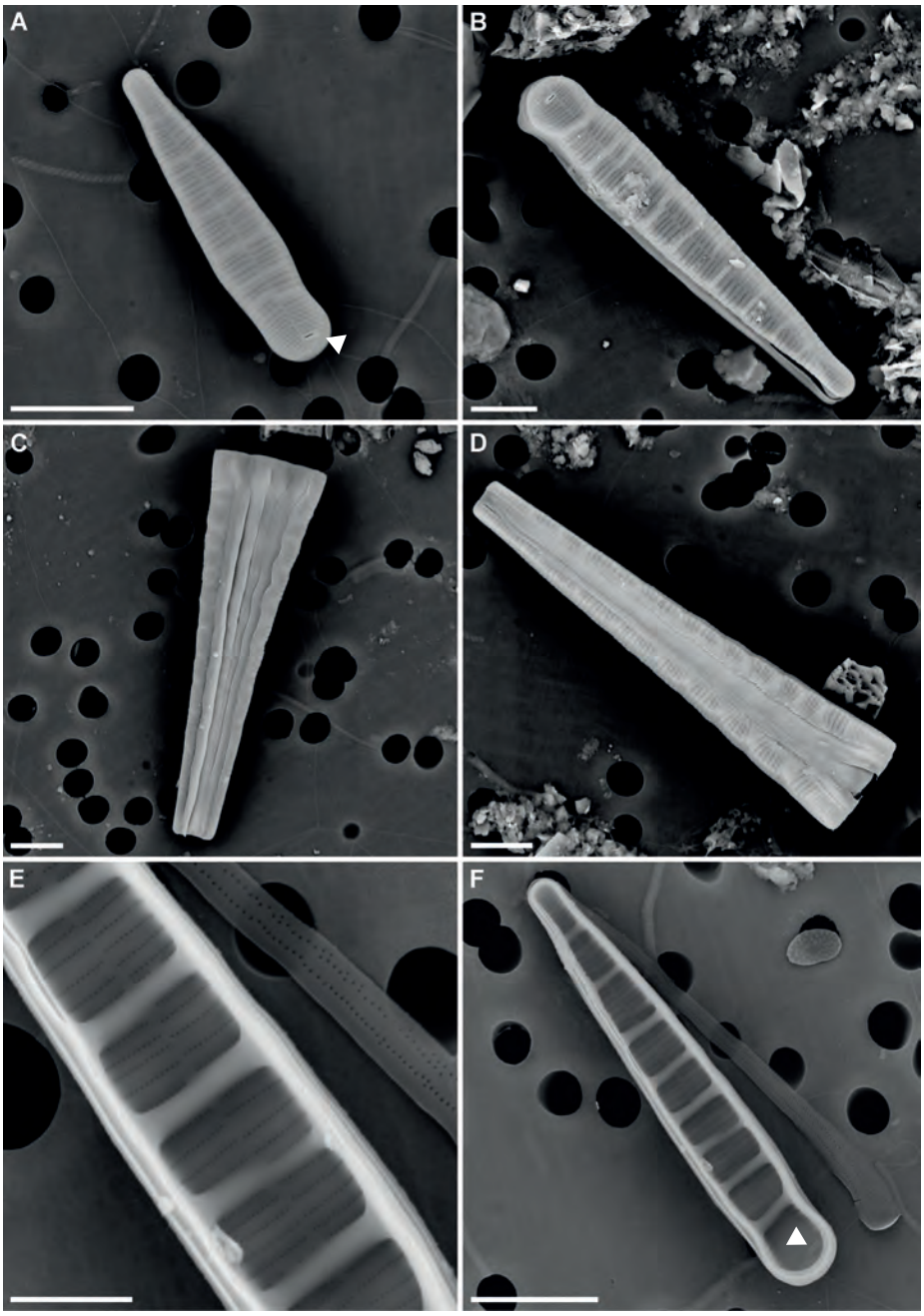


Fig. 44. *Meridion circulare* var. *constrictum*. **A-F**. SEM. **A-B.** External view of valve, note the rimoportula near the head pole apical (arrow **- A**). **C-D.** External view of girdle. **E-F.** Internal view of valve, note the internal opening of the rimoportula (arrow **- F**).
Scale bars = 10 µm (A-D), 3 µm (E), 8 µm (F).

Pseudostaurosira D.M. Williams & Round 1987

Type species: *Pseudostaurosira brevistriata* (Grunow) D.M. Williams & Round

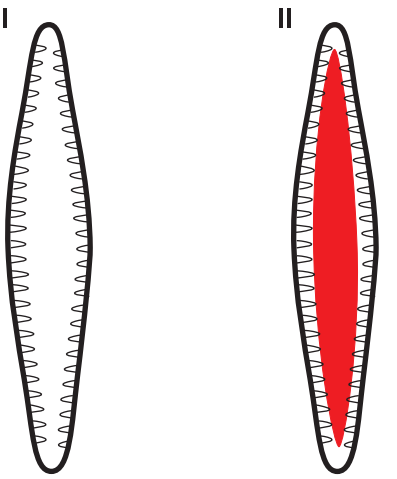
SYNONYM:
Fragilaria Lyngbye 1819 pro parte
Odontella C. Agardh 1832 pro parte

Characteristics – Cells **araphid** with short parallel striae through the length of the valve, areolae fine, not easily observed under LM (Fig. 45). **Axial area** broad, lanceolate. Spines may be present on junction of the valve face and valve mantle. Apical pore field at each pole.

Plastid structure – Cells with plate-like plastids one lying under each valve face (see *Fragilaria*).

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 axial area.

Ecology – Cells colonial, valve face to valve face forming ribbons or basally attached. Found in the benthos of waters with low to high conductivity and at a range of trophic levels.



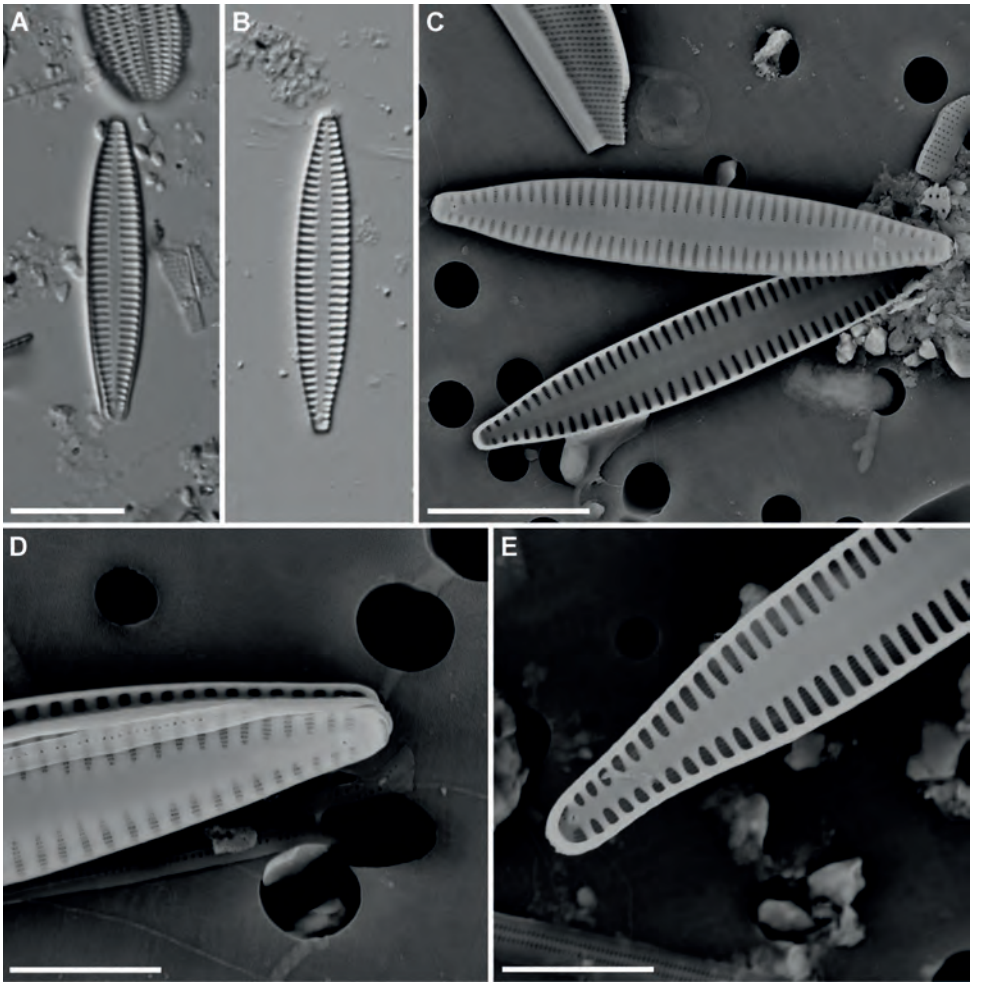


Fig. 45. *Pseudostaurosira brevistriata*. **A-B**. LM, valve view. **C-E.** SEM. **C.** External and internal view of valve. **D.** External view of valve apex. **E.** Internal view of valve apex.
Scale bars = 10 µm (A-C), 3 µm (D), 5 µm (E).

Staurosira Ehrenberg 1843

Type species: *Staurosira construens* Ehrenberg

SYNONYM:

Fragilaria Lyngbye 1819 pro parte

Characteristics – Cells **araphid**, elliptical or cruciform with robust parallel to radiate striae (II) through the length of the valve, areolae round to slightly elongate (Fig. 47: O-P), not easily observed under LM (Fig. 47: A-G, I-N). **Axial area** of variable width. Apical pore fields at one or both apices. Rimoportula absent. Spines present at the junction of the valve face and mantle. Distinguished from *Staurosirella* by the structure of the areolae (rounded).

Plastid structure – Cells with 2 plate-like plastids lying along the girdle (Fig. 46).

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 axial area.

Ecology – Cells colonial, linked valve face to valve face by spines forming ribbons (Fig. 46: A-B). Found in the benthos of waters with low to moderate conductivity and at a range of trophic levels.

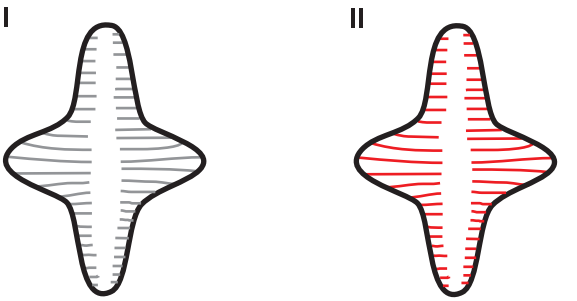


Fig. 46. *Staurosira construens*. **A-D.** LM, living cells. **A-B, D.** Cells linked valve face to valve face forming ribbon colonies. **C.** Valve view (right) and girdle view (above).
Scale bars = 10 µm.

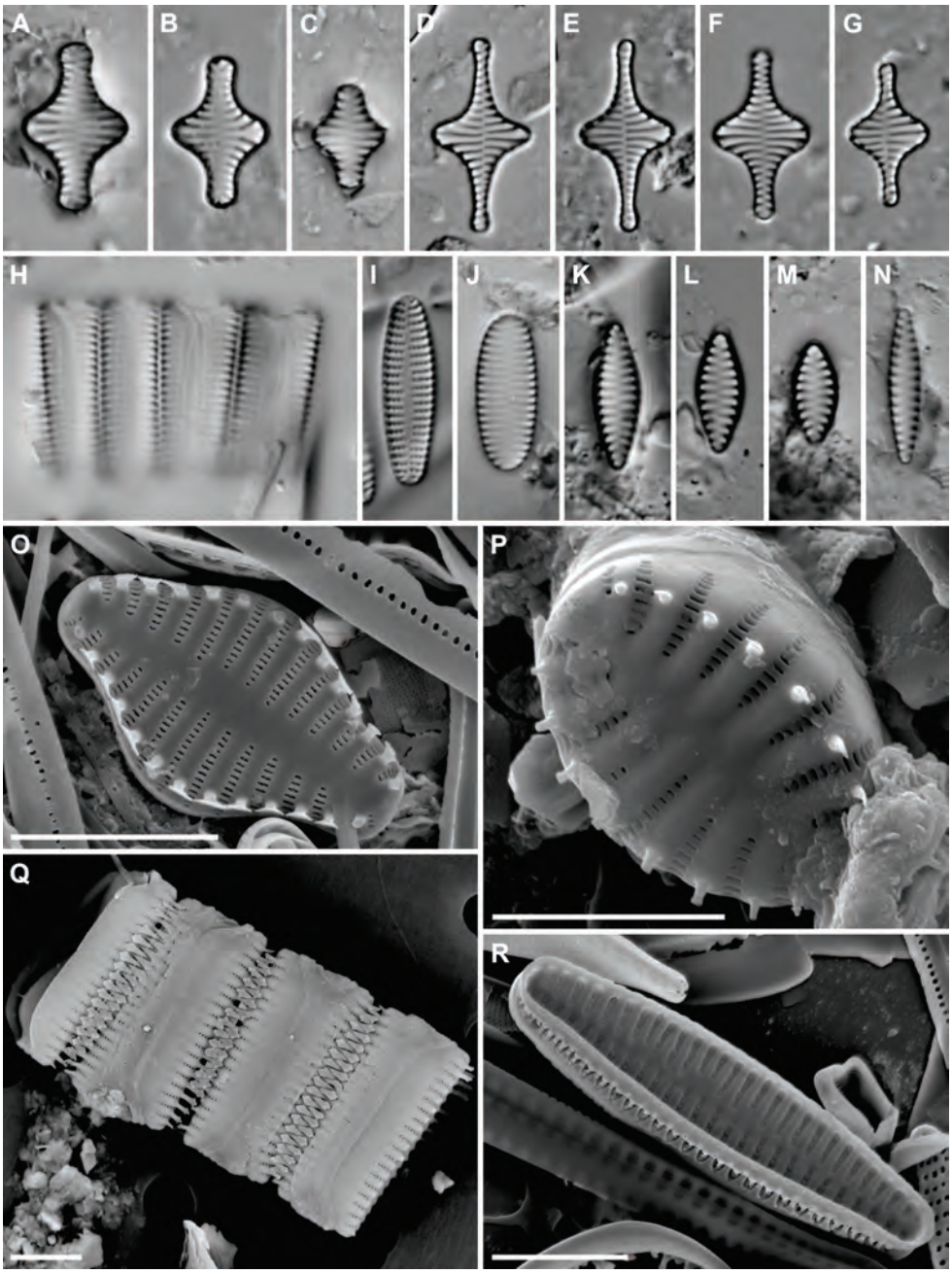


Fig. 47. *Staurosira* spp. **A-N.** LM, cleaned valves. **A-G, I-N.** Valve views. **H.** Girdle view. **O-R.** SEM. **O-P.** External view of valves, note the slightly elongated areolae. **Q.** Girdle view, showing spines at junction of valve face and mantle, forming ribbon colonies. **R.** Internal view of valve.
Scale bars = 10µm (A-N), 5 µm (O), 4µm (P-Q).

Staurosirella D.M. Williams & Round 1987

Type species: *Staurosirella lapponica* (Grunow) D.M. Williams & Round

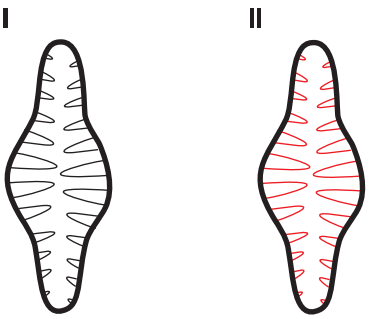
SYNONYM:
Fragilaria Lyngbye 1819 pro parte

Characteristics – Cells **araphid**, elliptical, linear or cruciform with robust parallel striae (II) through the length of the valve, areolae **lineolate** (Fig. 48: K), not easily observed under LM (Fig. 48: A-I). **Axial area** of variable width. Apical pore field at one or both apices. Rimoportula absent. Spines present at the junction of the valve face and mantle. Distinguished from *Staurosira* by the structure of the areolae (elongate).

Plastid structure – Cells with 2 plate-like plastids lying along the girdle (Fig. 48: A).

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 axial area.

Ecology – Cells colonial, linked valve face to valve face by spines forming ribbons. Found in the benthos of waters with low to moderate conductivity and at a range of trophic levels.



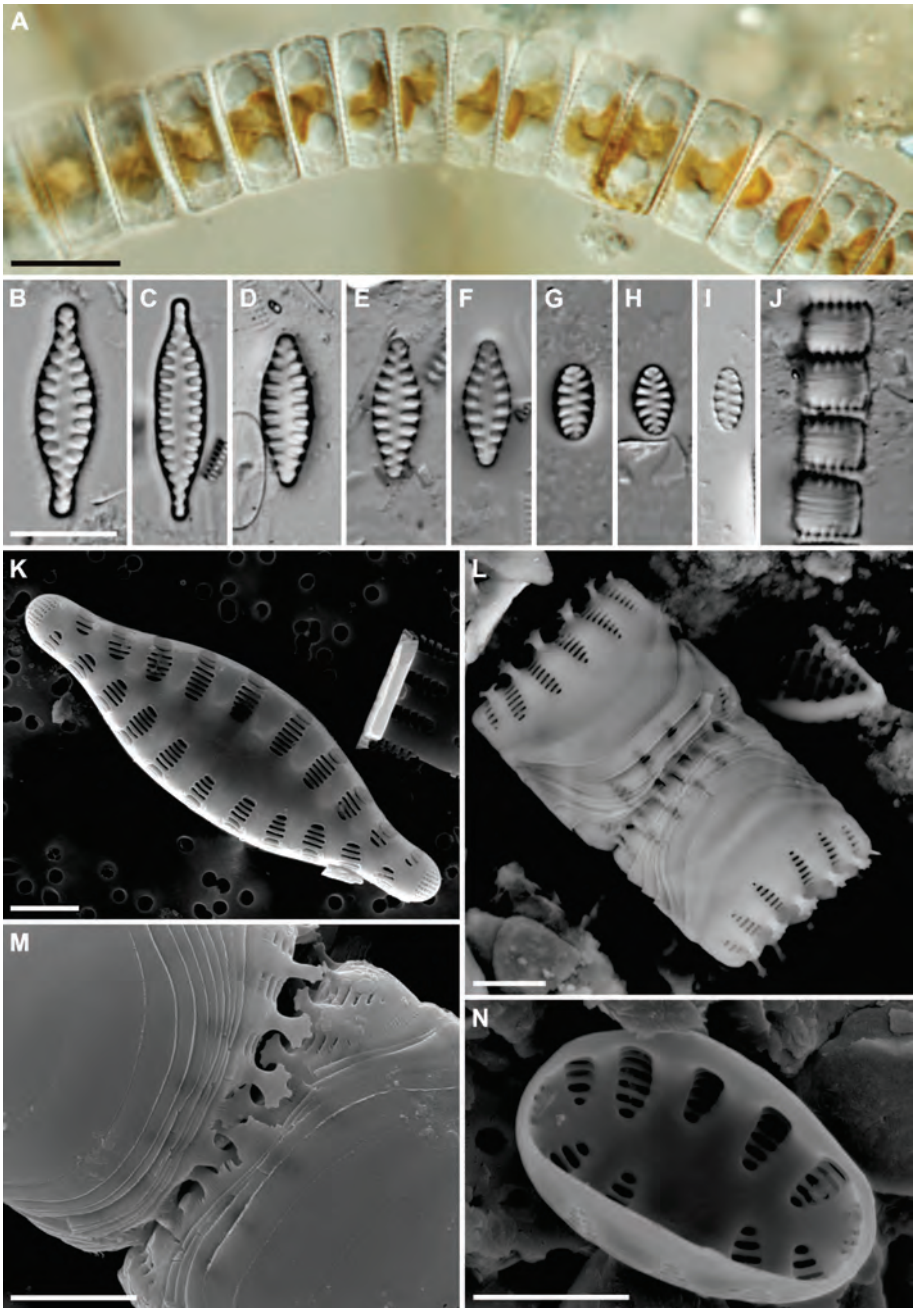


Fig. 48. *Staurosirella* spp. **A-J.** LM. **A.** Living cells. **B-J.** Cleaned valves. **B-I.** Valve views. **J.** *S. pinnata* (Ehrenberg) D.M. Williams & Round, girdle view. **K-N.** SEM. **K.** External view of valve, note the lineolate areolae. **L-M.** Girdle views, note the connecting spines. **N.** Internal view of valve. Scale bars = 10 µm (A-J), 2 µm (K-N).

Tabularia Kützing ex D.M. Williams & Round 1986

Type species: *Tabularia barbatula* (Kützing) D.M. Williams & Round

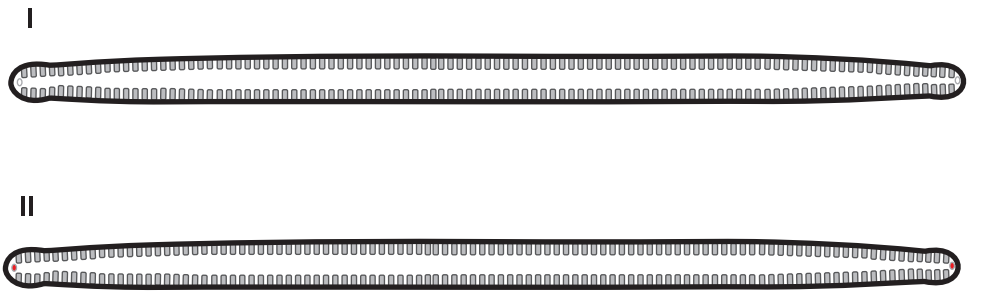
SYNONYM:
Fragilaria Lyngbye 1819 pro parte
Synedra Ehrenberg 1830 pro parte

Characteristics – Cells **araphid**, linear with parallel striae through the length of the valve, areolae fine, not easily observed under LM (Fig. 49: A). **Axial area** broad. **Rimoportula** (labiate or lipped process) present at both apices (II; Fig. 49: B, D). Apical pore field at each pole.

Plastid structure – Cells with plate-like plastids one lying under each valve face (see *Fragilaria*).

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 axial and central area.

Ecology – Cells colonial, basally attached. Found in the benthos of waters with moderate to high conductivity and at a range of trophic levels.



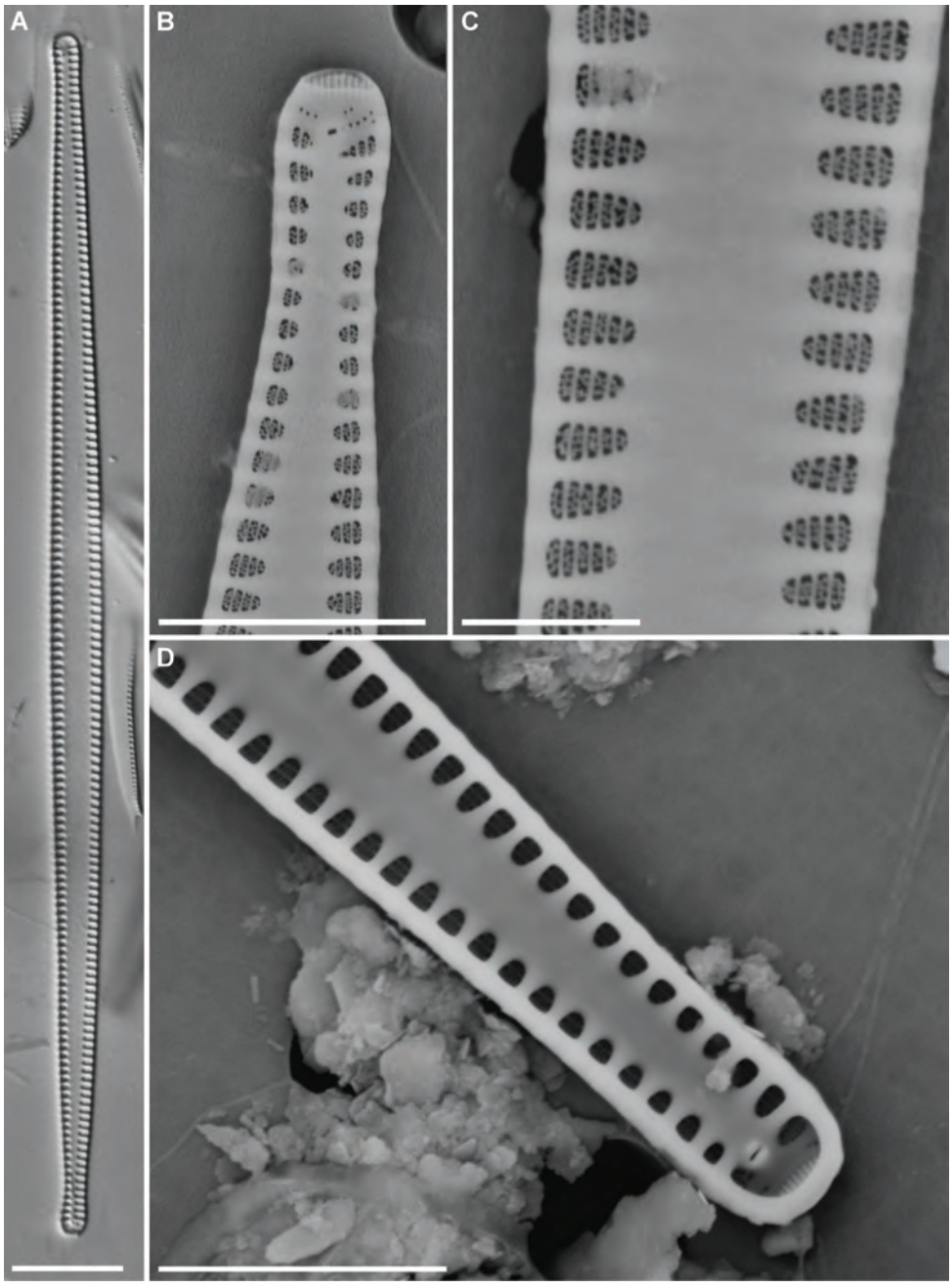


Fig. 49. *Tabularia fasciculata* (C. Agardh) D.M. Williams & Round. **A**. LM. **B-D**. SEM, internal view of valve, note position of internal opening of rimoportula. Scale bars = 10 µm (A), µm 5 µm (B, D), 2 µm (C).

Ulnaria (Kützing) Compère 2001

Type species: *Ulnaria ulna* (Nitzsch) Compère

SYNONYM:

Synedra Ehrenberg 1830 pro parte

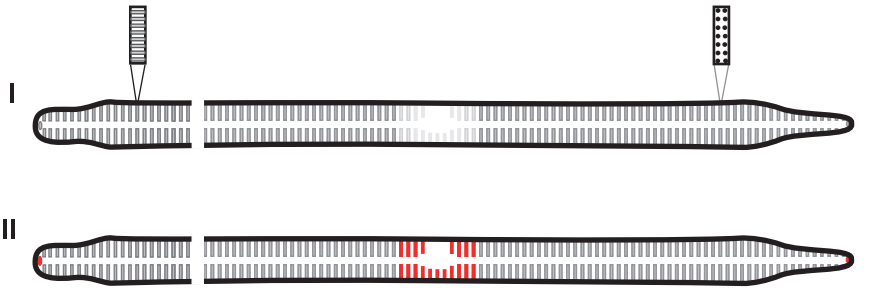
Characteristics – Cells **araphid**, often very long with parallel striae through the length of the valve, areolae fine and often not easily observed under LM (Fig. 52). **Axial area** narrow but clearly discernable. Central area may be present and varies in size (Fig. 52), may reach both valve margins (Fig. 52: B) or be unilaterally expanded (Fig. 52: C-D). Ghost striae may be present (II; Fig. 52: A, D). **Rimoportula** (labiate or lipped process) present at both apices (II). Small apical spines may be present (Fig. 53: A).

Plastid structure – Cells with 2 plate-like plastids lying under the valves (Fig. 51: D).

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

Ecology – Cells planktonic or colonial, basally attached (Fig. 50). Found in the benthos of waters with low to moderate conductivities and at a range of trophic levels. Thought to be adapted to survive high flow conditions.

Notes – The genus ***Synedra*** sensu lato will often be encountered in older literature. This genus contained number of species common to tropical African waters (e.g. *Synedra nyansae* G.S. West, synonym *S. dorsiventralis* O. Müller). The type of *Synedra* is now considered to be *S. gaillonii* (Bory) Ehrenberg which is a marine species. Most freshwater species from *Synedra* senu lato have now been transferred to *Ulnaria, e.g. Ulnaria nyansae* (G.S. West) D.M. Williams.



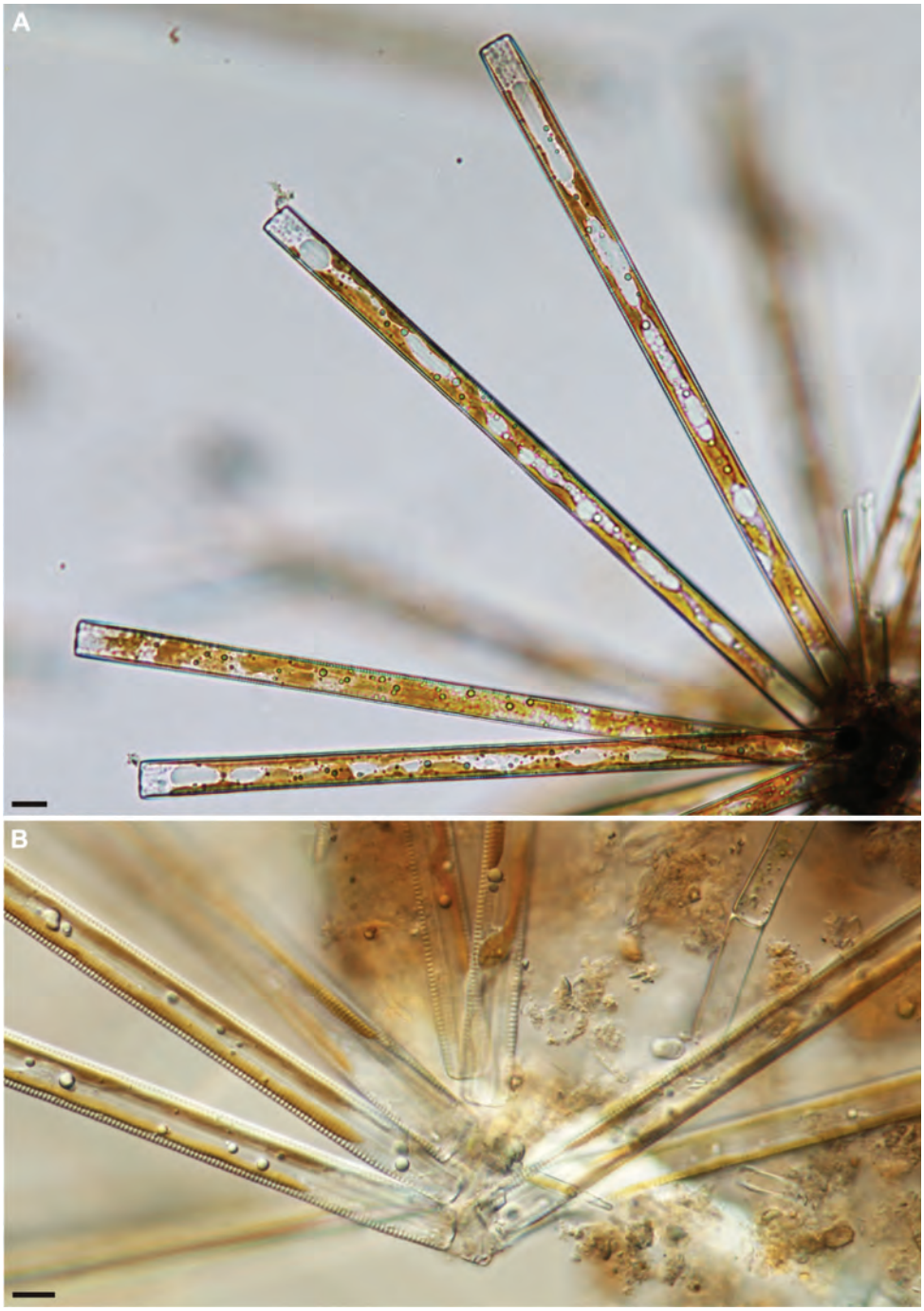


Fig. 50. *Ulnaria* spp. **A-B.** LM, living cells, girdle view, forming colony, cells basally attached.
Scale bars = 10 µm.

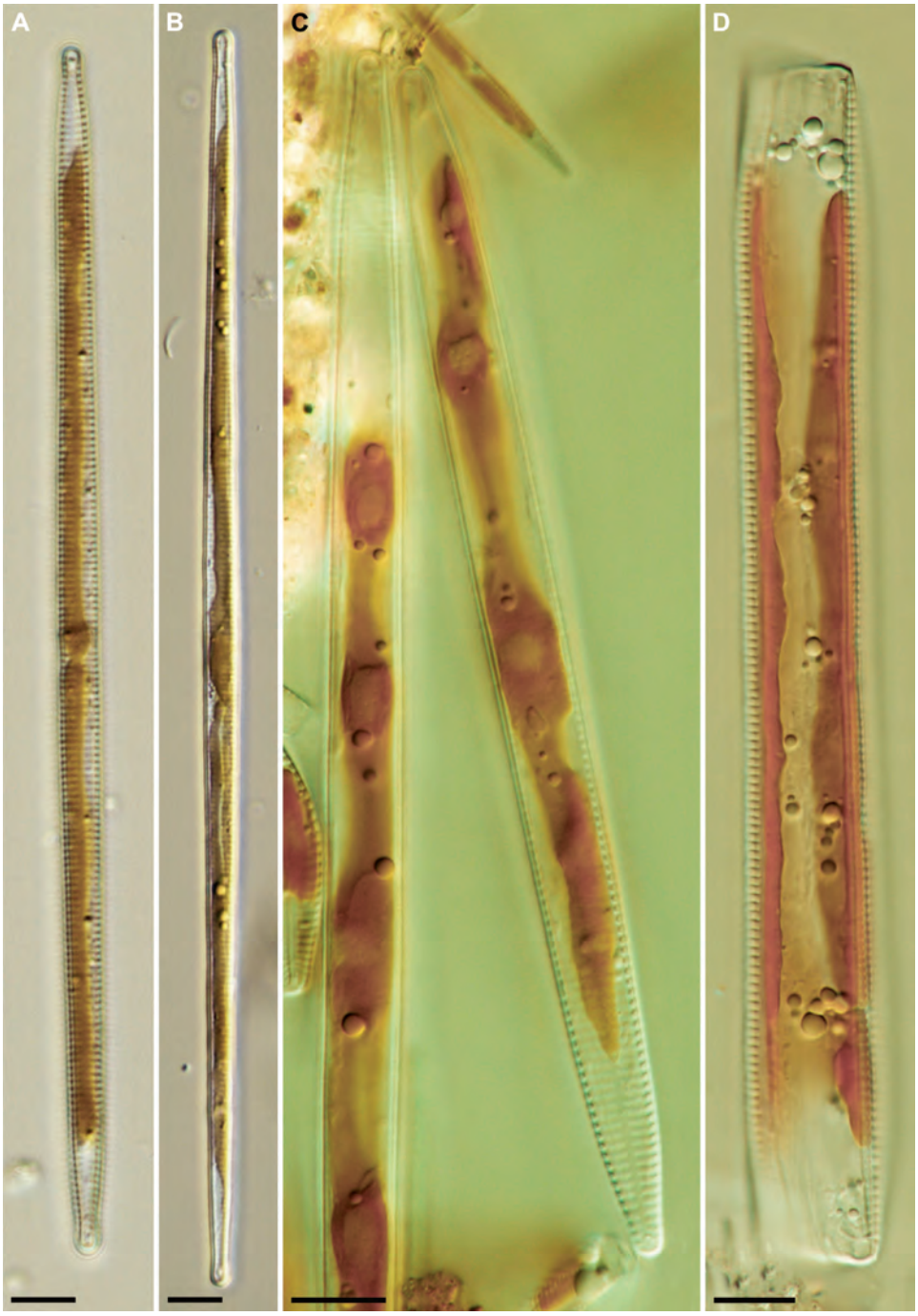


Fig. 51. *Ulnaria* spp. **A-D.** LM, living cells. **A-B.** Valve views. **C.** Valve views, forming colony, cells basally attached. **D.** Girdle view.
Scale bars = 10 µm.

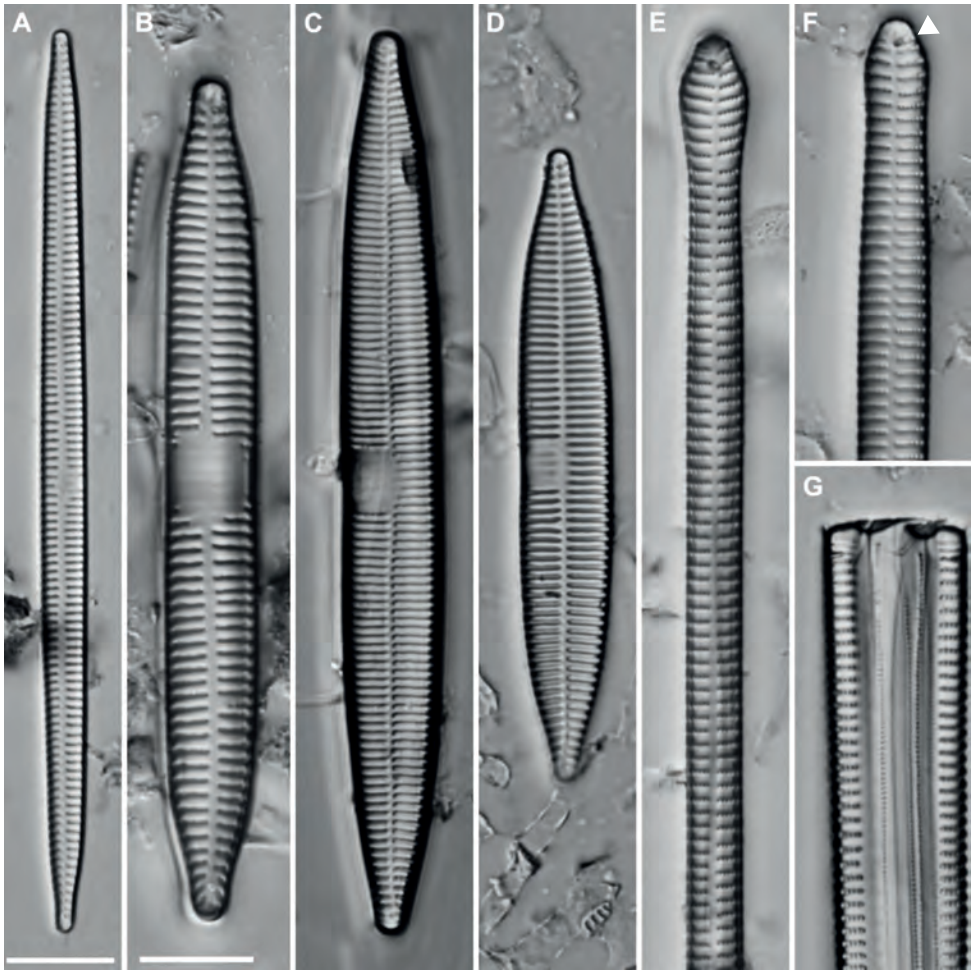


Fig. 52. *Ulnaria* spp. **A-G.** LM. **A-B.** Valve views. **C-D.** Valve views of *Ulnaria nyansae*. **E-F.** Valve views, note rimoportula (arrow - **F**). **G.** Girdle view. Scale bars = 10 µm.

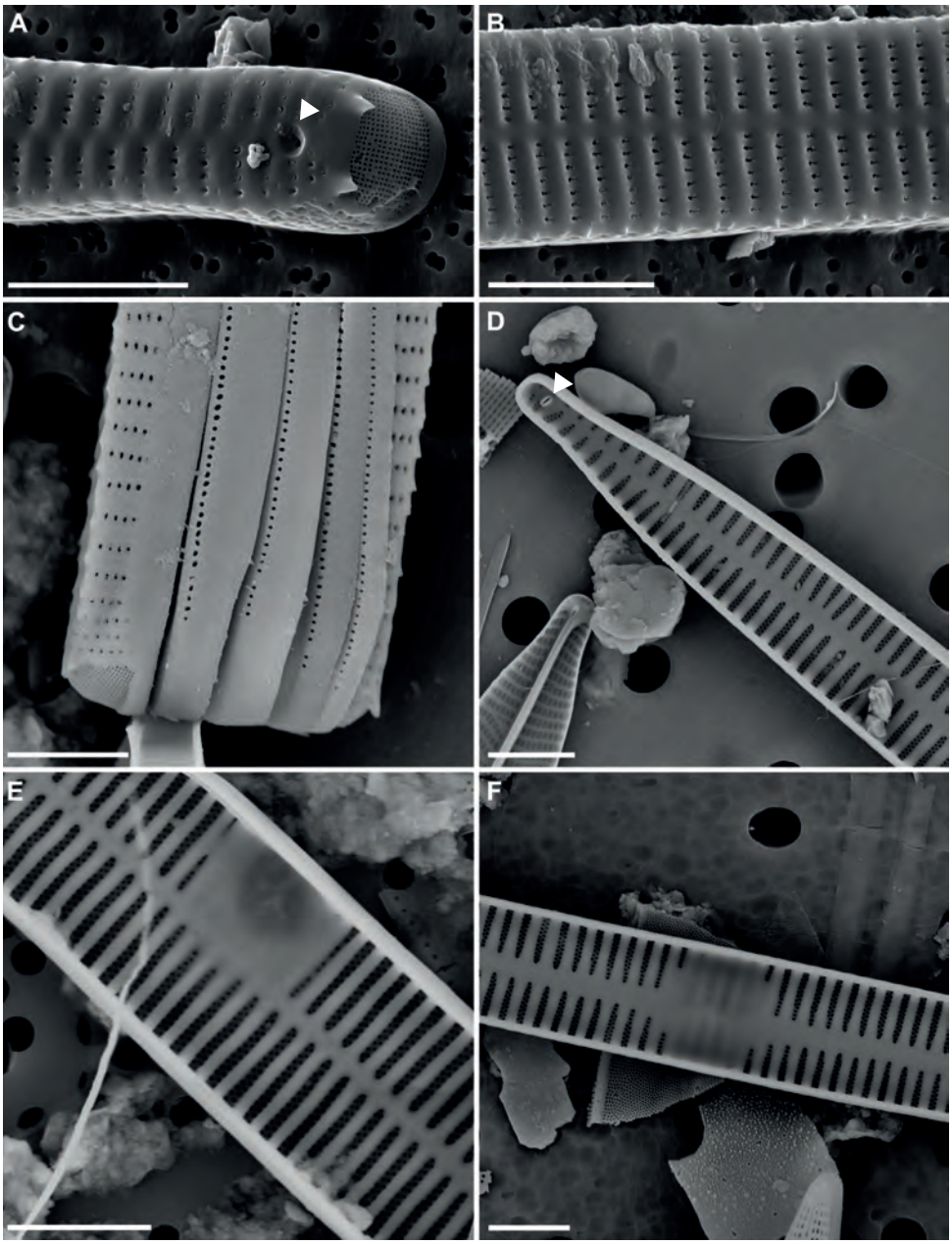


Fig. 53. *Ulnaria* spp. **A-F.** SEM. **A-B.** External view of valve**. A.** Cell apex, note apical pore field and rimoportula (arrow). **C.** External girdle view. **D-F.** Internal view of valve. **D.** Cell apex with internal opening of rimoportula (arrow). **E-F.** Central area, varies in size and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

Tabellaria (Ehrenberg) Kützing 1844

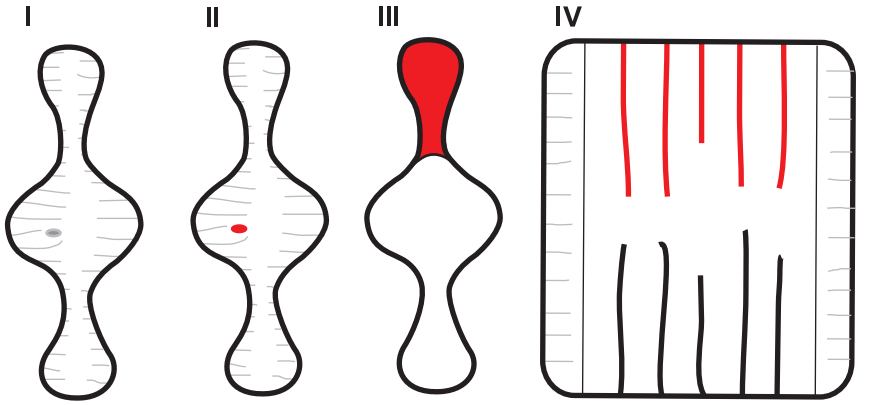
Type species: *Tabellaria flocculosa* (Roth) Kützing

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.



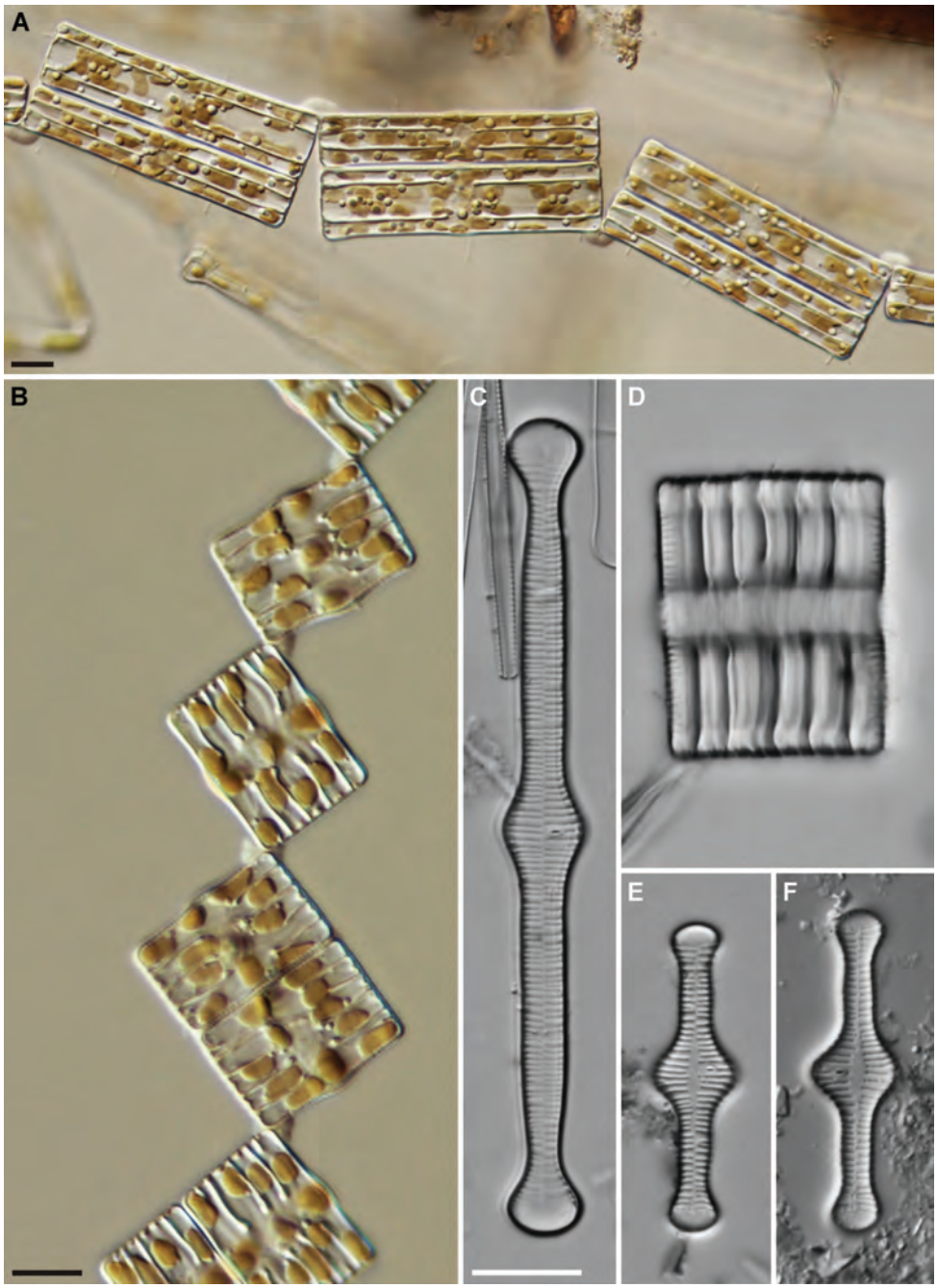


Fig. 54. *Tabellaria* spp. **A-F.** LM. **A-B.** Living cells forming zigzag colonies. **C-F.** Cleaned cells. **C, E-F.** Valve views. **D.** Girdle view. **A, C.** *T. fenestrata* (Lyngbye) Kützing. **B, D, F.** *T. flocculosa.*
Scale bars = 10 µm .

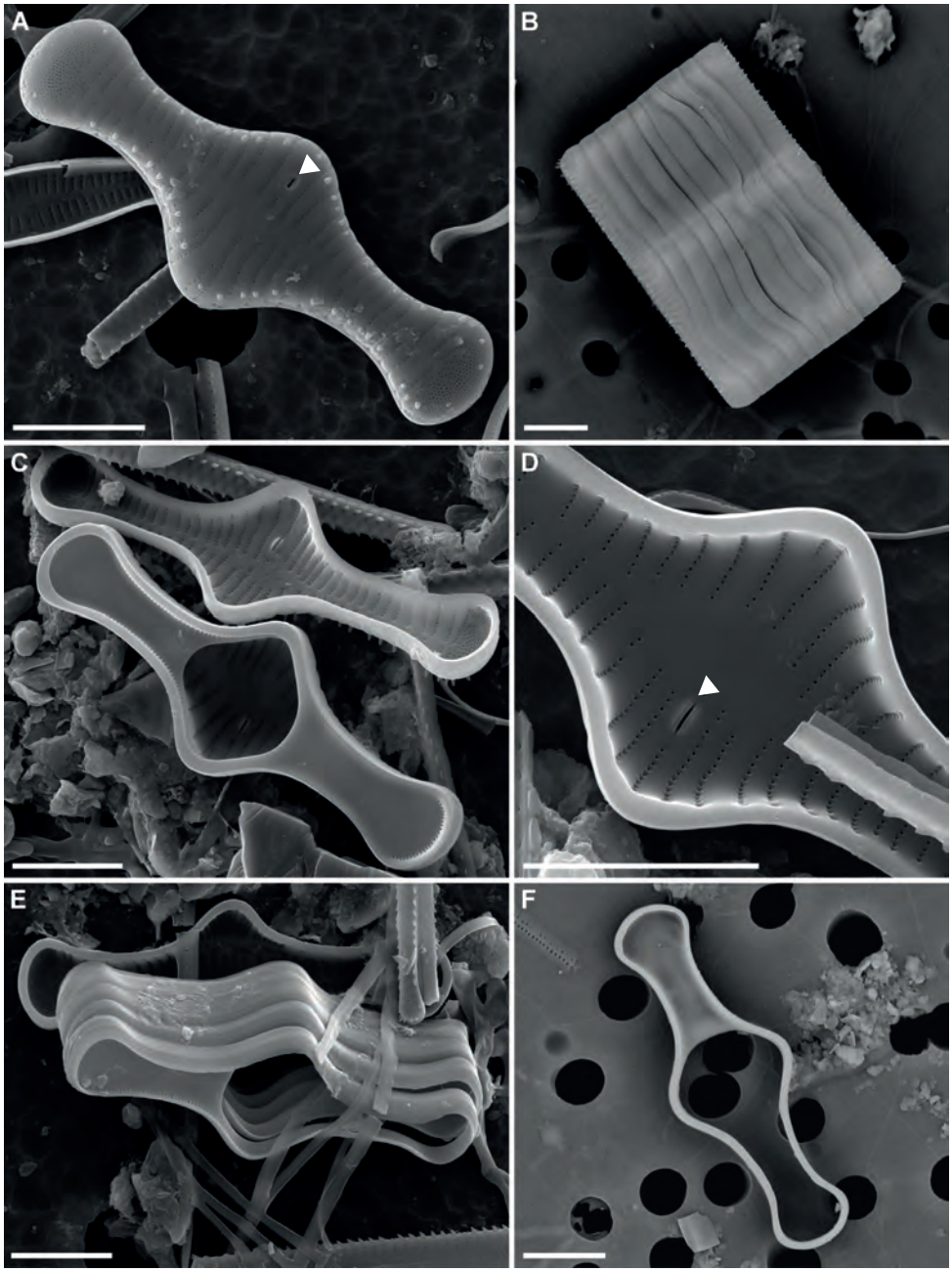


Fig. 55. *Tabellaria flocculosa*. **A-F.** SEM. **A.** External view of valve, note position of the rimoportula (arrow). **B.** Girdle view. **C, E-F.** Internal view of valve showing the septa. **D.** Internal view of valve, note internal opening of rimoportula (arrow).
Scale bars = 5 µm .

Actinella F.W. Lewis 1864

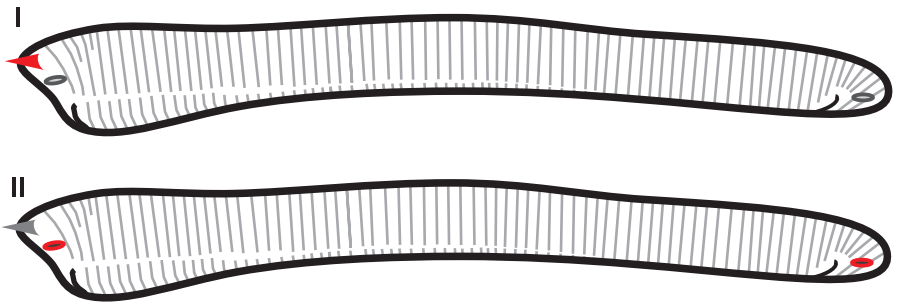
Type species: *Actinella punctata* F.W. Lewis

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.



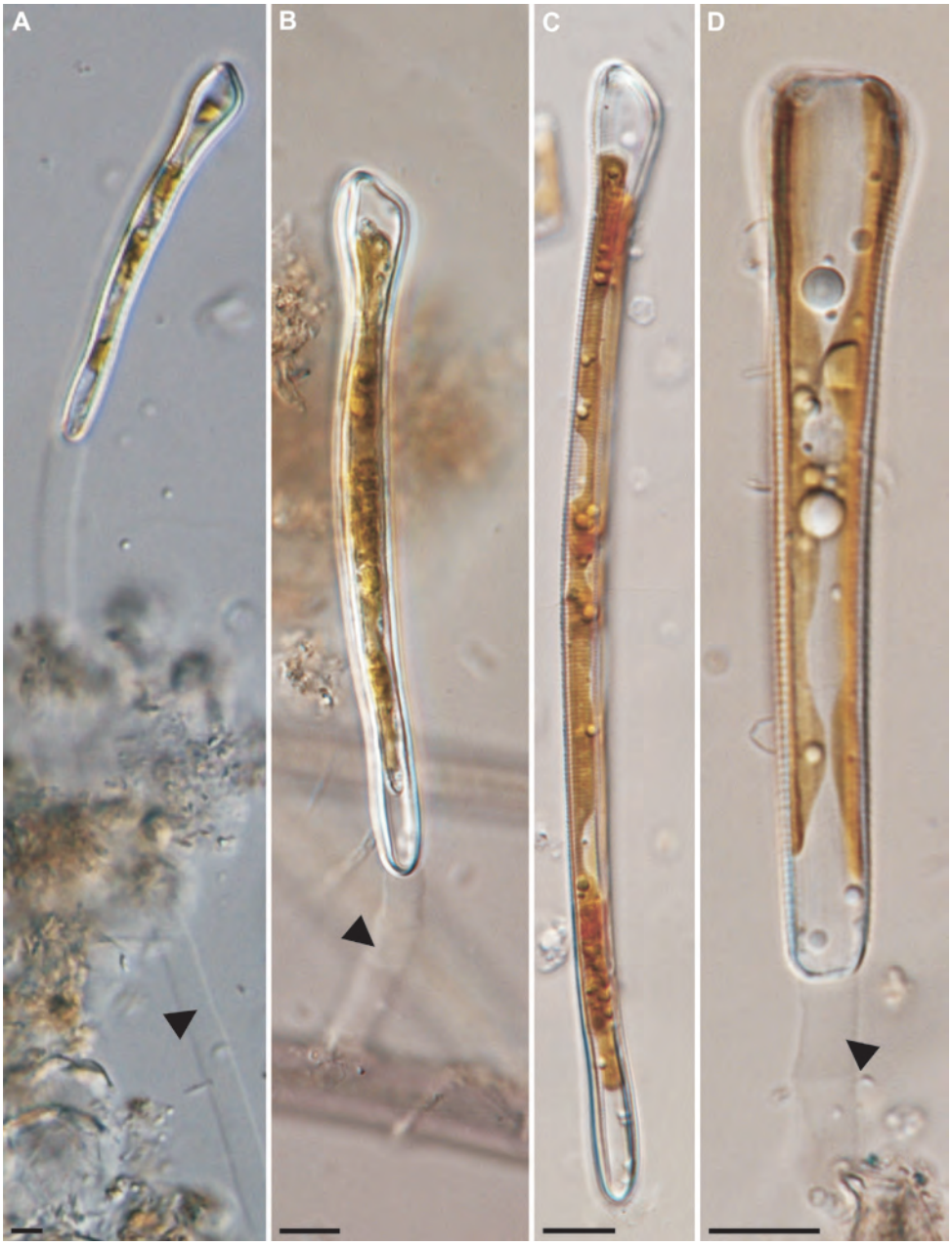


Fig. 56. *Actinella* spp. **A-D**. LM, living cells. **A-C.** *Actinella brasiliensis* Grunow valve view. **D**. *A. brasiliensis* girdle view.
Scale bars = 10 µm (A-D).

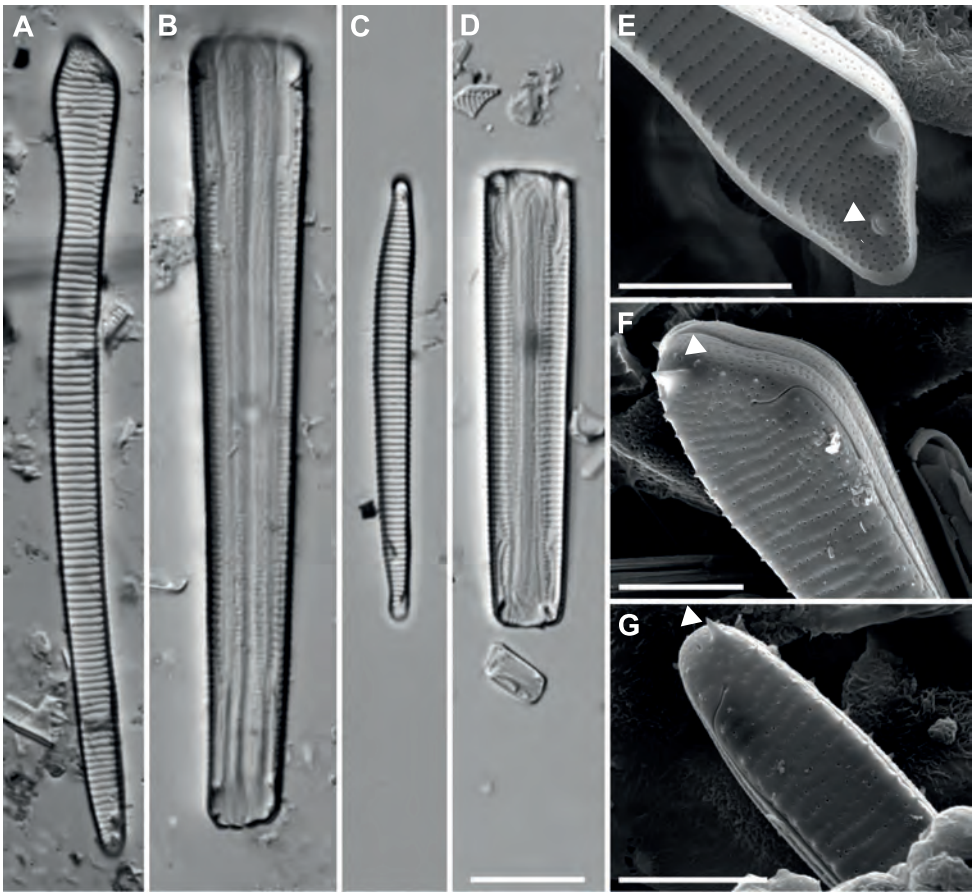


Fig. 57. *Actinella* spp. **A-D**. LM. **A**. *Actinella brasiliensis* valve view. **B**. *A. brasiliensis* girdle view. **C**. *Actinella* sp. valve view. **D**. *Actinella* sp. girdle view. **E-G**. SEM. **E**. Internal view of valve showing rimoportula near head pole (arrow). **F**. Head pole, note 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:

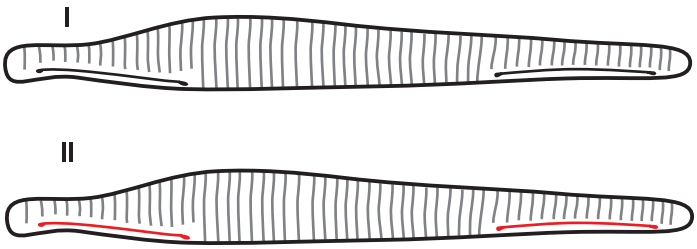
Actinella F. W. Lewis 1864 pro parte

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.



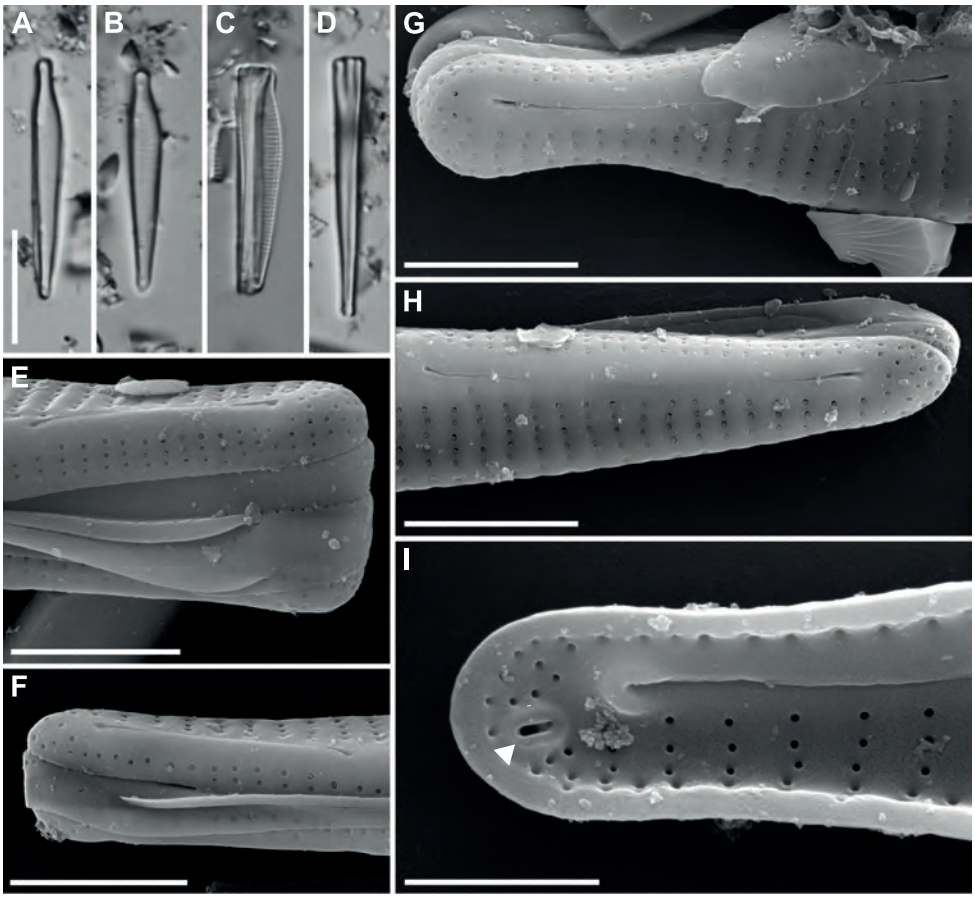


Fig. 58. *Actinellopsis murphyi*. **A-D**. LM. **A-B**. Valve view of cleaned material. **C**. Oblique view showing both valve face and girdle. **D**. Girdle view. **E-I**. SEM. **E.** Head pole, girdle view. **F**. Foot pole, girdle view. **E-F**. Showing the raphe does not extend onto the mantle. **G**. 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.

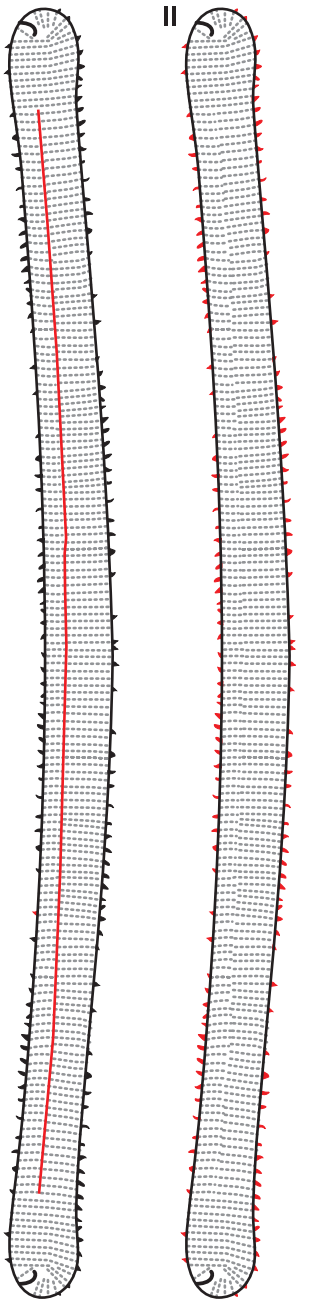


Fig. 59. *Desmogonium* spp. **A-D**. LM, living cells. **A-C**. Cells forming colonies, connected at both apices. **D**. Solitary cell, girdle view.
Scale bars = 10 µm.

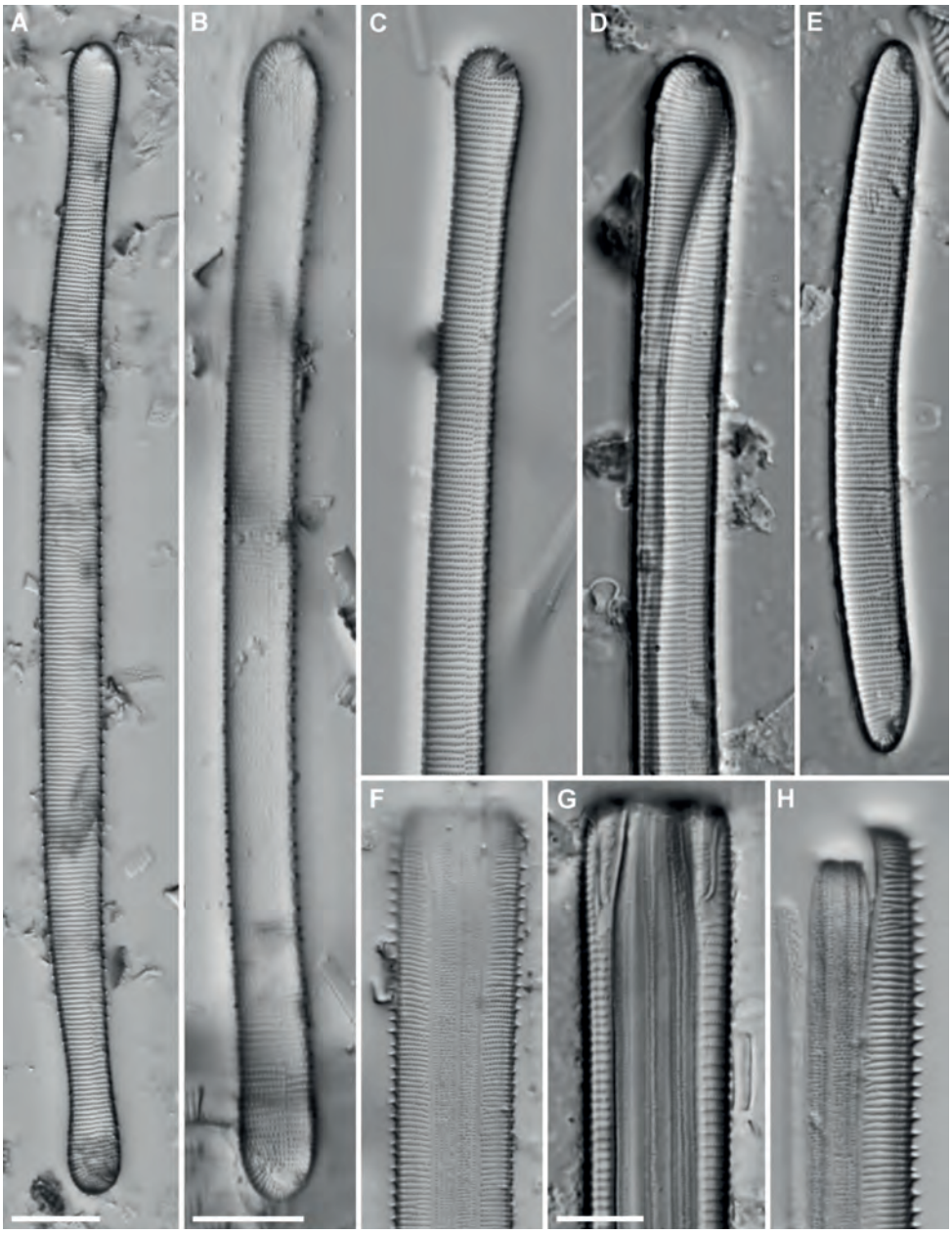


Fig. 60. *Desmogonium* spp. **A-H**. LM. **A-E**. Valve views of cleaned material. **F-H**. Girdle views of cleaned material, note marginal spines. Scale bars = 10 µm.

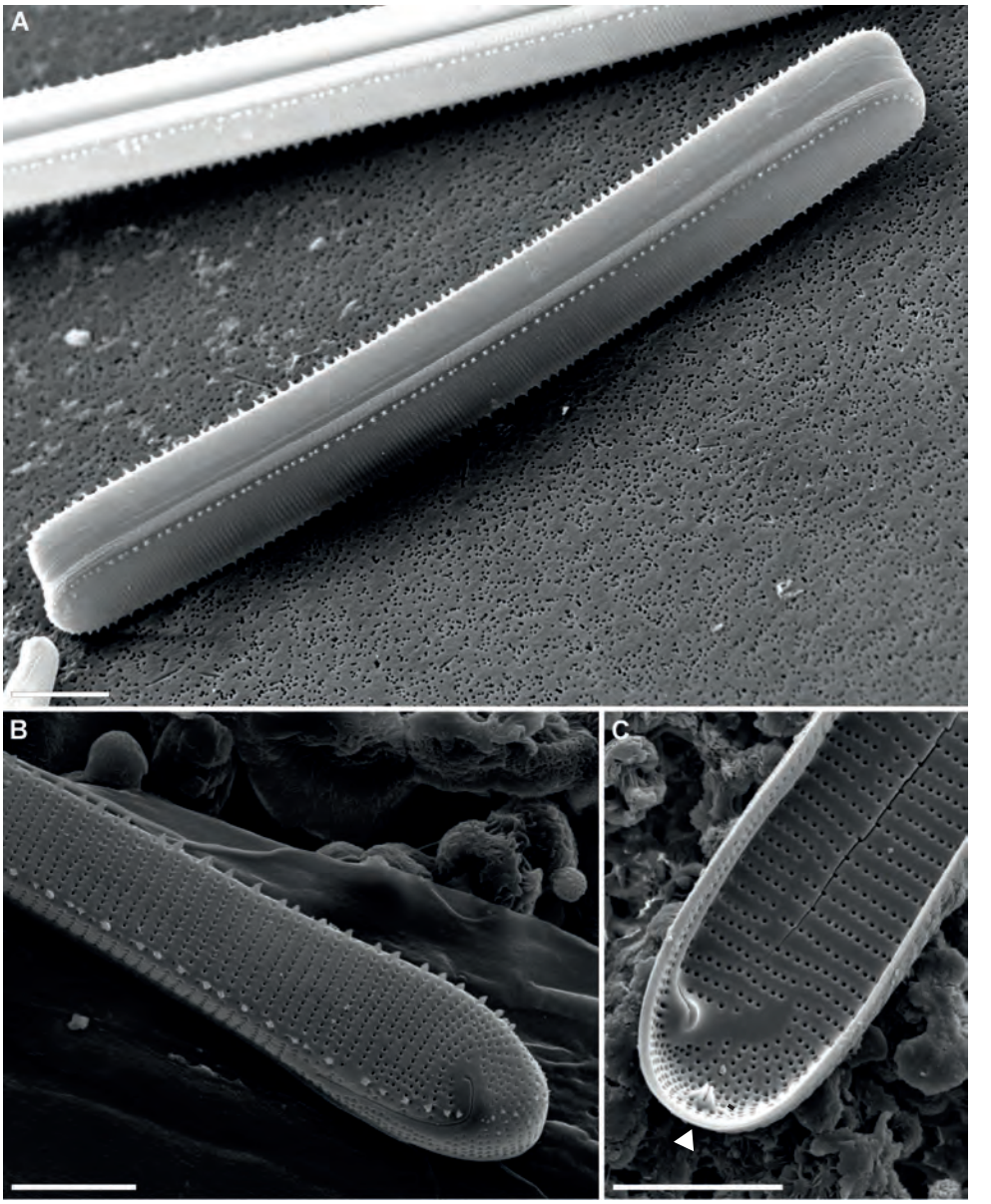


Fig. 61. *Desmogonium* spp. **A-C**. SEM. **A**. Oblique view of whole cell. **B**. External view of valve apex showing raphe ending and marginal spines. **C**. Internal view of valve showing raphe ending and rimoportula (arrow).
Scale bars = 10 µm (A), 5 µm (B-C).

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.

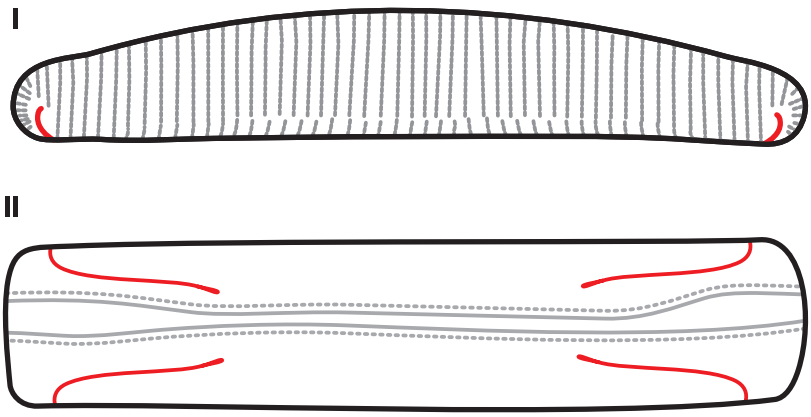


Fig. 62. *Eunotia spp*. **A-E**. LM, living cells. **A**. Valve view. **B-C**. *Eunotia exigua* (Brébisson ex Kützing) Rabenhorst, valve view (**B**), girdle view (**C**). **D-E**. Girdle views of *Eunotia* sp., note large lipid droplets (arrow).
Scale bars = 10 µm (A-E).

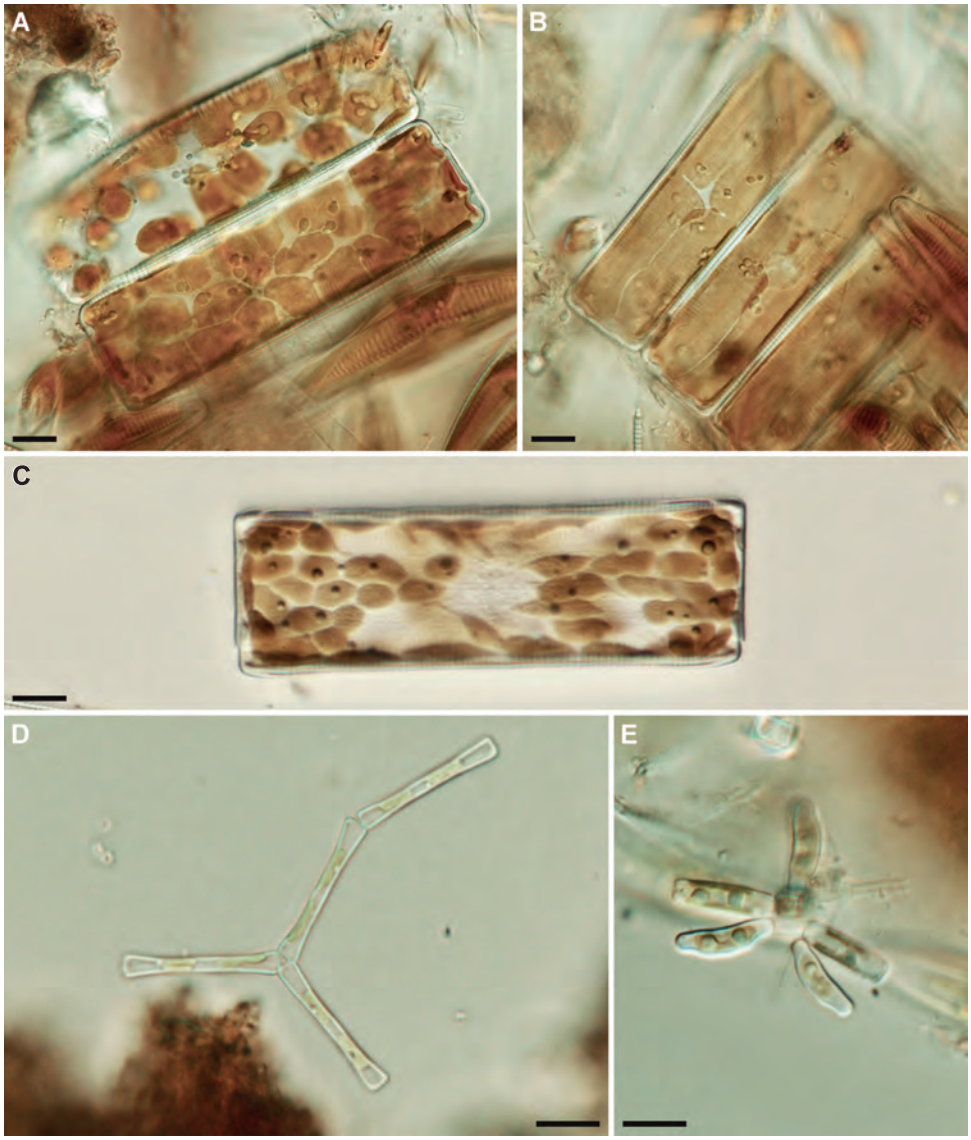


Fig. 63. *Eunotia* spp. **A-E**. LM, living cells. **A-B**. Large chain forming cells. **C**. Girdle view showing many small granular plastids. **D**. Cells linked at the corners to form colony. **E**. Cells united on a single mucilage pad and forming a colony. Scale bars = 10 µm (A-E).