

DESMIDS OF THE BROADS AREA OF N.W.-OVERIJSSSEL (THE NETHERLANDS) II

P. F. M. COESEL

Hugo de Vries Laboratorium, Universiteit van Amsterdam, Plantage Middenlaan 2A,
1018 DD Amsterdam

SUMMARY

As a sequence to a previous instalment an annotated check-list of 245 desmid taxa recorded from the broads area of NW-Overijssel is concluded. The desmid flora of that area is characterised by the high rate of representation of mesotrophic species typical of rich fen habitats. The regular hemi-atmophytic occurrence in wet *Scorpidium* cushions of a number of species with a predominantly arctic-alpine distribution is striking. The also diversified, tychoplanktonic desmid flora of the more eutrophic, peat excavated dikes and pools is seriously endangered as the result of water pollution.

4. ANNOTATED LIST OF DESMID SPECIES (continued)

Cosmarium Corda ex Ralfs

C. abbreviatum Racib.

var. *abbreviatum*

T.13:7-8

KRIEGER & GERLOFF 1969, p. 241, t.42:14.

Rather rare in tychoplankton of pools with *Stratiotetum*.

var. *germanicum* (Racib.) Krieg. & Gerl.

T.13:9-11

KRIEGER & GERLOFF 1969, p. 242, t.42:16.

Rather rare in fen hollows.

var. *minus* (W. & G. S. West) Krieg. & Gerl.

T.13:12-17

KRIEGER & GERLOFF 1969, p. 242, t.42:18.

The open sinus, as shown in our T.13:15-17 is reminiscent of *C. bioculatum* Bréb. The cell circumference of our collections is too angular, however, to render the material referable to the lastmentioned species. There are, moreover, transitions between open and closed sinuses within a single population.

Fairly common in benthos of fen hollows, especially in the Weerribben area; less common in tychoplankton of *Stratiotetum* pools.

C. anceps Lund.

T.14:11-13

KRIEGER & GERLOFF 1965, p. 183, t.37:2.

Rather rare in fen hollows (see also COESEL 1974b).

C. bacillare Lütken.

T.12:4-5

Syn.: *Actinotaenium inconspicuum* (W. & G. S. West) Teil.

KRIEGER & GERLOFF 1969, p. 404, t.68:20-22.

Rather rare in fen hollows.

C. bireme Nordst.

T.14:30

WEST & WEST 1908, p. 77, t.71:36-37.

In Nordstedt's original figure (see WEST & WEST 1908, t.71:36) the lateral angles are more basally situated. The figure of *C. bireme* in RŮŽIČKA (1973, t.8:22) agrees better with our material in this respect.

Rare in fen hollows (locality no. 2).

C. biretum Bréb. var. *trigibberum* Nordst. T.17:4

WEST & WEST 1912, p. 28, t.101:10–15.

Fairly common in tychoplankton of Stratiotetum pools.

C. blyttii Wille var. *bipunctatum* (Dick) Růž. T.20:3–4

RŮŽIČKA 1972, p. 465, t.61:18–19.

Common in benthos of fen hollows, fairly common in tychoplankton of Stratiotetum pools.

C. boeckii Wille T.20:13

WEST & WEST 1908, p. 234, t.86:26–32.

Common in tychoplankton of Stratiotetum pools, less common in fen hollows.

C. botrytis Menegh. ex Ralfs

var. *botrytis* T.16:3

WEST & WEST 1912, p. 1, t.96:1–2, 5–15.

The punctuation of the cell wall between the granules did not appear to be sufficient reason to refer the material to the var. *paxillosporum* described by WEST & WEST (1912) considering the remark by RŮŽIČKA (1972, p. 465) that such a punctuation is not an exclusive character of the var. *paxillosporum*, but may “gelegentlich” occur in all varieties of *C. botrytis*.

Common in benthos of fen hollows, fairly common in tychoplankton of Stratiotetum pools.

var. *tumidum* Wolle T.16:4

WEST & WEST 1912, p. 5, t.97:2–3.

Rare in tychoplankton of Stratiotetum pools.

C. connatum Bréb. T.12:16–17

KRIEGER & GERLOFF 1969, p. 327, t.52:1.

Very common in fen hollows.

C. conspersum Ralfs var. *sublatum* (Nordst.) Croas. T.17:1–2

NORDSTEDT 1888, p. 45, t.5:1–4 (as *C. sublatum*).

Following CROASDALE (1973, p. 87) all forms agreeing with *C. conspersum* Ralfs in cell shape but corresponding with *C. margaritatum* (Lund.) Roy & Biss. in the presence of punctulations between the granules, are referred to *C. conspersum* var. *sublatum*.

Very common in fen hollows.

C. contractum Kirchn. var. *retusum* (W. & G. S. West) Krieg. & Gerl. T.14:17

KRIEGER & GERLOFF 1962, p. 76, t.17:10.

Very rare in fen hollows (locality no. 2).

**C. controversum* W. & G. S. West T.16:2

WEST & WEST 1912, p. 9, t.97:7–8.

Rare in fen hollows (locality nos. 2 and 15).

C. crenatum Ralfs ex Ralfs T.19:2–3

WEST & WEST 1912, p. 35, t.98:9–12.

Fairly common in fen hollows (see also COESEL 1974b).

C. crenulatum (Näg.) Bréb. T.15:19–21

KRIEGER & GERLOFF 1965, p. 136, t.29:6 (as *C. impressulum* var. *crenulatum*).

In the area studied, this alga differed manifestly from the species *C. impressulum* shown in T.15:22–26; for this reason the taxonomic view of KRIEGER & GERLOFF concerning this species is not followed.

Common in benthos of fen hollows and in tychoplankton of Stratiotetum pools.

C. debaryi Arch. T.12:14–15

KRIEGER & GERLOFF 1962, p. 84, t.19:8.

Common in fen hollows.

C. depressum (Näg.) Lund. T.13:18–19

KRIEGER & GERLOFF 1962, p. 20, t.8:1.

Common in benthos of fen hollows and in tychoplankton of Stratiotetum pools.

C. didymoprotupsum W. & G. S. West

T.20:2

WEST & WEST 1908, p. 192, t.88:8.

Very rare in tychoplankton (see COESEL 1975a).

C. difficile Lütkem.

T.14:26-28

KRIEGER & GERLOFF 1969, p. 251, t.43:18.

Very common in fen hollows.

C. diplosporum (Lund.) Lütkem.

T.12:2-3

Basion.: *Actinotaenium diplosporum* (Lund.) Teil.

KRIEGER & GERLOFF 1969, p. 406, t.68:25.

Common in fen hollows.

**C. fastidiosum* W. & G. S. West

T.18:4-5

WEST & WEST 1908, p. 218, t. 85:11.

WEST & WEST (l.c.) who recorded this species in their monograph of the British desmids from only a single locality, mention as the length range 37-38.5 μm , whereas the material shown in T.18:4-5 has a length of about 50 μm . SKUJA (1929, p. 58, t.3:10-12) whose figures of *C. fastidiosum* agree remarkable well with ours, recorded greater dimensions than did West & West.

Fairly common in fen hollows.

C. fontigenum Nordst.var. *pseudofontigenum* (Gutw.) W. & G. S. West

T.14:22-23

KRIEGER & GERLOFF 1965, p. 205, t.39:2.

Rare in tychoplankton of Stratiotetum pools and in benthos of fen hollows (locality no. 2).

C. formosulum Hoff

T.20:7-9

WEST & WEST 1908, p. 240, t.88:1-3.

Common in tychoplankton, fairly common in benthos of fen hollows.

**C. furcatospermum* W. & G. S. West

T.18:12-13

WEST & WEST 1908, p. 206, t.81:10-11, t.84:8-10.

Fairly common in tychoplankton of Stratiotetum pools and in benthos of fen hollows (especially in the Weerribben area).

**C. garrolense* Roy & Biss. var. *crassum* Jao

T.15:34

KRIEGER & GERLOFF 1962, p. 44, t.22:8.

Only found once; in tychoplankton.

**C. goniodes* W. & G. S. Westvar. *goniodes*

T.12:8-9

KRIEGER & GERLOFF 1969, p. 277, t.45:20.

The character of the truncate and slightly retuse apex, said to be characteristic of *C. goniodes*, was not observed, but taking the great diversity in apex outline of the (much more numerous) var. *subturgidum* (see T.12:10-13) into account, it was decided to identify the taxon as var. *goniodes*.

Rare in fen hollows, mixed with the var. *subturgidum*.var. *subturgidum* W. & G. S. West

T.12:10-13

KRIEGER & GERLOFF 1969, p. 278, t.45:21.

Fairly common in fen hollows.

C. granatum Bréb.

T.15:1-5

KRIEGER & GERLOFF 1962, p. 111, t.24:2.

Common in benthos of fen hollows, fairly common in tychoplankton.

C. hians Borge

T.16:6

BORGE 1913, p. 13, t.1:6.

This species may be confused with *C. wittrockii* Lund., but the latter taxon has a coarser granulation and also slightly pointed poles in vertical view. FÖRSTER (1965, t.5:42-45, t.11:25-26) gave an idea of the range of variability in *C. hians*, which was also noted in our material.

Common in fen follows.

C. holmiense Lund. var. *integrum* Lund.

T.14:24-25

KRIEGER & GERLOFF 1965, p. 156, t.33:1.

Rather rare in fen hollows.

C. hornavanense Gutw.var. *dubovianum* (Lütkem.) Růž.

T.19:7

RŮŽIČKA 1949, p. 9, t.2:11-14, t.5:41-57.

Fairly common in fen hollows, rare in tycho plankton (see also COESEL 1975a).

var. *janoviense* (Gutw.) Růž.

T.19:8

RŮŽIČKA 1949, p. 12, t.3:18-20, t.6:58-65.

Rare in tycho plankton.

C. humile (Gay) Nordst.var. *humile*

T.18:14

WEST & WEST 1908, p. 221, t.85:16-18.

Common in tycho plankton (especially in Stratiotetum), fairly common in fen hollows.

var. *substriatum* (Nordst.) Schmidle

T.18:15

WEST & WEST 1908, p. 224, t.85:20.

Rare in tycho plankton of Stratiotetum pools.

C. impressulum Elfv.

T.15:22-26

KRIEGER & GERLOFF 1965, p. 133, t.29:4.

Common in fen hollows.

C. insigne Schmidle

T.16:7

SCHMIDLE 1893, p. 33, t.6:14; 1894, p. 57, t.7:20.

The specimens studied agree better with the description and figure in e.g., DICK (1930, p. 128, t.6:3-4) and LAPORTE (1931, p. 98, t.11:120) than with SCHMIDLE's original description.

Common in tycho plankton of Stratiotetum pools (see also COESEL 1974b).

C. laeve Rab.var. *laeve*

T.15:8-10

KRIEGER & GERLOFF 1969, p. 259, t.44:5.

Common in (tycho) plankton.

var. *pseudotangulare* Fritsch & Rich

T.15:6-7

KRIEGER & GERLOFF 1969, p. 263, t.44:11.

Rare in plankton of lakes.

C. margaritiferum Menegh. ex Ralfsforma *margaritiferum*

T.18:1

WEST & WEST 1908, p. 199, t.83:4-11.

Fairly common in fen hollows.

forma *kirchneri* (Börges.) W. & G. S. West

T.18:2

WEST & WEST 1908, p. 203, t.83:13.

While other workers (such as RŮŽIČKA 1973, p. 210) recorded transitions between the forma *kirchneri* and the forma *margaritiferum*, these two forms occur in the area studied as sharply distinguishable taxa.

Rather rare in fen hollows.

forma *badense* (Schmidle) comb. nova

T.18:3

Syn.: *C. malinvernianum* (Racib.) Schmidle var. *badense* Schmidle

SCHMIDLE 1894, p. 58, t.7:21.

C. malinvernianum var. *badense* Schmidle was considered to be a synonym of *C. margaritiferum* by WEST & WEST (1908, p. 202). Since the alga shown in our T.18:3 differs from the "typical" form of *C. margaritiferum* (as described and figured by WEST & WEST, l.c.) by its greater dimensions and larger, conical granules, characteristics figuring largely in Schmidle's description of *C. malinvernianum* var. *badense*, the present author proposes the name *C. margaritiferum* forma *badense* for this taxon. In the area studied this form was morphologically sharply distinct from the forma *margaritiferum* and *kirchneri*.

Rather rare in fen hollows.

C. meneghinii Bréb.

T.15:47–48

KRIEGER & GERLOFF 1965, p. 185, t.37:7.

Fairly common in tycho plankton.

**C. minimum* W. & G. S. West

T.14:6–7

KRIEGER & GERLOFF 1969, p. 290, t.47:10.

Rare in fen hollows (e.g. in locality no. 2).

**C. norimbergense* Reinschvar. *depressum* (W. & G. S. West) Krieg. & Gerl.

T.15:51–51

KRIEGER & GERLOFF 1969, p. 292, t.48:1.

Fairly common in benthos of fen hollows; rare in tycho plankton of Stratiotetum pools.

C. obtusatum Schmidleforma *obtusatum*

T.19:10–11

RŮŽIČKA 1953, p. 251, t.1:1–10, t.3:20–32.

Common in benthos of fen hollows and in tycho plankton of pools and ditches.

forma *aequalis* Růž.

T.19:12

RŮŽIČKA 1953, p. 251, t.2:16, t.4:33.

Common in tycho plankton.

C. ochthodes Nordst.

T.19:1

WEST & WEST 1912, p. 11, t. 98:4–6 (as *C. ochthodes* var. *amoebum* W. West).

According to RŮŽIČKA (1952) the var. *amoebum* distinguishes itself only from the type variety by the more trapezoid shape of the semi-cells. The two taxa are sometimes continuously linked by transitional forms. This renders the validity of the var. *amoebum* rather doubtful (RŮŽIČKA, l.c.). Our material, intermediate as far as the shape of the semi-cells is concerned, is according to the opinion of RŮŽIČKA (1973, t.11:3) not referable to the var. *amoebum*.

Very common in fen hollows, occasionally found with zygotes (see COESEL 1974a).

?**C. orthogonum* Delp. var. *gutwinskii* Krieg. & Gerl., forma

T.15:16–18

Our collections agree rather closely with a desmid described by LAPORTE (1931, p. 101, t. 12:139–140, 144) which according to this author approaches a forma of *C. orthogonum* Delp. described by GUTWINSKI in 1892, which unnamed form was later described as the var. *gutwinskii* by KRIEGER & GERLOFF (1965, p. 142, t.30:2). The alga figured in our T.15:16–18 differs from it in the more semiorbicular shape of the semi-cells instead of a subhexagonal shape characteristic of *C. orthogonum*. An affinity with *C. crenulatum* (Näg.) Bréb. is also conceivable. “*C. orthogonum* forma” of Laporte is – albeit with some diffidence – indeed associated with *C. impressulum* var. *crenulatum* by KRIEGER & GERLOFF (1965, p. 136). I prefer to refer to it as a form of *C. orthogonum* considering the broad, truncate apex and the relatively large dimensions in which the Netherlands specimens differ from *C. crenulatum*.

Fairly common in benthos of fen hollows, rare in tycho plankton of Stratiotetum pools.

C. pachydermum Lund.var. *pachydermum*

T.13:2

KRIEGER & GERLOFF 1962, p. 13, t.5:2.

Rather rare in fen hollows.

var. *aethiopicum* W. & G. S. West

T.13:1

KRIEGER & GERLOFF 1962, p. 14, t.5:3.

In our study area connected with var. *pachydermum* by intermediate forms. Occasionally found with zygosporos (see COESEL 1974a).

Very common in benthos of fen hollows, rare in tycho plankton.

**C. paraganatoides* Skuja

T.15:49–50

KRIEGER & GERLOFF 1965, p. 160, t.33:13.

Common in fen hollows.

***C. perminutum** G. S. West

T.12:6-7

Basion.: *Actinotaenium perminutum* (G. S. West) Teil.

KRIEGER & GERLOFF 1969, p. 396, t.68:1-2.

Fairly common in fen hollows.

C. phaseolus Bréb. ex Bréb.var. *phaseolus*

T.13:26

KRIEGER & GERLOFF 1962, p. 53, t.14:3.

Fairly common in benthos of fen hollows, rather rare in tycho plankton of Stratiotetum pools.

var. *elevatum* Nordst.

T.13:27

KRIEGER & GERLOFF 1962, p. 54, t.14:4.

In our study area connected with var. *phaseolus* by intermediate forms; distribution as of the typical variety.***C. polygonum** (Näg.) Arch. var. *acutius* Messik.

T.13:20-22

KRIEGER & GERLOFF 1965, p. 215, t.40:6.

Fairly common in tycho plankton (especially in Stratiotetum), rather rare in benthos of fen hollows.

C. portianum Arch.

T.16:5

WEST & WEST 1908, p. 165, t.80:4-7.

Rather rare in both tycho plankton of Stratiotetum pools and benthos of fen hollows.

C. praemorsum Bréb.

T.18:8

WEST & WEST 1908, p. 196, t.84:1-5.

Fairly common in tycho plankton, rather rare in benthos of fen hollows.

C. protractum (Näg.) De Bary

T.16:8

WEST & WEST 1908, p. 181, t.82:8, t.94:4-5.

Fairly common in tycho plankton, especially in stands of Stratiotetum vegetation.

***C. pseudobioculatum** Gutw.

T.14:29

KRIEGER & GERLOFF 1962, p. 65, t.15:18.

Found only once in tycho plankton.

***C. pseudoexiguum** Racib.

T.14:4-5

KRIEGER & GERLOFF 1969, p. 274, t.45:12.

Rare in fen hollows (e.g., in locality no. 2).

***C. pseudoprotuberans** Kirchn. var. *groenbladii* Croasd.

T.15:32-33

KRIEGER & GERLOFF 1965, p. 231, t.41:10.

Rather rare in both tycho plankton of Stratiotetum pools and benthos of fen hollows.

C. punctulatum Bréb. var. *subpunctulatum* (Nordst.) Börg.

T.18:9-10

WEST & WEST 1908, p. 209, t. 84:15-20, t.85:1-3.

Common in tycho plankton of pools and ditches, less common in benthos of fen hollows.

***C. quadratulum** (Gay) De Tonivar. *quadratulum*

T.15:43-44

KRIEGER & GERLOFF 1965, p. 188, t.37:9.

Rather rare in fen hollows.

var. *boldtii* (Messik.) Krieg. & Gerl.

T.15:45-46

KRIEGER & GERLOFF 1965, p. 190, t.37:11.

The alga figured here has, in comparison with the typical var. *boldtii* somewhat more elongated cells and was described as a forma by RŮŽIČKA (1972, p. 471, t.60:37-39.).

Common in fen hollows.

C. quadratum Ralfs ex Ralfsvar. *quadratum*

T.14:8

KRIEGER & GERLOFF 1969, p. 280, t.45:27, t.46:1-3.

Very common in fen hollows.

var. *willei* (Schmidle) Krieg. & Gerl.

T.14:9

KRIEGER & GERLOFF 1969, p. 283, t.46:5-6.

Common in fen hollows.

var. *nepalense* Förster

T.14:10

KRIEGER & GERLOFF 1969, p. 283, t.70:5.

In our study area, like the var. *willei* connected with var. *quadratum* by intermediate forms.

Fairly common in fen hollows.

C. quadrum Lund. forma *punctatum* Croasd.

T.17:3

The present author agrees with CROASDALE (1973, p. 87) that the presence of punctulations between the granules, a characteristic of *C. margaritatum* (Lund.) Roy & Biss., should take only second place to the cell shape which in this case indisputably points to *C. quadrum* Lund. and not to *C. margaritatum*. The opinion of KRIEGER (1932, p. 179, t.12:7), who identified this alga as the var. *quadrum* of *C. margaritatum*, is accordingly rejected here. Common in fen hollows.

C. quasillus Lund.

T.20:1

WEST & WEST 1908, p. 188, t.92:3.

Rather rare in fen hollows (see also COESEL 1975a).

C. rectangulare Grun.

T.14:14-16

KRIEGER & GERLOFF 1969, p. 265, t.44:15.

Common in fen hollows.

C. regnellii Wille

var. *kerguelense* Krieg. & Gerl.

T.15:35-37

KRIEGER & GERLOFF 1969, t.43:5.

Common in tychoplankton of pools and ditches.

var. *minimum* Eichl. & Gutw.

T.15:38-40

KRIEGER & GERLOFF 1969, t.43:8.

Very common in fen hollows.

var. *pseudoregnellii* (Messik.) Krieg. & Gerl.

T.15:41-42

KRIEGER & GERLOFF 1969, t.43:6.

Rather rare in tychoplankton of Stratiotetum pools.

C. regnesii Reinsch

T.16:9

WEST & WEST 1908, p. 36, t.68:19-28.

Rather rare in tychoplankton of Stratiotetum pools.

C. reniforme (Ralfs) Arch.

var. *reniforme*

T.17:5

WEST & WEST 1908, p. 157, t.79:1-2, t.82:15.

Common in tychoplankton of pools and ditches, less common in benthos of fen hollows.

var. *compressum* Nordst.

T.17:6

WEST & WEST 1908, p. 158, t.79:3-4.

In our study area connected with var. *reniforme* by intermediate forms; distribution as of typical variety.

C. speciosum Lund.

T.19:9

WEST & WEST 1908, p. 247, t.89:1-3.

Rather common in fen hollows.

C. sportella Bréb. var. *subnudum* W. & G. S. West

T.19:5-6

WEST & WEST 1908, p. 186, t.82:14.

The illustration in WEST & WEST (l.c.) shows a much more acute dentition than our T.19:5-6 which agrees better in this respect with those of *C. sportella* var. *subnudum* in RŮŽIČKA (1956, t.3:28).

Very rare in fen hollows (locality near "Duiningmermeer").

C. subbroomei Schmidle, forma W. & G. S. West

T.18:6-7

WEST & WEST 1912, p. 23, t.100:11.

Rather rare in benthos of fen hollows, rare in tychoplankton of Stratiotetum pools (see also COESEL 1975a).

C. subcostatum Nordst.forma *subcostatum*

T.20:10–11

WEST & WEST 1908, p. 236, t.87:3–5.

Common in tychoplankton, especially in stands of *Stratiotetum* vegetation.forma *minor* W. & G. S. West

T.20:12

WEST & WEST 1908, p. 238, t.87:6–9.

Distribution as of forma *subcostatum*.*C. subcucumis* Schmidle

T.14:1–3

KRIEGER & GERLOFF 1969, p. 284, t.47:1.

Rather common in fen hollows.

C. subgranatum (Nordst.) Lütkem.var. *subgranatum*

T.15:15

KRIEGER & GERLOFF 1965, p. 138, t.29:10.

Fairly common in fen hollows.

var. *borgei* Krieg. & Gerl.

T.15:11–14

KRIEGER & GERLOFF 1965, p. 139, t.29:11.

In our study area connected with var. *subgranatum* by intermediate forms.

Very common in benthos of fen hollows, common in tychoplankton of pools and ditches.

C. subprotumidum Nordst.var. *subprotumidum*

T.20:17

WEST & WEST 1908, p. 231, t.86:19–21.

Common in tychoplankton, especially in stands of *Stratiotetum* vegetation.var. *gregorii* (Roy & Biss.) W. & G. S. West

T.20:14–16

WEST & WEST 1908, p. 232, t.86:23–25.

Distribution as of var. *subprotumidum*.*C. subrectangulare* Lütkem. ex Grönb.

T.14:20–21

KRIEGER & GERLOFF 1969, p. 270, t.69:17 (as *C. rectangulare* var. *subrectangulare*).

In the area of study the differences between this taxon and *C. rectangulare* Grun. are so appreciable and especially so constant that the rank of species is preferred here to the varietal one attributed to it by KRIEGER & GERLOFF (l.c.).

Fairly common in fen hollows in the Weerribben area.

**C. subreinschii* Schmidle

T.15:29–31

KRIEGER & GERLOFF 1965, p. 139, t.29:12.

This species of *Cosmarium* distinguishes itself from the very similar *Euastrum montanum* W. & G. S. West by the smaller diameter and more sharply defined circumference of the central protuberance, by the rounded apical angles, and by the absence of a distinct apical emargination.

Fairly common in fen hollows.

C. subtumidum Nordst.

T.13:23–25

KRIEGER & GERLOFF 1965, p. 162, t.33:17.

Rather rare in tychoplankton of *Stratiotetum* pools.*C. taxichondriforme* Eichl. & Gutw.var. *taxichondriforme*

T.13:3–4

KRIEGER & GERLOFF 1962, p. 32, t.10:1.

The undulated sinus line and the basal angular wall thickening supposed to be characteristic of the species are not always manifest in our material.

Rather rare in fen hollows.

var. *nudum* Turn.

T.13:5–6

KRIEGER & GERLOFF 1962, p. 34, t.9:13 [as *C. nudum* (Turn.) Gutw.].

As in the var. *taxichondriforme*, in the area studied with variable sinus outline and variable wall thickness of the basal angles. Without chloroplast not sharply separable from the var. *taxichondriforme* as the number of pyrenoids is an important distinguishing feature.

Rather rare in fen hollows.

C. tetraophthalmum Bréb.

T.16:1

WEST & WEST 1908, p. 270, t.95:4-7.

Very common in fen hollows, rather rare in tycho plankton.

C. tinctum Ralfs

T.14:18-19

KRIEGER & GERLOFF 1962, p. 66, t.16:1.

Very rare in fen hollows (locality no. 2).

?C. trachypleurum Lund. var. *minus* Racib.

T.18:1

WEST & WEST 1908, p. 173, t.81:4-5.

The dimensions and the ornamentation of our material agree with the description and figure in WEST & WEST (l.c.), but in *C. trachypleurum* var. *minus* the shape of the semi-cell is supposed to be more oblong whereas, as shown in our figure, it is more trapezoid.

Very rare in tycho plankton.

C. turgidum Bréb.

T.12:1

Basion.: *Actinotaenium turgidum* (Bréb.) Teil.

KRIEGER & GERLOFF 1969, p. 364, t.62:6.

Very common in fen hollows.

C. turpinii Bréb. var. *podolicum* Gutw.

T.20:5-6

WEST & WEST 1908, p. 191, t.83:2.

Common in tycho plankton of Stratiotetum pools.

C. undulatum Corda ex Ralfs

T.15:27-28

KRIEGER & GERLOFF 1962, p. 40, t.11:10.

Rather in benthos of fen hollows, rare in tycho plankton of Stratiotetum pools.

C. vexatum W. West forma *granulatum* Förster

T.19:4

FÖRSTER 1964, p. 234, t.1:24.

Our specimens agree better with the figure in FÖRSTER (1970, t.25:6) than with the original illustration as regards cell outline and granulation pattern.

Fairly common in both benthos of fen hollows and tycho plankton of pools and ditches.

Xanthidium Ehr. ex Ralfs*X. antilopaeum* (Bréb.) ex Kütz.

T.21:3

WEST & WEST 1912, p. 63, t.108:7-18.

Rather common in tycho plankton of Stratiotetum pools, rare in benthos of fen hollows.

X. cristatum Bréb.var. *cristatum*

T.21:1

WEST & WEST 1912, p. 70, t.110:8-9, t.111:1.

Rare in fen hollows (e.g. in locality no. 1).

var. *uncinatum* Bréb.

T.21:2

WEST & WEST 1912, p. 73, t.111:2-4.

Rather rare in both tycho plankton of Stratiotetum pools and benthos of fen hollows.

X. fasciculatum Ehr. ex Ralfs

T.21:4

WEST & WEST 1912, p. 75, t.111:6-8.

Rare in fen hollows (e.g. in locality no. 1).

Staurodesmus Teil.*S. brevispina* (Bréb.) Croasd.

T.22:12

TEILING 1967, p. 579, t.22:2-3.

Syn: *Staurastrum brevispinum* Bréb.; compare WEST & WEST 1912, p. 145, t.123:1-4 (including forma *major* W. & G. S. West).

Fairly common in tycho plankton of Stratiotetum pools, rather rare in benthos of fen hollows.

S. convergens (Ehr. ex Ralfs) Teil. var. *laportei* Teil. T.21:5

TEILING 1967, p. 588, t.25:4-7, t.26:1-3.

Arthrodesmus convergens Ehr. ex Ralfs sensu WEST & WEST 1912, p. 106, t.116:6

Rare in fen hollows (e.g. in locality no. 1).

S. cuspidatus (Bréb. ex Ralfs) Teil. T.22:8-10

TEILING 1967, p. 534, t.9:15.

Staurastrum cuspidatum Bréb. ex Ralfs var. *divergens* Nordst. sensu WEST, WEST & CARTER 1923, p. 25, t.132:16.

Rather rare in plankton of larger pools and lakes.

S. dejectus (Bréb. ex Ralfs) Teil.

var. *dejectus*

T.22:5

TEILING 1967, p. 529, t.9:1-3.

Staurastrum apiculatum Bréb. sensu WEST, WEST & CARTER 1923, p. 6, t.129:7.

Rare in fen hollows (e.g. in locality no. 1).

var. *borealis* Croasd.

T.22:6-7

CROASDALE 1965, p. 328, t.7:4-7.

Rather rare in benthos of fen hollows, rare in tychoplankton of Stratiotetum pools.

S. extensus (Anderss.) Teil. var. *vulgaris* (Eichl. & Racib.) Croasd. T.21:6-7

TEILING 1967, p. 515, t.5:19.

Syn.: *Arthrodesmus incus* (Bréb.) Hass. ex Ralfs var. *vulgaris* Eichl. & Racib.

Rare in fen hollows (locality no. 1).

S. mamillatus (Nordst.) Teil. T.22:1-4

TEILING 1967, p. 536, t.9:18.

Staurastrum cuspidatum Bréb. ex Ralfs sensu WEST, WEST & CARTER 1923, p. 23, t.132:13-14.

Common in tychoplankton of Stratiotetum pools.

S. patens (Nordst.) Croasd. T.22:11

TEILING 1967, p. 543, t.20-21.

Syn.: *Staurastrum dejectum* Bréb. ex Ralfs var. *patens* Nordst., compare WEST, WEST & CARTER 1923, p. 9, t.130:1-2. In our study area not always easily distinguishable from *Stauroidesmus dejectus* var. *dejectus*.

Fairly common in tychoplankton of Stratiotetum pools, rather rare in benthos of fen hollows.

Staurastrum Meyen ex Ralfs*S. alternans* Bréb. T.24:4-5

WEST & WEST 1912, p. 170, t.126:8-9.

The form depicted in our T.24:4 is of common occurrence in tychoplankton of Stratiotetum pools, the one in our T.24:5 is regularly found in benthos of fen hollows.

S. avicula Bréb.

var. *avicula*

T.25:4

WEST, WEST & CARTER 1923, p. 40, t.133:8-10.

Common in tychoplankton, especially in stands of Stratiotetum vegetation.

var. *exornatum* Messik.

T.25:5-6

MESSIKOMMER 1929, p. 157, t.1:15.

Rare in fen hollows (locality no. 2).

S. bieneanum Rab. T.23:1-4

WEST & WEST 1912, p. 135, t.120:4-6.

The angles are by no means always so acute as figured in WEST & WEST (l.c.). They may sometimes be almost rounded (compare also RŮŽIČKA 1973, t.14:3).

Fairly common in tychoplankton of Stratiotetum pools.

****S. boreale* W. & G. S. West**var. *boreale*

T.30:9–12

WEST, WEST & CARTER 1923, p. 112, t.146:5.

Fairly common in fen hollows.

?var. *boreale*, forma

T.30:13–15

This form, here referred to *S. boreale* on account of dimensions, cell shape, and granulation pattern differs from the more typical var. *boreale* in its more gaping sinus and the straight to concave apex when seen in frontal view.

Rare in fen hollows (locality no. 1).

var. *quadriradiatum* Korshikov

T.30:16–20

KORSHIKOV 1941, p. 75, t.7:7.

Rather rare in fen hollows.

***S. brebissonii* Arch.**

T.26:6–7

WEST, WEST & CARTER 1923, p. 61, t.137:4–5.

Rather common in tychoplankton of Stratiotetum pools.

***S. chaetoceras* (Schröd.) G. M. Smith**

T.31:5–15

SMITH 1924, p. 99, t.76:21–24, t.77:1.

Relatively few of our specimens resemble the original illustration of *S. chaetoceras* (compare our T.31:5); the majority of the figures agrees, as far as the biradiate forms are concerned, with what is usually called *S. tetracerum* var. *validum* W. & G. S. West in the pertaining literature (compare, e.g., NYGAARD 1945, t.4:59 with our T.31:6), and as far as the triradiate ones are concerned, with *S. paradoxum* Meyen (compare, e.g., NYGAARD 1945, t.4:57 with our T.31:11–14). BROOK (1959a, p. 601) already pointed out that the above-mentioned figures of NYGAARD relate to *S. chaetoceras*, and our series of illustrations of intermediate forms confirms this. Common in plankton of dikes, larger pools and lakes.

****S. cingulum* (W. & G. S. West) G. M. Smith**

T.29:7–10

WEST, WEST & CARTER 1923, p. 105, t.145:9–10 (as *S. paradoxum* Meyen var. *cingulum* W. & G. S. West).

The original description and figure of this taxon refer to a typically planktonic species with long and curved arms. BROOK (1959a), who revised the collective species *S. paradoxum* Meyen and *S. gracile* Ralfs, figured a great variety of forms of *S. cingulum* including some agreeing very closely with our T.29:7–10 (compare BROOK 1959a, t.13:5–8).

Rather rare in plankton of lakes.

***S. crenulatum* (Näg.) Delp.**

T.29:11–15

WEST, WEST & CARTER 1923, p. 110, t.143:9–13.

Our tychoplanktonic material (T.29:11–12) is more typical than the specimens from the benthos of fen hollows. (T.29:13–15). The latter form agrees better with several published figures of *S. gracile* Ralfs but cannot belong here on account of, e.g., the granulation pattern.

Rather rare in both tychoplankton of Stratiotetum pools and benthos of fen hollows.

***S. dilatatum* Ehr. ex Ralfs**

T.24:6–8

WEST & WEST 1912, p. 172, t.126:10–15.

Fairly common in fen hollows.

****S. dispar* Bréb.**

T.24:11–12

WEST & WEST 1912, p. 187, t.127:7.

Fairly common in tychoplankton of Stratiotetum pools.

***S. forficulatum* Lund.**

T.27:2–3

WEST, WEST & CARTER 1923, p. 187, t.154:14–16.

Rather rare in fen hollows.

***S. furcigerum* (Bréb. ex Ralfs) Arch.**

T.27:5

WEST, WEST & CARTER 1923, p. 188, t.156:7–8, 11.

Common in tychoplankton of Stratiotetum pools, rare in benthos of fen hollows.

S. gladiosum Turn. var. *delicatulum* W. & G. S. West

T.26:2-3

WEST, WEST & CARTER 1923, p. 58, t.137:3.

Common in tycho plankton of Stratiotetum pools (see also COESEL 1975a).

S. gracile Ralfs ex Ralfs

T.29:16-17

BROOK 1959a, p. 590, text-fig. 3.

The description and figure of this species in BROOK (l.c.) who studied Ralfs' type material agree satisfactorily with our figures.

Rare in tycho plankton of Stratiotetum pools.

**S. granulosum* (Ehr.) ex Ralfs var. *acutum* (Bréb.) W. & G. S. West

T.25:3

WEST & WEST 1912, p. 190, t.128:14.

Rather rare in fen hollows.

?*S. hexacerum* (Ehr. ex Kütz.) Witttr.

T.30:4-8

WEST, WEST & CARTER 1923, p. 138, t.142:11-14.

RŮŽIČKA (1972, p. 476) pointed out that this is a dubious species because the original figure in EHRENBURG (1838, t.10:10; as *Desmidium hexaceros*) is rather inaccurate and the interpretation given to it in the subsequent literature including WEST, WEST & CARTER (l.c.) is rather different.

Common in tycho plankton.

S. inflexum Bréb.

T.29:18-19

WEST, WEST & CARTER 1923, p. 108, t.143:7-8.

Common in benthos of fen hollows, fairly common in tycho plankton of Stratiotetum pools.

**S. kaiseri* Růž.

T.23:5-8

KAISER 1919, p. 228, f. 32 (as *S. orbiculare* Ralfs var. *angulatum*).

This taxon, raised to specific rank by RŮŽIČKA (1972, p. 477), exhibits a rather variable sinus outline in our area of study. The angular thickening supposed to be characteristic is not always so pronounced either. It is nevertheless a most characteristic species which is not easily confused with other taxa.

Common in fen hollows.

**S. lapponicum* (Schmidle) Grönb.

T.24:1-3

GRÖNBLAD 1927, p. 29, t.2:106-107.

Common in fen hollows.

S. lunatum Ralfs var. *planctonicum* W. & G. S. West

T.25:1-2

WEST, WEST & CARTER 1923, p. 30, t.133:20-22.

Fairly common in tycho plankton of Stratiotetum pools.

S. manfeldtii Delp.

var. *manfeldtii*

T.28:5-6

DELPONTE 1878, p. 160, t.13:6-19.

S. manfeldtii Delp. and *S. sebaldi* Reinsch var. *ornatum* Nordst. are two closely affined taxa. TEILING (1947) considers especially "shape of the corpus and hence of the sinus" to be the differentiating character of the greatest taxonomic value, and of more importance than the outline, the arrangement of the granules, verrucae, and spines, or the length and direction of the processes. According to TEILING (l.c.), *S. manfeldtii* is characterised by a narrow sinus and a cylindrical basal part of the semicell, whereas *S. sebaldi* var. *ornatum* is characterised by an open sinus and a conical-cup shaped semicell. TEILING (l.c.) none the less states that "even the corpus character does not exclude questionable intermediate forms". As an example he mentions *S. manfeldtii* in NYGAARD (1945, fig. 79), in which a specimen is shown with an open sinus combined with a cylindrical shape of basal part of the semicell. Also our figures *T.28:5-6* are dualistic in this respect. Following NYGAARD (l.c.) and also, e.g., SKUJA (1964, t.55:3-4) the present author is inclined to let, in this case, the shape of the semicell prevail taxonomically over that of the sinus.

Common in tycho plankton of Stratiotetum pools.

var. *parvum* Messik.

T.28:7-8

MESSIKOMMER 1942, p. 173, t.19:1.

The original description of MESSIKOMMER (l.c.) mentions 4-radiate cells provided with faintly diverging arms. RŮŽIČKA (1973, p. 218, t. 15:10-18) signalled a rather great variation in the number and

position of the arms, and also in the ornamentation. His figure t.15:18 in particular agrees very closely with our material.

Distribution as of var. *manfeldtii*.

S. micron W. West var. *perpendicularum* (Grönb.) Brook T.31:16

BROOK 1959b, p. 161, t.27:4-5.

Our figure approaches Brook's illustrations of this taxon very closely (compare also BROOK 1960, t.91:1-6).

Rare in (tycho)plankton of pools.

S. muticum Bréb. ex Ralfs T.23:11-13

WEST & WEST 1912, p. 133, t.118:16-20.

Fairly common in fen hollows.

S. oligacanthum Bréb. T.27:4

WEST, WEST & CARTER 1923, p. 48, t.139:6.

Common in fen hollows.

S. orbiculare Ralfs ex Ralfs var. *depressum* Roy & Biss. T.23:9-10

WEST & WEST 1912, p. 158, t.124:17-19.

Rather rare in fen hollows.

S. oxycanthum Arch.

var. *oxyacanthum* T.28:1-3

WEST, WEST & CARTER 1923, p. 169, t.143:18-19.

Common in fen hollows.

var. *polyacanthum* Nordst. T.28:4

WEST, WEST & CARTER 1923, p. 170, t.143:20-22.

Fairly common in fen hollows.

**S. pingue* Teil. T.29:1-6

TEILING 1942, p. 66, f. 3-5.

In the same way as *S. planctonicum* Teil. is considered by TEILING (1947) to represent the planktonic derivative of the benthic *S. sebaldi* var. *ornatum* Nordst.; *S. pingue* represents according to this worker the planktonic evolution product of *S. manfeldtii* Delp. Like the latter species, *S. pingue* is characterised by the subcylindrical basal part of the semicell. The specific planktonic nature is expressed in the more slender appearance (the relatively longer arms) and the almost complete absence of ornamentation. Our forms, in particular the one shown in *T.29:2-5*, deviate from the original description of *S. pingue* in TEILING (1942) in the relatively shorter arms and also in the smaller absolute dimensions. They agree much better with BROOK's figures (1959a, t.18:5-9) of the "small form" of *S. pingue*.

The 4-armed form shown in *T.29:1* was only found occasionally, whereas the smaller 3-armed form (*T.29:2-6*) was rather regularly encountered in the plankton of pools and lakes.

**S. planctonicum* Teil. var. *ornatum* (Grönb.) Teil. T.28:9

TEILING 1947, p. 227, f. 15.

S. planctonicum Teil. is considered by its author TEILING (1947) to be a planktonic taxon derived from the benthic *S. sebaldi* var. *ornatum* Nordst. *S. planctonicum* var. *ornatum* (Grönb.) Teil. must be regarded as a transitional form between the manifestly ornamented *S. sebaldi* var. *ornatum* and the almost smooth-walled *S. planctonicum*. Rare in plankton of larger pools and lakes.

?*S. polymorphum* Bréb. T.30:1-3

RALFS 1848, p. 135, t.22:9, T.34:6.

The specimens shown here in *T.30* are more slender than DE BRÉBISSE's original figures of *S. polymorphum* in Ralfs (l.c.). It is also a question if our figures relate to the same species, considering the different apical granule pattern of the material shown in *T.30:1* (from tycho)plankton) and of the algae shown in *T.30:2-3* (from a benthonic sample). The specimens illustrated in *T.30:1* agree very well with the species described by DELPONTE (1878, t.12:30-35) as *S. oblongum* - a species hardly ever mentioned in later publications - whereas those shown in *T.30:2-3* agree in their coarser ornamentation with the likewise rather unknown *S. haaboeliense* Wille as illustrated in WEST, WEST & CARTER (1923, t.142:19-20).

Very rare in benthos of fen hollows (locality no. 10), once found in tycho)plankton.

S. polytrichum (Perty) Rab.

T.26:1

PERTY 1852, p. 210, t.16:24.

MESSIKOMMER (1935, p. 124) has pointed out that the figures of this species as given by WEST, WEST & CARTER (1923, t.136:8–10) are confusing because the spinules are drawn as appreciably shorter and bulkier than they are in the original illustration of PERTY (l.c.). Our material – provided with long and often curved spines – agrees almost exactly with the figure of *S. polytrichum* in MESSIKOMMER (1935, t.2:15).

Rather rare in fen hollows.

S. proboscideum (Bréb.) Arch.

T.24:15–16

WEST, WEST & CARTER 1923, p. 129, t.143:14–16.

Common in fen hollows.

S. spongiosum Bréb.

T.27:1

WEST, WEST & CARTER 1923, p. 76, t.140:14.

Rare in fen hollows (e.g. in locality no. 15).

**S. striatum* (W. & G. S. West) Růž.

T.24:9–10

RŮŽIČKA 1957, p. 148, t.3:54.

Syn.: *S. punctulatum* Bréb. var. *striatum* W. & G. S. West, in WEST & WEST 1912, p. 186, t.128:5–6.

Rare in tychoplankton of Stratiotetum pools.

?S. striolatum (Näg.) Arch.

T.24:13–14

WEST & WEST 1912, p. 177, t.127:1–5.

The identification is somewhat doubtful. *S. striolatum* should, judging by the original figure of NÄGELI (1849, t.8A:3) and those of WEST & WEST (l.c.), have a retuse to at best straight dorsal margin, whereas the apex line is clearly convex in our material. It is not impossible that our specimens belong to the hardly identifiable "*Staurastrum* spec." of RŮŽIČKA (1972, p. 481, t.63:24–25; 1973, p. 220, t.14:16–17).

Rather rare in fen hollows.

**S. subavicula* (W. West) W. & G. S. West

T.25:10–11

WEST, WEST & CARTER 1923, p. 181, t.155:10.

S. subavicula is characterised in WEST, WEST & CARTER (l.c.) by six bifurcate processes on the apex, whereas our specimens bear only simple spines in the corresponding places. Only once was a specimen encountered in which the series of simple spines was interrupted by a bifurcate process (see our illustration in T.25:11).

PETERFI (1972, t.2:10–17) found a whole series of transitions between specimens with only simple spines and forms with a complete set of bifurcate spines.

Rather rare in tychoplankton of Stratiotetum pools.

**S. subcruciatum* Cooke & Wills

T.25:7–9

WEST, WEST & CARTER 1923, p. 42, t.133:6–7.

Rare in plankton of larger pools and lakes.

S. tetracerum (Kütz.) Ralfs ex Ralfsvar. *tetracerum*

T.31:1–2

WEST, WEST & CARTER 1923, p. 118, t.2–4.

Common in tychoplankton of pools, rare in benthos of fen hollows.

var. *cameloides* (Georgev.) Florin

T.31:3–4

FLORIN 1957, p. 133, f. 29:5–8.

The biradial form is of fairly common occurrence, the triradial one rather rare in the plankton of larger pools and lakes.

**S. trapezicum* Boldt

T.26:4–5

BOLDT 1888, p. 35, t.2:46,

RŮŽIČKA (1972, p. 481, t.63:15) whose illustration of *S. trapezicum* shows a striking resemblance to ours, has pointed out that the most conspicuous feature in Boldt's original figure, viz., the duplicated spines, is too variable to be taxonomically very significant.

Fairly common in fen hollows.

Hyalotheca Ehr. ex Ralfs*H. dissiliens* (J. E. Smith) ex Bréb.

T.32:1-2

WEST, WEST & CARTER 1923, p. 229, t.161:16-27.

Fairly common in both tychoplankton of Stratiotetum pools and benthos of fen hollows. In the latter habitat in a number of cases with zygospores.

Desmidium Ag. ex Ralfs*D. aptogonum* Bréb. ex Kütz.

T.32:3-4

WEST, WEST & CARTER 1923, p. 242, t.164:1-3.

Fairly common in tychoplankton of Stratiotetum pools, rather rare in benthos of fen hollows.

D. swartzii Ag. ex Ralfs

T.32:5-6

WEST, WEST & CARTER 1923, p. 246, t.163:5-8.

Fairly common in benthos of fen hollows, rather rare in tychoplankton of Stratiotetum pools.

Sphaerosoma Corda ex Ralfs*S. granulatum* Roy & Biss.

T.32:7-8

WEST, WEST & CARTER 1923, p. 213, t.160:6-7.

Rare in both benthos of fen hollows and (tycho)plankton of pools and lakes.

5. DISCUSSION

With a total of nearly 250 recorded desmid taxa, the holocene broads area of N.W.-Overijssel can easily compete with the desmid "treasure-houses" in the Netherlands province of N. Brabant and Drente discovered and described by HEIMANS (1925) and BEIJERINCK (1926), respectively. The absence of a category of oligotrophic desmid species, so characteristic of the poor fen and bog vegetation types as found on the pleistocene sands of Brabant and Drente, is amply compensated by a greater diversity of the mesotrophic species characteristic of rich fen vegetation (compare COESEL 1975b). In this respect there is a greater correspondence with the desmid flora of the nature conservancy "Het Hol", likewise a holocene broads area, situated in the W. of the Netherlands (compare HEIMANS & MEIJER 1955). Precisely because the category of mesotrophic species has declined alarmingly in the above-mentioned pleistocene localities during the last half-century (see COESEL & SMIT 1977, COESEL et al. 1978), the Netherlands nowadays possess in the lowland marsh area of N.W. Overijssel by far the richest desmid site.

As the most extensive and most species-rich fen localities the localities nos. 1 and 2 can be ear-marked, whilst locality no. 12 is relatively the richest in the rare species of the broads area in question (such as *Penium spirostriolatum*, *Closterium cynthia*, *C. pseudolunula*, and *Euastrum ansatum*). The regular occurrence in this area of species reputedly with a predominantly arctic-alpine distribution such as *Cosmarium crenatum*, *C. speciosum*, *C. holmiense* var. *integrum*, *C. anceps*, and *C. paraganatoides*, is also very striking. These latter species, which have only occasionally or not at all been recorded from elsewhere in the Netherlands (compare COESEL 1974b), live hemi-atmophytically in soggy *Scorpidium* cushions in fen hollows containing neutral to faintly acid surface water.

Apart from a rich benthic desmid flora in the mesotrophic, weakly acid quivering fen hollows, a diversified tychoplanktonic desmid flora is found in the more eutrophic, alkaline peat-excavated pools. As characteristic taxa the following may be mentioned: *Cosmarium insigne*, *C. protractum*, *C. biretum* var. *trigibberum*, *C. turpinii*, *Staurastrum manfeldtii* and *S. gladiosum* var. *delicatulum*. As a result of the fast deteriorating water quality in the area concerned these species become progressively restricted in their occurrence to some hydrologically more or less isolated refugia.

ACKNOWLEDGEMENTS

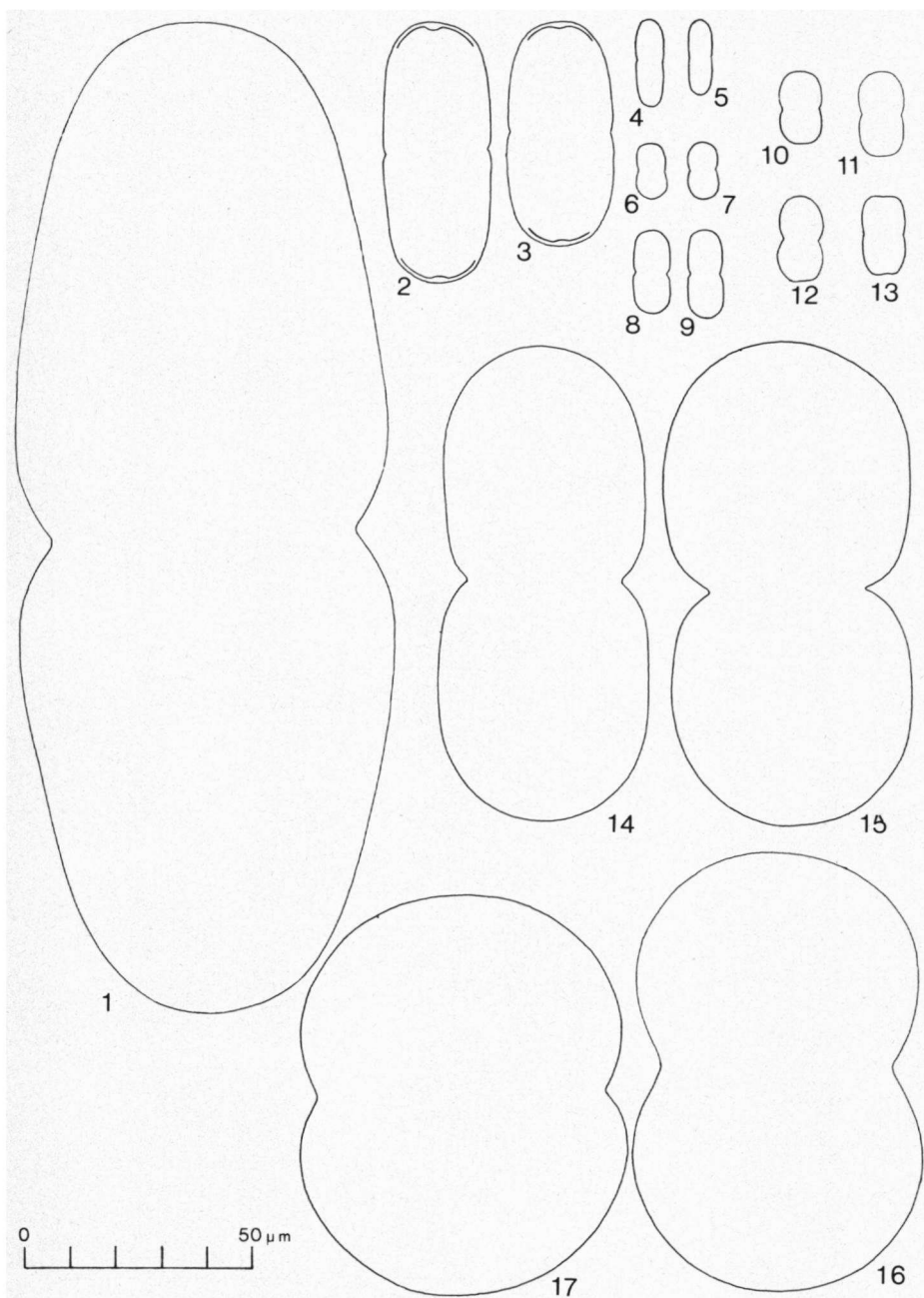
The author thanks Professor A. D. J. Meeuse for his critical perusal of the manuscript and his assistance with the English rendering.

REFERENCES

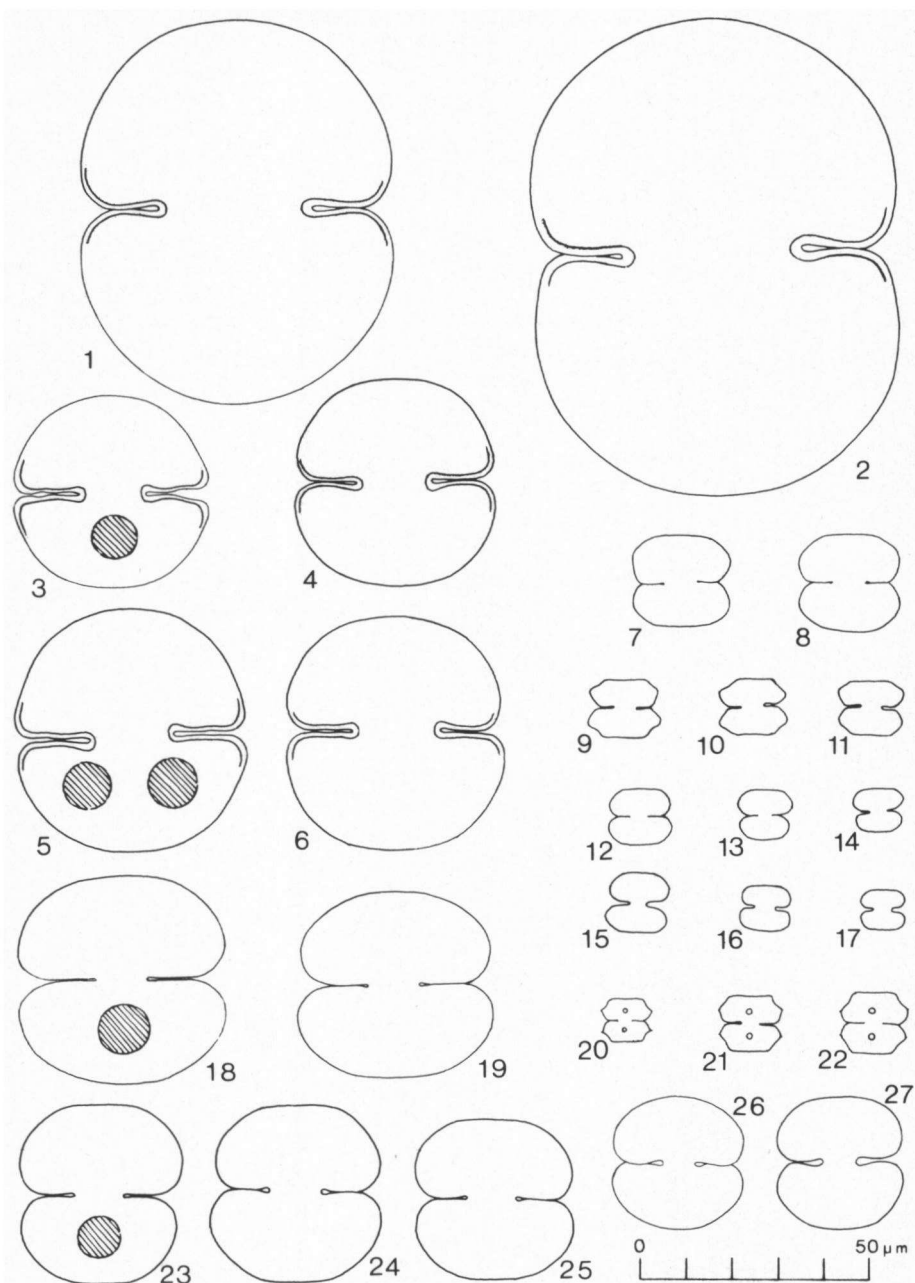
- BEIJERINCK, W. (1926): Over verspreiding en periodiciteit van de zoetwaterwieren in Drentsche heideplassen (with a summary in English). *Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Tweede Sect.* **25** (2): 5–211.
- BOLDT, R. (1888): Desmidieer från Grönland. *Bih. Kongl. Svenska Vetensk.-Akad. Handl.* **13** (3:5): 1–49.
- BORGE, O. (1913): Beiträge zur Algenflora von Schweden. 2. Die Algenflora um den Torne-Träsksee in Schwedisch-Lappland. *Bot. Not.* **1913**: 1–32, 49–64, 97–110.
- BROOK, A. J. (1959a): *Staurastrum paradoxum* Meyen and *S. gracile* Ralfs in the British Freshwater Plankton, and a Revision of the *S. anatinum*-group of Radiate Desmids. *Trans. Roy. Soc. Edinburgh* **63** (3:26): 589–628.
- (1959b): *Staurastrum pendulum* var. *pinguiforme* Croasdale, *S. minor* West f. *major* f. nov., fac. *quadrata* and *S. micron* var. *perpiculatum* (Grönblad) nov. comb., desmids new to the British Freshwater plankton. *Nova Hedwigia* **1** (2): 157–162.
- (1960): The Varieties of *Staurastrum paradoxum* Meyen – nomen dubium. *Nova Hedwigia* **1** (3/4): 431–442.
- COESEL, P. F. M. (1974a): Notes on sexual reproduction in desmids. 1. Zygospor formation in nature (with special reference to some unusual records of zygotes). *Acta Bot. Neerl.* **23** (4): 361–368.
- (1974b): Bijdragen tot de kennis der Nederlandse Desmidiaceënfloora 1. Enige interessante soorten uit het plessengebied van N.W.-Overijssel. *Gorteria* **7** (2): 20–26.
- (1975a): Bijdragen tot de kennis der Nederlandse Desmidiaceënfloora 3. N.W.-Overijssel (2). *Gorteria* **7** (12): 207–213.
- (1975b): The relevance of desmids in the biological typology and evaluation of fresh waters. *Hydrobiol. Bull.* **9** (3): 93–101.
- , R. KWAKKESTEIN & A. VERSCHOOR (1978): Oligotrophication and eutrophication tendencies in some Dutch moorland pools, as reflected in their desmid flora. *Hydrobiologia* **61** (1): 21–31.
- & H. D. W. SMIT (1977): Jukwieren in Drente, vroeger en nu. Veranderingen in de Desmidiaceënfloora van enige Drentse vennen gedurende de laatste 50 jaar. *De Levende Natuur* **80** (2): 34–44.
- CROASDALE, H. (1965): Desmids of Devon Island, N.W.T., Canada. *Trans. Amer. Microsc. Soc.* **84**(3): 301–335.
- (1973): Freshwater Algae of Ellesmere Island, N.W.T. *Natl. Mus. Canada, Publ. in Bot.* **3**: 1–131.
- DELPONTE, J. B. (1878): Specimen Desmidiacearum Subalpinarum. *Mem. Reale Accad. Sci. Torino*, ser. 2, **30**: 1–186.
- DICK, J. (1930): Pfälzische Desmidiaceen. *Mitt. Pfälz. Vereins Naturk. Pollichia*, n.F. **3**: 93–144.

- EHRENBERG, C. G. (1838): *Die Infusionstierchen als vollkommene Organismen*. Ein Blick in das tiefere organische Leben der Natur. Leipzig.
- FLORIN, M. B. (1957): Plankton of fresh and brackish waters in the Södertälje area. *Acta Phytogeogr. Suec.* 37: 1–144.
- FÖRSTER, K. (1964): Einige Desmidiaceen aus der Umgebung von Addis Abeba. *Rev. Algol.*, n.s. 7 (3): 223–236.
- (1965): Beitrag zur Desmidiaceen-Flora der Torne-Lappmark in Schwedisch Lappland. *Ark. Bot.* 6 (3): 109–161.
- (1970): Beitrag zur Desmidiaceenflora von Süd-Holstein und der Hansestadt Hamburg. *Nova Hedwigia* 20: 253–411.
- GRÖNBLAD, R. (1927): Beitrag zur Kenntnis der Desmidiaceen Schlesiens. *Commentat. Biol.* 2 (5): 1–39.
- GUTWINSKI, R. (1892): Materyaly do flory glonów Galicyi. III. *Spraw. Komis. Fizjogr.* 28: 104–166.
- HEIMANS, J. (1925): De Desmidiaceenflora van de Oisterwijkse vennen. *Ned. Kruidk. Arch.* 31: 245–262.
- & W. MEIJER (1955): De Desmidiaceen van het plassen gebied Het Hol bij Kortenhoef. In: W. MEIJER & R. J. DE WIT (eds.), *Kortenhoef*, pp. 105–108. Amsterdam.
- KAISER, P. E. (1919): Desmidiaceen des Berchtesgadener Landes. *Kryptog. Forsch.* 1 (4): 216–230.
- KORSHIKOV, A. (1941): Materialy k flore vodoroslej Kolskogo poluoostrova. *Trudy Inst. Bot. Khar'kov.* 4: 53–76.
- KRIEGER, W. (1932): Die Desmidiaceen der Deutschen Limnologischen Sunda-Expedition. *Arch. Hydrobiol., suppl.* 11: 129–230.
- & J. GERLOFF (1962–1969): *Die Gattung Cosmarium*. Lief. 1 (1962), Lief. 2 (1965), Lief. 3 (1969). Cramer, Weinheim.
- LAPORTE, L.-J. (1931): Recherches sur la biologie et systématique des Desmidiées. *Encycl. Biol.* 9: 1–147.
- MESSIKOMMER, E. (1929): Beiträge zur Kenntniss der Algenflora des Kantons Zürich. IV. Folge: Die Algenvegetation der Moore am Pfaffikersee. *Vierteljahrsschr. Naturf. Ges. Zürich* 74: 139–163.
- (1935): Algen aus dem Obertoggenburg. *Mitt. Bot. Mus. Univ. Zürich* 148: 95–130.
- (1942): Beitrag zur Kenntnis der Algenflora und Algenvegetation des Hochgebirges um Davos. *Beitr. Geobot. Landesaufn. Schweiz* 24: 1–452.
- NÄGELI, C. (1849): Gattungen einzelliger Algen physiologisch und systematisch bearbeitet. *Neue Denkschr. Allg. Schweiz. Ges. Gesamten Naturwiss.* 10: 1–139.
- NORDSTEDT, O. (1888): Fresh-water Algae, collected by Dr. S. Berggren in New Zealand and Australia. *Kongl. Svenska Vetenskapsakad. Handl.*, n.s. 22 (8): 1–97.
- NYGAARD, G. (1945): *Dansk Planteplankton*. Gyldendal, København.
- PERTY, M. (1852): *Zur Kenntnis kleinster Lebensformen nach Bau, Funktionen, Systematik, mit Specialverzeichnis der in der Schweiz beobachteten*. Bern.
- PETERFI, L. (1972): Variability of *Staurastrum* in natural populations with remarks on its taxonomic and nomenclatural implications. *Rev. Roum. Biol.-Botanique* 17 (1): 19–28.
- RALFS, J. (1848): *The British Desmidiaceae*. Reeve, Benham and Reeve, London.
- RŮŽIČKA, J. (1949): *Cosmarium hornavanense* Gutw. *Sborn. Nár. Mus. v. Praze* 5B (2): 1–22.
- (1952): Zur Frage des *Cosmarium ochthodes* Nordst. *Preslia* 24: 267–280.
- (1953): *Cosmarium obtusatum* Schmidle. *Preslia* 25: 229–262.
- (1956): Die Desmidiaceen der Moravice-Quellen (Grosser Kessel, Gesenke). *Přir. Sborn. Ostravsk. Kraje* 17 (1): 38–58.
- (1957): Die Desmidiaceen der oberen Moldau (Böhmerwald). *Preslia* 29: 132–154.
- (1972): Die Zieralgen der Insel Hiddensee. *Arch. Protistenk.* 114: 453–485.
- (1973): Die Zieralgen des Naturschutzgebietes "Řežbínec" (Südböhmen). *Preslia* 45: 193–241.
- SCHMIDLE, W. (1893): Beiträge zur Algenflora des Schwarzwaldes und der Rheinebene. *Ber. Naturf. Ges. Freiburg* 7 (1): 68–112.
- (1894): Aus der Chlorophyceen-Flora der Torfstiche zu Virnheim. *Flora* 78 (1): 42–66.
- SKUJA, H. (1929): Süßwasseralgen von den westestnischen Inseln Saaremaa und Hiiumaa. *Acta Horti Bot. Univ. Latv.* 4: 1–76.
- (1964): Grundzüge der Algenflora und Algenvegetation der Fjeldgegenden um Abisko in

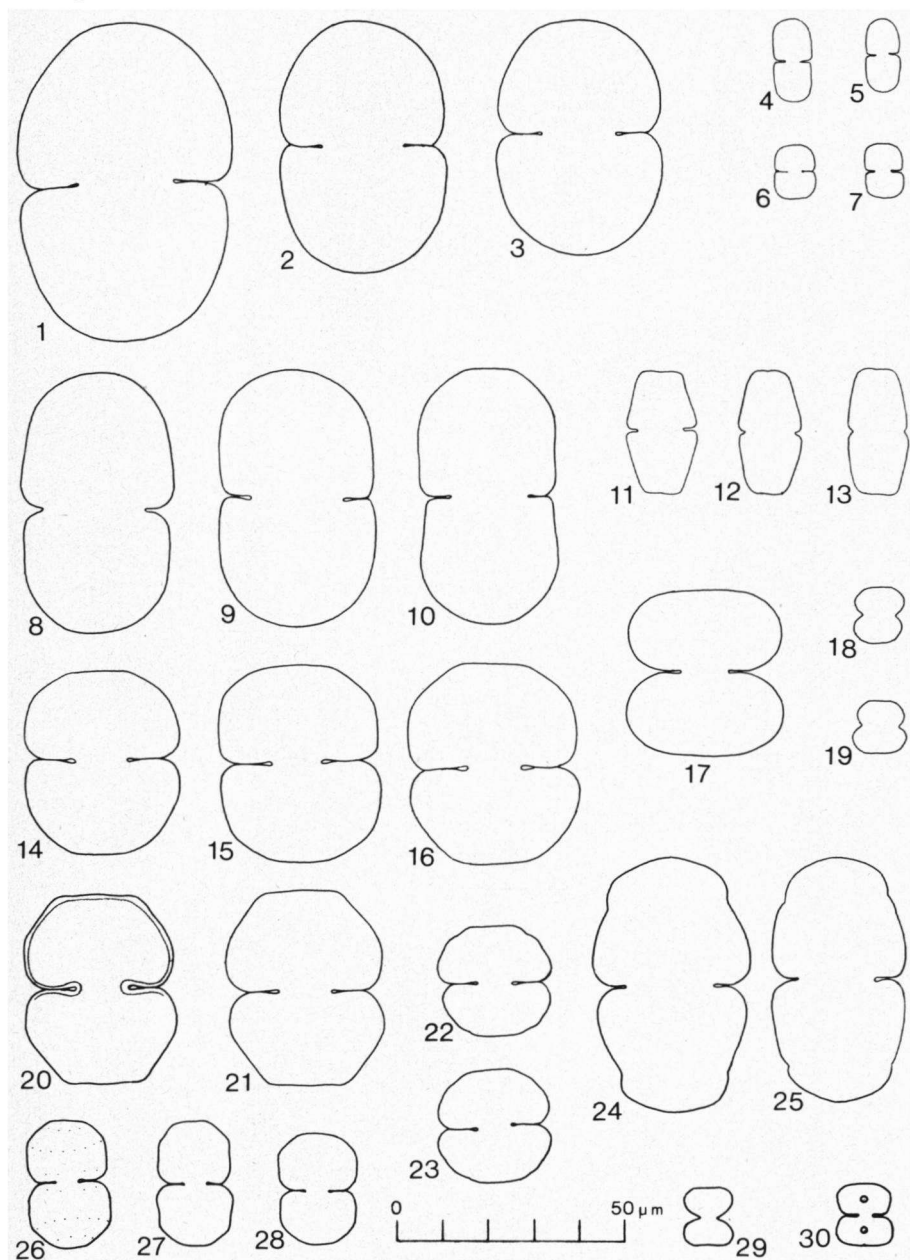
- Schwedisch-Lappland. *Nova Acta Regiae Soc. Sci. Upsal.*, ser. 4, **18** (3): 1–465.
- SMITH, G. M. (1924): Phytoplankton of the Inland Lakes of Wisconsin II. *Wisconsin Geol. & Nat. Hist. Surv. Bull.* **57** (Part II): 1–227.
- TEILING, E. (1942): Schwedische Planktonalgen 3. Neue oder wenig bekannte Formen. *Bot. Not.* **1942** (1): 63–68.
- (1947): *Staurastrum planctonicum* and *St. pingue*. A study of planktic evolution. *Svensk Bot. Tidskr.* **41** (2): 218–234.
- (1967): The desmid genus *Stauroidesmus*. *Ark. Bot.*, ser. 2, **6** (11): 467–629.
- WEST, W. & G. S. WEST (1908, 1912): *A Monograph of the British Desmidiaceae*. Vol. 3 (1908), Vol. 4 (1912). Ray Society, London.
- WEST, W., G. S. WEST & N. CARTER (1923): *A Monograph of the British Desmidiaceae*. Vol. 5. Ray Society, London.



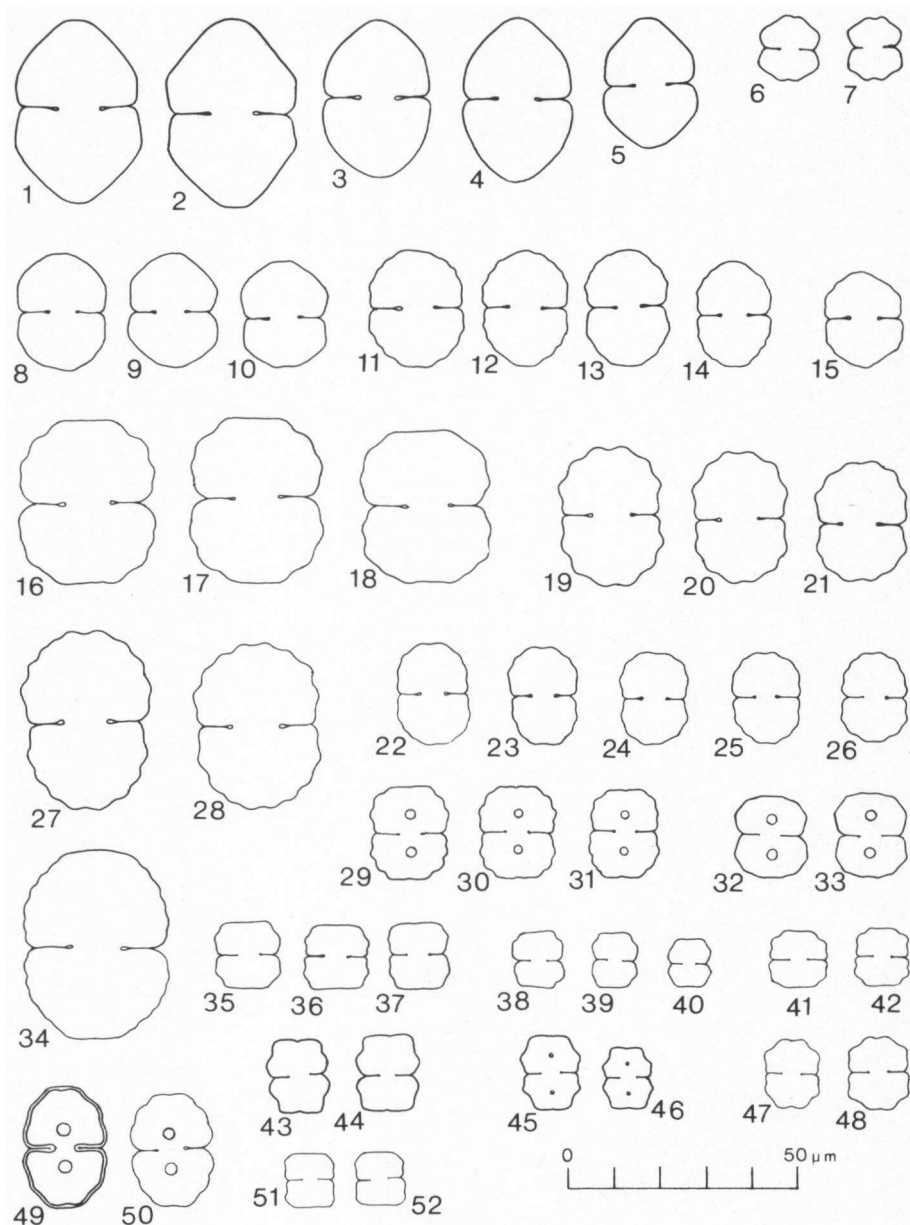
Tab. 12. – 1. *Cosmarium turgidum*; 2–3. *C. diplosporum*; 4–5. *C. bacillare*; 6–7. *C. perminutum*; 8–9. *C. goniodes* var. *goniodes*; 10–13. *C. goniodes* var. *subturgidum*; 14–15. *C. debaryi*; 16–17. *C. connatum*.



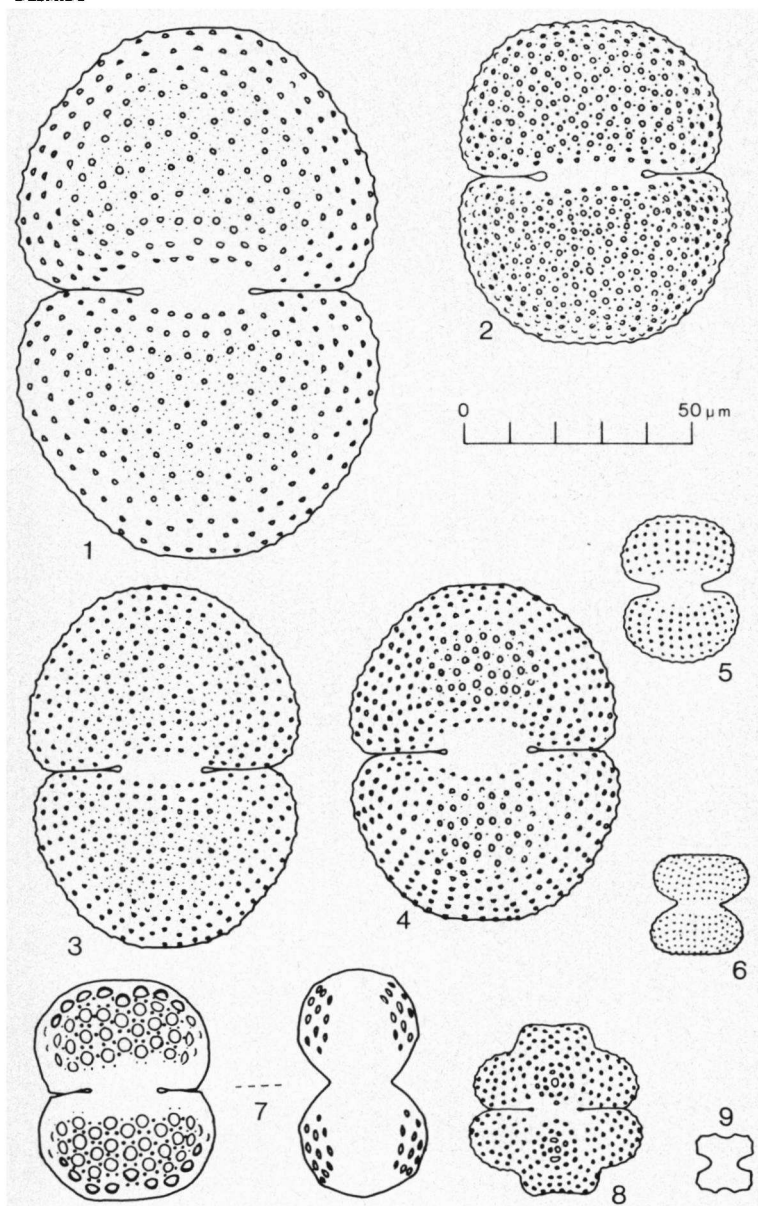
Tab. 13. – 1. *Cosmarium pachydermum* var. *aethiopicum*; 2. *C. pachydermum* var. *pachydermum*; 3–4. *C. taxichondriforme* var. *taxichondriforme*; 5–6. *C. taxichondriforme* var. *nudum*; 7–8. *C. abbreviatum* var. *abbreviatum*; 9–11. *C. abbreviatum* var. *germanicum*; 12–17. *C. abbreviatum* var. *minus*; 18–19. *C. depressum*; 20–22. *C. polygonum* var. *acutius*; 23–25. *C. subtumidum*; 26. *C. phaseolus* var. *phaseolus*; 27. *C. phaseolus* var. *elevatum*.



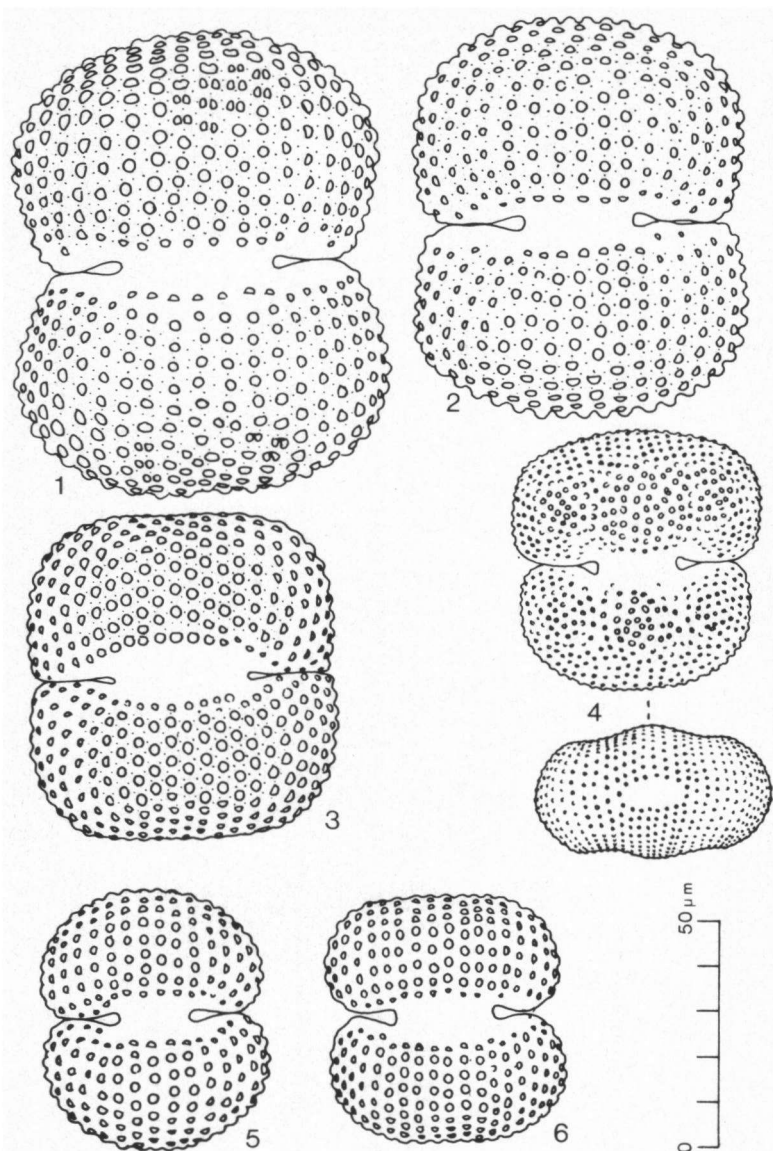
Tab. 14. - 1-3. *Cosmarium subcucumis*; 4-5. *C. pseudoexiguum*; 6-7. *C. minimum*; 8. *C. quadratum* var. *quadratum*; 9. *C. quadratum* var. *willei*; 10. *C. quadratum* var. *nepalense*; 11-13. *C. anceps*; 14-16. *C. rectangulare*; 17. *C. contractum* var. *retusum*; 18-19. *C. tinctum*; 20-21. *C. subrectangulare*; 22-23. *C. fontigenum* var. *pseudofontigenum*; 24-25. *C. holmiense* var. *integrum*; 26-28. *C. difficile*; 29. *C. pseudobioculatum*; 30. *C. bireme*.



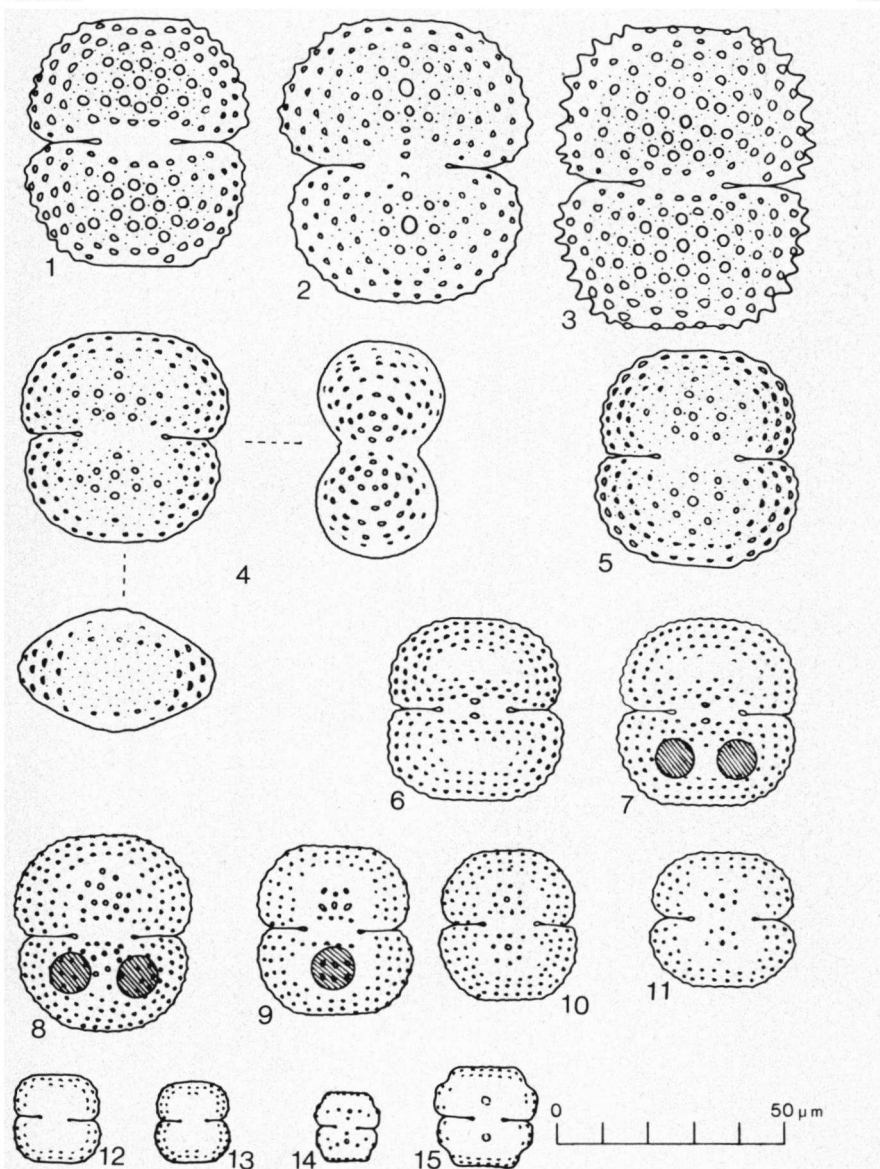
Tab. 15. — 1–5. *Cosmarium granatum*; 6–7. *C. laeve* var. *pseudooctangulare*; 8–10. *C. laeve* var. *laeve*; 11–14. *C. subgranatum* var. *borgei*; 15. *C. subgranatum* var. *subgranatum*; 16–18. ?*C. orthogonum* var. *gutwinskii*, forma; 19–21. *C. crenulatum*; 22–26. *C. impressulum*; 27–28. *C. undulatum*; 29–31. *C. subreinschii*; 32–33. *C. pseudoprotuberans* var. *groenbladii*; 34. *C. garrolense* var. *crassum*; 35–37. *C. regnellii* var. *kerguelense*; 38–40. *C. regnellii* var. *minimum*; 41–42. *C. regnellii* var. *pseudoregnellii*; 43–44. *C. quadratulum* var. *quadratulum*; 45–46. *C. quadratulum* var. *boldtii*; 47–48. *C. meneghinii*; 49–50. *C. paragranatoides*; 51–52. *C. norimbergense* var. *depressum*.



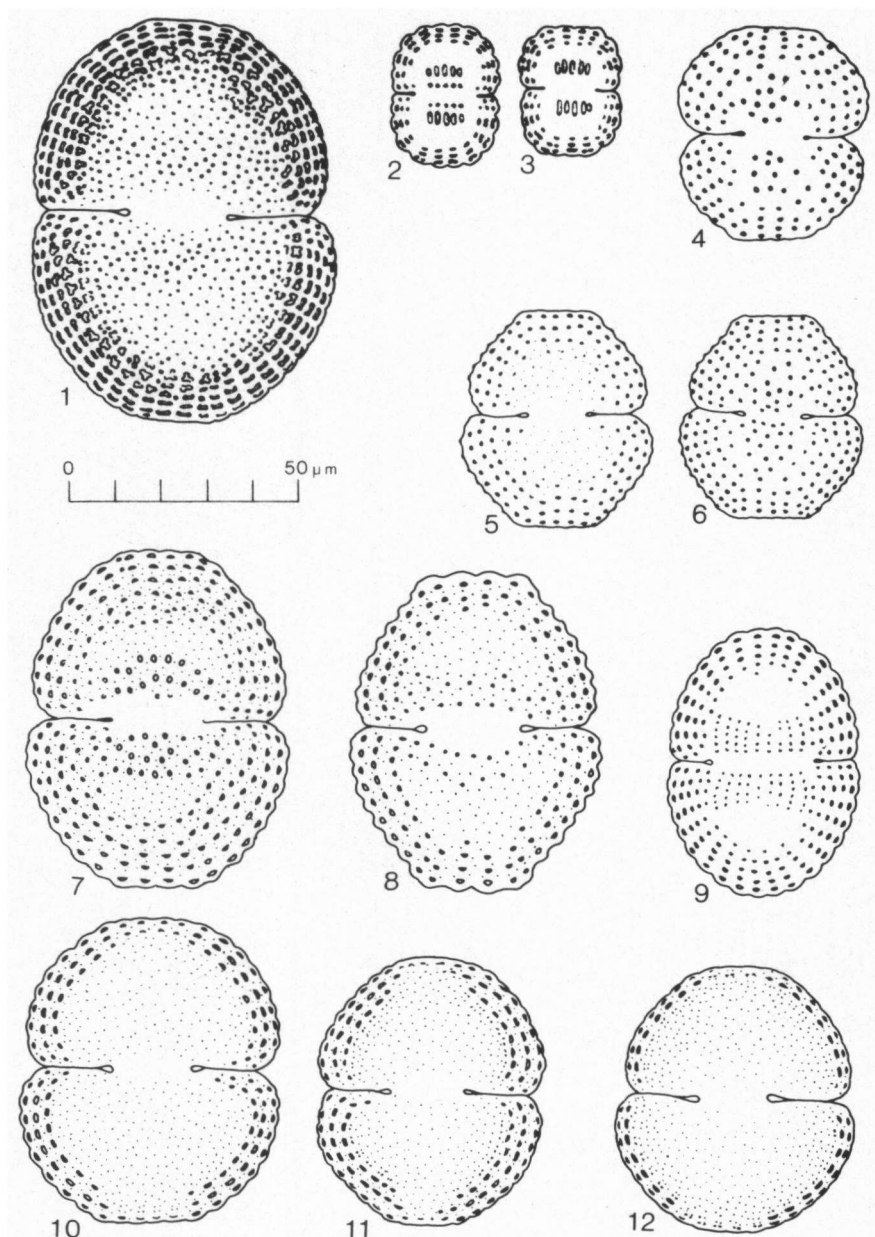
Tab. 16. – 1. *Cosmarium tetraphthalmum*; 2. *C. controversum*; 3. *C. botrytis* var. *botrytis*; 4. *C. botrytis* var. *tumidum*; 5. *C. portianum*; 6. *C. hians*; 7. *C. insigne*; 8. *C. protractum*; 9. *C. regnesii*.



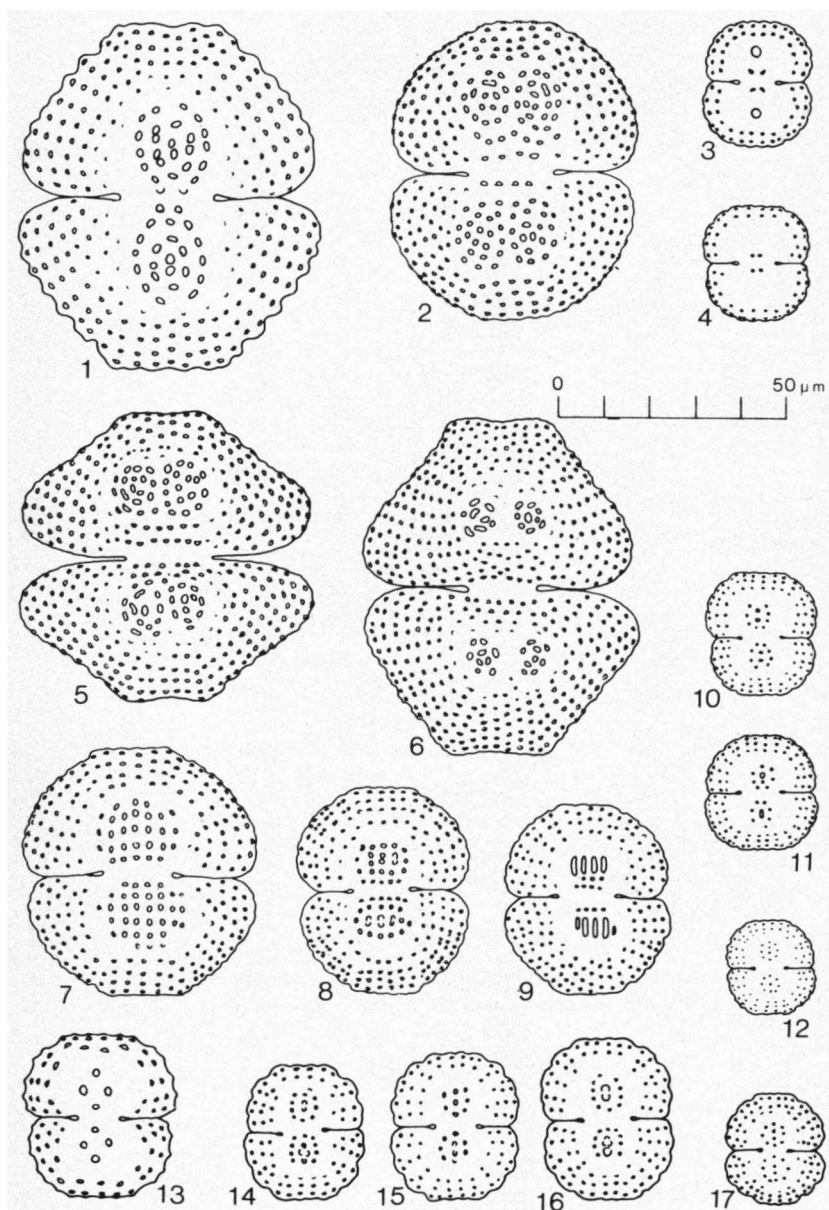
Tab. 17. – 1-2. *Cosmarium conspersum* var. *sublatum*; 3. *C. quadrum* forma *punctatum*; 4. *C. biretum* var. *trigibberum*; 5. *C. reniforme* var. *reniforme*; 6. *C. reniforme* var. *compressum*.



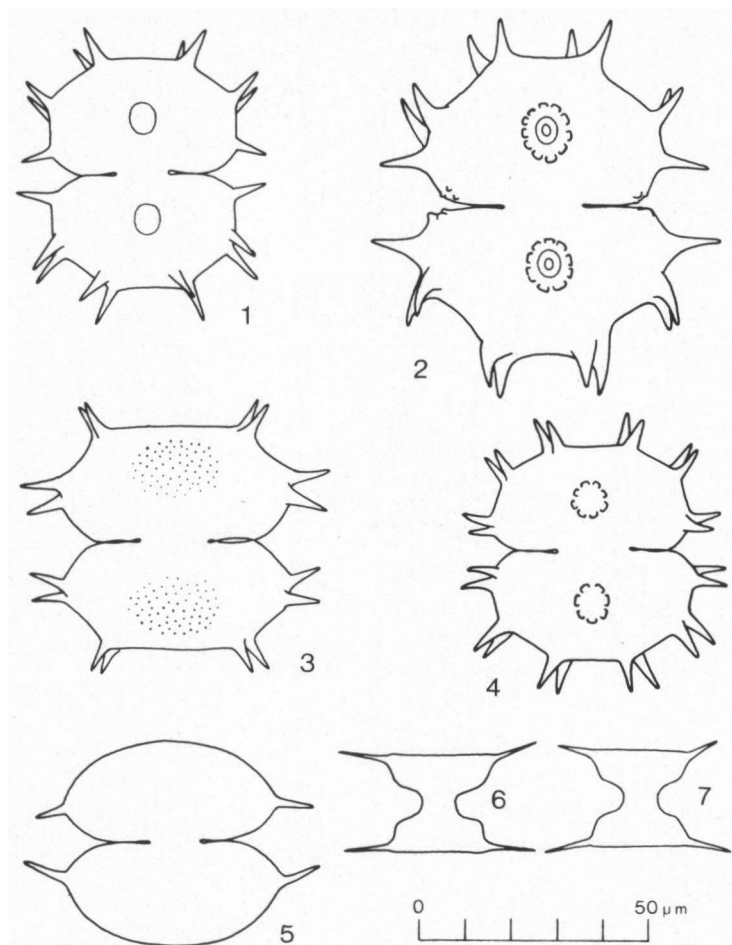
Tab. 18. – 1. *Cosmarium margaritiferum* forma *margaritiferum*; 2. *C. margaritiferum* forma *kirchneri*; 3. *C. margaritiferum* forma *badense*; 4–5. *C. fastidiosum*; 6–7. *C. subbroomei*; 8. *C. praemorsum*; 9–10. *C. punctulatum* var. *subpunctulatum*; 11. ?*C. trachypleurum* var. *minus*; 12–13. *C. furcatospermum*; 14. *C. humile* var. *humile*; 15. *C. humile* var. *substriatum*.



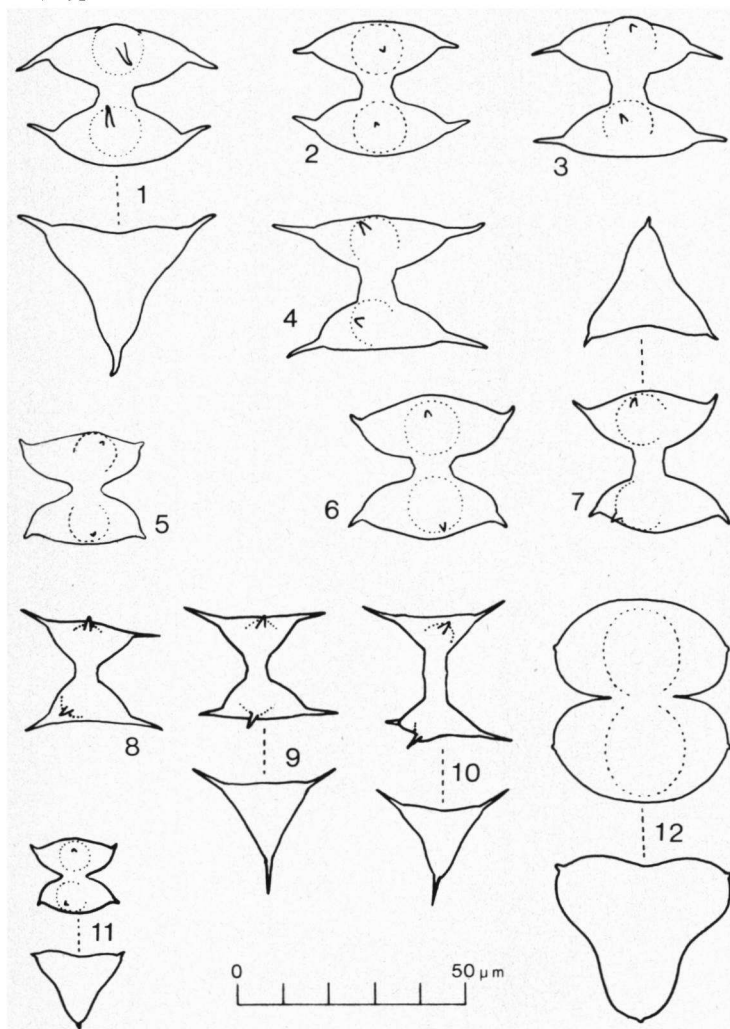
Tab. 19. – 1. *Cosmarium ochthodes*; 2–3. *C. crenatum*; 4. *C. vexatum* forma *granulatum*; 5–6. *C. sportella* var. *subnudum*; 7. *C. hornavanense* var. *dubovianum*; 8. *C. hornavanense* var. *janoviense*; 9. *C. speciosum*; 10–11. *C. obtusatum* forma *obtusatum*; 12. *C. obtusatum* forma *aequalis*.



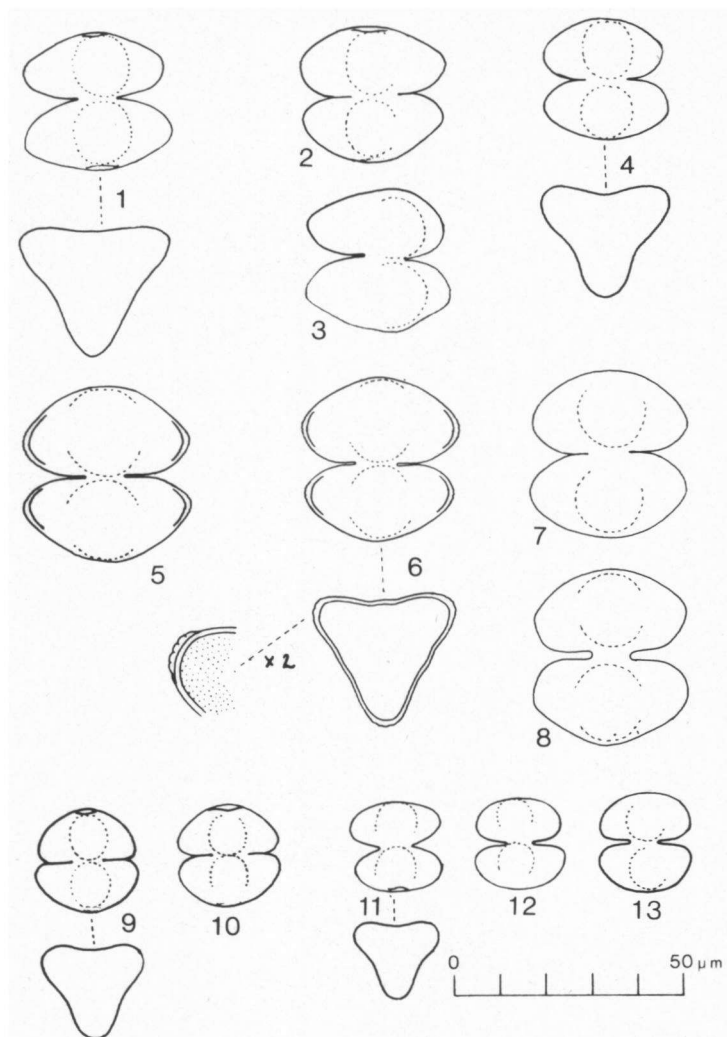
Tab. 20. – 1. *Cosmarium quasillus*; 2. *C. didymoprotupsum*; 3–4. *C. blyttii* var. *bipunctatum*; 5–6. *C. turpinii* var. *podolicum*; 7–9. *C. formosulum*; 10–11. *C. subcostatum* forma *subcostatum*; 12. *C. subcostatum* forma *minor*; 13. *C. boeckii*; 14–16. *C. subprotumidum* var. *gregori*; 17. *C. subprotumidum* var. *subprotumidum*.



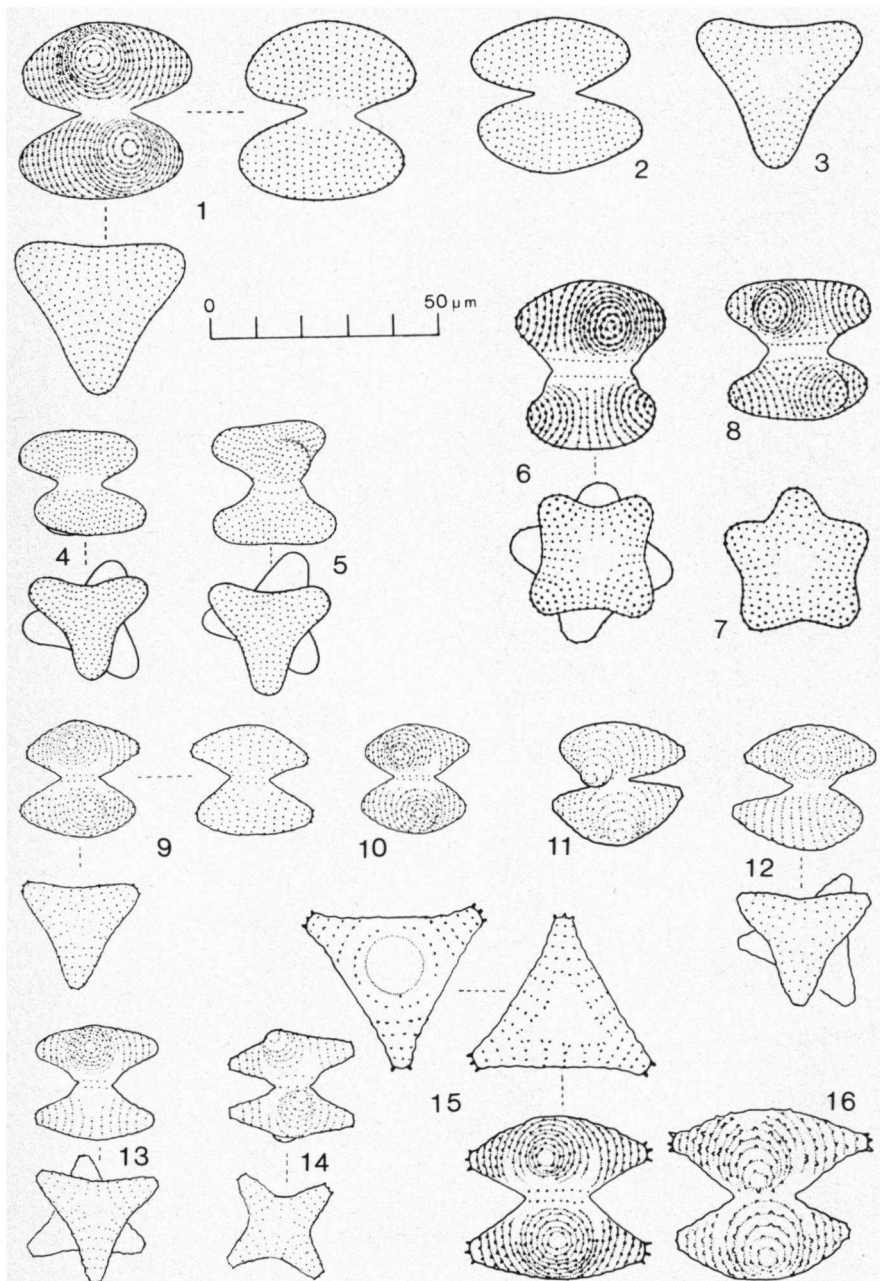
Tab. 21. – 1. *Xanthidium cristatum* var. *cristatum*; 2. *X. cristatum* var. *uncinatum*; 3. *X. anti-lopaeum*; 4. *X. fasciculatum*; 5. *Staurodesmus convergens* var. *laportei*; 6–7. *S. extensus* var. *vulgaris*.



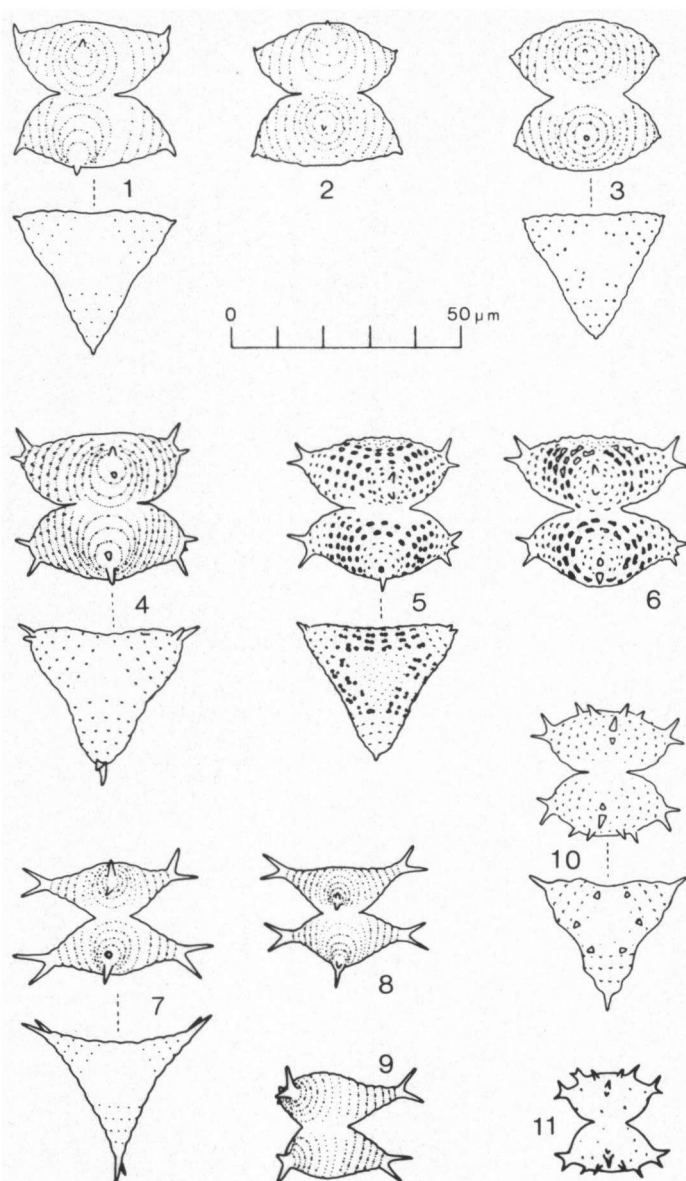
Tab. 22. – 1–4. *Staurodesmus mamillatus*; 5. *S. dejectus* var. *dejectus*; 6–7. *S. dejectus* var. *borealis*; 8–10. *S. cuspidatus*; 11. *S. patens*; 12. *S. brevispina*.



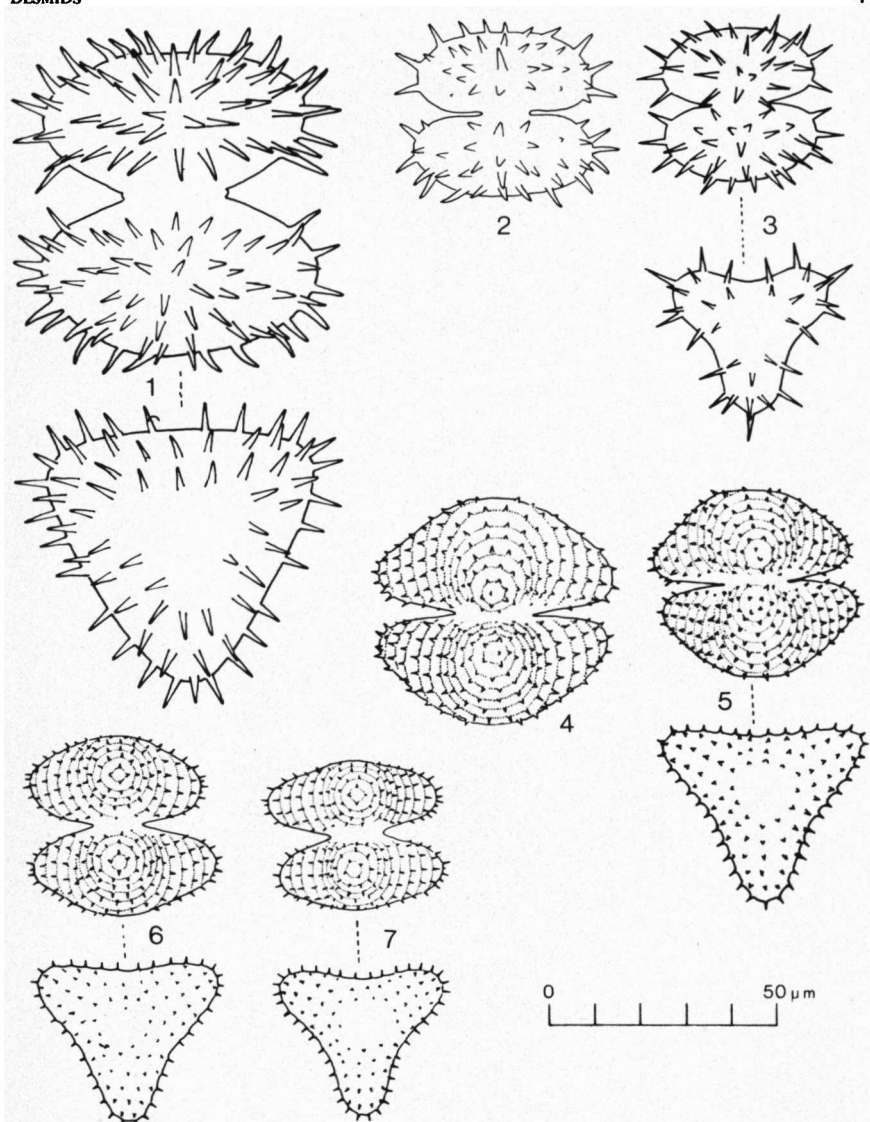
Tab. 23. – 1–4. *Staurastrum bienanum*; 5–8. *S. kaiseri*; 9–10. *S. orbiculare* var. *depressum*; 11–13. *S. muticum*.



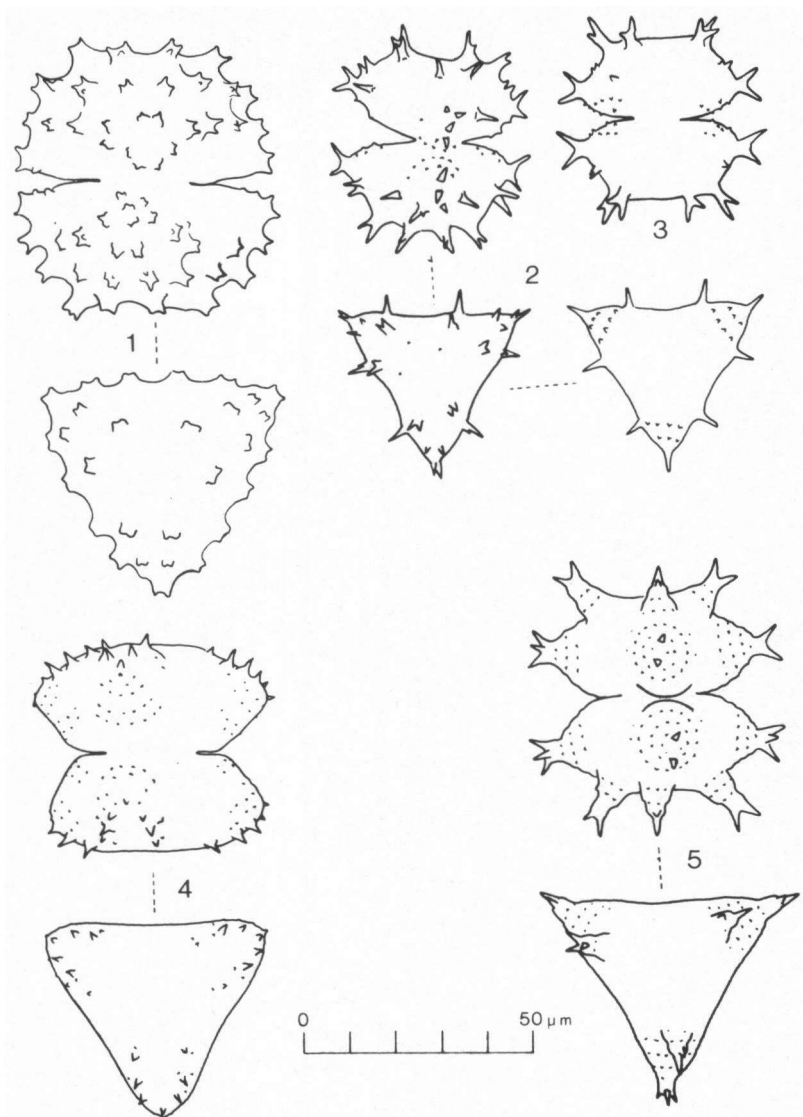
Tab. 24. – 1–3. *Staurastrum lapponicum*; 4–5. *S. alternans*; 6–8. *S. dilatatum*; 9–10. *S. striatum*; 11–12. *S. dispar*; 13–14. ?*S. striolatum*; 15–16. *S. proboscideum*.



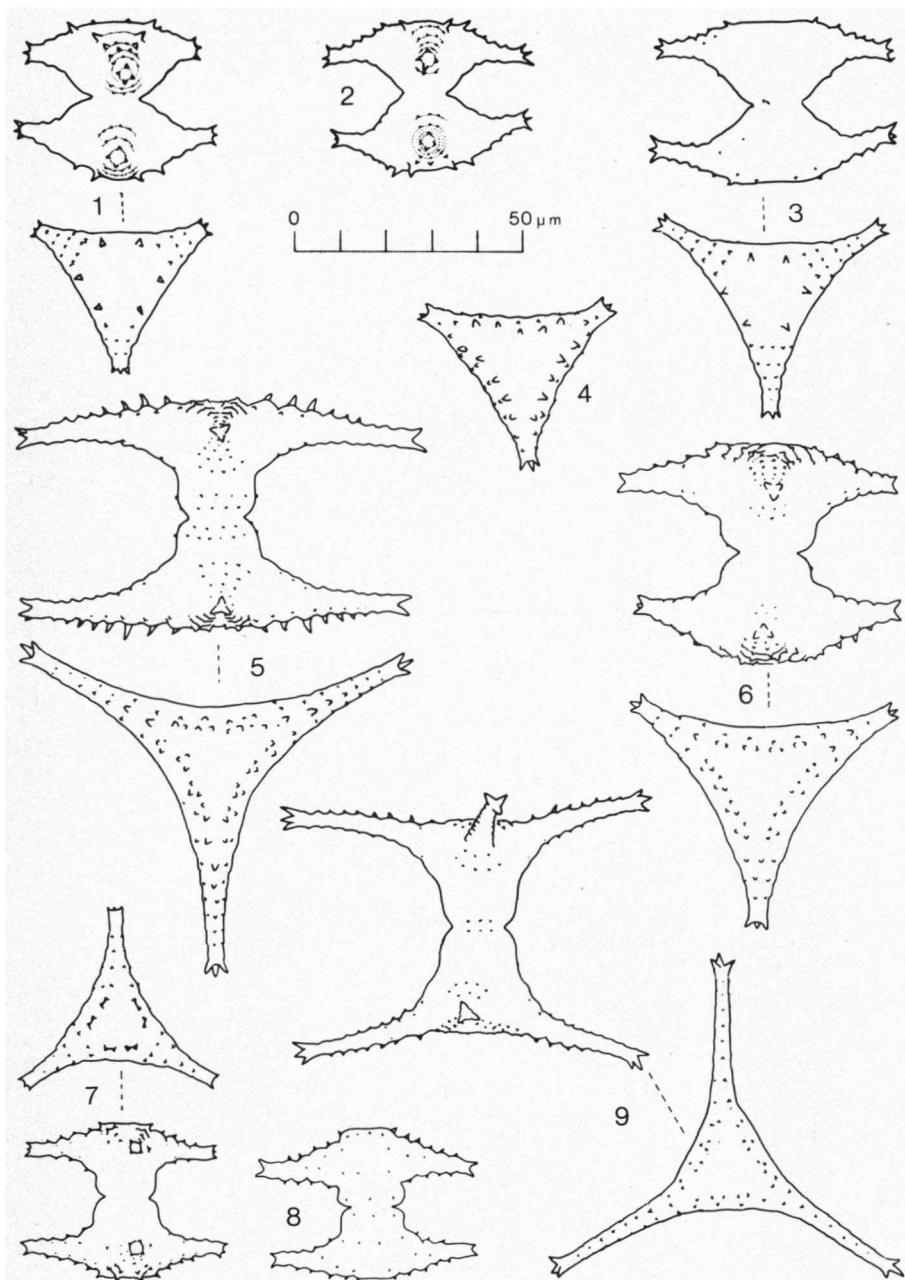
Tab. 25. – 1–2. *Staurastrum lunatum* var. *planctonicum*; 3. *S. granulosum* var. *acutum*; 4. *S. avicula* var. *avicula*; 5–6. *S. avicula* var. *exornatum*; 7–9. *S. subcruciatum*; 10–11. *S. subavicula*.



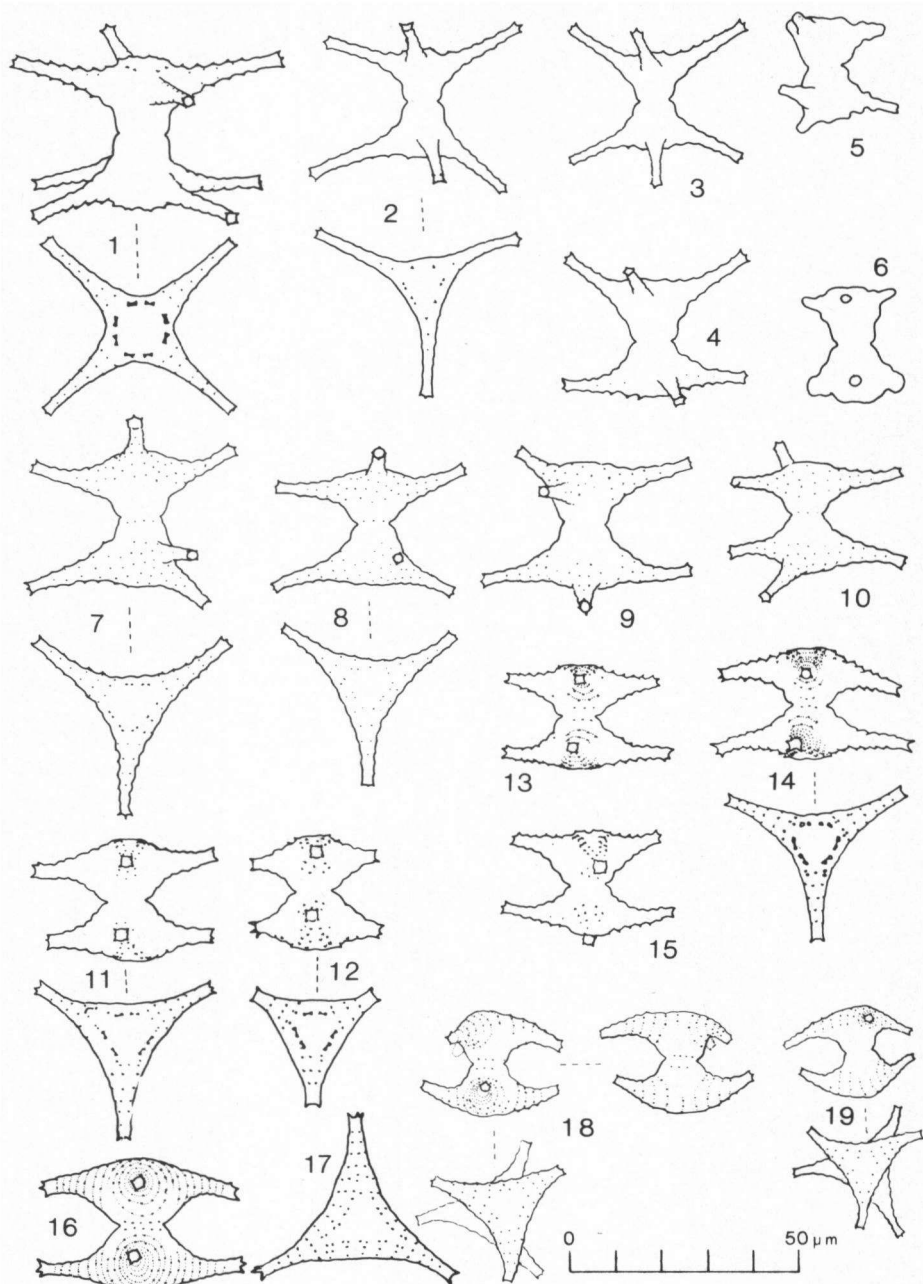
Tab. 26. – 1. *Staurastrum polytrichum*; 2–3. *S. gladiosum* var. *delicatulum*; 4–5. *S. trapezicum*; 6–7. *S. brebissonii*.



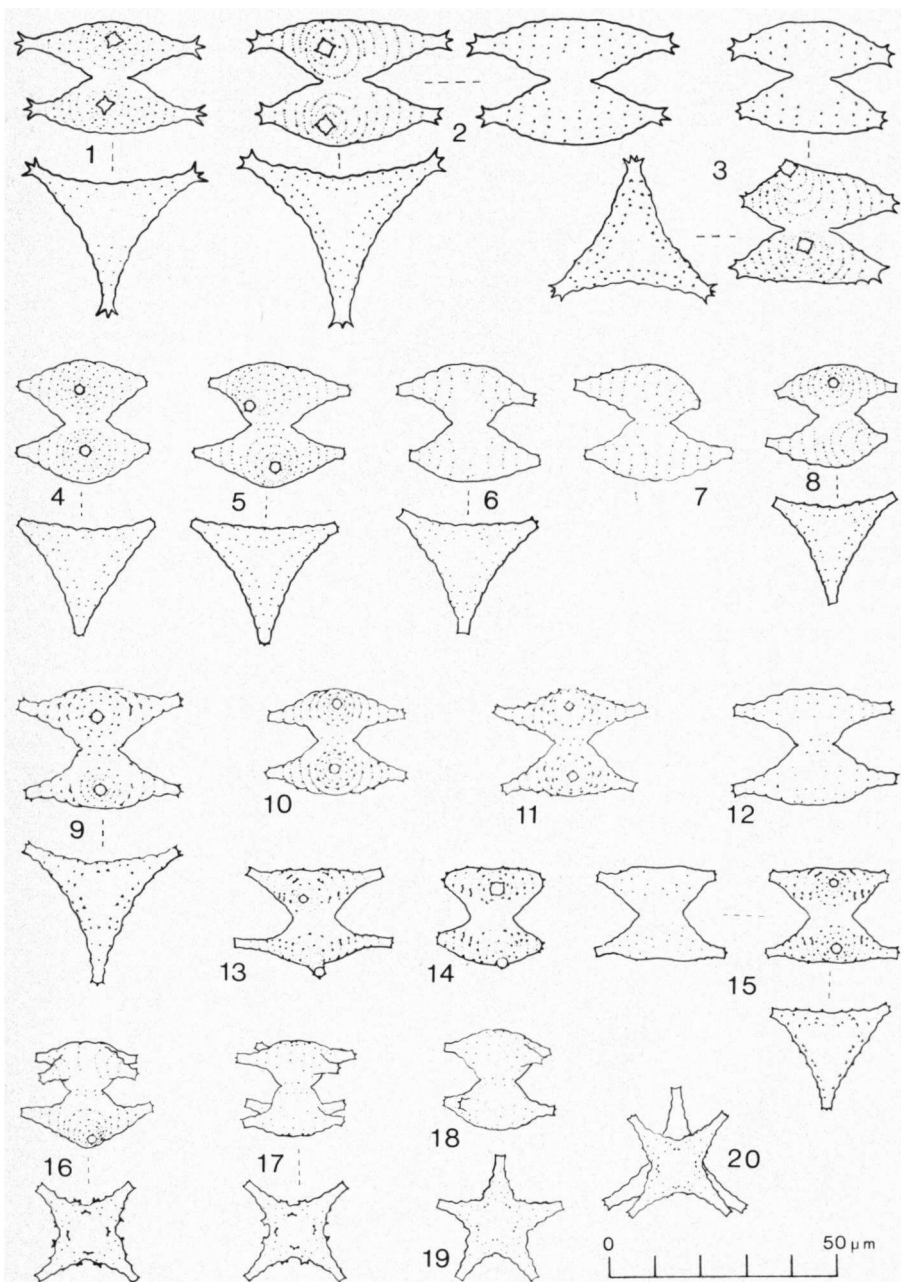
Tab. 27. – 1. *Staurastrum spongiosum*; 2–3. *S. forficulatum*; 4. *S. oligacanthum*; 5. *S. furcigerum*.



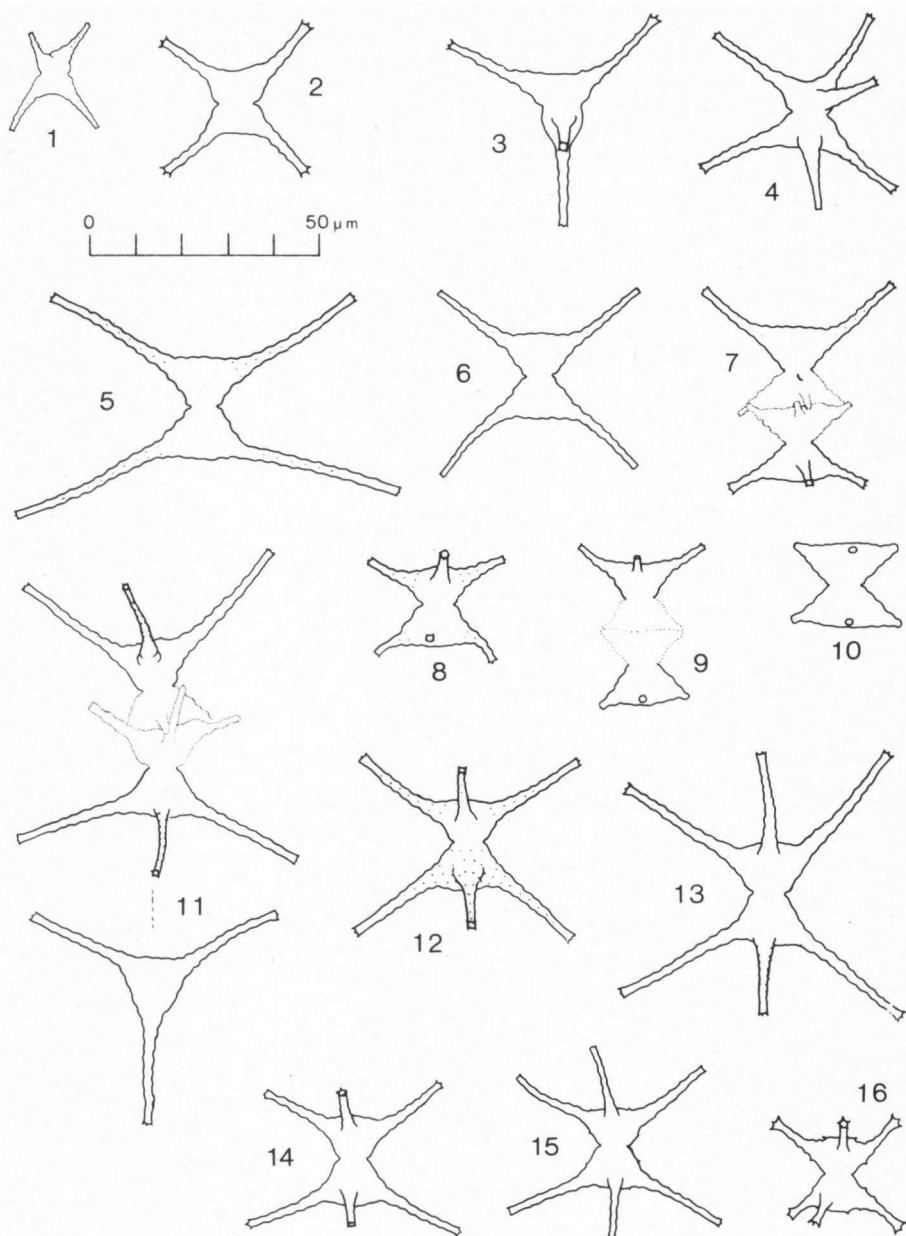
Tab. 28. – 1–3. *Staurastrum oxyacanthum* var. *oxyacanthum*; 4. *S. oxyacanthum* var. *polyacanthum*; 5–6. *S. manfeldtii* var. *manfeldtii*; 7–8. *S. manfeldtii* var. *parvum*; 9. *S. planctonicum* var. *ornatum*.



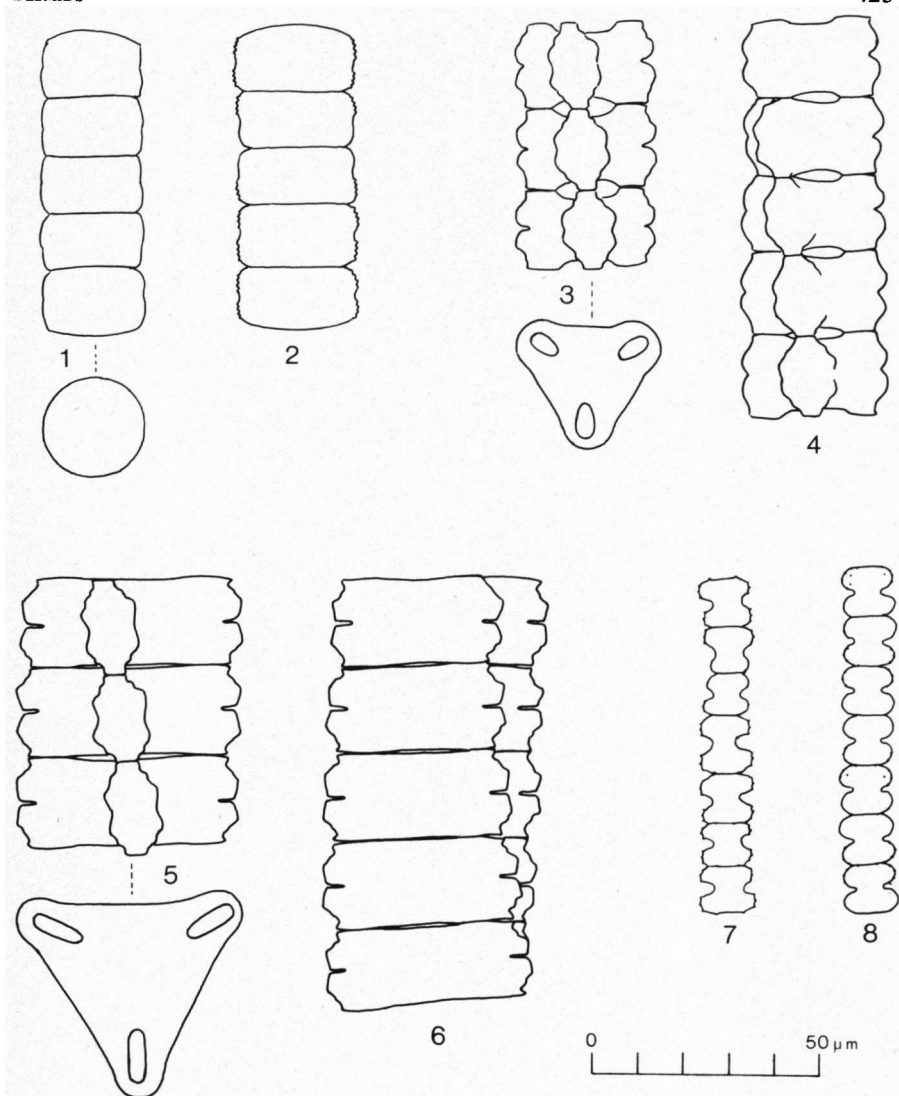
Tab. 29. — 1–6. *Staurastrum pingue* (5–6: aberrant forms); 7–10. *S. cingulum*; 11–15. *S. crenulatum*; 16–17. *S. gracile*; 18–19. *S. inflexum*.



Tab. 30. – 1–3. ? *Staurastrum polymorphum*; 4–8. ? *S. hexacerum*; 9–12. *S. boreale* var. *boreale*; 13–15. ? *S. boreale* var. *boreale*, forma; 16–20. *S. boreale* var. *quadriradiatum*.



Tab. 31. – 1–2. *Staurastrum tetracerum* var. *tetracerum*; 3–4. *S. tetracerum* var. *cameloides*; 5–15. *S. chaetoceras* (8–10: aberrant forms); 16. *S. micron*.



Tab. 32. – 1–2. *Hyalotheca dissiliens*; 3–4. *Desmidium aptogonum*; 5–6. *D. swartzii*; 7–8. *Sphaerosma granulatum*.