Cocconeis Ehrenberg 1836

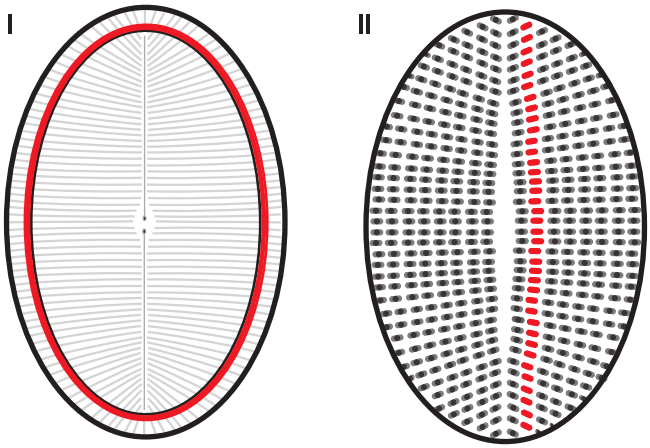
Type species: *Cocconeis scutellum* Ehrenberg

Characteristics – Cells **monoraphid**, ranging in size. Shape elliptical to almost round. Strongly **heterovalvar** with the raphid valve (I) having fine striae composed of small areolae, while the rapheless valve (II) has striae composed of large easily discernable areolae which often form undulating longitudinal lines (II, Fig. 100: C, G). Raphid valve usually has a **hyaline ring** (I, Fig. 100: B, D, H, I) running close to the valve margin. Valve may be strongly curved on the transapical axis (e.g. *Cocconeis pediculus* Ehrenberg; Fig. 101: A, D).

Plastid structure – A single C-shaped plastid is present (Fig. 99: A-E).

Identification of species – Species in this genus are distinguished based on cell size and shape as well as the areolae size and number and distribution on the rapheless valve as well as the width of the axial area. The raphid valve is very similar between species. The structure and presence/absence of the hyaline ring as well as the curvature of the cell in girdle view can be of importance in distinguishing species.

Ecology – Cells solitary and attached. Found in both fresh and brackish waters across a range of pH and trophic levels. Cells adapted to attach to a variety of substrata, may occur *en-masse* completely covering the surface of filaments of green algae (Fig. 99: A-B; Fig. 101: A).



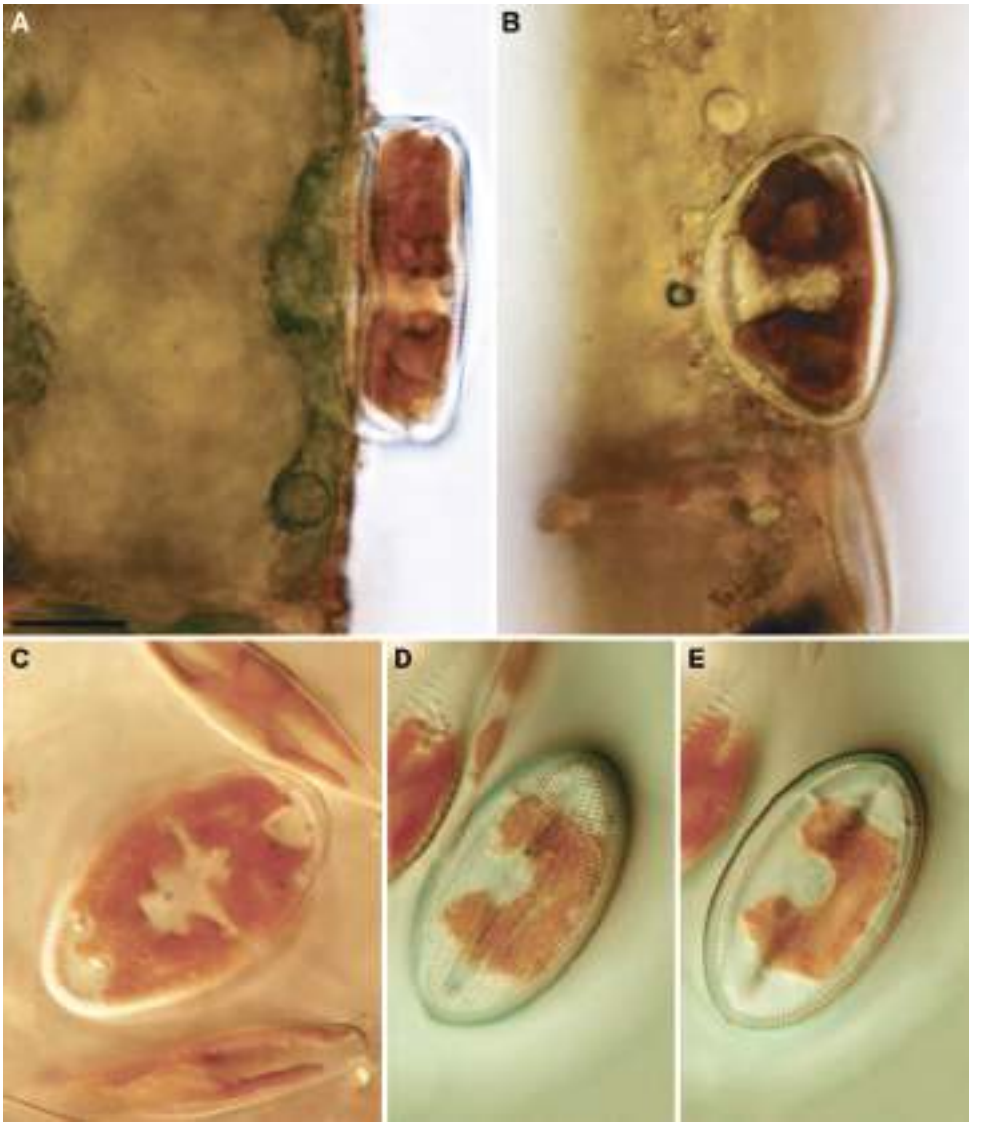


Fig. 99. *Cocconeis* spp. **A-E**. LM. **A-B**. Living cells, girdle view, cells appressed to the surface of filamentous algae. **C**. Living cell showing lobed chloroplast and lipid droplets. **D-E**. Living cells valve view, different foci of the same cell.
Scale bar = 10 µm.

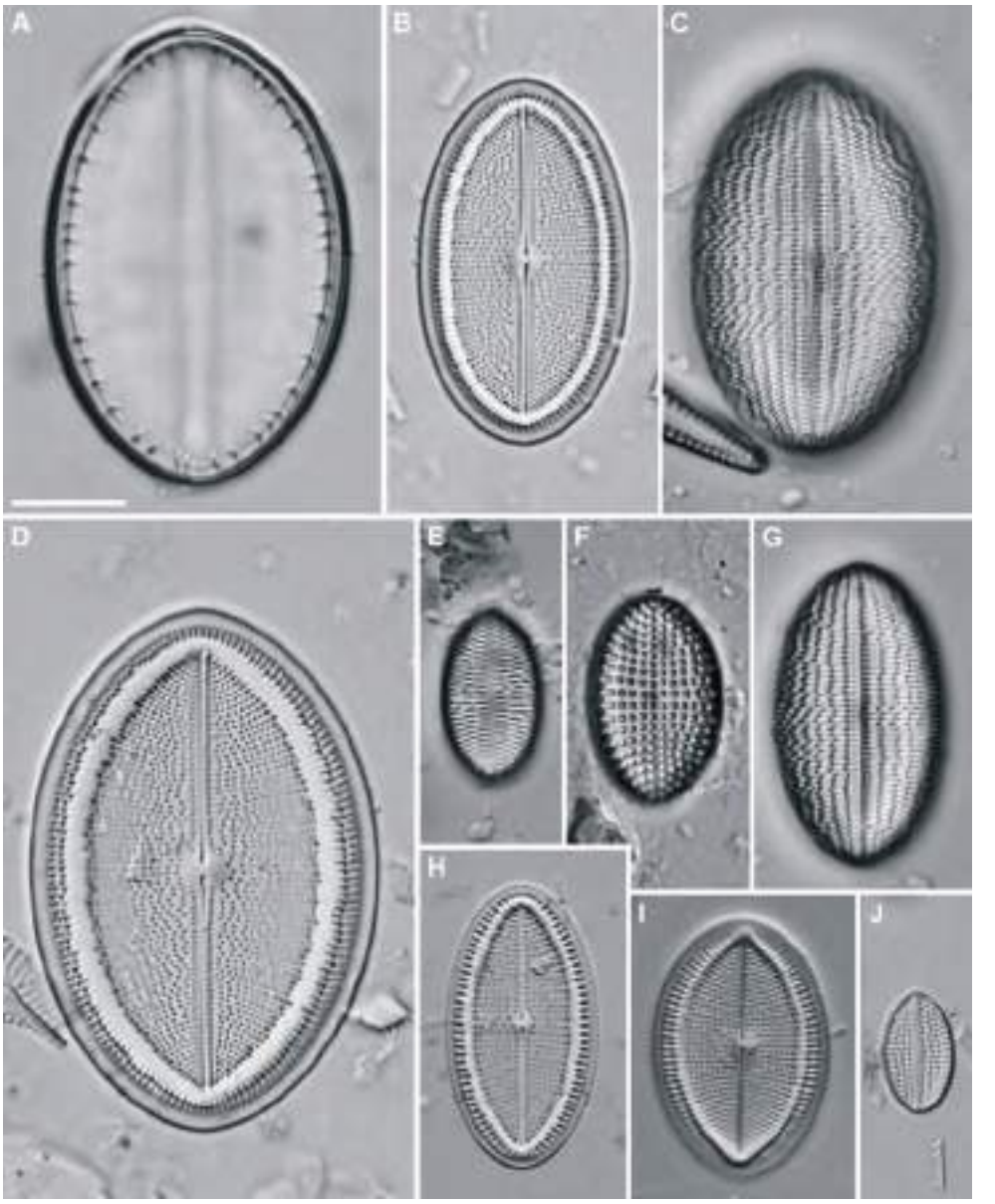


Fig. 100. *Cocconeis* spp. **A-J**. LM. **A**. Copula of *Cocconeis* sp. **B, D, H, I**. RV views of Cocconeis spp. **C, E, F, G, J**. RLV views of *Cocconeis* spp. **F**. *C. schroederi* Foged.
Scale bar = 10 µm.

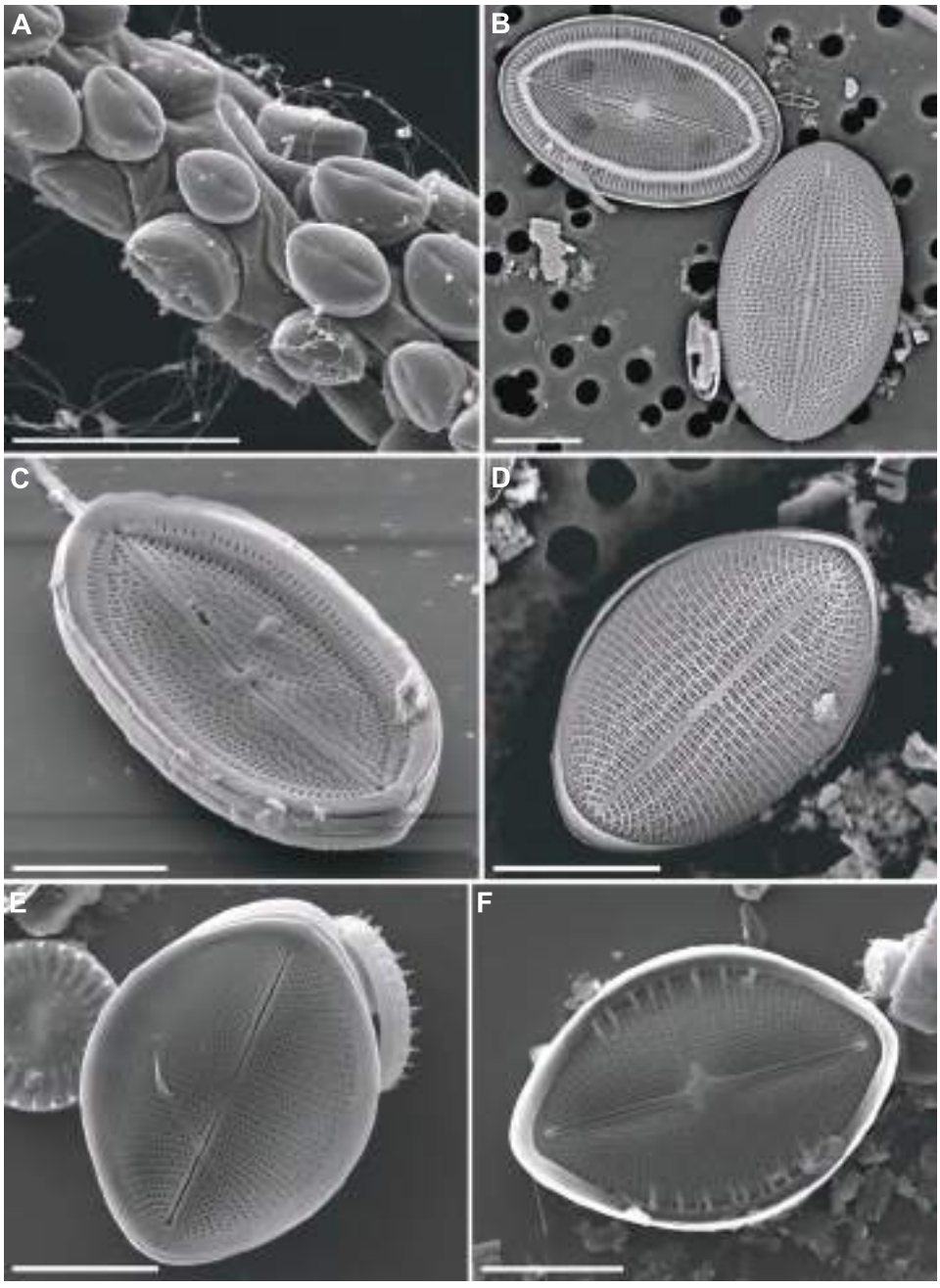


Fig. 101. *Cocconeis* spp. **A-F**. SEM. **A**. Cells of *Cocconeis pediculus* on the surface of a filament of green algae. **B**. *Cocconeis placentula* Ehrenberg RV (left) and RLV (right). **C**. Oblique view of RV of *Cocconeis* sp. **D-F**. External view of *Cocconeis pediculus*, RLV (**D**), RV (**E**), internal view of valve (**F**). Scale bars = 5 µm (A),10 µm (B-F).

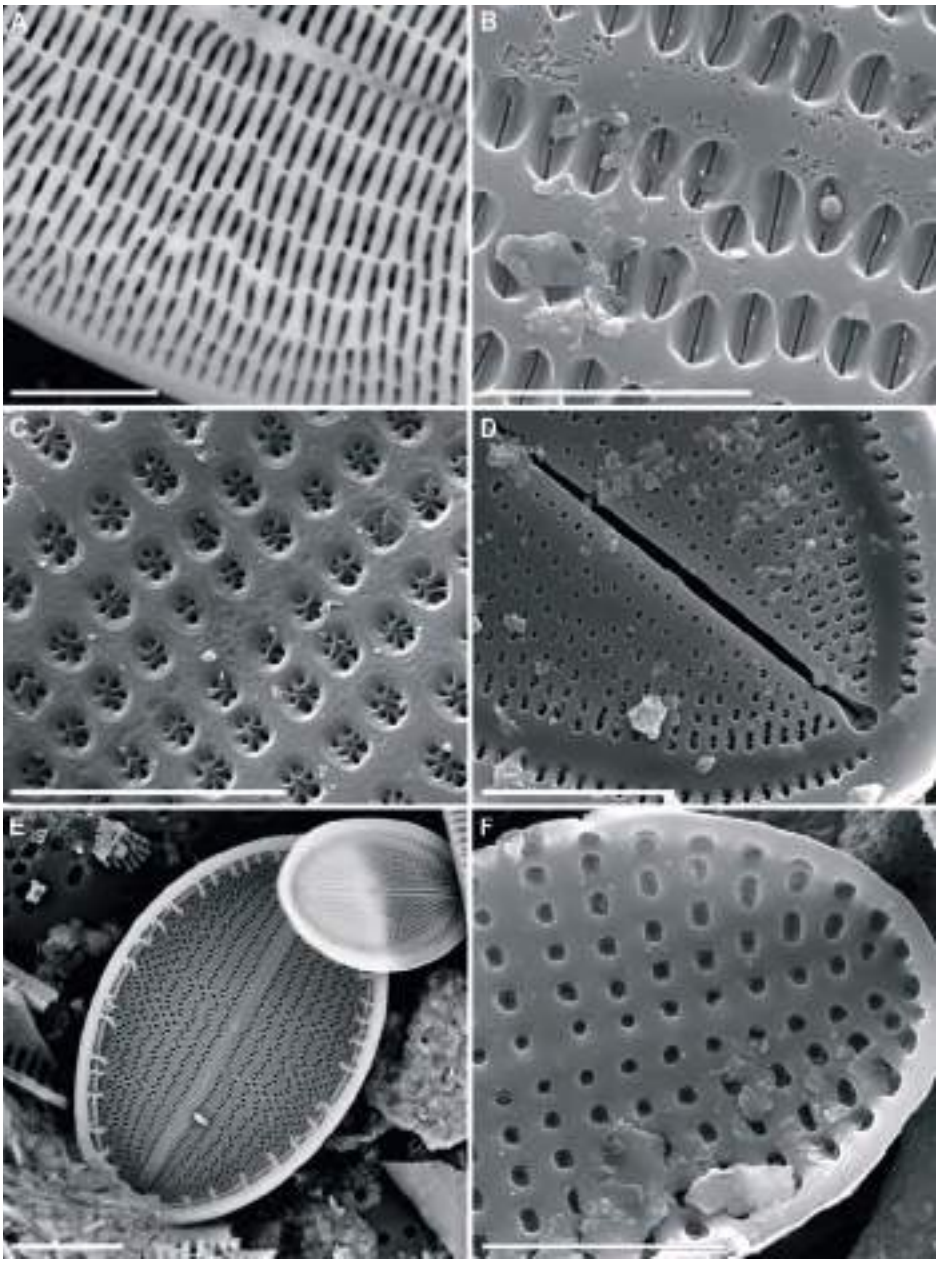


Fig. 102. *Cocconeis* spp. **A-F.** SEM. **A**. Areolae on RLV of *Cocconeis pediculus*. **B**. Areolae on RLV of a *Cocconeis* sp. **C**. Areolae on RLV of *C. schroederi*. **D**. Areolae on RV of a *Cocconeis* sp. **E**. Internal view of RV of *Cocconeis* sp., note copula with silica outgrowths. **F**. Internal view of valve showing areolae on RV of *C. schroederi*.
Scale bars = 3 µm (A-B), 4 µm (C), 5 µm (D, F), 10 µm (E).

Achnanthidium Kützing 1844

Type species: *Achnanthidium microcephalum* Kützing

SYNONYM:

Achnanthes Bory 1822 pro parte

Characteristics – Cells of *Achnanthidium* are **monoraphid**, mostly delicate and the valve structure can be difficult to observe in LM. The cells are bent in girdle view (I) and **heterovalvar** with only one valve bearing a raphe (II) and the second bearing no raphe slit and only an **axial area** (III). Striae are rather difficult to resolve in LM and usually no areolae can be observed. As cells are bent, it is difficult to focus on both the central and apical striae at the same time; this may be a useful tool to distinguish *Achnanthidium* from other similar sized taxa such as *Eolimna* Lange-Bertalot & W. Schiller which have a flat valve face, as well as a more elliptical shape.

Plastid structure – There is one large plastid lying against the girdle which may extend beneath one (Fig. 103: A) or both valves (Fig. 103: D). Often 2 lipid droplets may be observed at each end of the cell (Fig. 103: A, E).

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. The orientation and or presence/absence of striae in the central area as well as the shape of the central area are very important.

Ecology – Cells solitary or in pairs, usually attached by an apical mucilage stalk (Fig. 103: A-B) but also motile. Found in waters of varying trophic state but most taxa in this genus are thought to occur in well oxygenated waters. It may occur *en-masse* completely covering the surface of, for example, filamentous green algae.

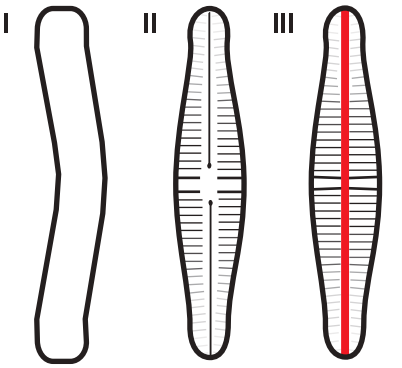


Fig. 103. *Achnanthidium* spp. **A-I**. LM. **A-B**. Living cells with mucilage stalks (arrows). Living cell, girdle view. **C-D**. Living cells of *Achnanthidium exiguum* (Grunow) Czarnecki. **E**. Living cell, valve view, note lipid droplets (arrow). **F-I.** Cleaned material of *Achnanthidium* spp. **F-G**. *Achnanthidium taiaense* (J.R. Carter & Deny) J.C.Taylor, E. Morales & Ector.
Scale bars = 10 µm (A-H).

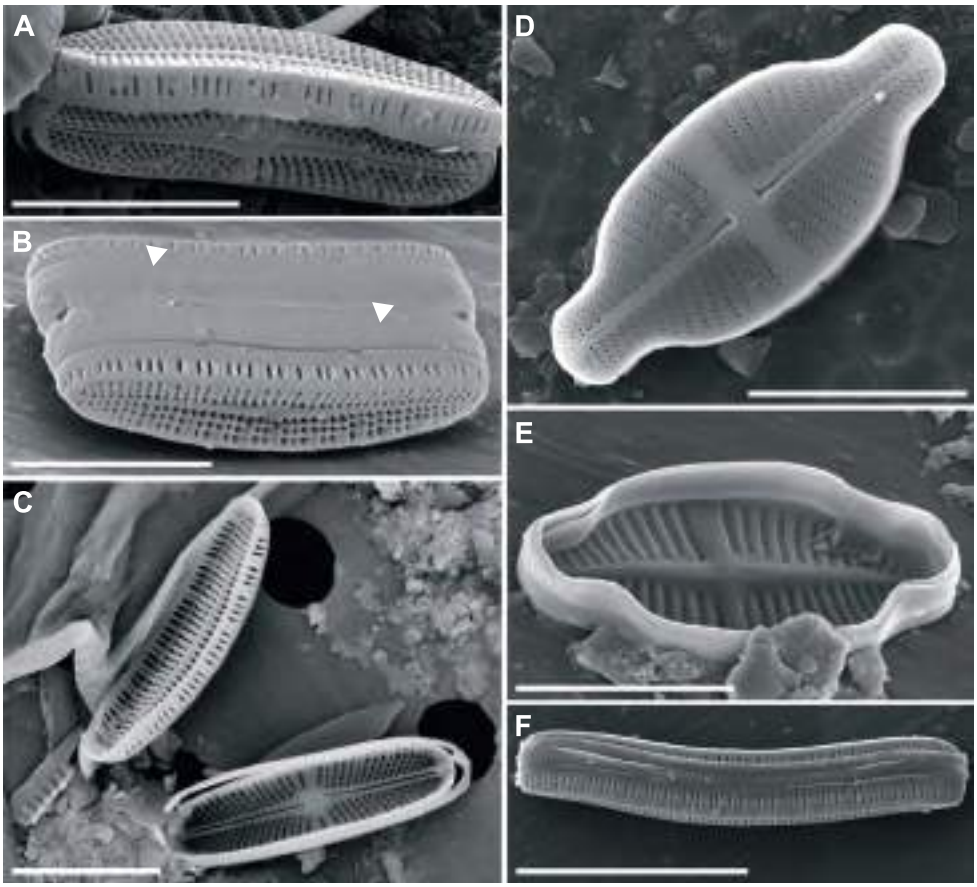


Fig. 104. *Achnanthidium* spp. **A-F**. SEM. **A-B.** Exterior view of valve, oblique view. **B**. Exterior view, detail of the valvocopulae (arrows). **C.** Internal views of valve of RLV and RV. **D**. External view of valve of *Achnanthidium exiguum*. **E**. Internal view of valve of *A. exiguum.* **F**. Girdle view. Scale bars = 5 µm (A-E), 10 µm (F).

Planothidium Round & Bukhtiyarova 1996

Type species: *Planothidium lanceolatum* (Brébisson ex Kützing) Lange-Bertalot

SYNONYM:

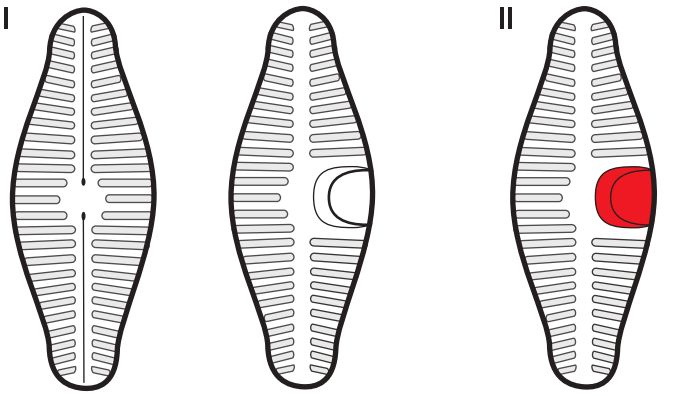
Achnanthes Bory 1822 pro parte

Characteristics – Cells **heterovalvar**, **monoraphid**, elliptical with rounded, broadly rounded or sub-capitate apices. Curved in girdle view (one valve slightly convex, the other slightly concave). Striae robust and clearly discernable under LM (Fig. 105: C-N), composed of 2 rows of very small round areolae, visible only under SEM (Fig. 106: A-D). Raphe straight and simple (Fig. 105: C, E, G, K, M) with expanded central endings. Rapheless valve (RLV) has a narrow axial area and may possess a **silica hood** (also known as a "horseshoe structure") or other unilateral silica thickening on the interior of the valve (II).

Plastid structure – Single plate-like plastid lying under the RLV valve extending under the girdle (Fig. 105: A-B).

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 and axial areas, the shape and curvature of the central raphe endings as well as structure and positioning of the silica thickenings of the RLV.

Ecology – Cells solitary, attached (**adnate**) by the raphe valve face to the substrata. Found in the benthos of mesotrophic to hypereutrophic waters with moderate to high conductivities.



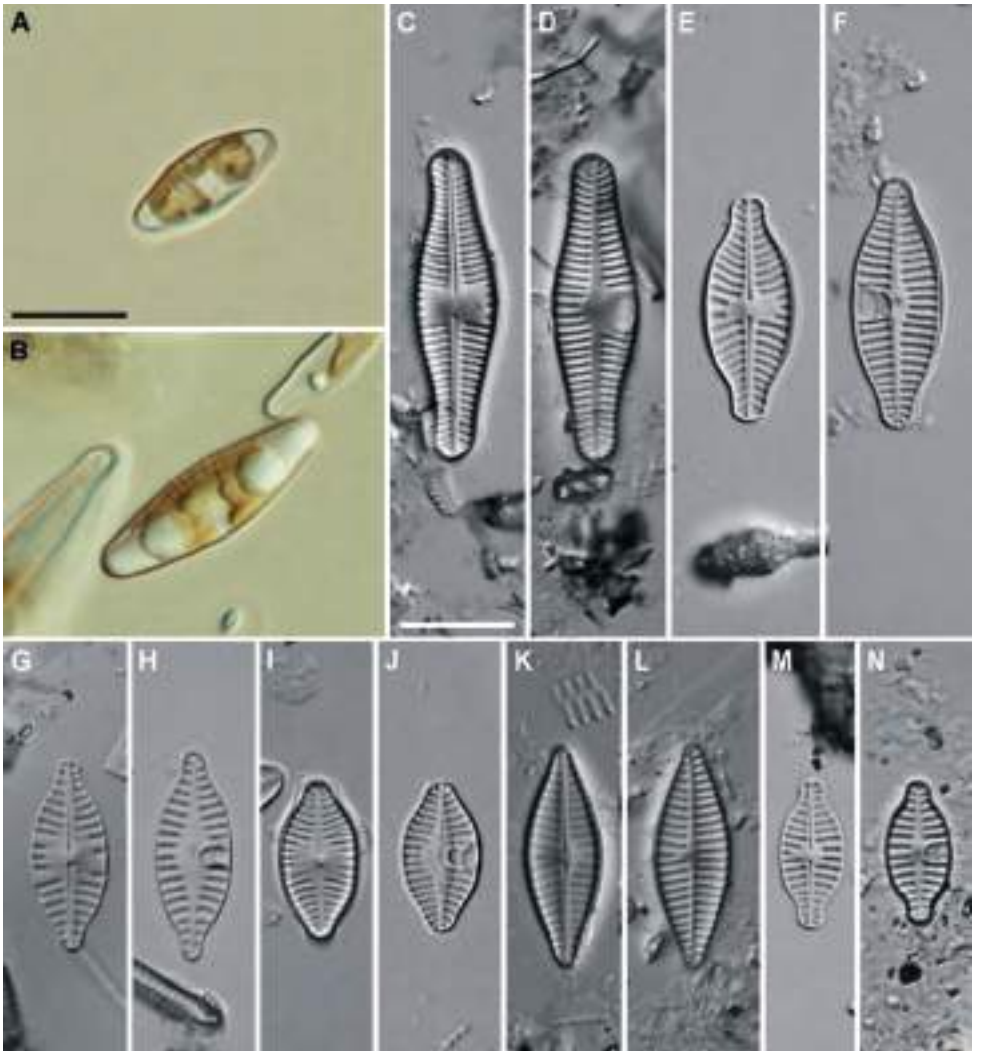


Fig. 105. *Planothidium* spp. **A-N**. LM. **A-B.** Living cells. **C-N.** Cleaned valves. **C, E, G, I, M.** *Planothidium* spp., raphe valves. **D, F, H, J, N.** *Planothidium* spp., rapheless valve, note "horseshoe structure" of silica hood. **K.** *Planothidium delicatulum* (Kützing) Round & Bukhtiyarova, raphe valve. **L.** *Planothidium delicatulum*, rapheless valve.
Scale bar = 10 µm (A-N).

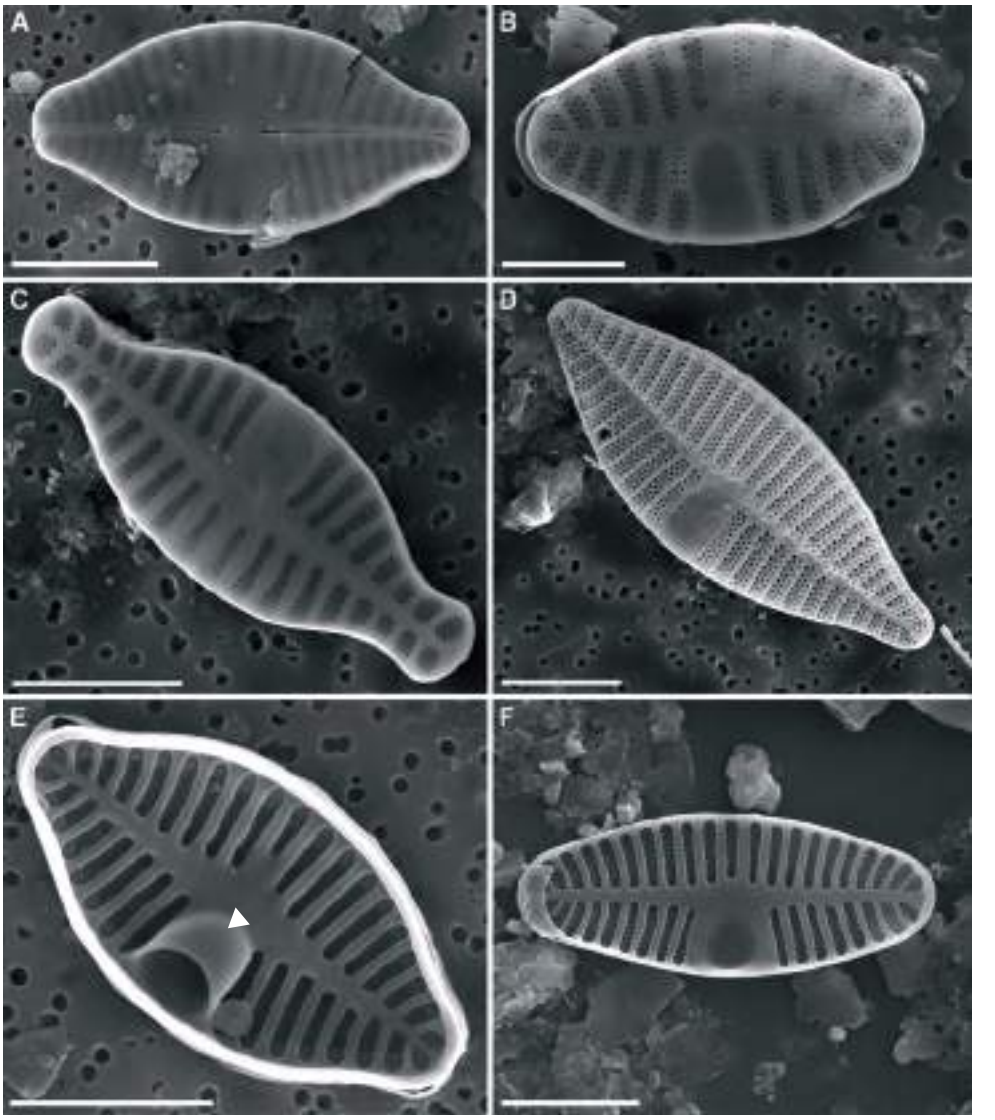


Fig. 106. *Planothidium* spp. **A-F**. SEM. **A.** External view of raphe valve. **B-C.** External view of rapheless valves. **D.** *Planothidium delicatulum*, external view of rapheless valve. **E-F.** Internal view of rapheless valves, note "horseshoe structure" of silica hood (arrow **- E)**.
Scale bars = 2 µm (A-F).

Cavinula D.G. Mann & Stickle 1990

Type species: *Cavinula cocconeiformis* (W. Gregory ex Greville) D.G. Mann & Stickle

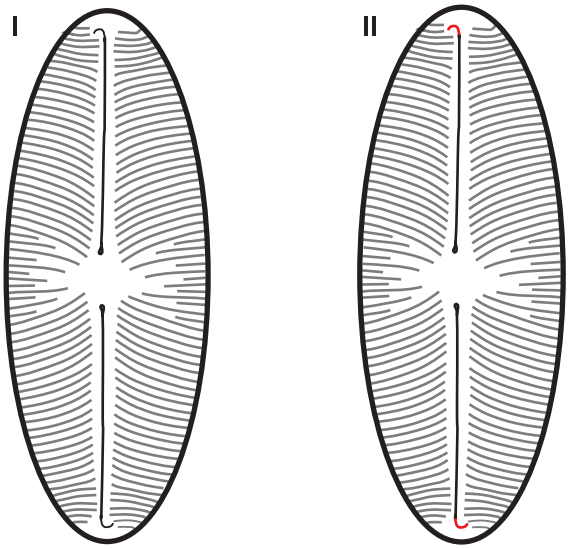
SYNONYM:
Navicula Bory 1822 pro parte

Characteristics – Cells **biraphid** with radiate striae, areolae may be small and difficult to observe under LM (Fig. 107: C, D) or large and very clearly distinguishable (Fig. 107: E, H-I). In general, the terminal raphe fissures endings do not extend onto the valve mantle and are usually curved in opposite directions (II).

Plastid structure – Cells with one or two H-shaped plastids often with many lobes (Fig. 107: A-B).

Identification of species – Species in this genus are distinguished based on cell size and shape as well as striae pattern, density and the structure of the areolae.

Ecology – Cells solitary and motile. Found in the benthos of oligotrophic waters and extending to moist sub-aerial habitats. Some species may be found in water with higher conductivities.



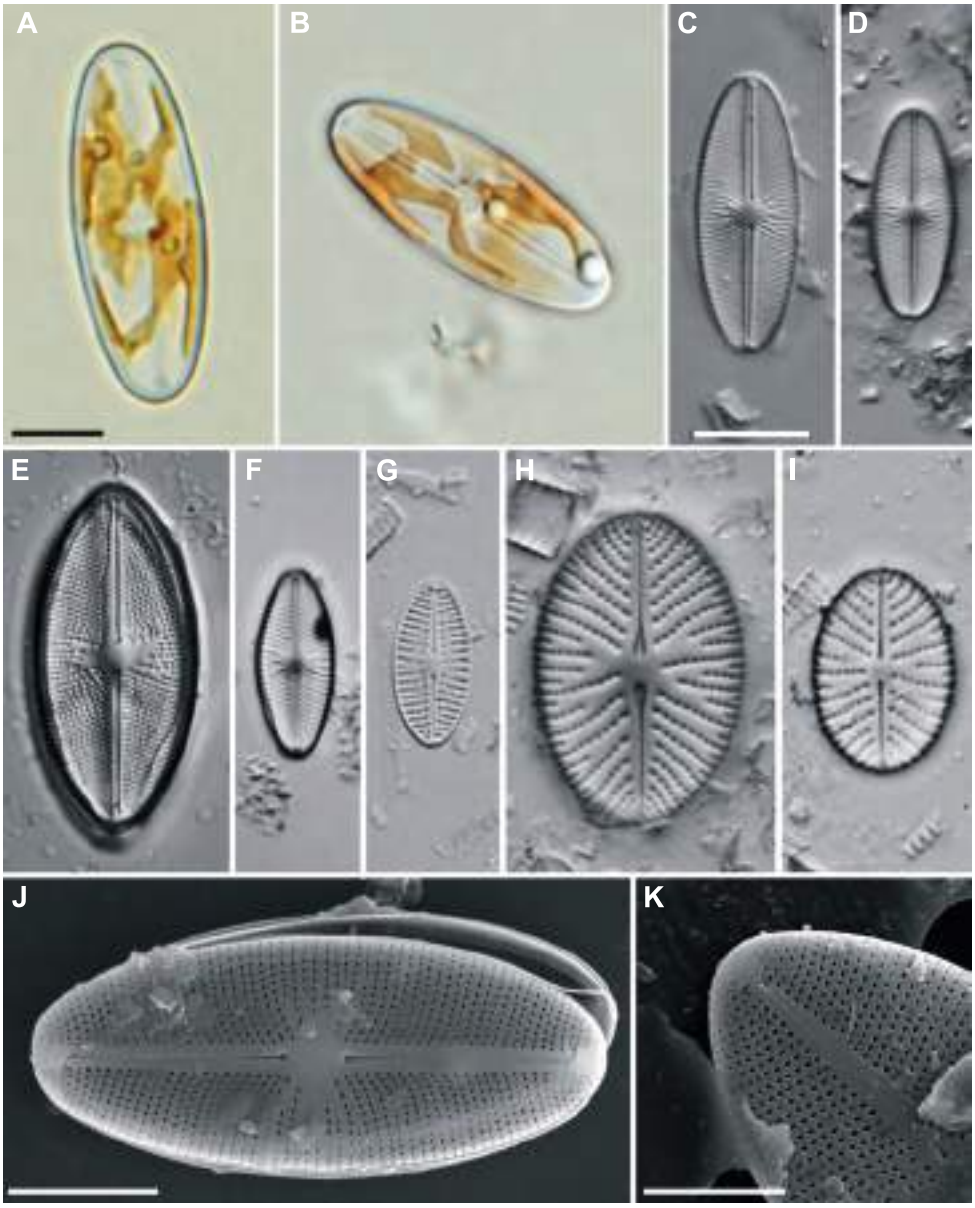


Fig. 107. *Cavinula* spp. **A-I.** LM. **A-B.** Living cells of *Cavinula davisiae* Bahls, note highly lobed plastid structure. **C-D.** Cleaned cells of *C. davisiae.* **E, F, H.** Various tropical African taxa. **G.** *Cavinula lilandae* Cocquyt, de Haan & J.C. Taylor. **I.** *C. scutelloides* (W. Smith) Lange-Bertalot. **J-K.** SEM, external view of valve of *C. davisiae* showing complete valve (**J**) and detail of terminal raphe ending (**K**). Scale bars = 10 µm (A-J), 5 µm (K).

Diadesmis Kützing 1844

Type species: *Diadesmis confervacea* Kützing

SYNONYM:

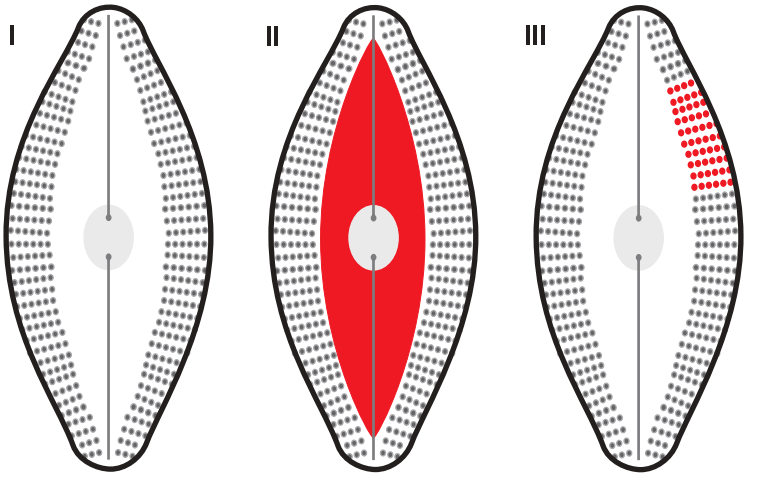
Navicula Bory 1822 pro parte

Characteristics – Cells **biraphid**, with broad **axial area** (II). Striae easily discernable composed of relatively widely spaced round areolae (III). Raphe with straight central and terminal endings. Cells often observed in girdle view as the individual cells form chains which may often not be separated during cleaning (Fig. 108: A, I, J). The valve mantle has a single row of large and distinctly visible elongate areolae (Fig. 108: A, I, J). Cells may have connective spines at the junction of the valve face and mantle which are not easily visible under LM.

Plastid structure – Cells with a single lobed plastid.

Identification of species – Up till now only one species known from tropical Africa: *Diadesmis confervacea.*

Ecology – Cells always linked face to face to form ribbon-like colonies. Found in the benthos of eutrophic waters with moderate conductivity.



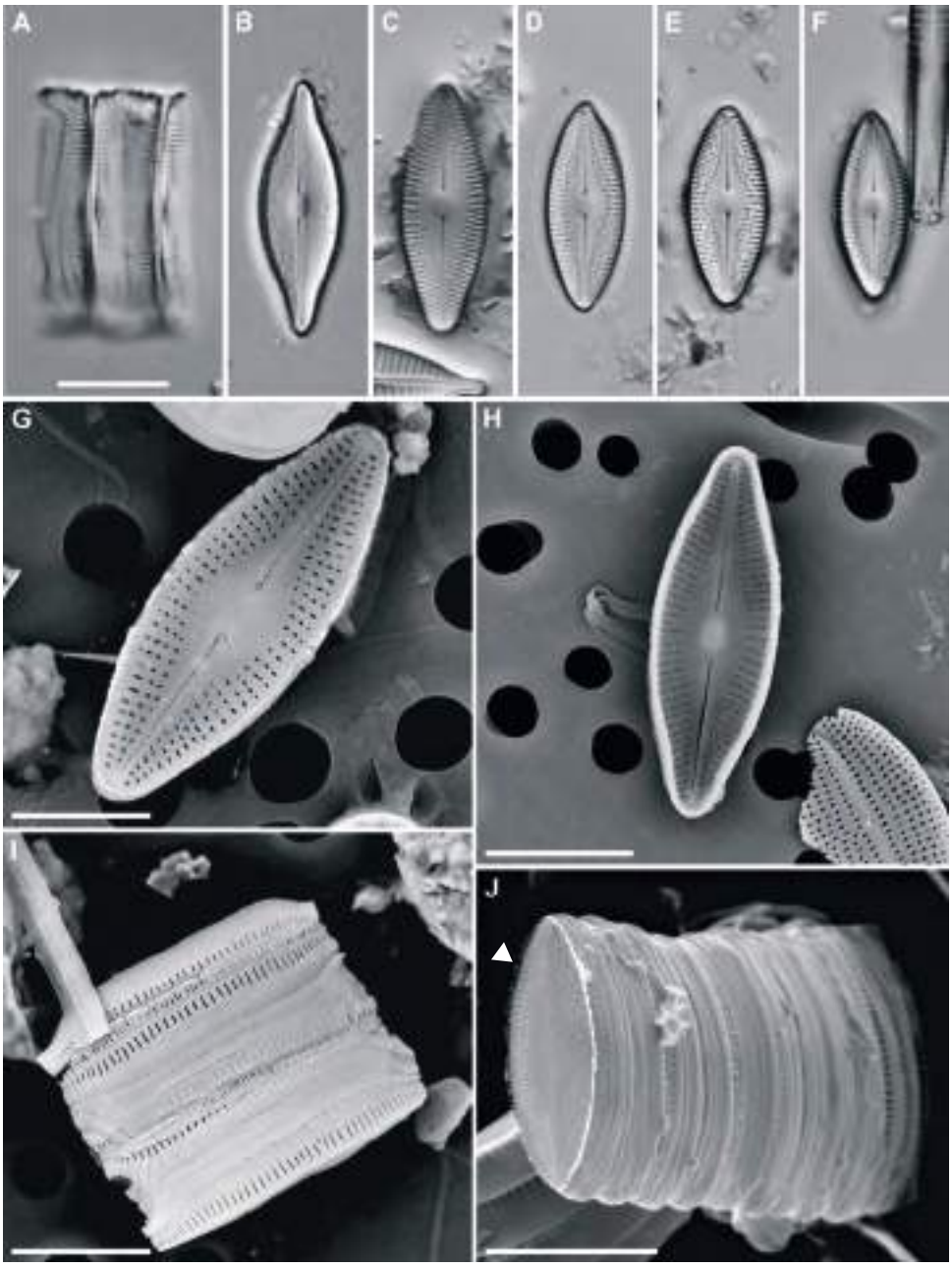


Fig. 108. *Diadesmis* spp. **A-F**. LM. **A**. Girdle view of *Diadesmis confervacea*. **B**. *Diadesmis* sp. **C-F**. Valve view *D. confervacea*. **G-J**. SEM. **G**. External view of valve. **H**. Internal view of valve. **I**. Girdle view of two frustules. **J**. Oblique view of a chain of frustules, note broad axial area and marginal spine-like structures (arrow).
Scale bars = 10 µm (A-F, J), 5 µm (G), 8 µm (H-I).

Humidophila R.L. Lowe, Kociolek, J.R. Johansen, Van de Vijver, Lange-Bertalot & Kopalová 2014

Type species: *Humidophila undulata* R.L. Lowe, Kociolek & J.R. Johansen

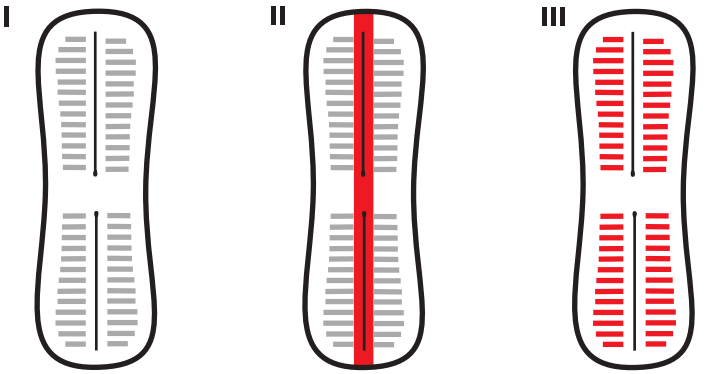
SYNONYM:
Diadesmis Kützing 1844 pro parte

Characteristics – Cells **biraphid**, usually small in size, with narrow **axial area** (II). Striae composed of few elongate areolae (often only 1-2) (III, Fig. 109: G). The mantle has a single row of large and distinctly visible areolae (Fig. 109: G). The raphe endings are straight both in the centre of the cell and at the apices and do not extend onto the margin.

Plastid structure – Cells with a single lobed plastid (Fig. 109: A).

Identification of species – Species can be identified by cell size, cell shape, shape of the apices and structure and density of the striae as well as the number of areolae in each stria.

Ecology – Cells solitary and motile. Found in the benthos of acidic oligotrophic waters, most common in moist sub-aerial habitats such as mosses and damp rocks. Washed into streams by anthropogenic activities such as mining, deforestation, road building etc.



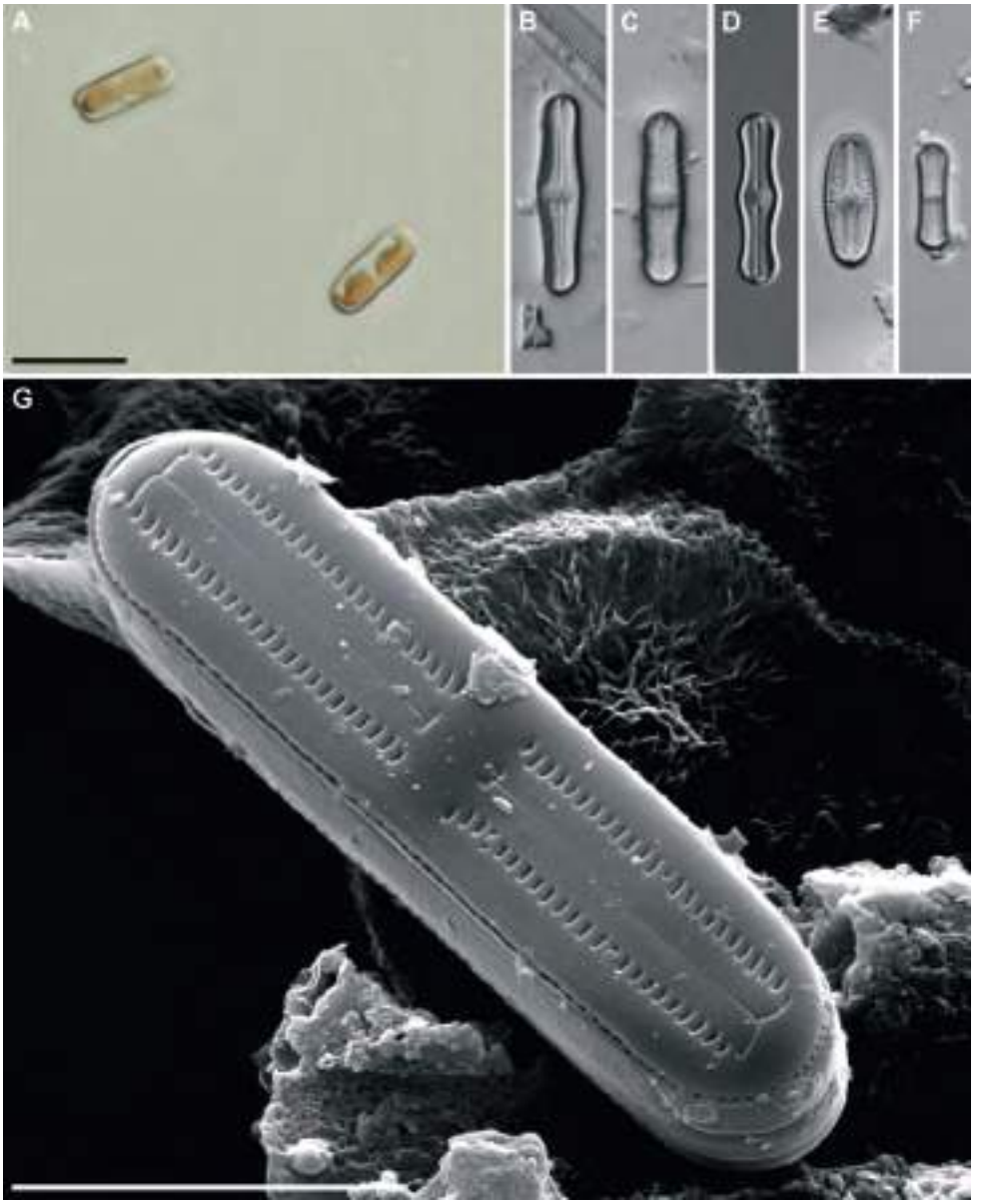


Fig. 109. *Humidophila* spp. **A-F**. LM. **A**. Living cells, girdle view (left), valve view (right). **B-F**. Cleaned material, valve views. **G**. SEM. Oblique external view of valve, note single areolae comprising the striae.
Scale bars = 10 µm (A-F), 5 µm (G).

Luticola D.G. Mann 1990

Type species: *Luticola mutica* (Kützing) D.G. Mann

SYNONYM:

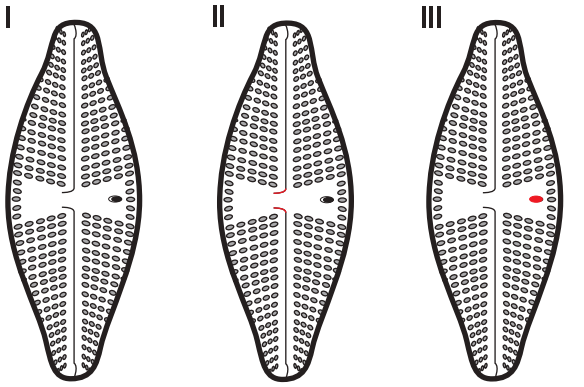
Navicula Bory 1822 pro parte

Characteristics – Cells **biraphid**, small, elliptical to linear elliptical with broadly rounded or capitate apices. Valve margins may undulate. Striae parallel or radiate mid-valve becoming radiate towards the apices, composed of single rows of large areolae easily discernable under LM. Raphe straight and simple (Fig. 110: D-N). with central endings either hooked or bent in the same direction (II) opposite the side with the stigma. Central area variable in shape and extent with single isolated stigma (III; Fig. 110: D-N; Fig. 111: A-F).

Plastid structure – Single plastid with a central pyrenoid (Fig. 110: A-B), lying with its centre along one side of the girdle, 2 lobes extending under each valve face, indented longitudinally under the raphe (Fig. 110: C).

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 and curvature of the central raphe endings.

Ecology – Cells solitary, free living and motile. Found mostly in terrestrial and sub-aerial habitats, may be washed into rivers and streams.



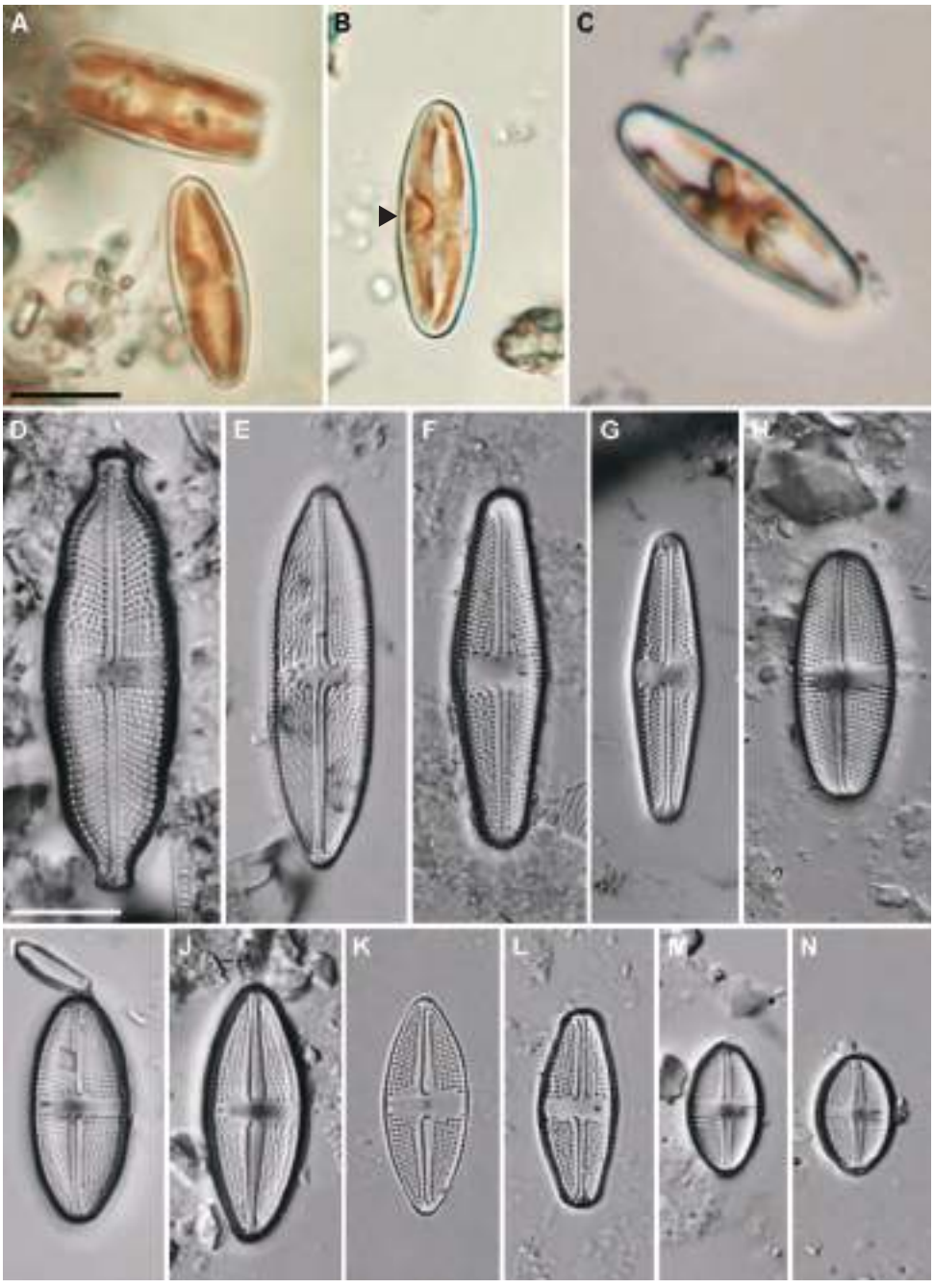


Fig. 110. *Luticola* spp. **A-N.** LM. **A-C.** Living cells, note the central pyrenoid (arrow - **B**). **D-N.** Cleaned valves.
Scale bars = 10 µm (A-N).

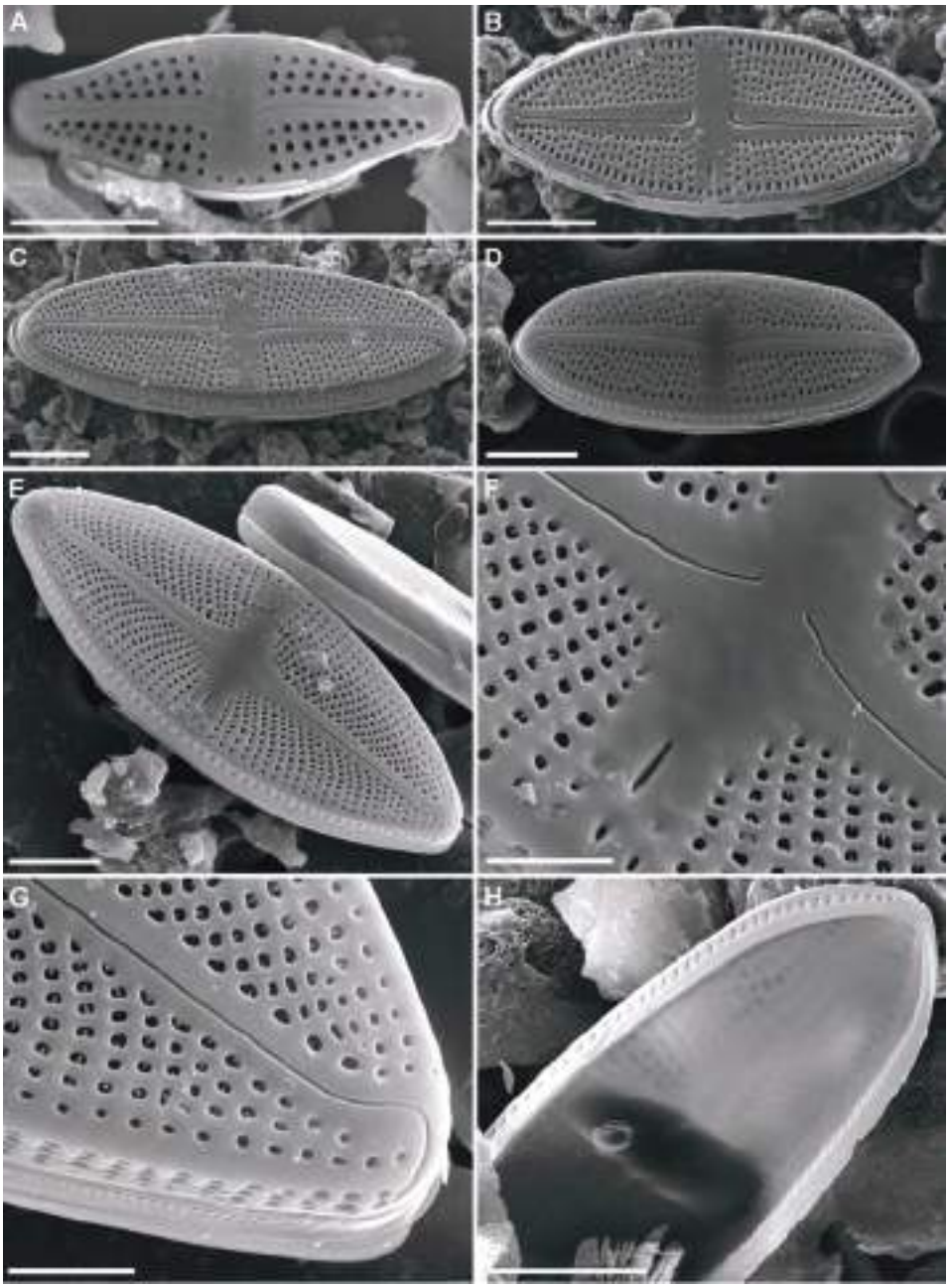


Fig. 111. *Luticola* spp. **A-H.** SEM. **A-E.** External view of valves. **F.** External view of valve, detail of bent central raphe endings and stigma. **G.** External view of valve, detail of apex and hooked terminal raphe ending. **H.** Internal view of valve, detail of stigma.
Scale bars = 5 µm (A-E, H), 2 µm (F-G).

Amphipleura Kützing 1844

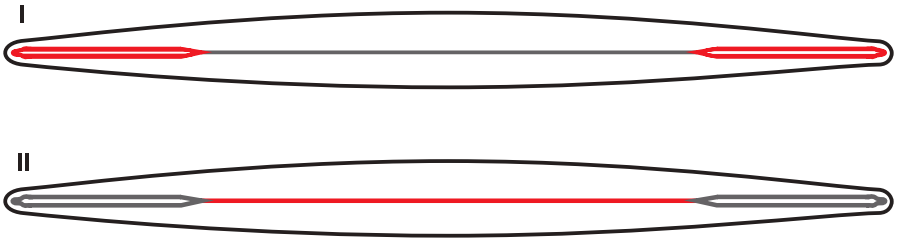
Type species: *Amphipleura pellucida* (Kützing) Kützing

Characteristics – Cells **biraphid**, large and long. Striae are very difficult to resolve in LM. The raphe is very short and present only near the apices (Fig. 113: A-D). The raphe branches are not visible under LM and are located between ribs which in LM resemble the eye of a needle (I). These ribs fuse into a single structure (**median rib**) running the length of cell (II).

Plastid structure – Single plastid with 2 lobes (H-shaped, Fig. 112: A-B). Large pyrenoid in the center of the cell (C), several lipid droplets scattered through the cell.

Identification of species – Up till now only one species known from tropical Africa: *Amphipleura pellucida*.

Ecology – Cells solitary, free living in the benthos. Occurs in oligo- to mesotrophic waters.



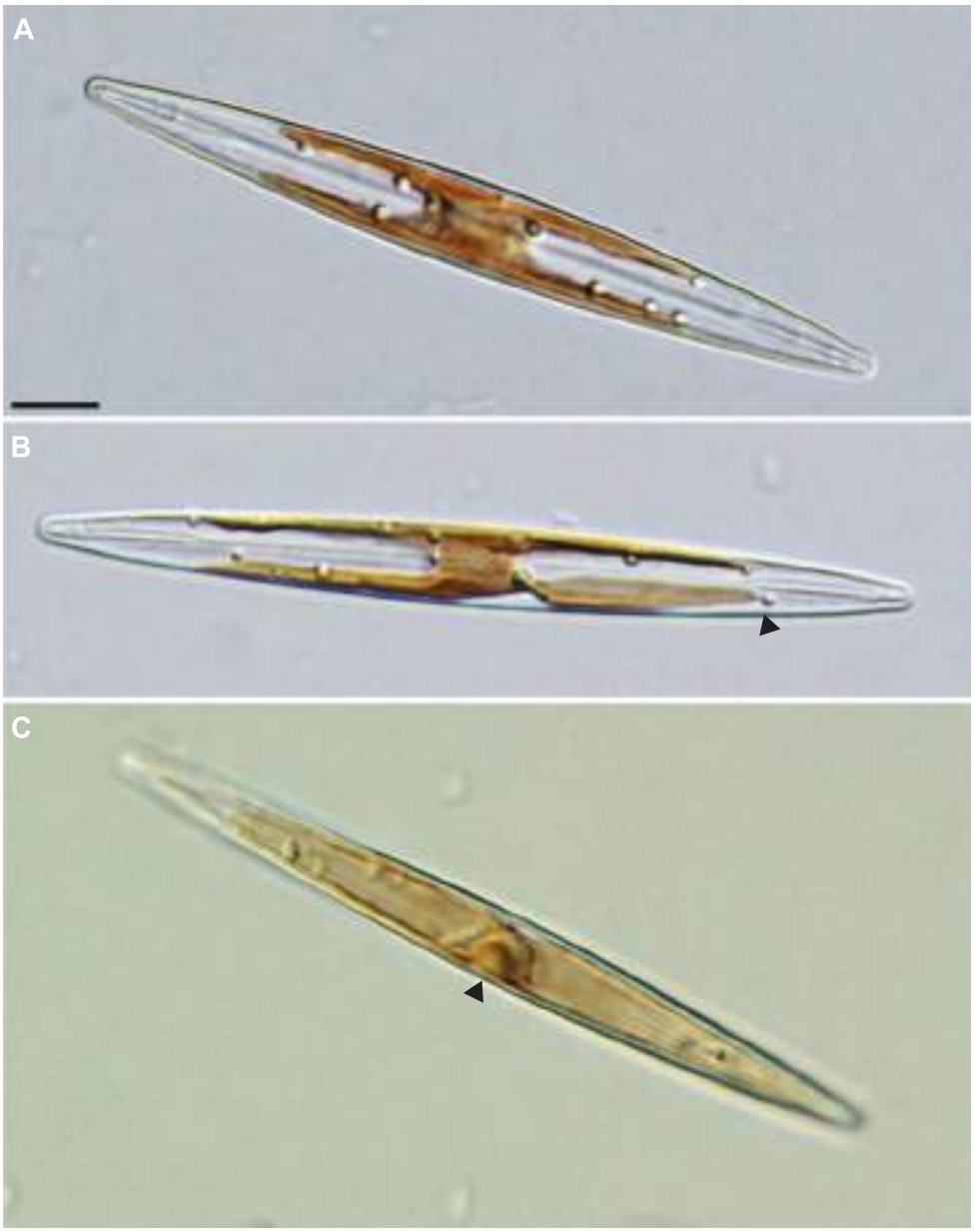


Fig. 112. *Amphipleura pellucida*. **A-C.** LM. **A-B.** Living cells, valve view, note lipid droplets (arrow - **B**). **C.** Living cell, girdle view, note large central pyrenoid (arrow). Scale bar = 10 µm.

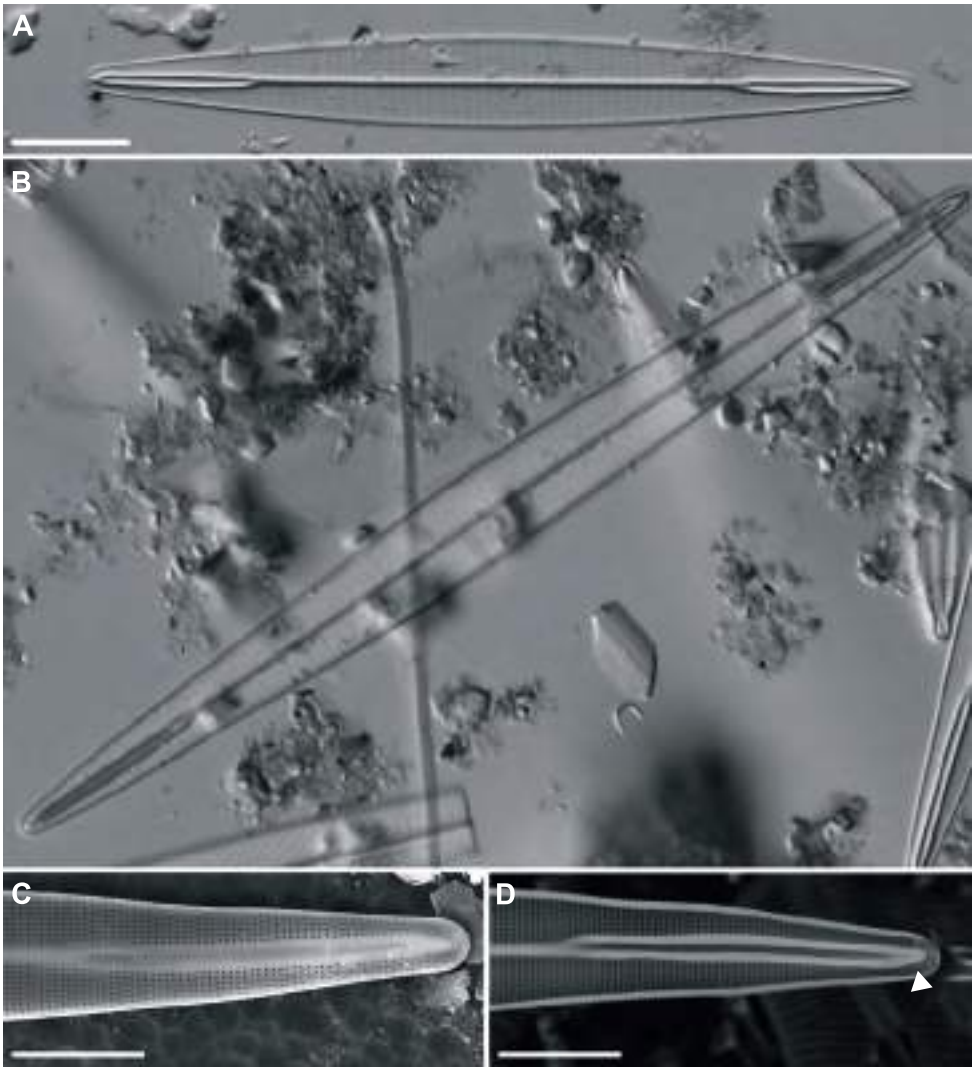


Fig. 113. *Amphipleura pellucida*. **A-B.** LM, cleaned material, valve view. **C-D.** SEM. **C.** External view of valve showing shortened raphe slit. **D.** Internal view of valve view showing thickened central rib, axial ribs parallel to the raphe, and the helictoglossa (arrow).
Scale bars = 10 µm (A-B), 5 µm (C-D).

Frustulia Rabenhorst 1853

Type species: *Frustulia saxonica* Rabenhorst

Characteristics – Cells **biraphid**, ranging in size. Margins may undulate or have a constriction mid-valve. Raphe between two clearly visible thickened ribs (III). Raphe terminates near the apices in characteristic **porte-crayon endings**, visible both in LM (II; Fig. 115: A) and under SEM (Fig. 116: F). Striae composed of very small areolae arranged into both transapical and longitudinal striae.

Plastid structure – Two plate-like plastids each containing a central pyrenoid (Fig. 114).

Identification of species – Species can be identified by cell size, cell shape, undulations of the valve margin, shape of the apices, structure and density of the striae as well as structure of the axial and central area including whether the silica ribs are continuous or interrupted in the central area (Fig. 115).

Ecology – Cells solitary, free living and motile or colonial living in mucilage tubes (Fig. 114: D). Found in the benthos of acidic oligotrophic waters with low conductivities.

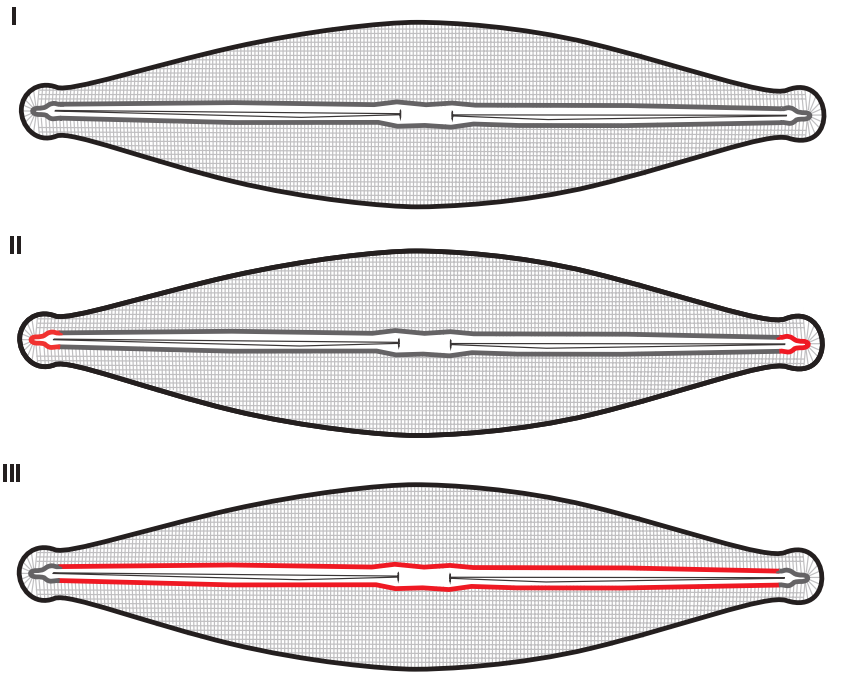


Fig. 114. *Frustulia* spp. **A-D.** LM, living cells. **A, D.** Cells inhabiting mucilage (arrow) tubes. **B.** Valve view, not large lipid droplets. **C.** Girdle view. Scale bars = 10 µm (A-D).

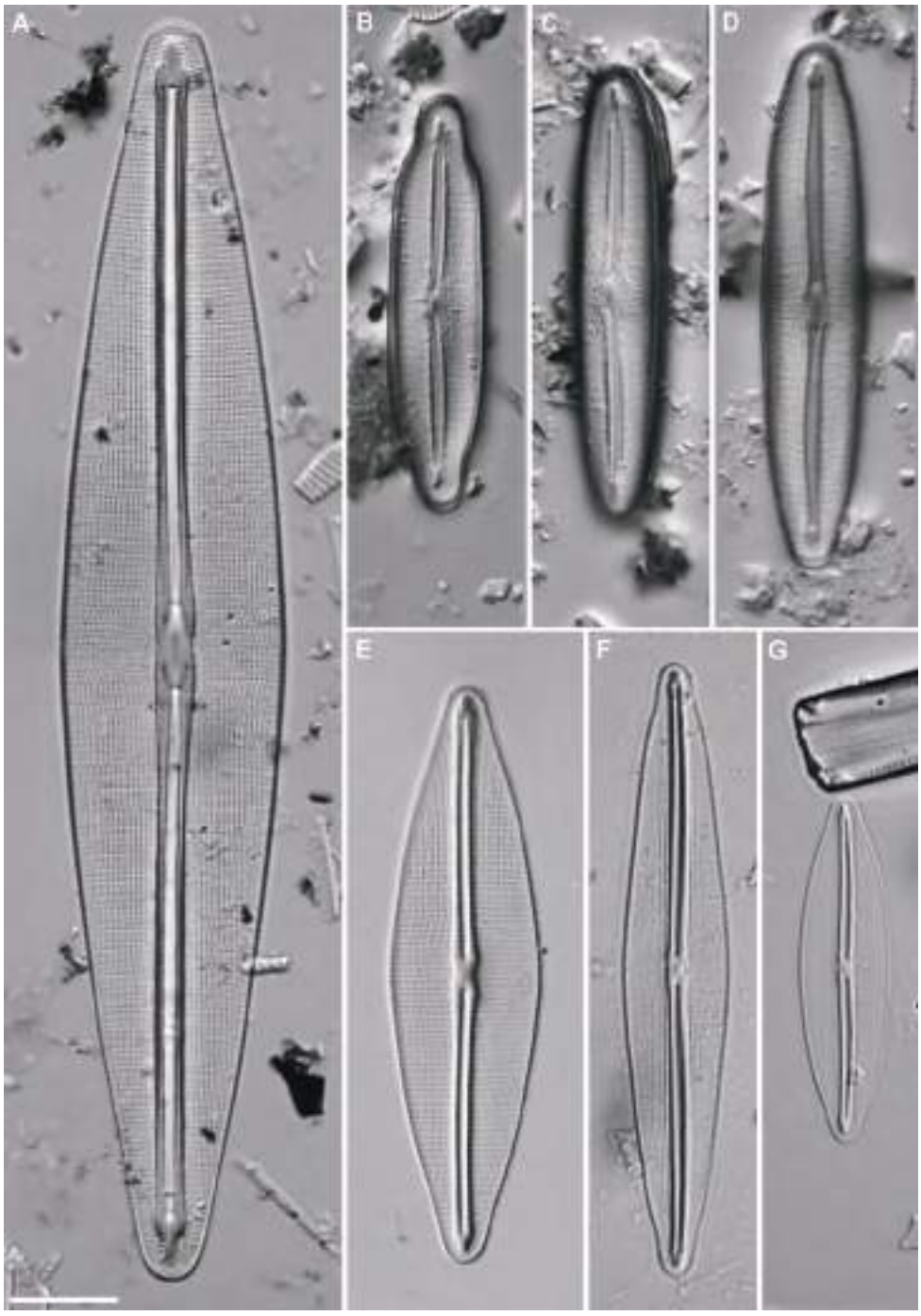


Fig. 115. *Frustulia* spp. **A-G.** LM, cleaned valves.
Scale bar = 10 µm (A-G).

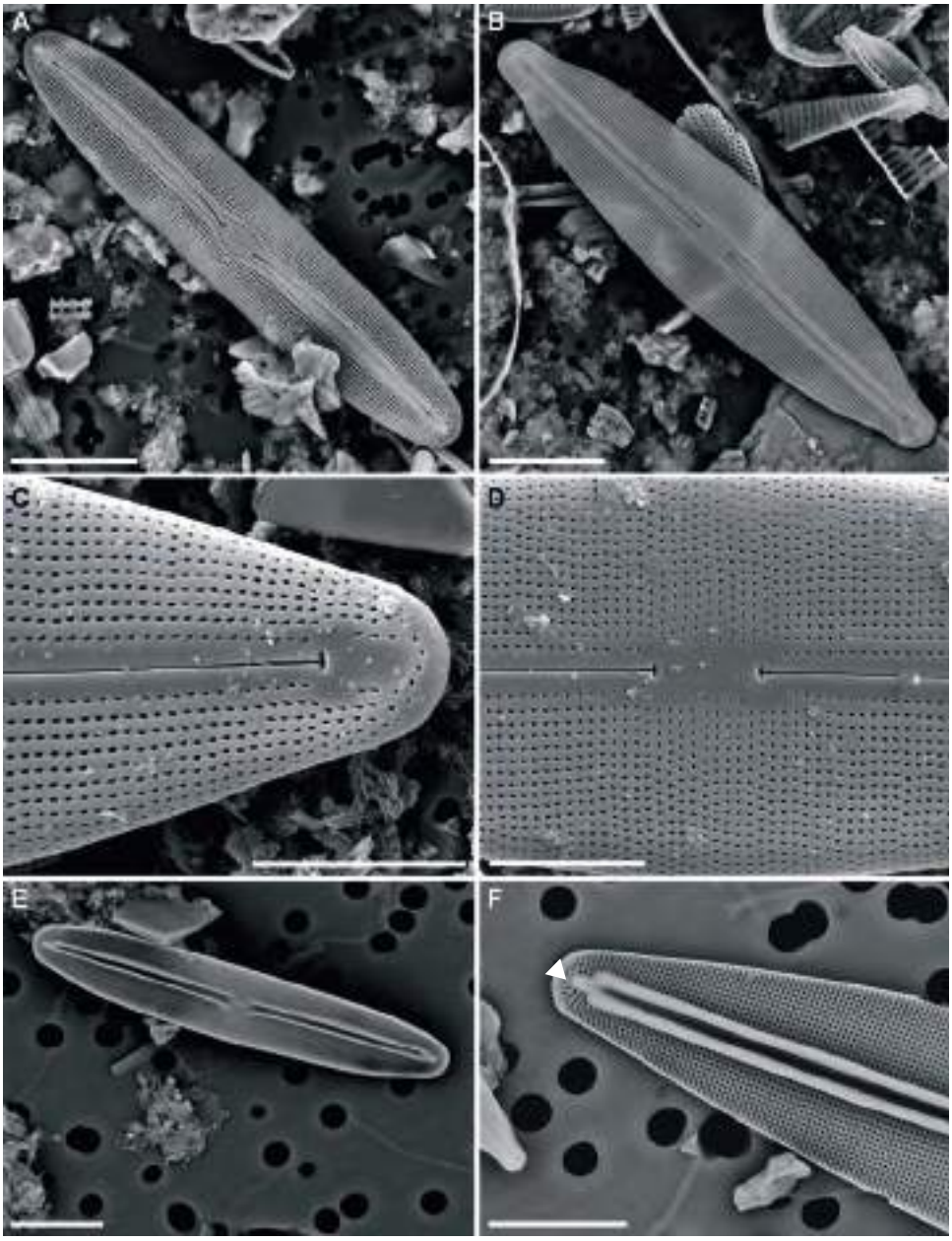


Fig. 116. *Frustulia* spp. **A-F.** SEM. **A.** *F. vulgaris* (Thwaites) De Toni, external view of valve. **B.** External view of valve of *Frustulia* sp. **C.** External view of valve, detail of apex. **D.** External view of valve, detail of central area, note T-shaped raphe endings. **E.** *F. vulgaris*, internal view of valve. **F.** *F. vulgaris*, internal view of valve, detail of apex, note helictoglossa (arrow).
Scale bars = 10 µm (A-B, E-F), 5 µm (C-D).

Brachysira Kützing 1836

Type species: *Brachysira aponina* Kützing

SYNONYM:

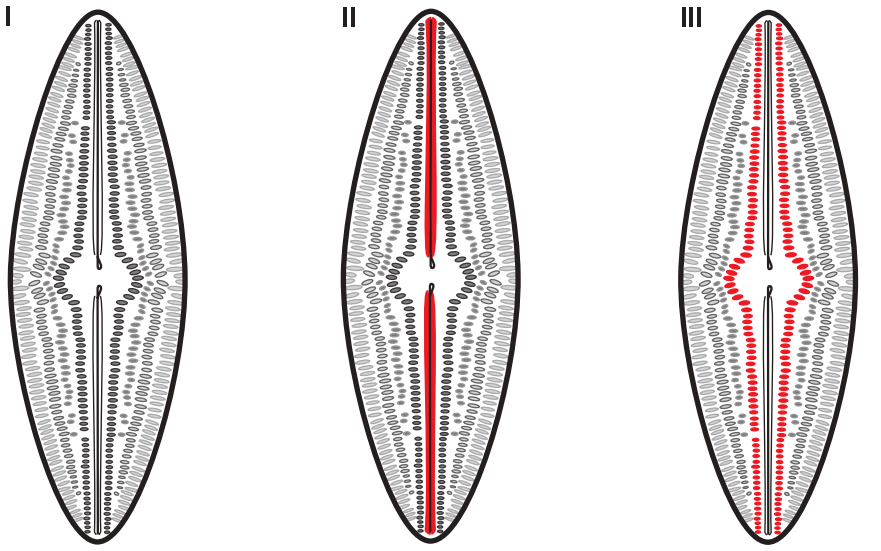
Anomoeoneis Pfitzer 1871 pro parte

Characteristics – Cells **biraphid**, size and shape variable, linear or linear-lanceolate sometimes cruciform, **biraphid** with raphe located between 2 distinct transapical ribs (II, Fig. 117: K, Fig. 118: B). Axial area very narrow. Areolae distinct and irregular in distribution creating undulating longitudinal lines (III).

Plastid structure – Single plastid with lobes extending under each valve face (Fig. 117: A-D). Large lipid droplets visible (Fig.117: B).

Identification of species – Species in this genus are distinguished based on cell size and shape and the shape of the apices. Size of the areolae is an important characteristic to consider as well as the presence or absence of a distinct swelling in the central area.

Ecology – Cells solitary and motile. Found in acidic oligotrophic waters.



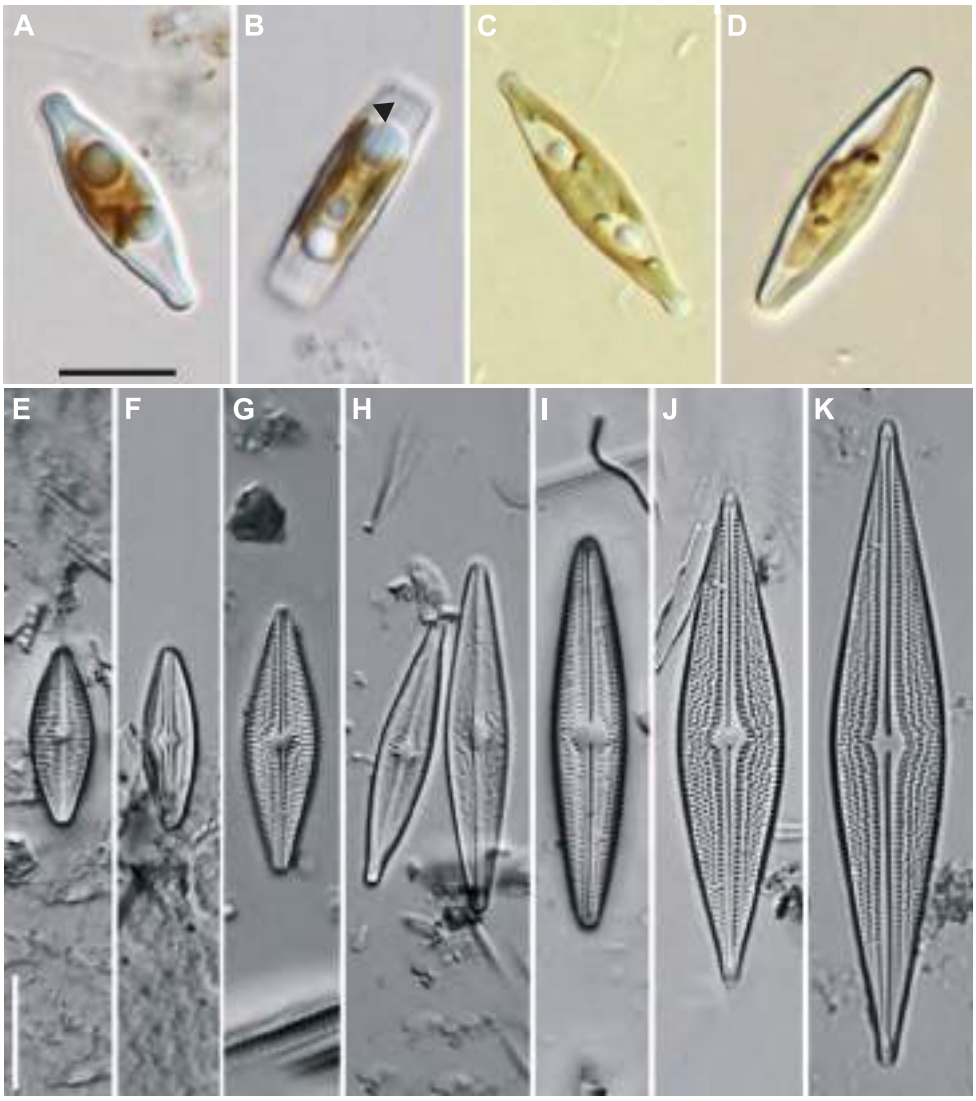


Fig. 117. *Brachysira* spp. **A-K.** LM. **A-D**. Living cells. **A, C-D.** Valve view. **B.** Girdle view, note large lipid droplets (arrow). **E-K.** Cleaned material showing valve views. Scale bars = 10 µm (A-K).

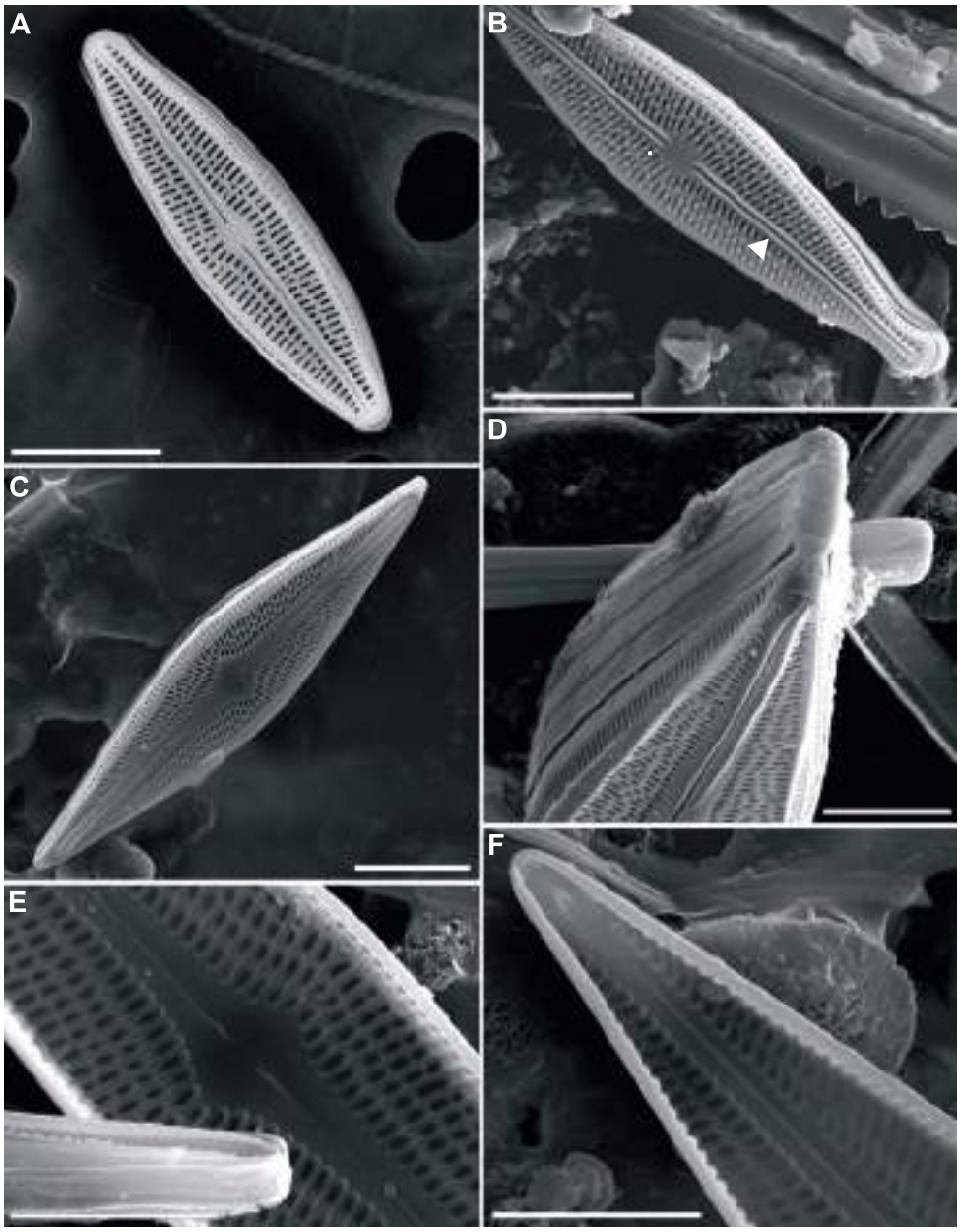


Fig. 118. *Brachysira* spp. **A-F.** SEM. **A-C.** External view of valve, note transapical rib (arrow **- B**). **D.** External view of valve, cell apex showing structure of terminal raphe ending. **E**. Internal view of valve showing central raphe endings. **F.** Internal view of valve showing terminal raphe ending and helictoglossa.
Scale bars = 5 µm (A-B, D-F), 10 µm (C).

Neidium Pfitzer 1871

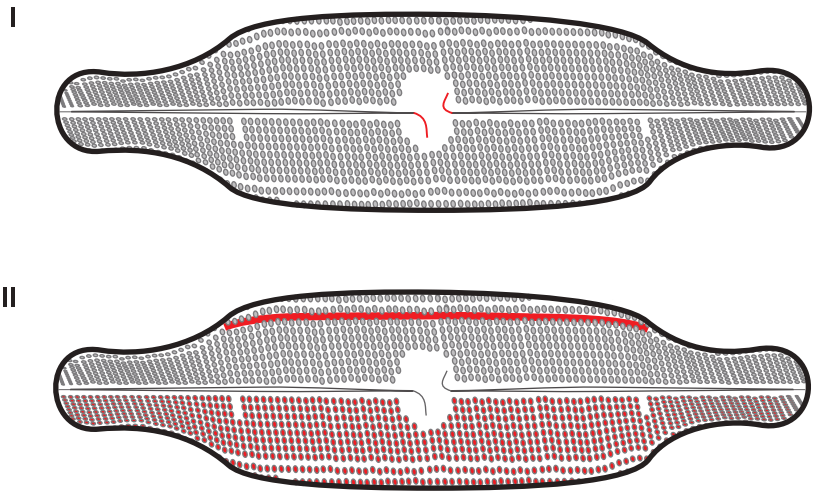
Type species: *Neidium affine* (Ehrenberg) Pfitzer

Characteristics – Cells **biraphid**, variable in size and outline, usually linear to linear elliptic with strongly protracted capitate or rostrate apices. Some taxa have undulate (Fig. 119: E) or tri-undulate valve margins and acutely rounded apices (Fig. 119: D). Striae are coarse, composed of single rows of easily discernable areolae. Striae may be convergent on the upper half of the valve and radiate on the lower half (II). Raphe has distinctive central endings, deflected in opposite directions, which can be hooked or curved or have one hooked and one curved ending (I; Fig. 120: A-C; Fig. 121: A, C). Striae interrupted near the margin by one or several longitudinal hyaline lines (II; Fig. 119: B-E, G-I; Fig. 120: A-C). Voight discordance is clearly discernable (II; Fig. 120: B; Fig. 121: B).

Plastid structure – Cells with 4 plastids each containing a pyrenoid and extending under the valve faces (Fig. 119: A).

Identification of species – Species can be identified by cell size, cell shape, shape of the apices, orientation and density of the striae as well as shape of the central area and the shape and curvature of the central raphe endings.

Ecology – Cells solitary, free living and motile. Found in the benthos of acidic and alkaline oligotrophic waters with moderate conductivities.



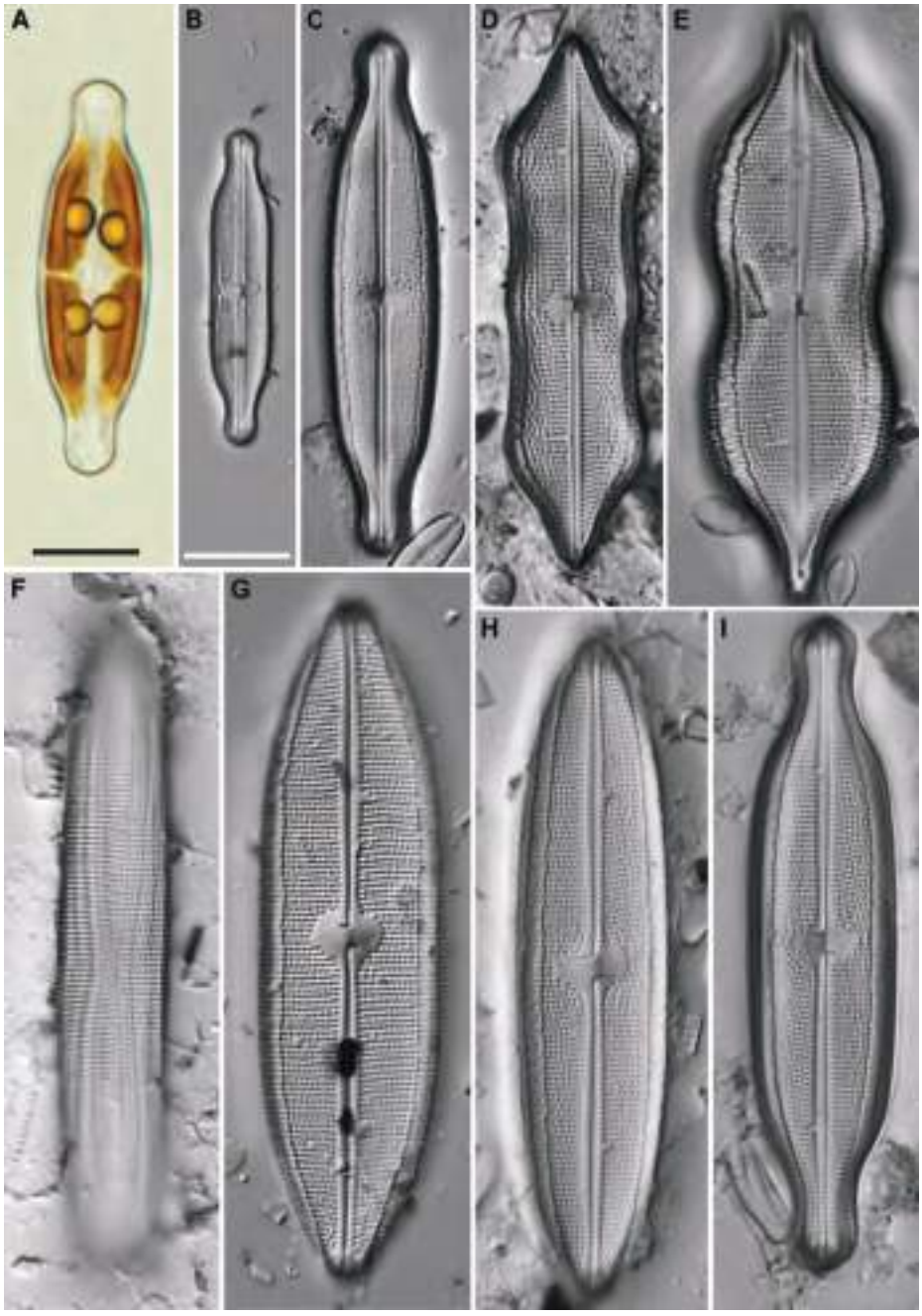


Fig. 119. *Neidium* spp. **A-I.** LM. **A.** Living cell, note the 4 plastids each bearing a pyrenoid. **B-I.** Cleaned valves. **B-E, G-I.** Valve views, note longitudinal hyaline lines near the valve margin. **F.** Girdle view.
Scale bars = 10 µm (A-I).

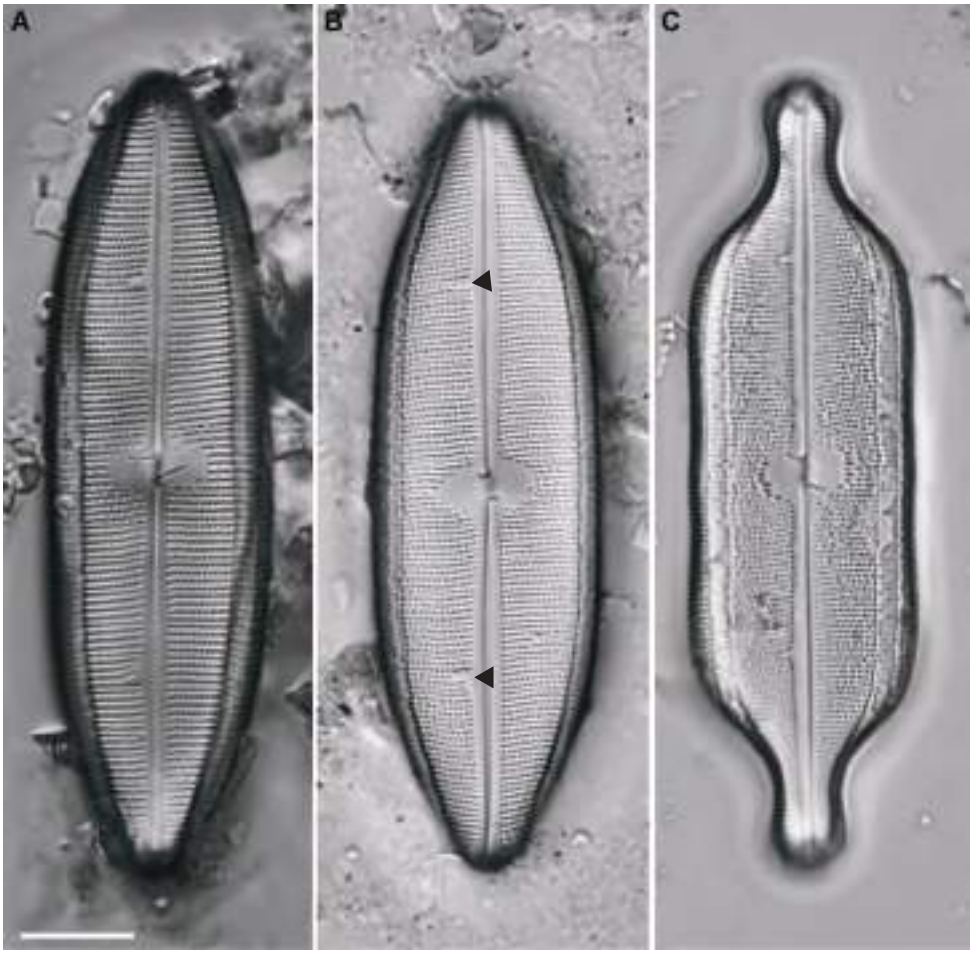


Fig. 120. *Neidium* spp. **A-C.** LM, valve views, note longitudinal hyaline lines near the valve margin and the Voight discordance (arrows - **B**).
Scale bar = 10 µm (A-C).

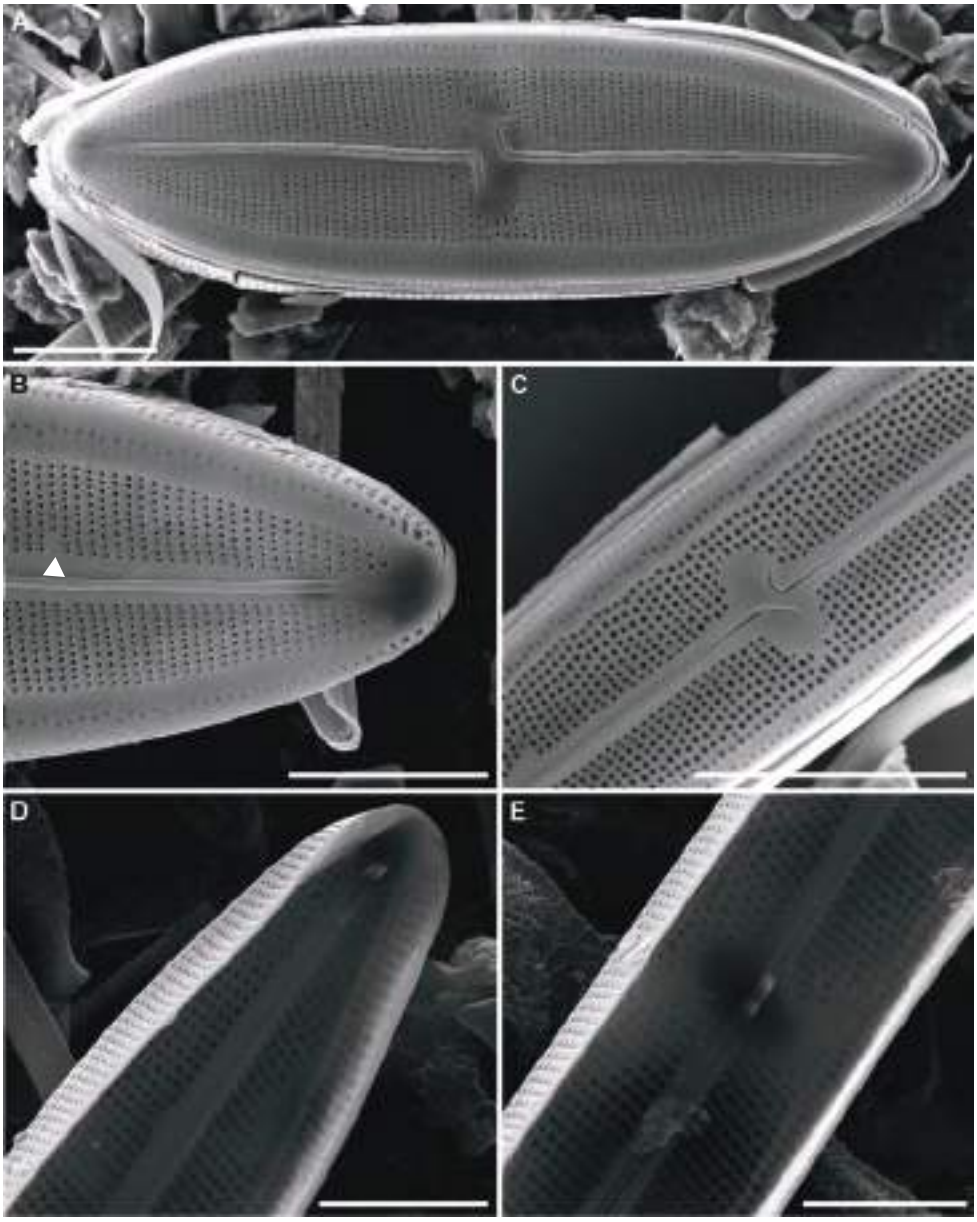


Fig. 121. *Neidium* spp. **A-E**. SEM. **A.** External view of entire valve. **B.** Detail of apex, note Voight discordance (arrow). **C.** Detail of central raphe endings, deflected in opposite directions, **D-E.** Internal view of valve.
Scale bars = 10 µm (A-C), 5 µm (D-E).

Fallacia Stickle 1990

Type species: *Fallacia pygmaea* (Kützing) Stickle & D.G. Mann

SYNONYM:

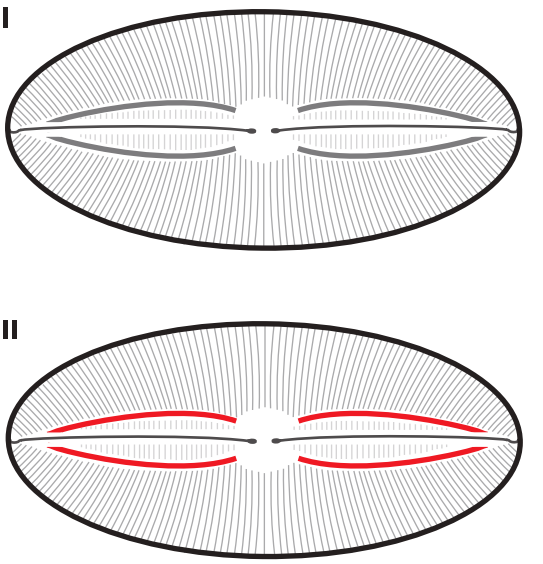
Navicula Bory 1822 pro parte

Characteristics – Cells **biraphid**, elliptical with broadly rounded apices. Striae fine, radiate throughout composed of single rows of areolae which may not be discernable under LM (Fig. 122: B-D). Raphe straight and complex, striae interrupted by H-shaped (lyre-shaped) hyaline area parallel to the raphe (II, Fig. 122: B-E).

Plastid structure – Cells with H-shaped plastid with 2 plates connected by a narrow isthmus (Fig. 122: A).

Identification of species – Up till now only one species known from tropical Africa: *Fallacia pygmaea.*

Ecology – Cells solitary, free living and motile. Found in the benthos of eutrophic waters with moderate to high conductivities.



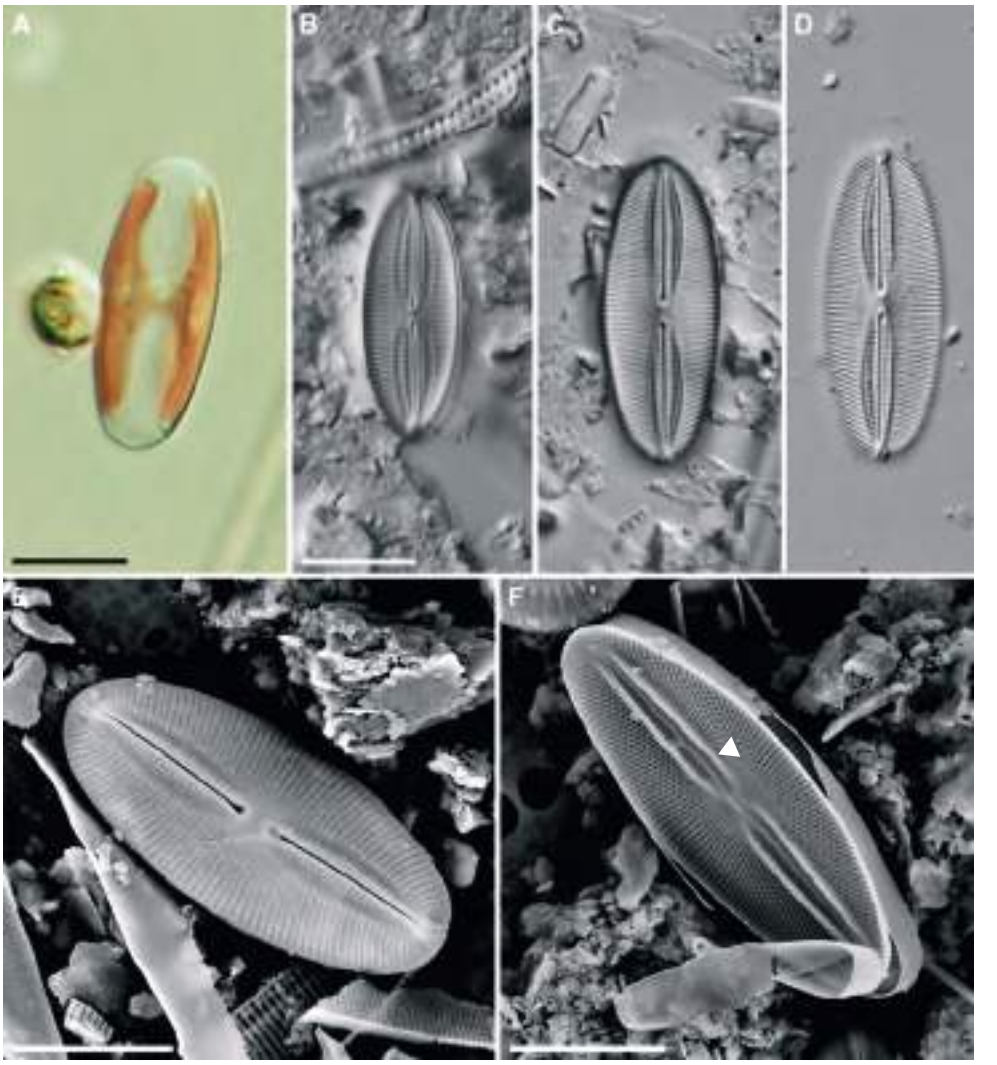


Fig. 122. *Fallacia pygmaea*. **A-D.** LM. **A.** Living cell, valve view. **B-D.** Valve views of cleaned material. **E-F.** SEM. **E.** External view of valve. **F.** Internal view of valve, note thickened silica ribs (arrow) in axial area which appear as hyaline lines in LM. Scale bars = 10 µm (A-D, F), 8 µm (E).

Pseudofallacia Y. Liu, Kociolek & Q.X. Wang 2012

Type species: *Pseudofallacia occulata* Y. Liu, Kociolek & Q.X. Wang

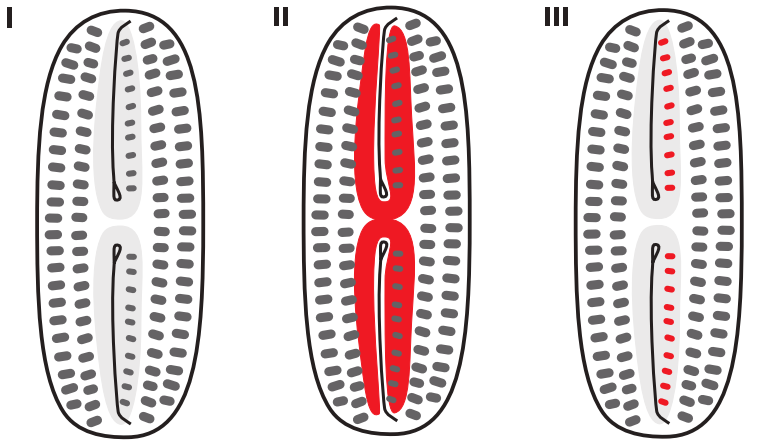
SYNONYM:
Fallacia Stickle & D.G. Mann 1990 pro parte
Navicula Bory 1822 pro parte

Characteristics – Cells **biraphid**, small in size, elliptical to linear elliptical with broadly rounded apices. Striae fine, radiate or parallel composed of single rows of areolae which may not discernable under LM (Fig. 123) or more robust (Fig. 123). Raphe straight and simple (Fig. 123) with H-shaped hyaline area parallel to the raphe (II). Longitudinal lines of isolated areolae are present adjacent to the raphe. Under SEM the conopeum has fine perforations (Fig. 123).

Plastid structure – Cells with one H-shaped plastid (Fig. 123).

Identification of species – Species can be identified by cell size, cell shape, structure and density of the striae as well as structure and extent of the H-shaped hyaline area.

Ecology – Cells solitary, free living and motile. Found in the benthos of oligotrophic to eutrophic waters in both low and moderate conductivities.



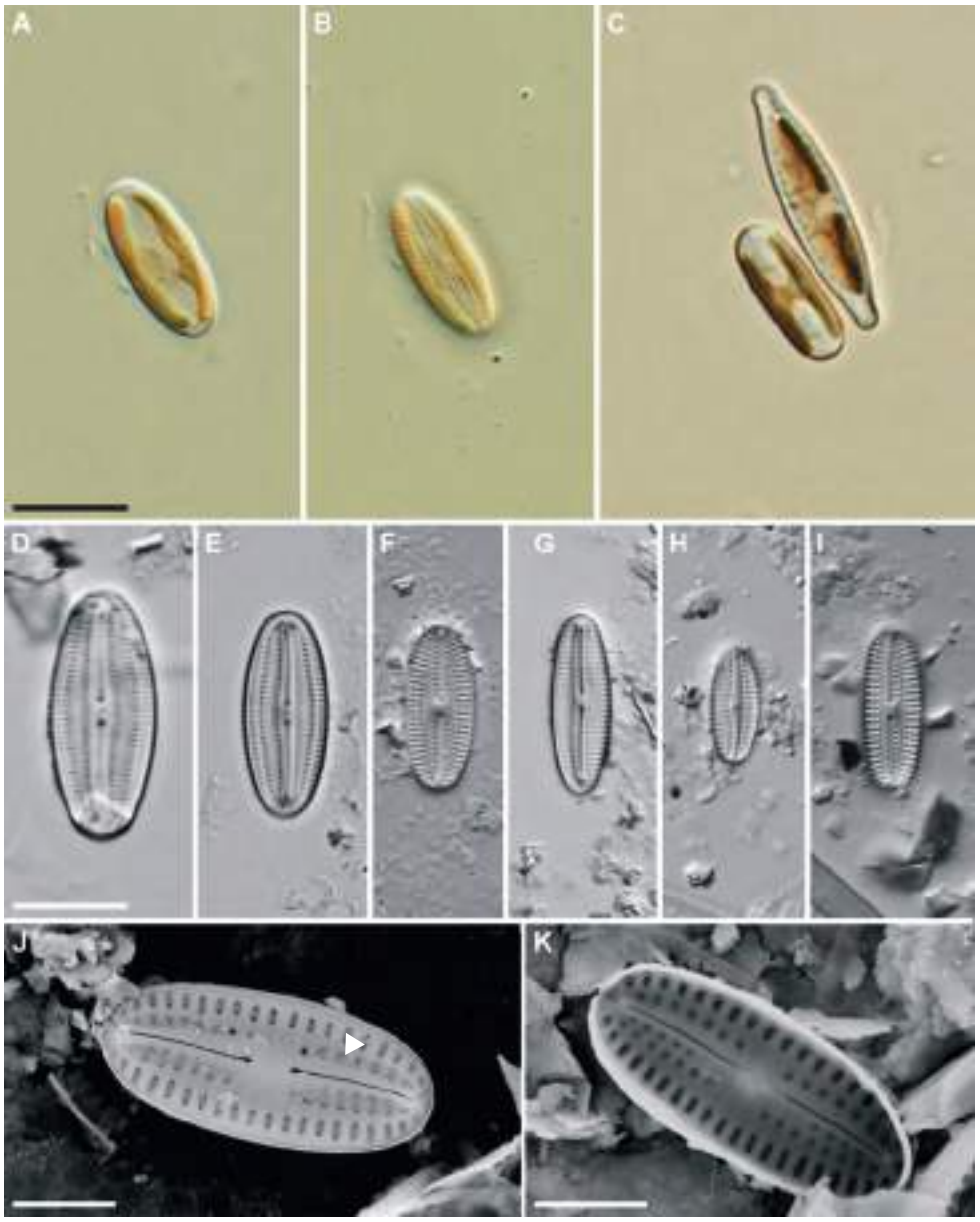


Fig. 123. *Pseudofallacia* spp. **A-I.** LM. **A-B.** Living cell, single cell, different foci. **C.** Living cell with typical H-shaped chloroplast. **D-I.** Valve views of *Pseudofallacia* species. **J-K.** SEM. **J.** External view of valve of *Fallacia* [*Pseudofallacia*] *umpatica* (Cholnoky) D.G. Mann, note conopeum covering external openings of areolae close to the axial area (arrow). **K.** Internal view of valve of *Fallacia [Pseudofallacia] umpatica.*
Scale bars = 10 µm (A-I), 3 µm (J-K).

Sellaphora Mereschkowsky 1902

Type species: *Sellaphora pupula* (Kützing) Mereschkowsky

SYNONYM:

Navicula Bory 1822 pro parte

Characteristics – Cells **biraphid**, with broadly rounded to sub-capitate apices. Striae fine but discernable under LM (Fig. 125), composed of single rows of small round areolae. Raphe straight and simple (Fig. 125) carried in a sternum, terminal raphe endings extend onto the valve mantle. Thickened bars of silica present at the poles (II; Fig. 126: F) on the valve interior in most taxa, which appear as hyaline areas on the valve exterior (Fig. 125: I-J; Fig. 126: A). Central area is usually rectangular and well delimited.

Plastid structure – Cells with 2 plate-like plastids, one along each side of the girdle with central bridge (Fig. 124). Large lipid bodies present.

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 and curvature of the terminal raphe endings.

Ecology – Cells solitary, free living and motile, occasionally planktonic. Found in the benthos of eutrophic to hypereutrophic waters with moderate to high conductivities.

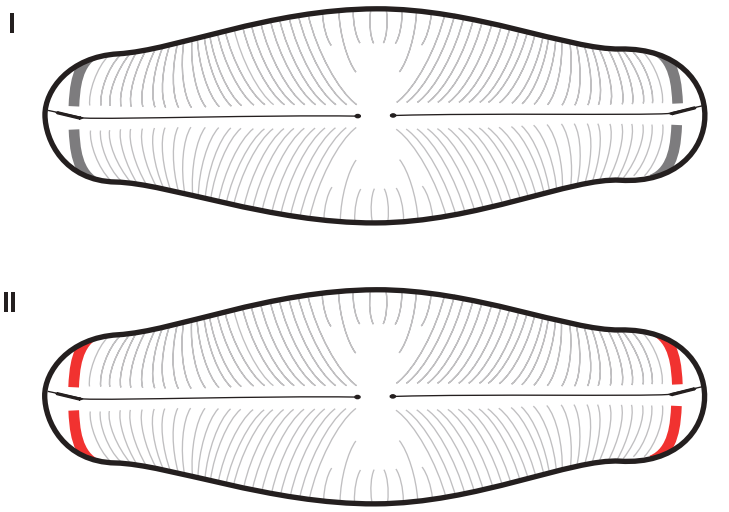


Fig. 124. *Sellaphora* spp. **A-D.** LM, living cells. **A-C.** *Sellaphora pupula* sensu lato, note lipid bodies. **D.** *Sellaphora seminulum* (Grunow) D.G. Mann. Scale bars = 10 µm (A-D).

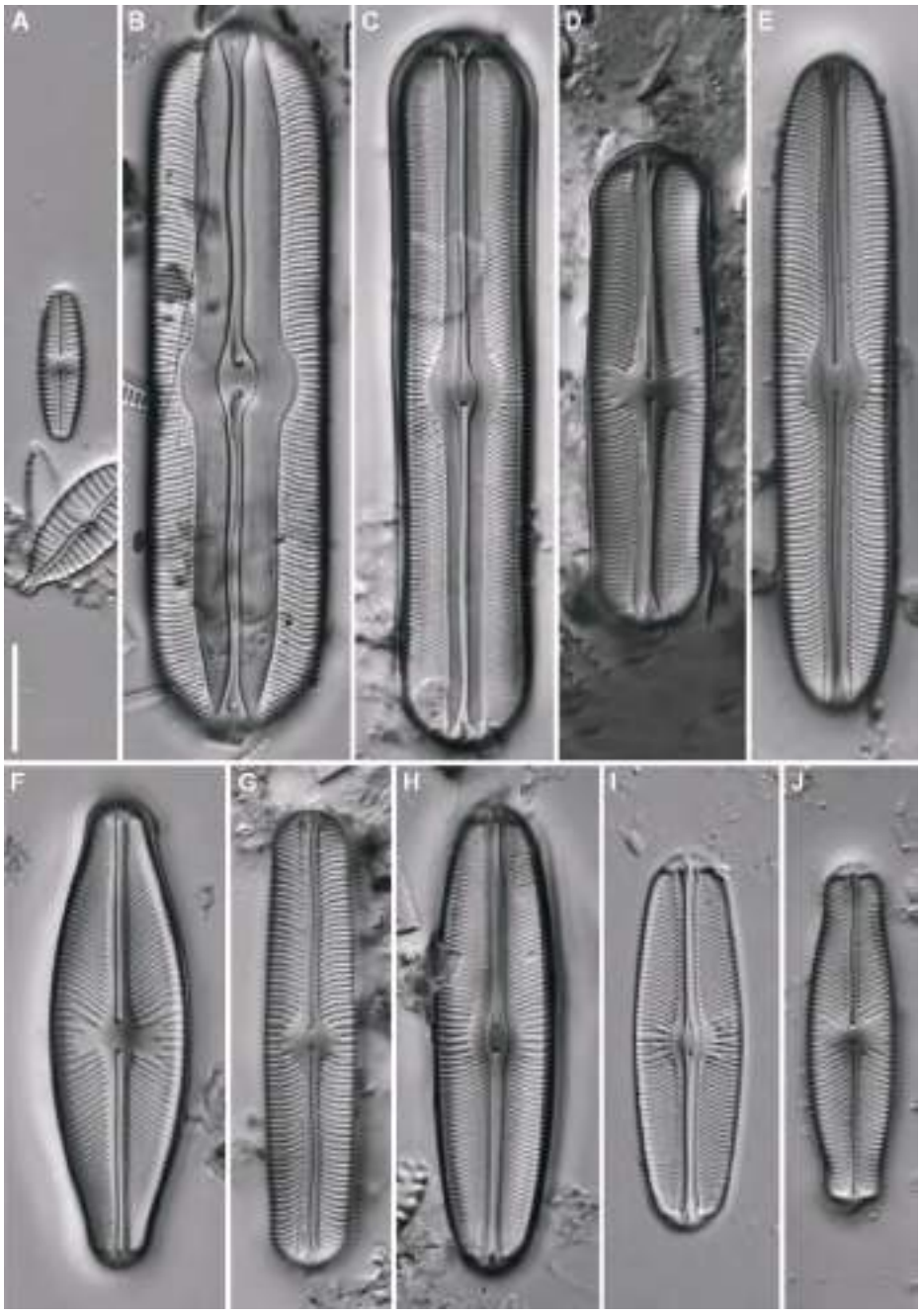


Fig. 125. *Sellaphora* spp. **A-J.** LM, cleaned valves. **A.** *Sellaphora seminulum*. **B.** *Sellaphora americana* (Ehrenberg) D.G. Mann. **F.** *Sellaphora nyassensis* (O. Müller) D.G. Mann. **J.** *Sellaphora pupula* sensu lato. Scale bar = 10 µm (A-J).

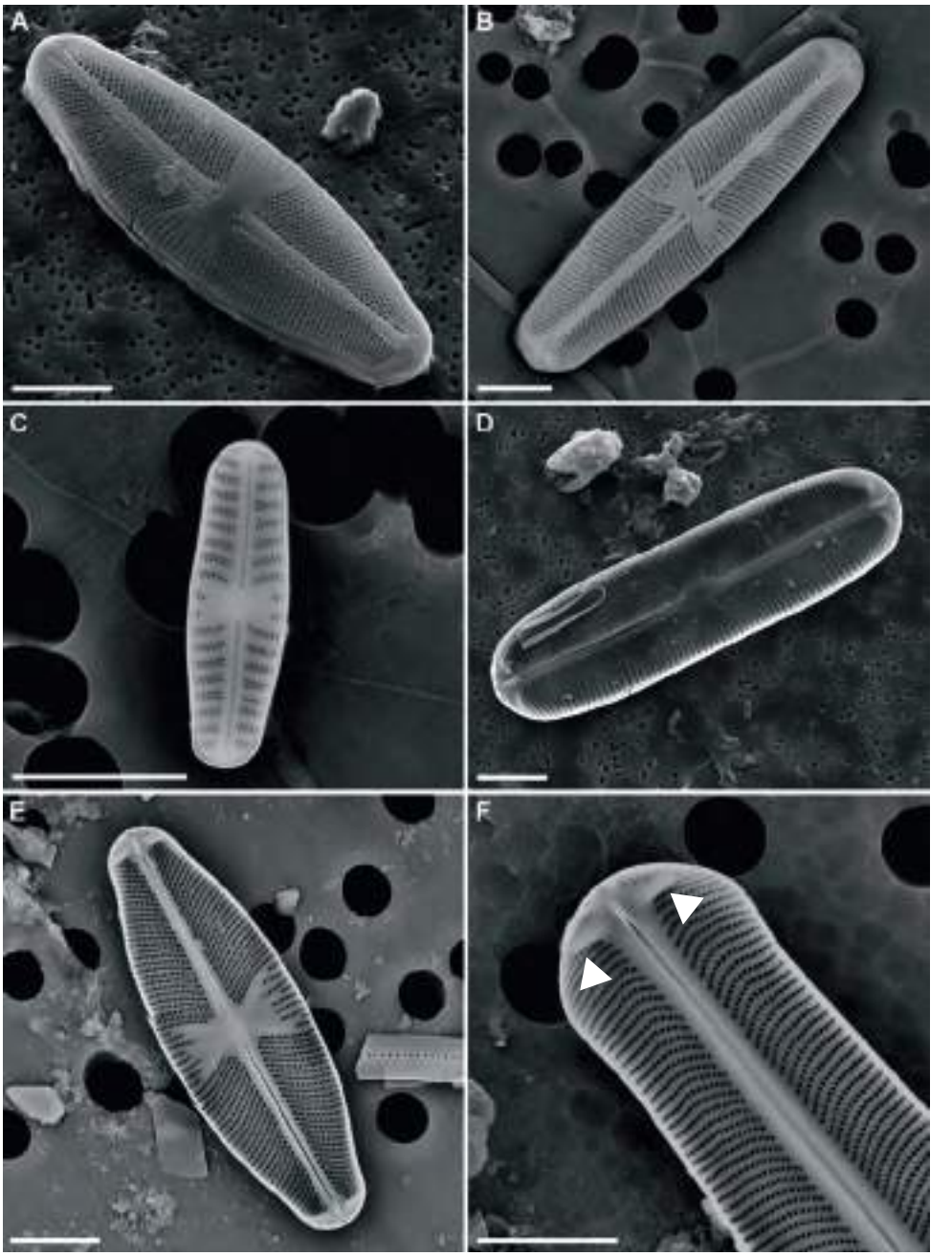


Fig. 126. *Sellaphora* spp. **A-F.** SEM. **A-B.** *Sellaphora* spp., external view of valves. **C.** *Sellaphora seminulum*, external view of valve. **D-F.** *Sellaphora* spp., internal view of valves, note silica bars (arrows - **F**).
Scale bars = 5 µm (A-F).

Caloneis Cleve 1894

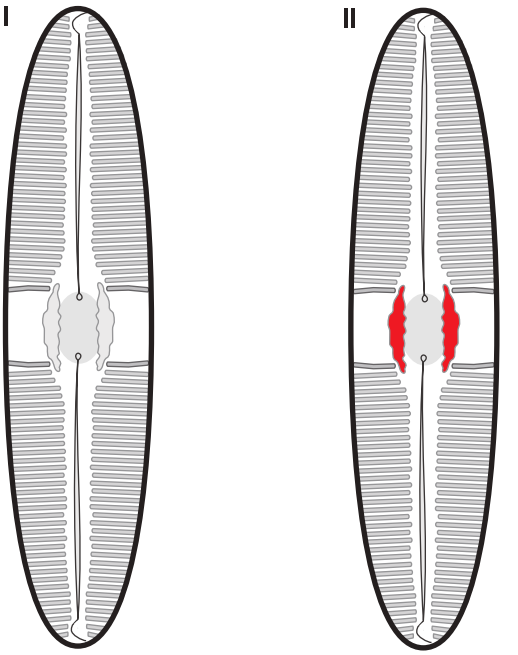
Type species: *Caloneis amphisbaena* (Bory) Cleve

Characteristics – Cells size and shape variable and may be strongly triundulate (Fig. 127: I), **biraphid**. Tube striae are present, individual areolae cannot be observed under LM. Central area broad usually reaching the valve margins and often bearing irregular depressions in the valve face (II).

Plastid structure – Cells with one plastid with a narrow bridge across the centre of the cell (Fig. 127: A) or two plastids along the girdle sides. Large lipid droplets visible.

Identification of species – Species in this genus are distinguished based on cell size and shape (especially valve outline), striae density, the shape of the apices, the shape of the central area and structure of the depressions found in the central area (II).

Ecology – Cells solitary and motile. Found in acidic and alkaline waters across all trophic levels.



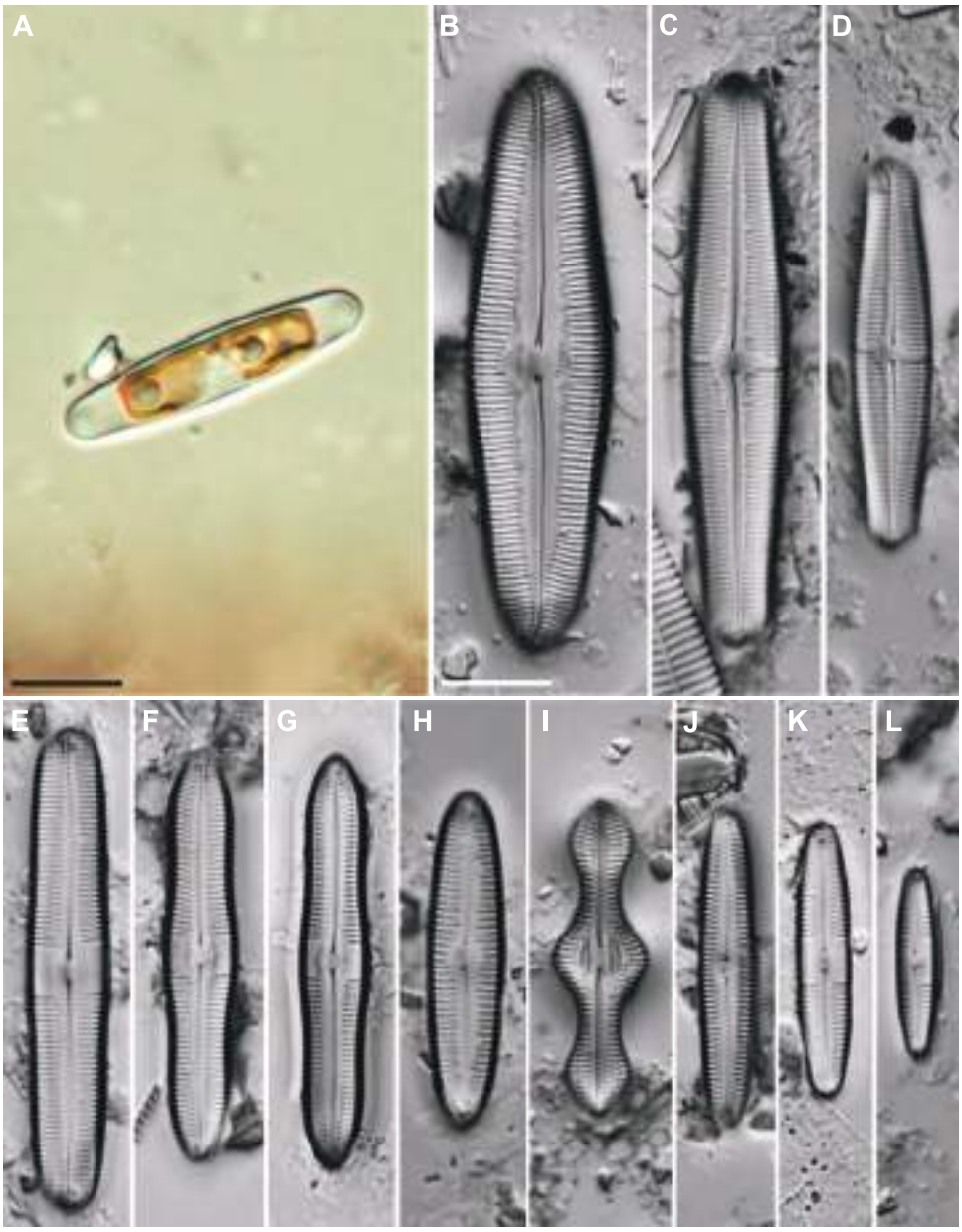


Fig. 127. *Caloneis* spp. **A-L.** LM. **A.** Living cell, valve view. **B-L.** Cleaned material, illustrating various taxa.
Scale bars = 10 µm (A-L).

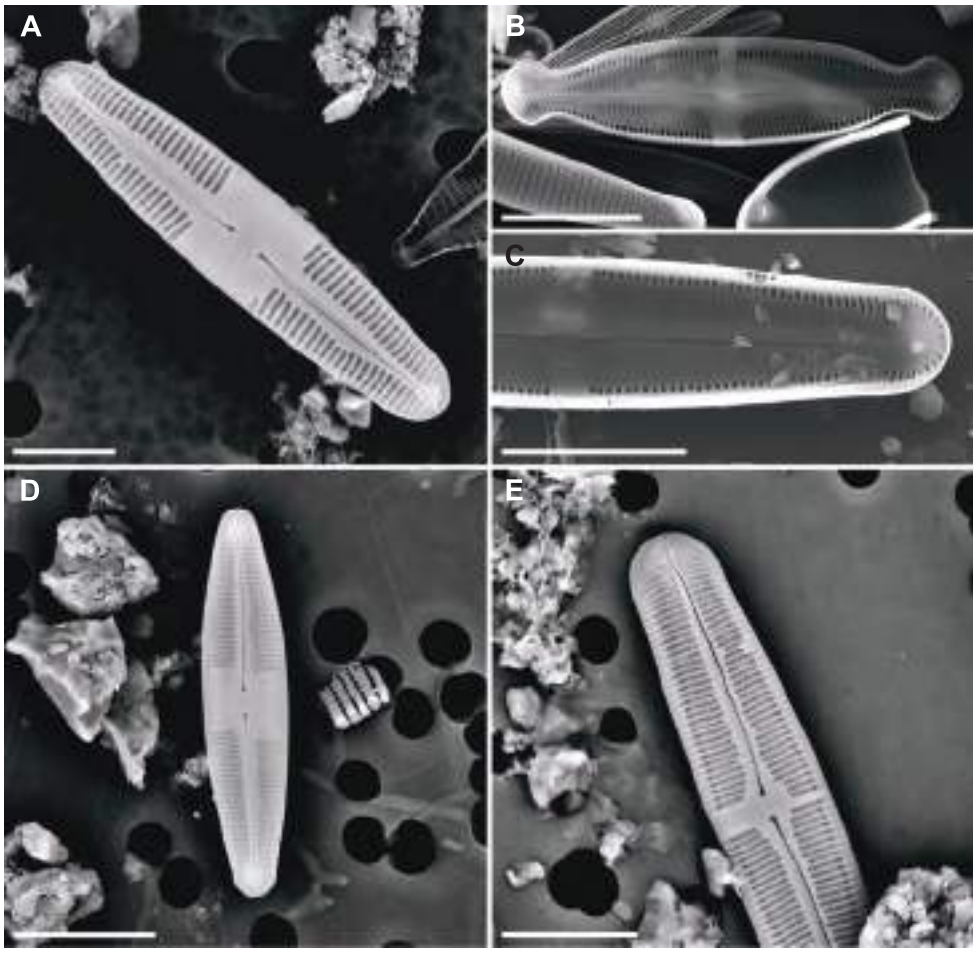


Fig. 128. *Caloneis* spp. **A-E.** SEM. **A, E.** External view of valve showing structure of tube striae. **B-C.** Internal view of valve showing internal occlusion of the striae, these occlusions appear as longitudinal lines in LM. **D.** External view of valve of *Caloneis hyalina* Hustedt.
Scale bars = 5 µm (A), 10 µm (B-C), 8 µm (D-E).

Pinnularia Ehrenberg 1843

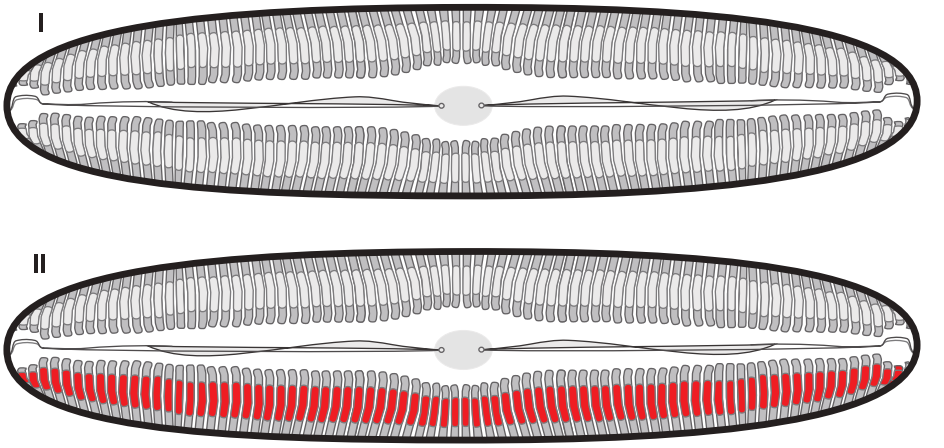
Type species: *Pinnularia viridis* (Nitzsch) Ehrenberg

Characteristics – Cells **biraphid**, can be very large in size, valve shape generally linear to linear-elliptical with broadly rounded, capitate or sub-capitate apices. Striae **alveolate**, easily discernable under LM (Fig. 130; Fig. 131) and composed or numerous small round areolae (Fig. 132: C). Raphe system complex or simple. Central area may be expanded and reach both valve margins. Sometimes longitudinal lines are present (II).

Plastid structure – A range of chloroplast types, usually 2 plate-like plastids, and one along each side of the girdle (Fig. 129). Plastids may be undulate (Fig. 129: C). Many scattered lipid bodies present.

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 and extent of the central and axial areas and the structure and curvature of the central and terminal raphe endings.

Ecology – Cells solitary, free living and motile. Abundant in slightly acidic, oligotrophic waters with low conductivity. Some taxa are found in eutrophic conditions and others are considered typical of sub-aerial habitats.



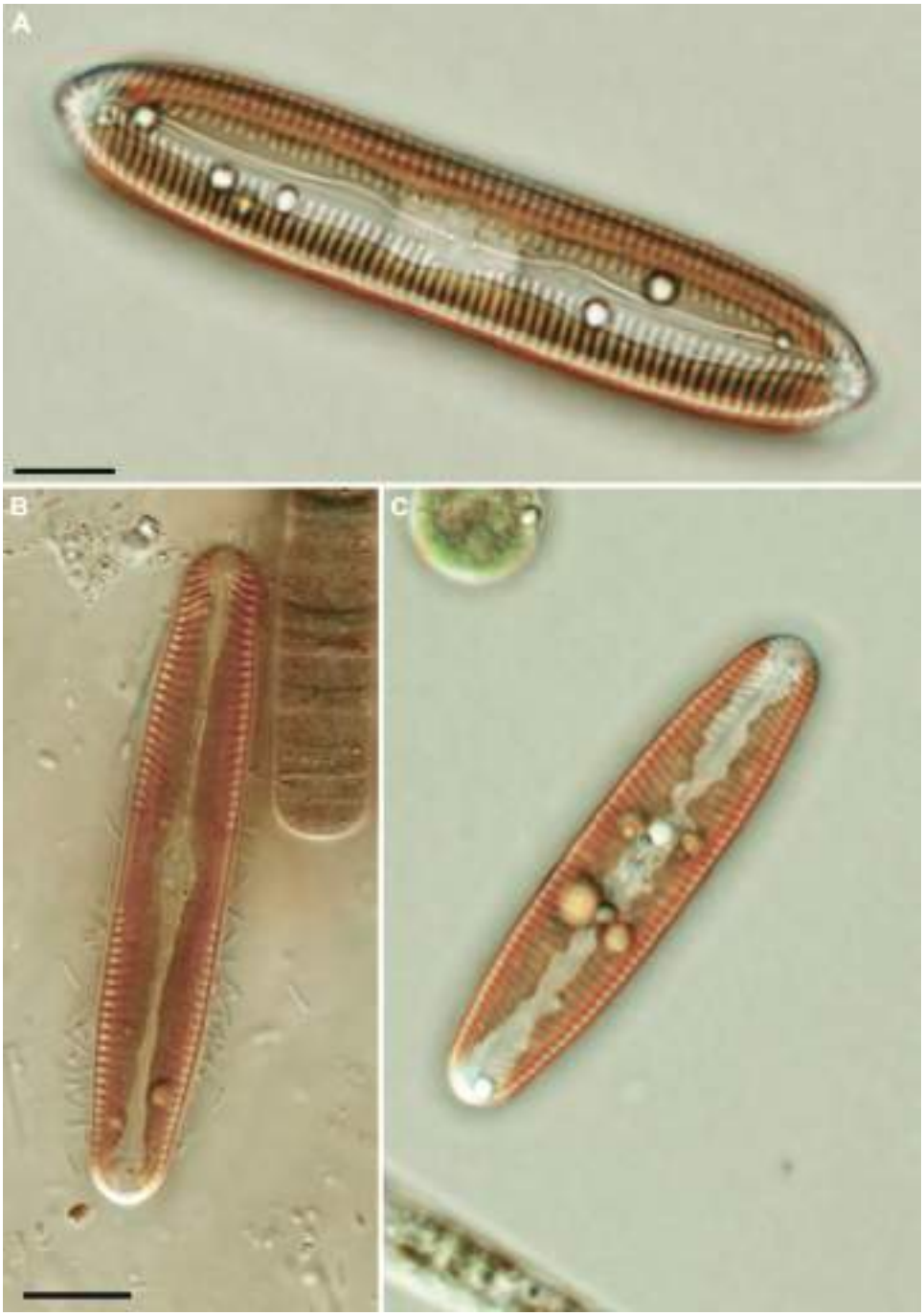


Fig. 129. *Pinnularia* spp. **A-C.** LM, living cells, note the scattered lipid bodies. **C.** undulate plastid.
Scale bars = 10 µm (A-C).

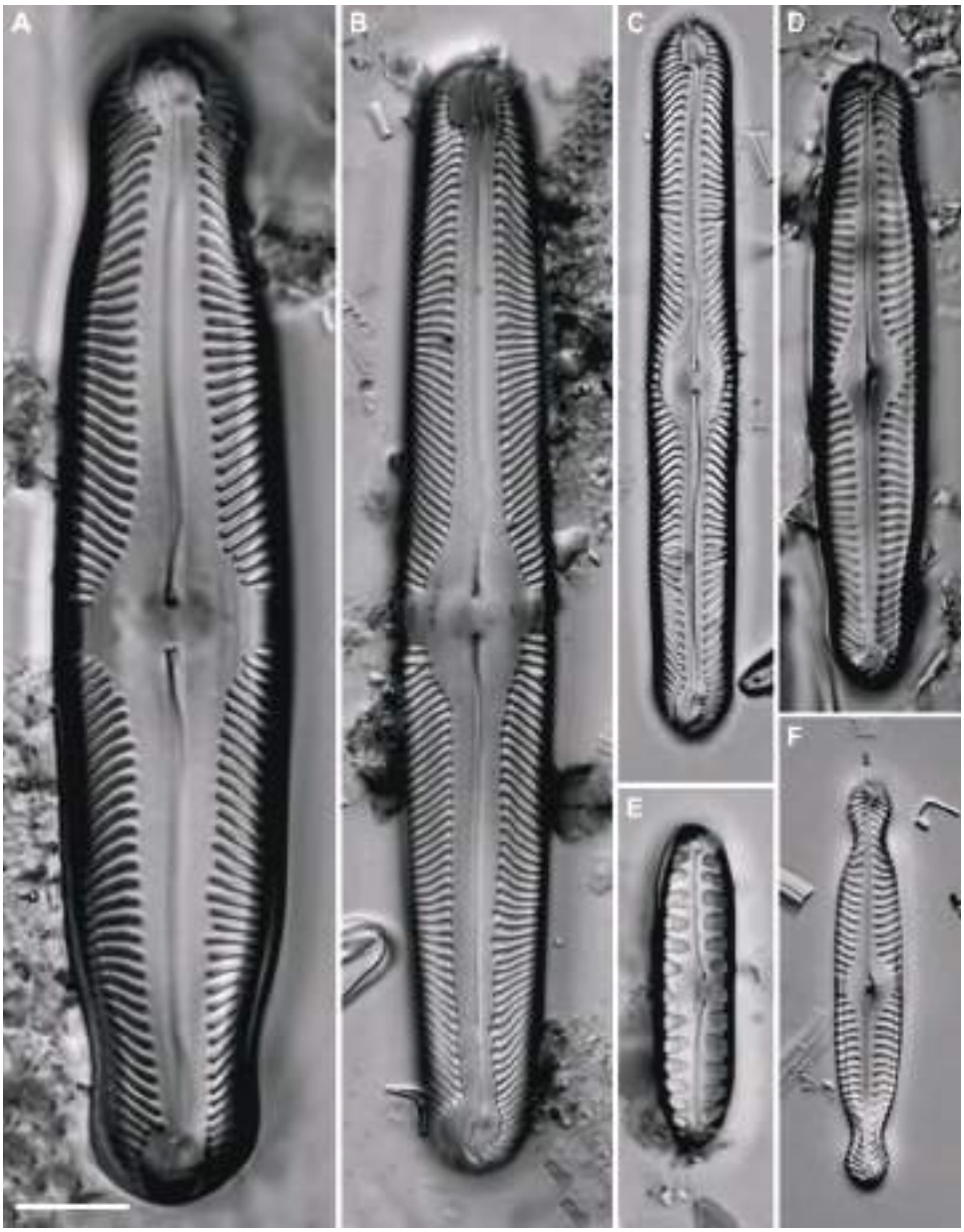


Fig. 130. *Pinnularia* spp. **A-F**. LM, valve views of cleaned material. **E.** *P. borealis* Ehrenberg sensu lato.
Scale bar = 10 µm (A-F).

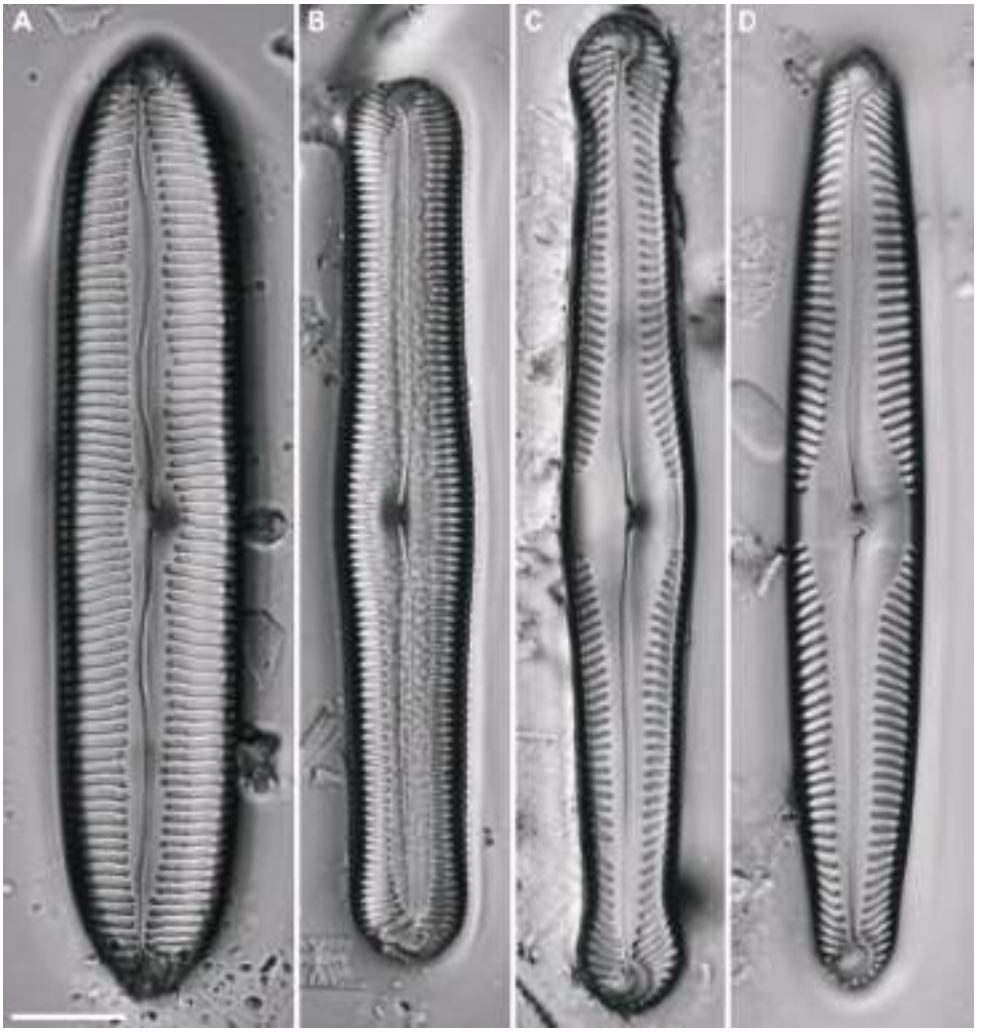


Fig. 131. *Pinnularia* spp. **A-D**. LM, valve views of cleaned material. **B.** *P. acrosphaeria* (Brébisson) Rabenhorst. Scale bar = 10 µm (A-D).

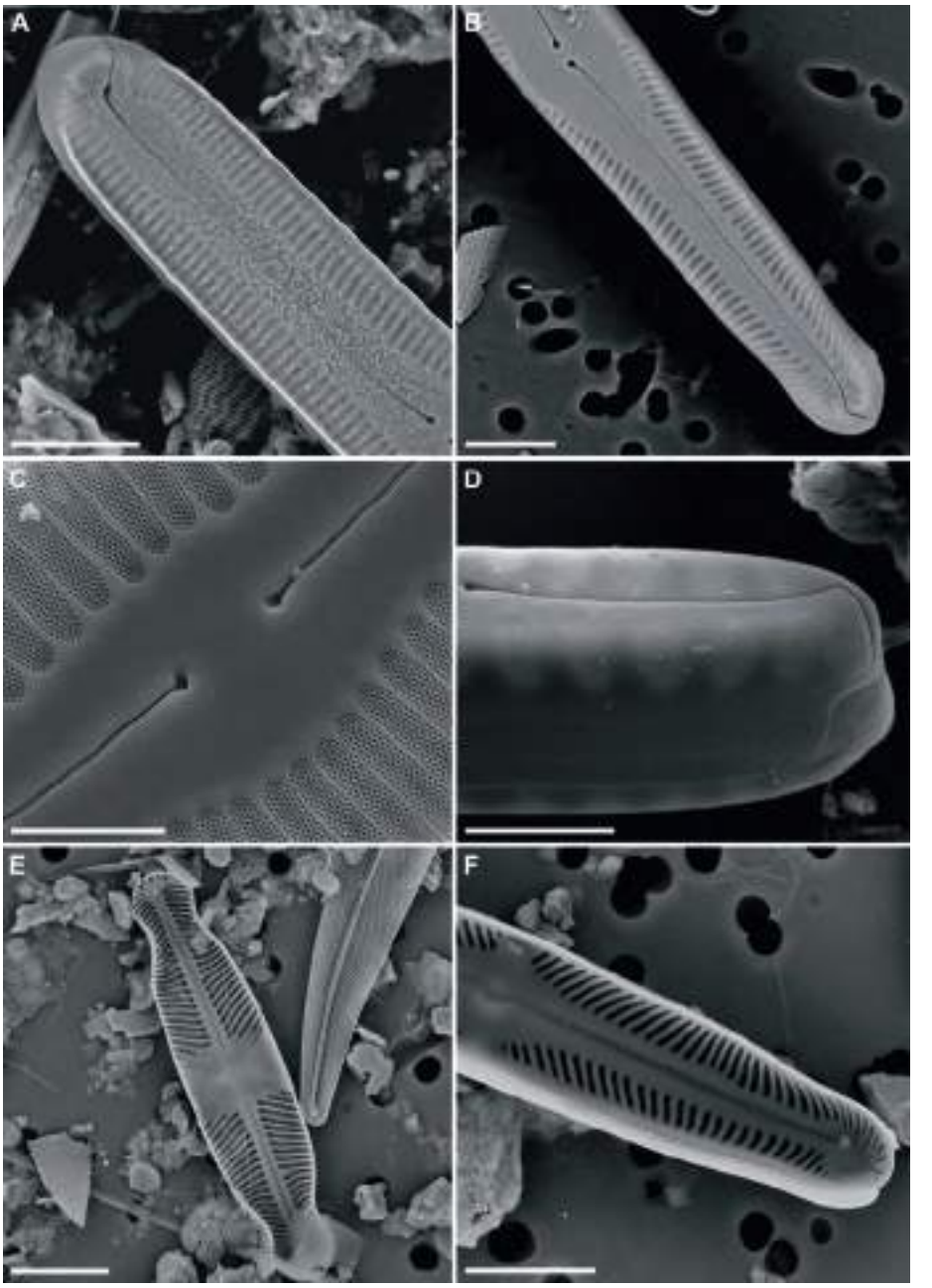


Fig. 132. *Pinnularia* spp. **A-F.** SEM. **A-D.** External view of valves. **A.** *P. acrosphaeria*, note irregular silica ornamentations in axial area. **B.** Detail of central and terminal raphe ending. **C.** Detail of central raphe endings and striae, composed of numerous small round areolae. **D.** Mantle view. **E-F.** Internal view of valves, note the alveolate striae.
Scale bars = 10 µm (A, B, E, F), 5 µm (C, D).