discern under LM.

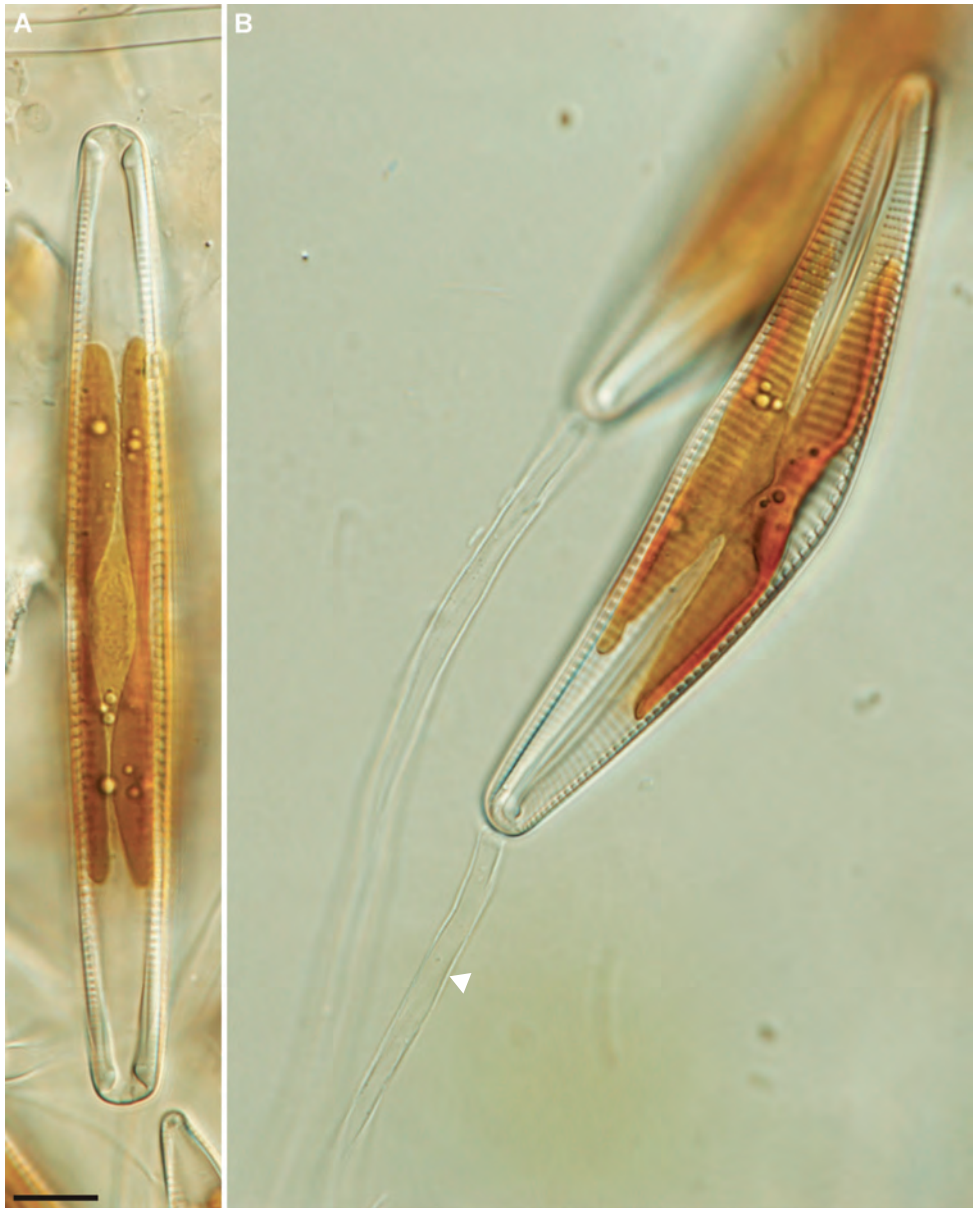
**Plastid structure** – Cells with one H-shaped plastid and a large pyrenoid (Fig. 74: D) in the centre against one girdle. Several small lipid droplets scattered throughout the cell (Fig. 73: A-B; Fig. 74: B).

**Identification of species** – Species can be identified by cell size, cell shape, shape of the apices, structure and density of the striae and the size, number and position of the stigmata in relation to the striae. Shape and extent of the central area as well as the curvature of the raphe are important.

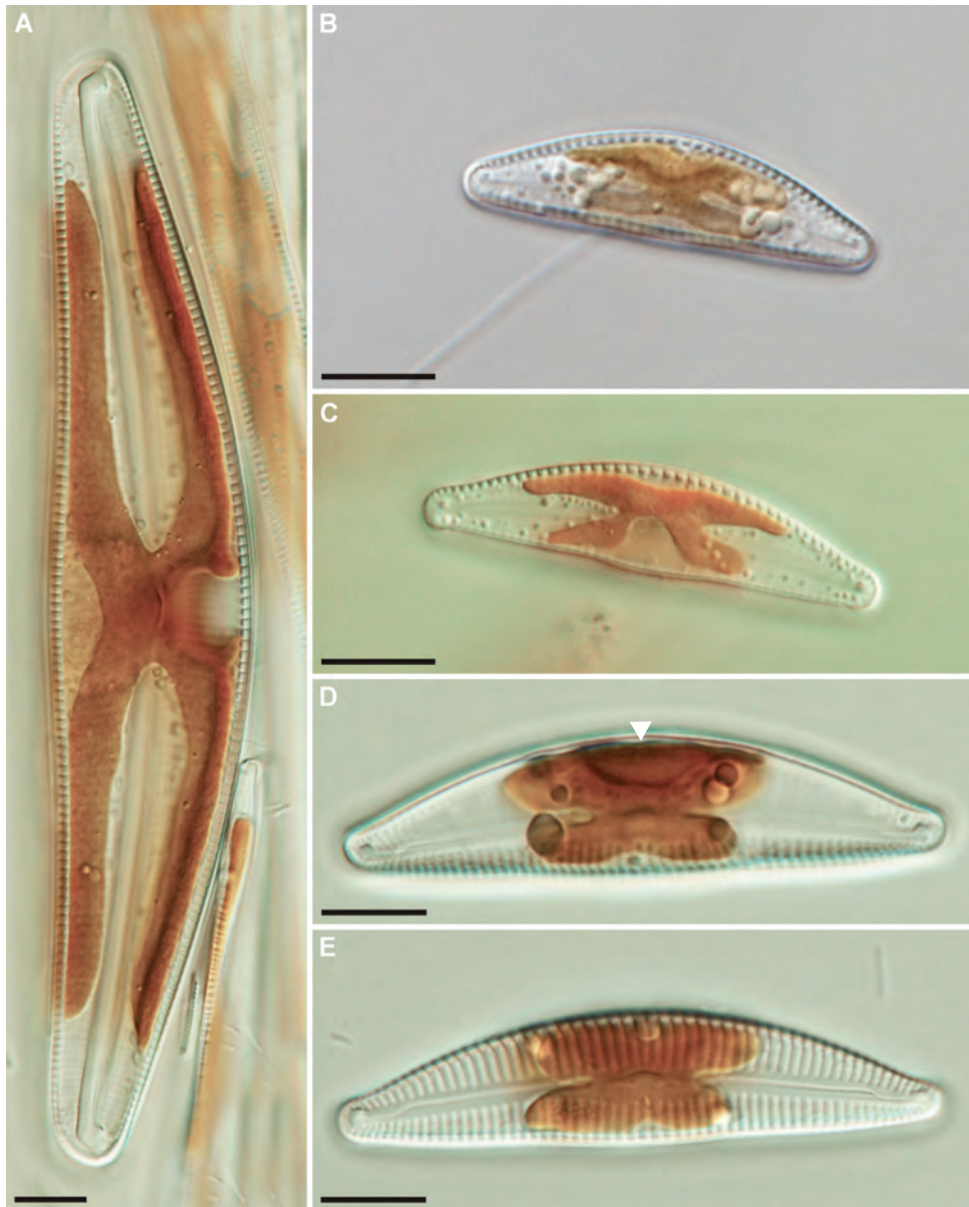
**Ecology** – Cells solitary, mostly attached but occurs also free living and motile. Found in the benthos of oligotrophic to mesotrophic waters preferring alkaline habitats.



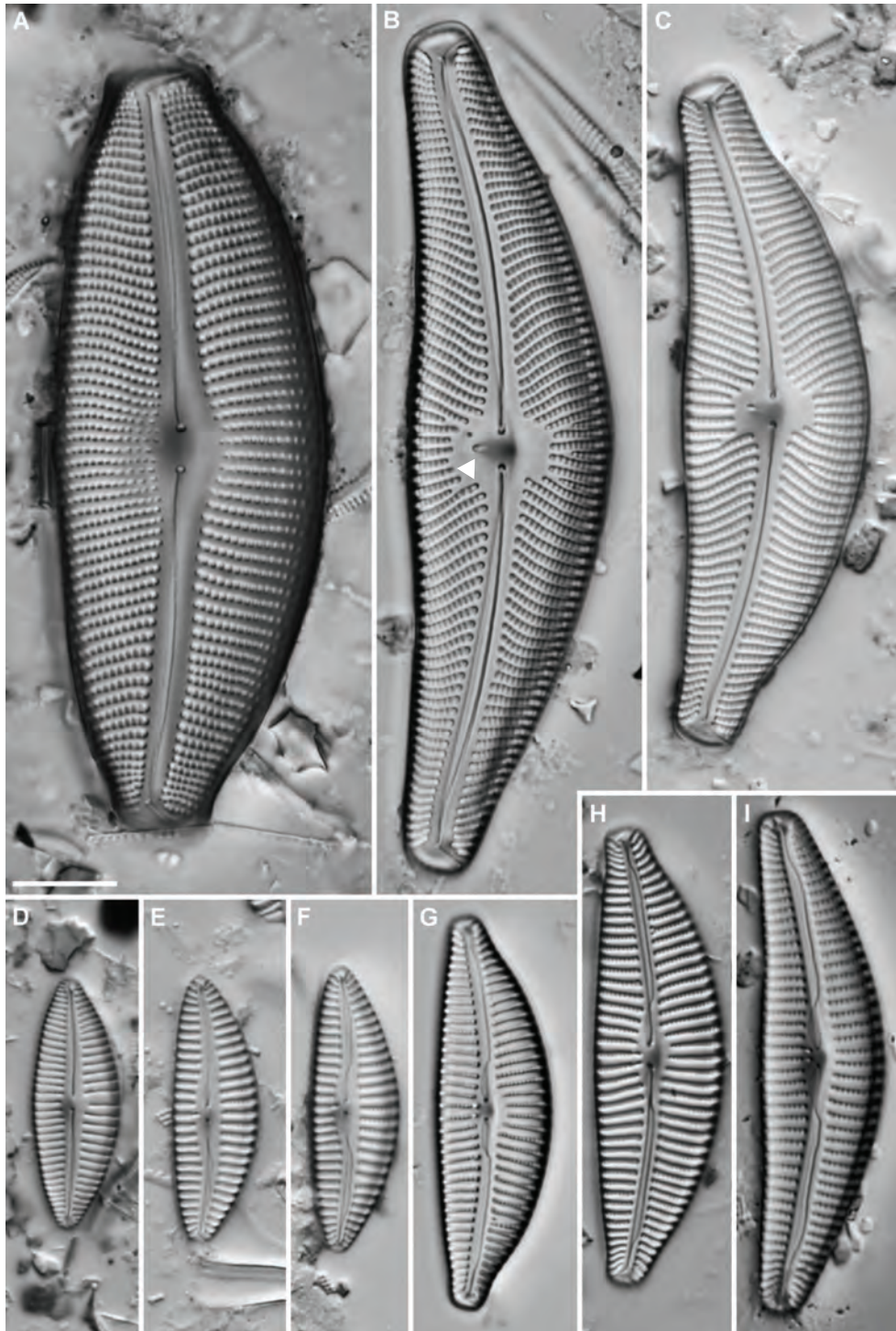




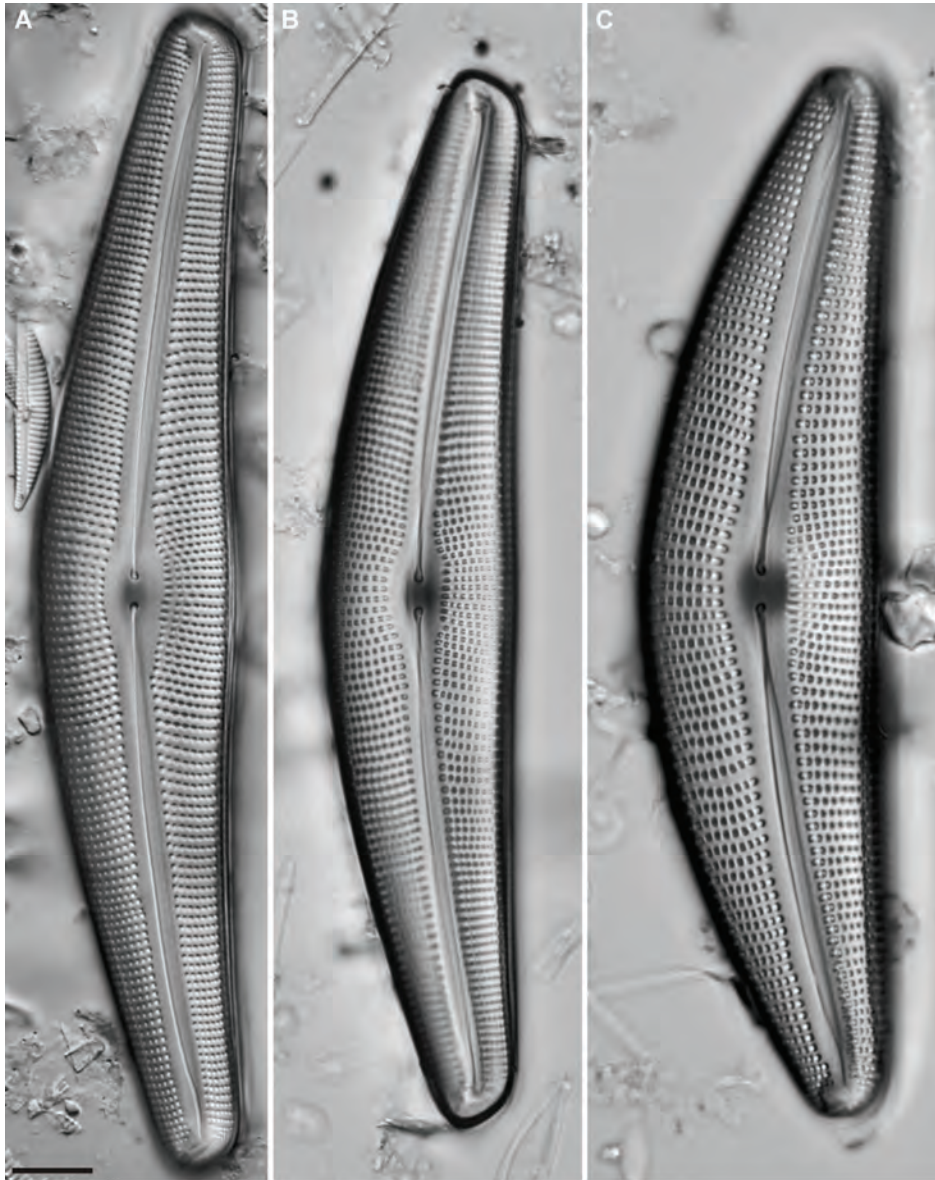
**Fig. 73.** *Cymbella* spp. **A-B.** LM. **A.** Living cell, girdle view. **B.** Living cells with mucilage stalks (arrow).  
Scale bar = 10  $\mu$ m.



**Fig. 74.** *Cymbella* spp. **A-E.** LM. **A-B.** Valve views of living cells. **A.** *Cymbella aspera* (Ehrenberg) H. Peragallo. **B.** Cell with a large number of lipid droplets. **C.** *Cymbella kappii* (Cholnoky) Cholnoky. **D-E.** *Cymbella turgidula* Grunow, same cell different foci, note large pyrenoid (arrow - **D**).  
Scale bars = 10  $\mu$ m (A-E).



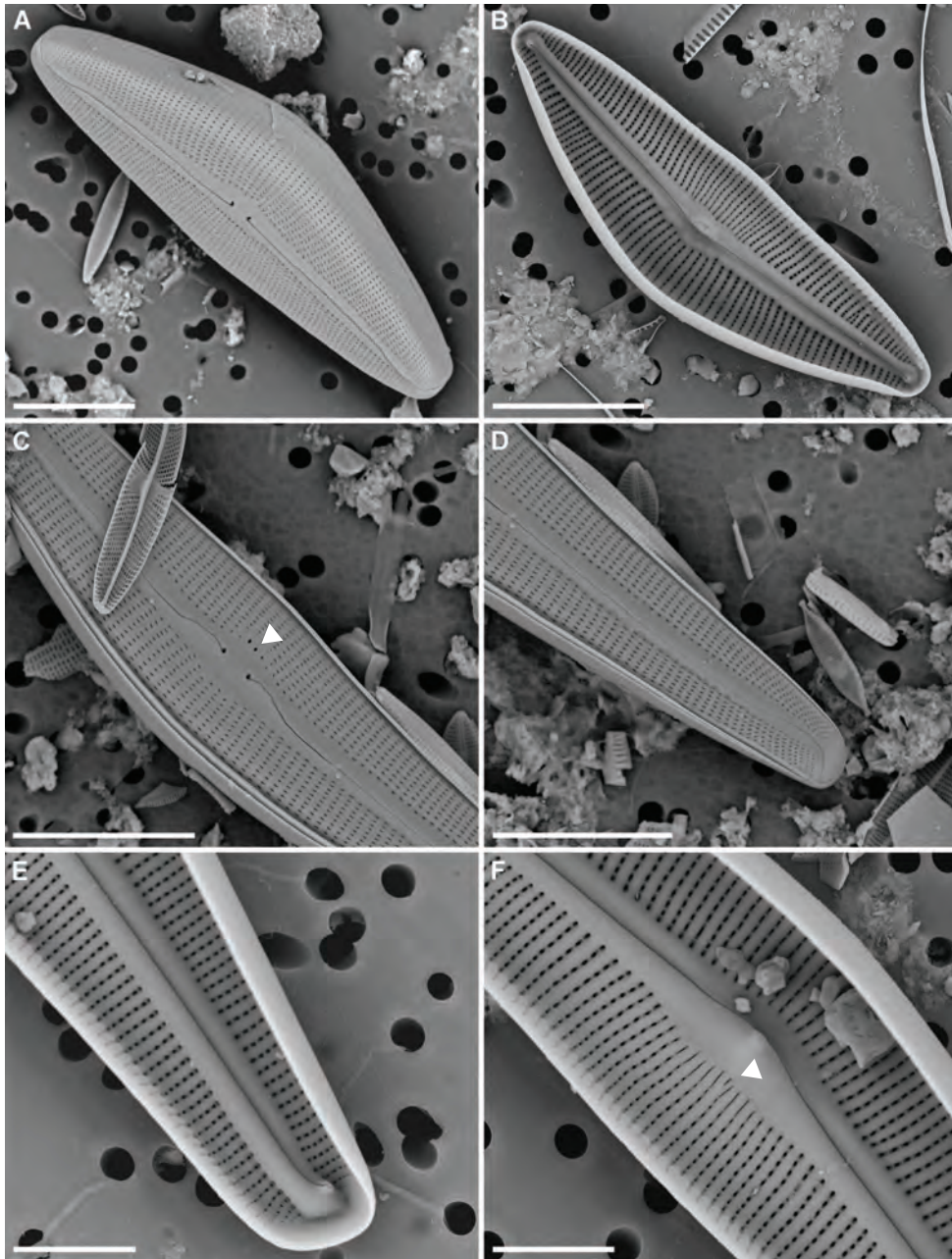




**Fig. 76.** *Cymbella* spp. **A-C.** LM, valve views. **A-B.** *Cymbella aspera*.  
**C.** *Cymbella* sp.  
Scale bar = 10  $\mu$ m.

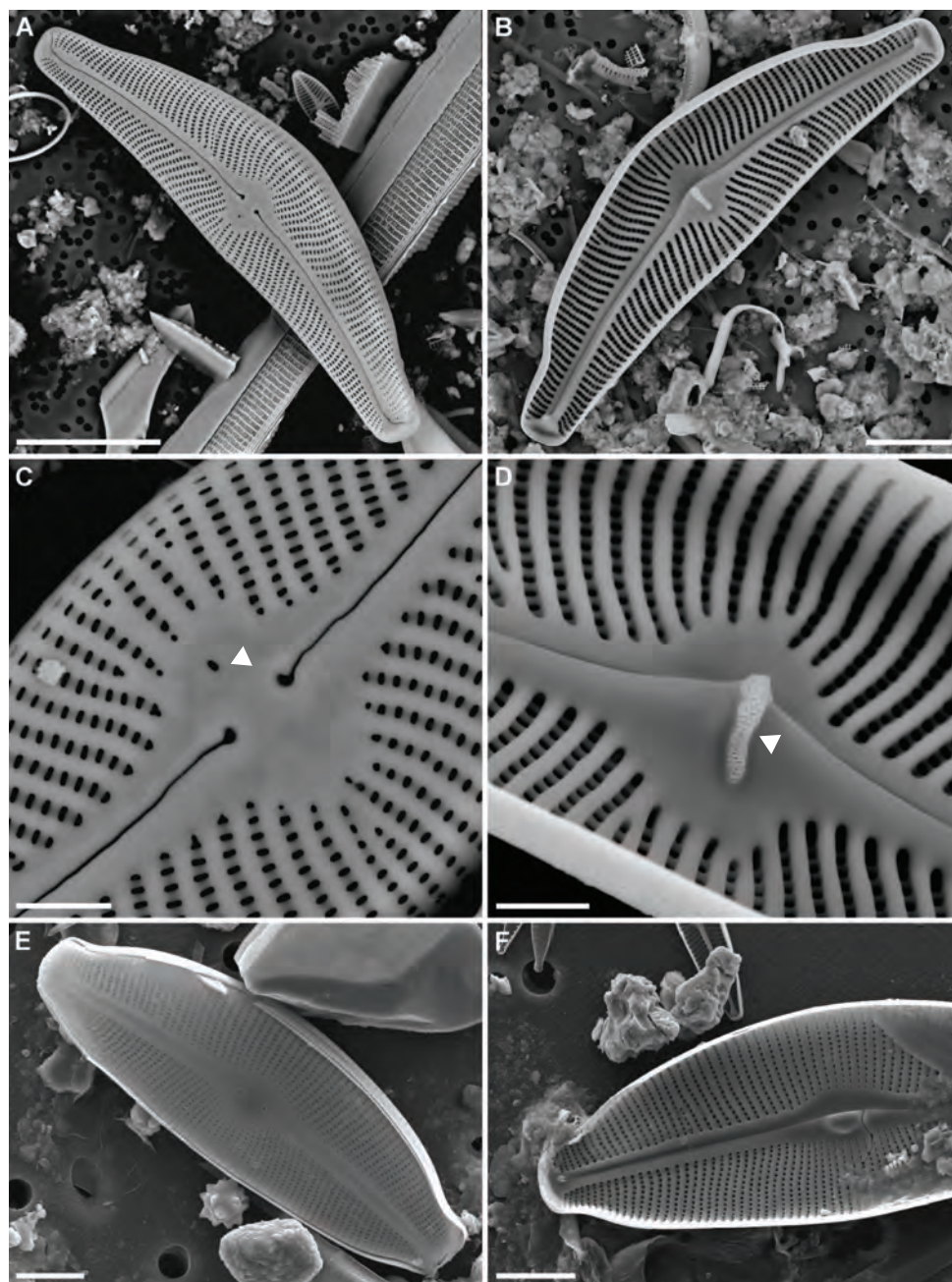
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**Fig. 75.** *Cymbella* spp. **A-I.** LM, valve views. **A.** *Cymbella cucumis* A.W.F. Schmidt. **B-C.** *C. tumida* (Brébisson) Van Heurk, note stigma (arrow - **B**). **D.** *C. kolbei* Hustedt. **E-F.** *C. zambesiana* Krammer. **G.** *Cymbella* sp. **H.** *C. turgidula*. **I.** *Cymbella* sp.  
Scale bar = 10  $\mu$ m.



**Fig. 77.** *Cymbella* sp. **A-F.** SEM. **A.** *Cymbella aspera*, external view of valve. **B.** *C. aspera* internal view of valve. **C-F.** *C. cymbiformis*. **C.** External view of valve, central area, note external openings of stigmata (arrow). **D.** External view of valve, cell apex. **E.** Internal view of valve, cell apex. **F.** Internal view of valve, central area, note structure of stigma (arrow).  
Scale bars = 20  $\mu\text{m}$  (A-D), 10  $\mu\text{m}$  (E-F).





**Fig. 78.** *Cymbella* sp. **A-F.** SEM. **A-D.** *Cymbella tumida*. **A.** External view of valve. **B.** Internal view of valve. **C.** Central area, external view, note opening of stigma (arrow). **D.** Internal view of stigma (arrow). **E.** *C. cucumis*, external view of valve. **F.** *C. cucumis*, internal view of valve.  
 Scale bars = 20  $\mu\text{m}$  (A-B), 3  $\mu\text{m}$  (C-D), 10  $\mu\text{m}$  (E-F).



***Cymbopleura*** (Krammer) Krammer 1999

Type species: *Cymbopleura subaequalis* (Grunow) Krammer

SYNONYM:

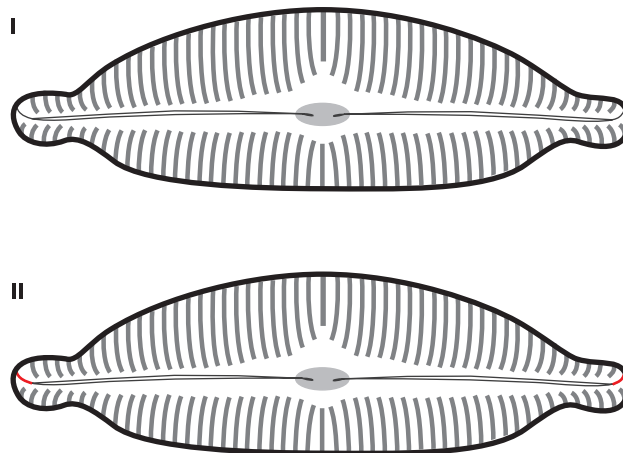
*Cymbella* C. Agardh 1830 pro parte

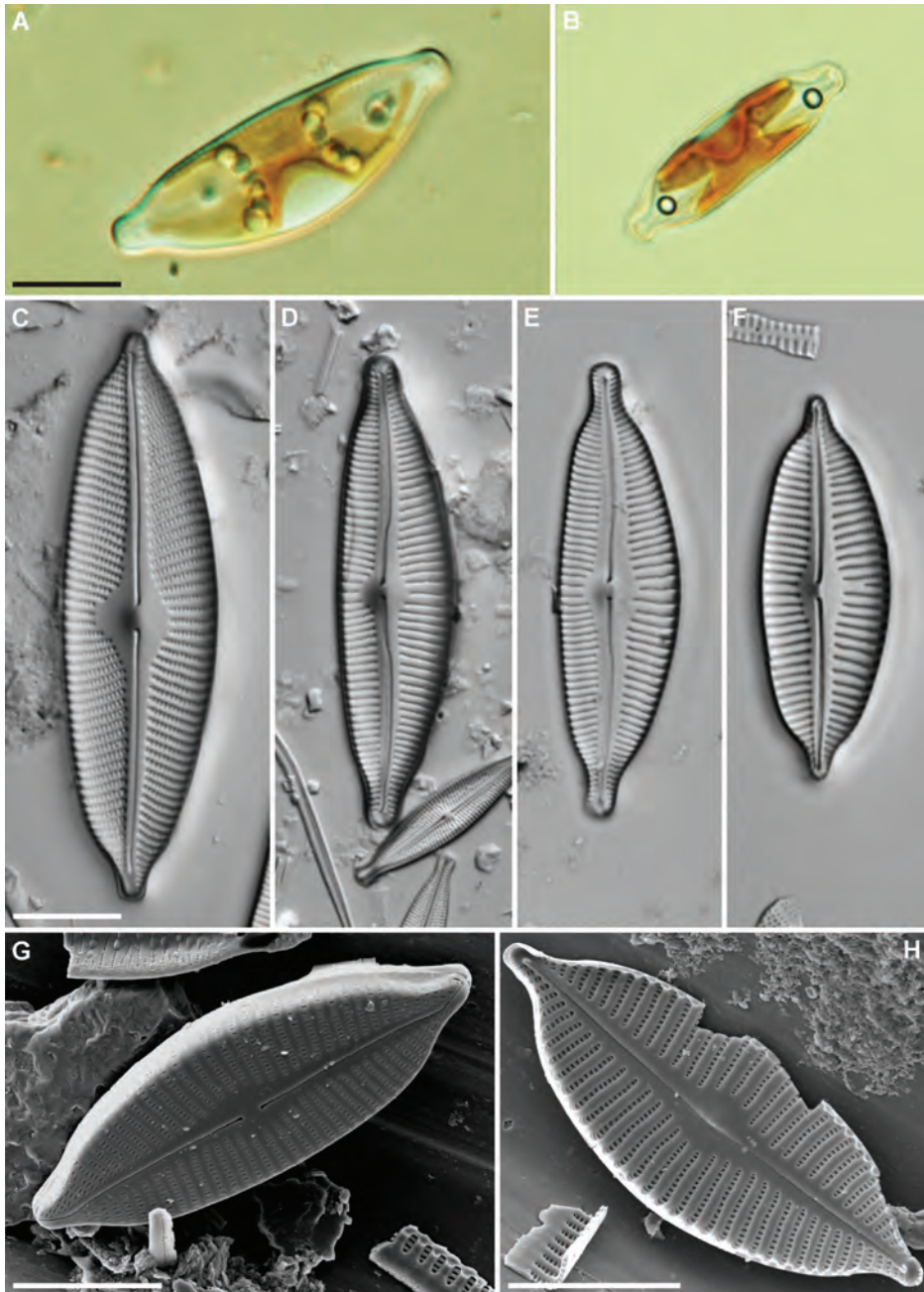
**Characteristics** – Cells **biraphid**, weakly **dorsiventral**, dorsal margin more curved than the ventral margin. Striae slightly radiate throughout the valve. Raphe complex and terminal raphe endings bent towards the dorsal side (II). (Fig. 79: G). **Stigma** absent. **Apical pore fields** absent although SEM may be needed to determine this.

**Plastid structure** – Cells with one H-shaped plastid and a large pyrenoid in the centre of the cell against one girdle. Several small lipid droplets scattered throughout the cell (Fig. 79: A-B).

**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. Found in the benthos of oligotrophic slightly acidic waters.





**Fig. 79.** *Cymbopleura* spp. **A-F.** LM, valve views. **A-B.** Living cells. **C-F.** Cleaned valves. **C.** *Cymbopleura* sp. **D-E.** *Cymbopleura amphicephala* (Nägeli) Krammer. **G-H.** SEM. **G.** *Cymbopleura* sp., external view of valve. **H.** *Cymbopleura* sp., internal view of valve. Scale bars = 10 μm (A-H).

***Encyonema* Kützing 1833**Type species: *Encyonema paradoxum* Kützing

SYNONYM:

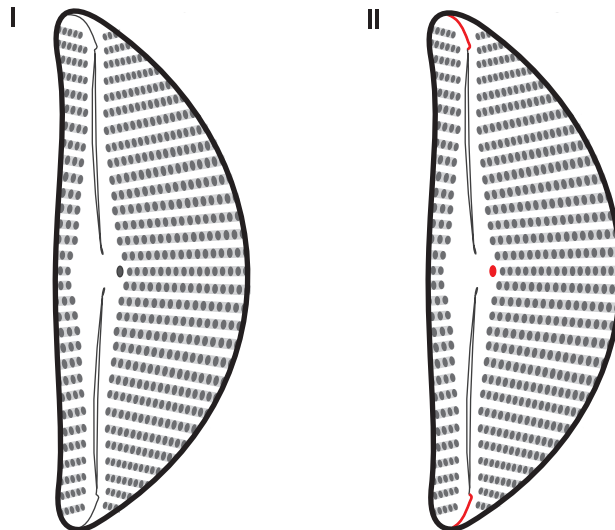
*Cymbella* C. Agardh 1830 pro parte

**Characteristics** – Cells **biraphid**, **dorsiventral**, dorsal margin strongly curved, ventral margin more or less straight or slightly curved. Raphe complex and terminal raphe endings bent towards the ventral side (II, Fig. 81: A-F). **Stigma(ta)** usually absent but if present located in the central area on the dorsal side (II, Fig. 81: C-E). **Apical pore fields** absent.

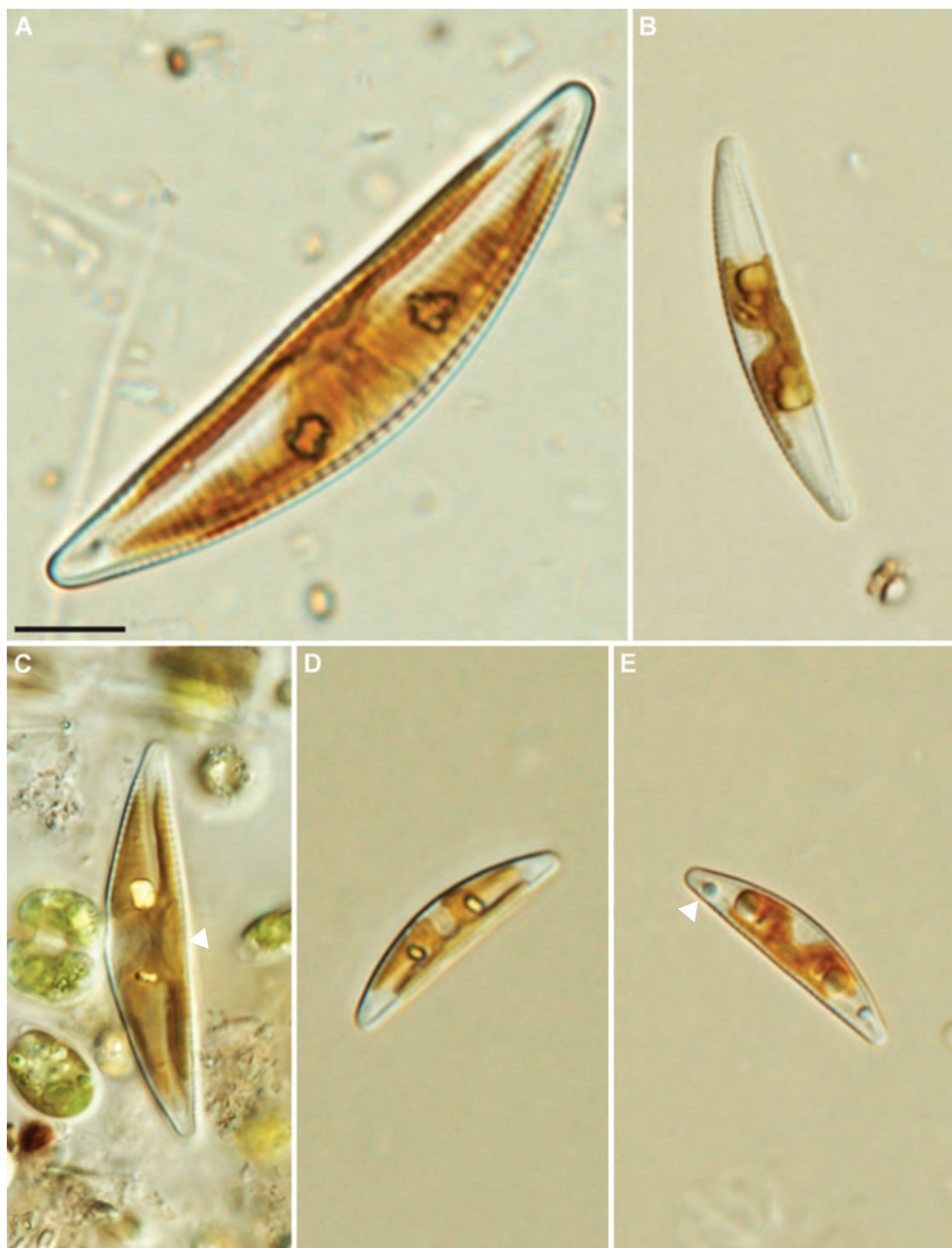
**Plastid structure** – Cells with one H-shaped plastid and a large pyrenoid in the central region against the ventral side (Fig. 80: C). Several small lipid droplets scattered throughout the cell (Fig. 80: E).

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

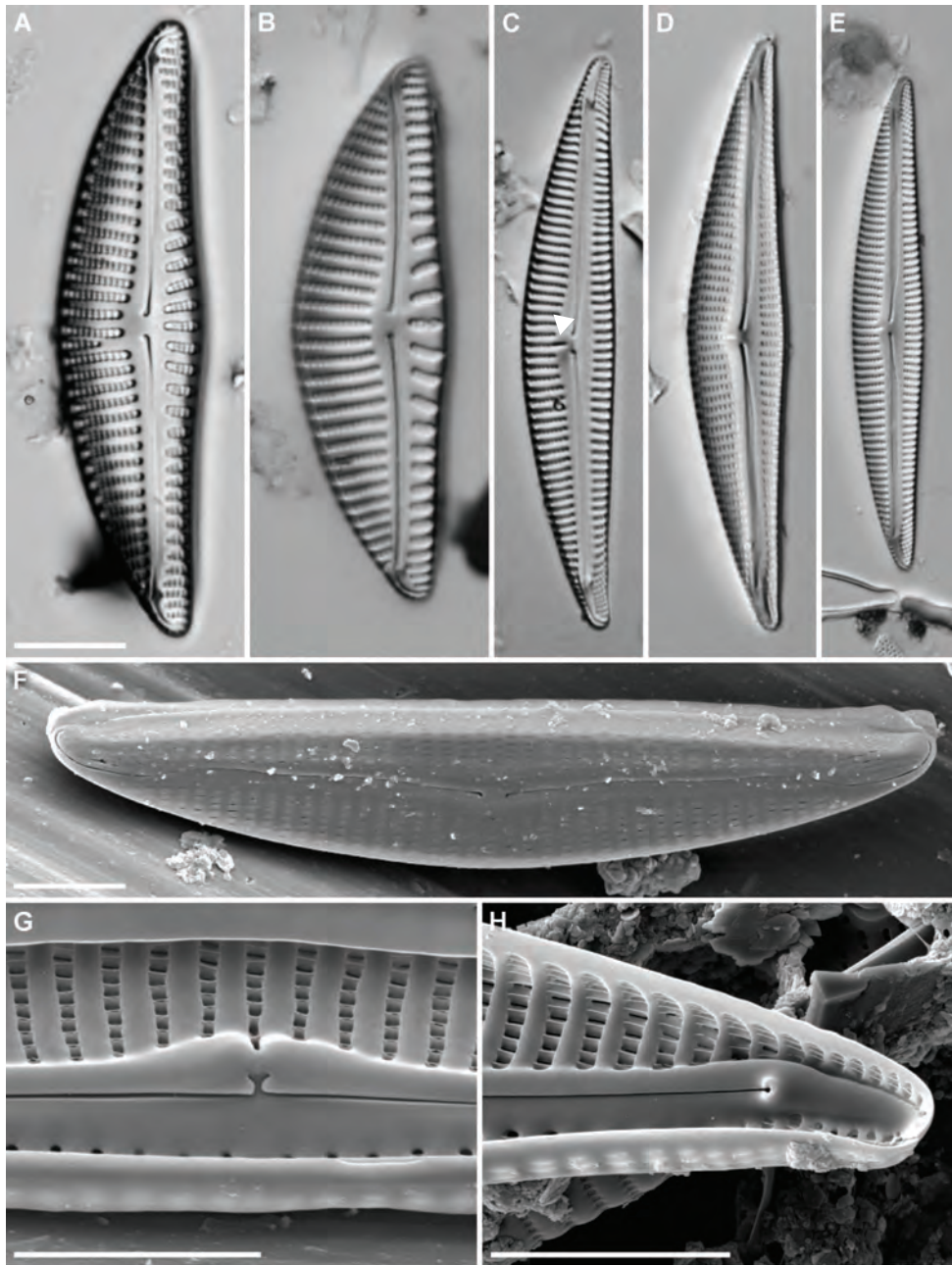
**Ecology** – Cells solitary, in mucilage tubes or free living and motile. Found in the benthos of oligotrophic to mesotrophic waters in both acidic and alkaline habitats at various trophic levels.







**Fig. 80.** *Encyonema* spp. **A-E.** LM. Living cells, valve views, note pyrenoid (arrow - **C**) and lipid droplets (arrow - **E**).  
Scale bar = 10  $\mu$ m.



**Fig. 81.** *Encyonema* spp. **A-E.** LM. Valve views, note stigma on dorsal side (arrow - **C**). **F-H.** SEM. **F.** Valve view of complete valve. **G.** Internal view of valve, detail of central area and central raphe endings. **H.** Internal view of valve, detail of cell apex showing helictoglossa.  
Scale bars = 10 μm (A-E), 5 μm (F-H).

***Encyonopsis*** Krammer 1997

Type species: *Encyonopsis cesatii* (Rabenhorst) Krammer

SYNONYM:

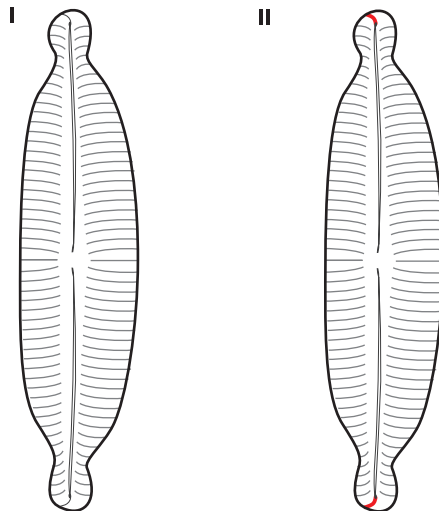
*Cymbella* C. Agardh 1830 pro parte

**Characteristics** – Cells **biraphid**, of variable size, slightly to moderately **dorsiventral**, raphe complex and terminal raphe endings bent towards the ventral side (II, Fig. 83: B). **Apical pore fields** absent.

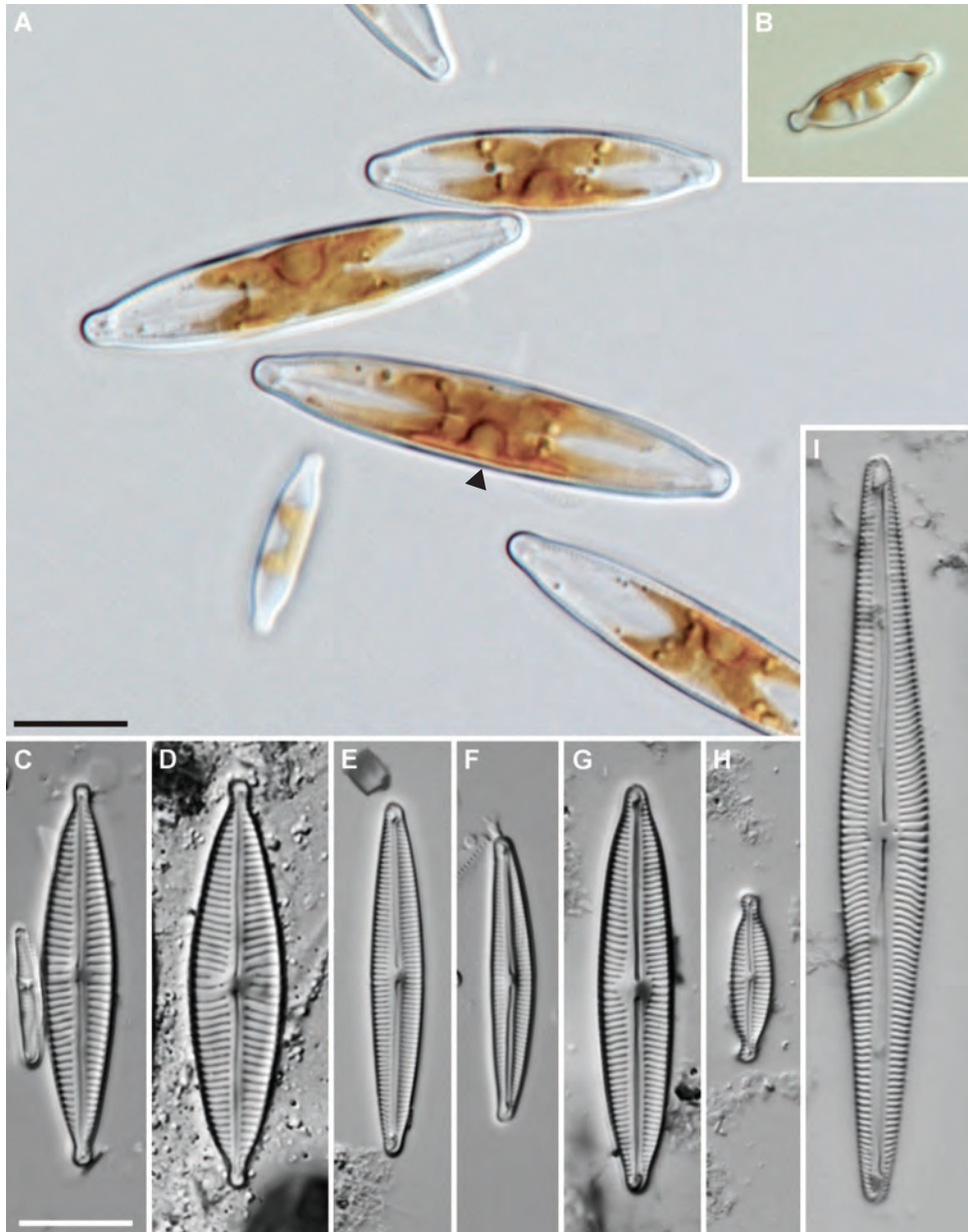
**Plastid structure** – Cells with one H-shaped plastid and a large pyrenoid in the central region against the ventral side. Several small lipid droplets scattered throughout the cell (Fig. 82: A).

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

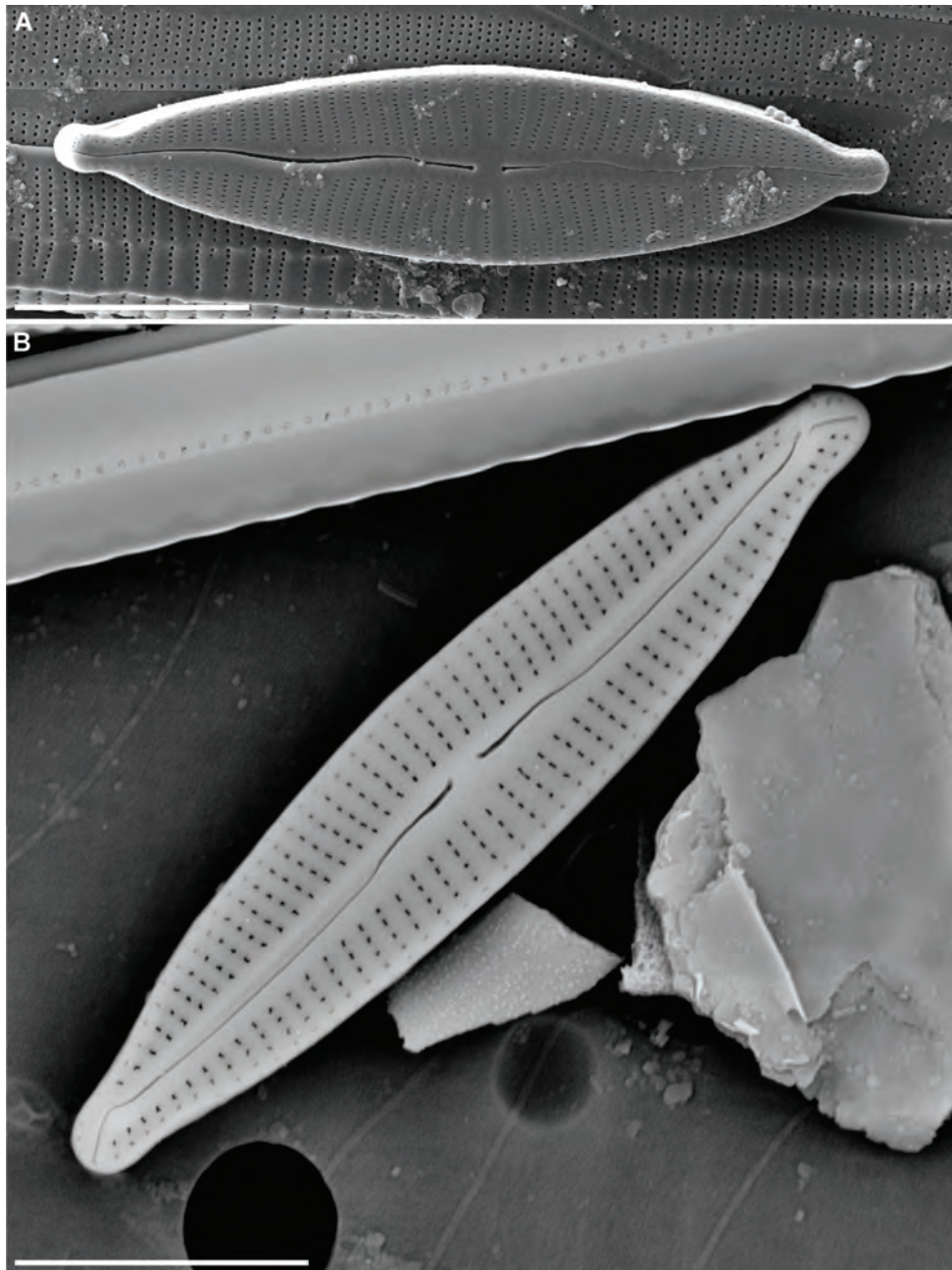
**Ecology** – Cells solitary, free living and motile. Found in the benthos of oligotrophic to mesotrophic waters in both acidic and alkaline habitats at various trophic levels.







**Fig. 82.** *Encyonopsis* spp. **A-I.** LM. **A.** Living cells, valve views, note pyrenoid (arrow). **B.** Living cell, valve view of *Encyonopsis microcephala* (Grunow) Krammer. **C-D.** Valve views of *Encyonopsis frequentis* Krammer. **E-F.** Valve views of *E. neerlandica* Van de Vijver, Verweij, Van der Wal & Mertens. **G.** *E. falaisensis* (Grunow) Krammer, valve view. **H.** *E. microcephala*, valve view. **I.** *E. treinishii* Bahls, valve view. Scale bars = 10 µm.



**Fig. 83.** *Encyonopsis* spp. **A-B.** SEM. **A.** *Encyonopsis frequentis*, external view of valve. **B.** External view of valve of *E. neerlandica*.  
Scale bars = 10  $\mu$ m (A), 5  $\mu$ m (B).

***Placoneis*** Mereschkowsky 1903Type species: *Placoneis gastrum* (Ehrenberg) Mereschkowsky

SYNONYM:

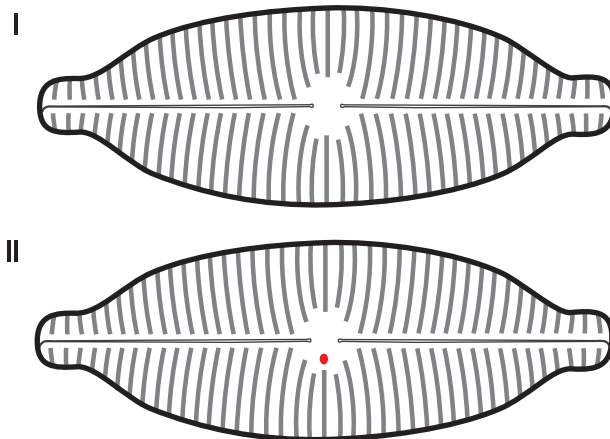
*Navicula* Bory 1822 pro parte

**Characteristics** – Cells **biraphid**, generally large and robust, elliptical with broadly rounded, rounded or sub-capitate apices. Striae easily discernable under LM (Fig. 84) and composed of single rows of round or elongate, **denticulate** (internally occluded) areolae (Fig. 85: F). Raphe straight with expanded central endings (Fig. 85: A-B), terminal raphe endings bent towards same (Fig. 85: B) or opposite (Fig. 85: A) directions. Central area generally expanded with **stigma(ta)** occasionally present (II; Fig. 84: B; Fig. 85: E).

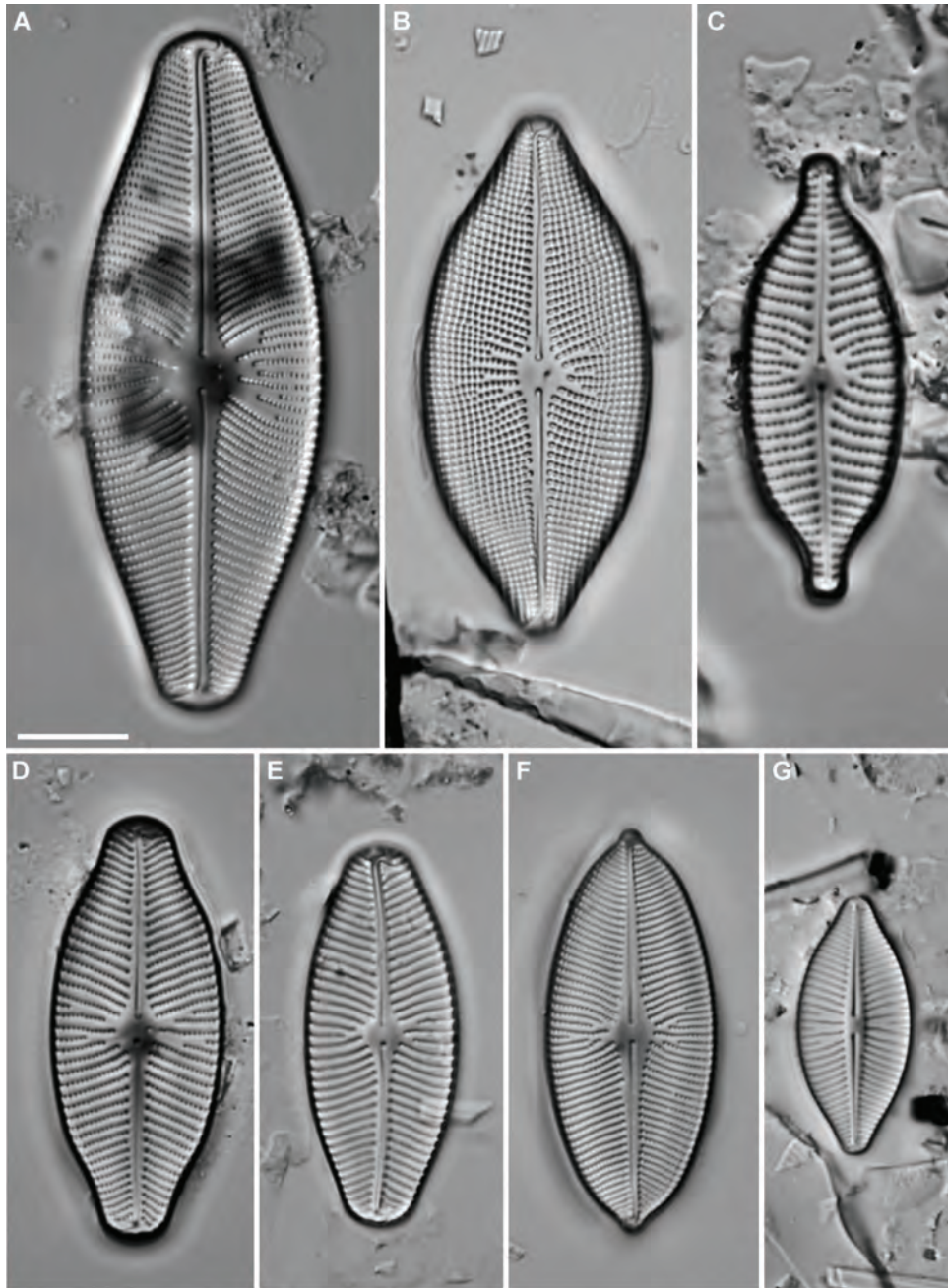
**Plastid structure** – Single plastid has a central axis along the apical axis of the cell with four lobes at each end which extend under the valves. Many scattered lipid bodies.

**Identification of species** – Species can be identified by cell size, cell shape, shape of the apices, structure and density of the striae as well as structure of the central area and the shape of the central raphe endings and the presence/absence of a stigma.

**Ecology** – Cells solitary, free living and motile. Found in the benthos of a variety of water types, in tropical Africa this taxon seems to favour oligotrophic waters with low to moderate conductivities.







**Fig. 84.** *Placoneis* spp. **A-G.** LM. **A.** *Placoneis* sp., valve view. **B.** “*Navicula omegopsis*” Hustedt, valve view. **E.** *P. cocquytiae* Fofana, Sow, J.C. Taylor, Ector & Van de Vijver, valve view. **F.** “*Navicula ashantiensis*” Foged, valve view. **G.** *P. hambergii* (Hustedt) Bruder, valve view.  
Scale bar = 10  $\mu$ m.