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Contribution to the desmid flora of the Primorsky Territory, Russia

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Abstract The desmid flora of the Primorsky Territory (Russian Far East) is investigated. In the present paper 55 taxa of the genera *Closterium*, *Pleurotaenium*, *Euastrum*, *Micrasterias*, *Actinotaenium*, *Cosmarium*, *Xanthidium*, *Staurodesmus*, *Staurastrum*, *Desmidium*, *Sphaerozosma* are presented. Among them 19 species and 17 varieties are reported for the first time from Russia. Some of the taxa showed variations in morphology and these variations and differences with previous records are discussed with biogeographical notes.

Key words: Desmids, new records, Russia, Primorsky Territory.

The Primorsky Territory is very rich in aquatic habitats, and algae are diverse here. For 70 years, the species composition in 79 rivers, 68 smaller streams, 26 lakes and 7 reservoirs has been studied. A few detailed reviews of the history of these studies have been published (Kukharenko, 1974a, 1989; Medvedeva & Barinova, 1990). At present, the list of freshwater algae of this region accounts for 1,659 species, 297 of these belonging to the order Desmidiales (Gontcharov, in press). However, this number is far from complete that reflects the natural diversity of the desmids actually existing there. It should be emphasized that until now, no special taxonomic study of these algae has been undertaken and all desmid species were noted during floristic research in the above-mentioned waterbodies.

The present paper deals with Desmidiales which have been found for the first time in the Primorsky Territory. Some of these algae exhibited a wide range of morphological variability. In these cases, I tried to examine as many specimens as possible to estimate limits of this variability in the natural populations. These reports will appear elsewhere. For a few species, morphological features which differ from previous data were revealed and discussed.

Samples for this investigation were collected during 1988–1996 from localities listed below (Fig. 1) by mainly squeezing aquatic plants and scraping different natural substrata. Material was fixed by 4% neutral formaldehyde. Samples were examined under the Olympus CH-2 light microscope in the Laboratory of Biological Sciences, Faculty of Education, Ibaraki University, Japan. The samples are deposited at the Herbarium, Department of Botany, National Science

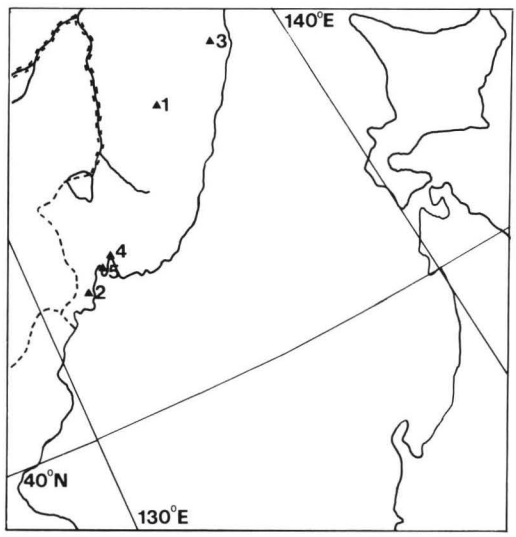


Fig. 1. Map showing the localities of the sampling sights in the Primorsky Territory. Dot line indicates a boundary of Russian Federation, ⊿-sampling sights.

Museum (TNS), Japan.

The enumeration of the species is in accordance with the system of Ruzicka (1977). Concerning the concept of the genus *Artrodesmus* Ehr. ex Ralfs, the view of Teiling (1948) is followed. The arrangement of the species within each genus is alphabetical.

All dimensions are given in micrometers; the following abbreviations are used: L=length of cell, W=width of cell, T=thickness of cell, I=breadth of isthmus, csp=with spines, ssp=without spines, cpr=with processes, spr=without processes and Loc.=locality.

The distribution of the taxa in the territory of Russia is cited Palamar-Mordvintceva (1982), otherwise, references are given.

Localities:

1. 1988.08.20–22. 134°50′46″E, 45°54′06″N. Mesotrophic meander-type lake in Bolshaya Ussurka river basin. T=19–21°C, pH=6.8.

2. 1995.08.10, 1996.07.28. 130°58′12″E, 42°47′N. Small swampy lakes and ponds near Riazanovka station. T=22–26°C, pH=6.3–6.8.

3. 1995.10.07. 137°58′25″E, 47°11′18″N. Eliseevskoye Lake (peatbog). Peya plateau, elevation 700 m. T=14°C, pH=5.1.

4. 1996.07.15. 132°15′28″E, 43°24′38″N. Small swampy lakes and drainage channel near Artem-II station. T=23°C, pH=6.7.

5. 1996.07.22. 132°02′13″E, 43°14′28″N. Small swampy lakes near Sputnik station. T=24°C, pH=6.7.

In all localities except 3 merged and submerged aquatic vegetation was well developed.

SPECIES ENUMERATION

Order *Desmidiales*
Family *Closteriaceae* Pritch.
Closterium Nitzsch ex Ralfs
C. praelongum Bréb. Fig. 2.

L 650–820 μm, W 18,8–38,8 μm, apex 5 μm. Loc. 2.

This species often occurs in western regions of Russia and in some places in Siberia. In the far-eastern part of the country, it has been known only in Kamchatka (Kossinskaya, 1960).

Family *Desmidiaceae* Ralfs
Pleurotaenium Näg.
P. truncatum (Bréb.) Näg. Fig. 3.

L 475 μm, W 67,5 μm, I 55 μm, apex 35 μm. Loc. 2.

Species is distributed mainly in the boreal regions of Russia. In the eastern part of the country, it has been reported from the Kuril Islands and Yakutia (Kossinskaya, 1960).

Euastrum Ehr. ex Ralfs
E. dubium Näg. var. *ornatum* Wolosz. Fig. 4.

L 30 μm, W 23,8 μm, I 7,5 μm. Loc. 1.

Perhaps, this variety is reported for the first time in Russia. Type variety of the species has been found in the territory of the region of a small mountain lake (Medvedeva, 1984).

E. sinuosum Lenorm. var. *aboënse* (Elfv.) Cedergr. Fig. 5.

L 68,8 μm, W 30–35 μm, I 8,8 μm. Loc. 3.

This variety was found in central regions of Russia as well as in the Kuril Islands (Kossinskaya, 1960).

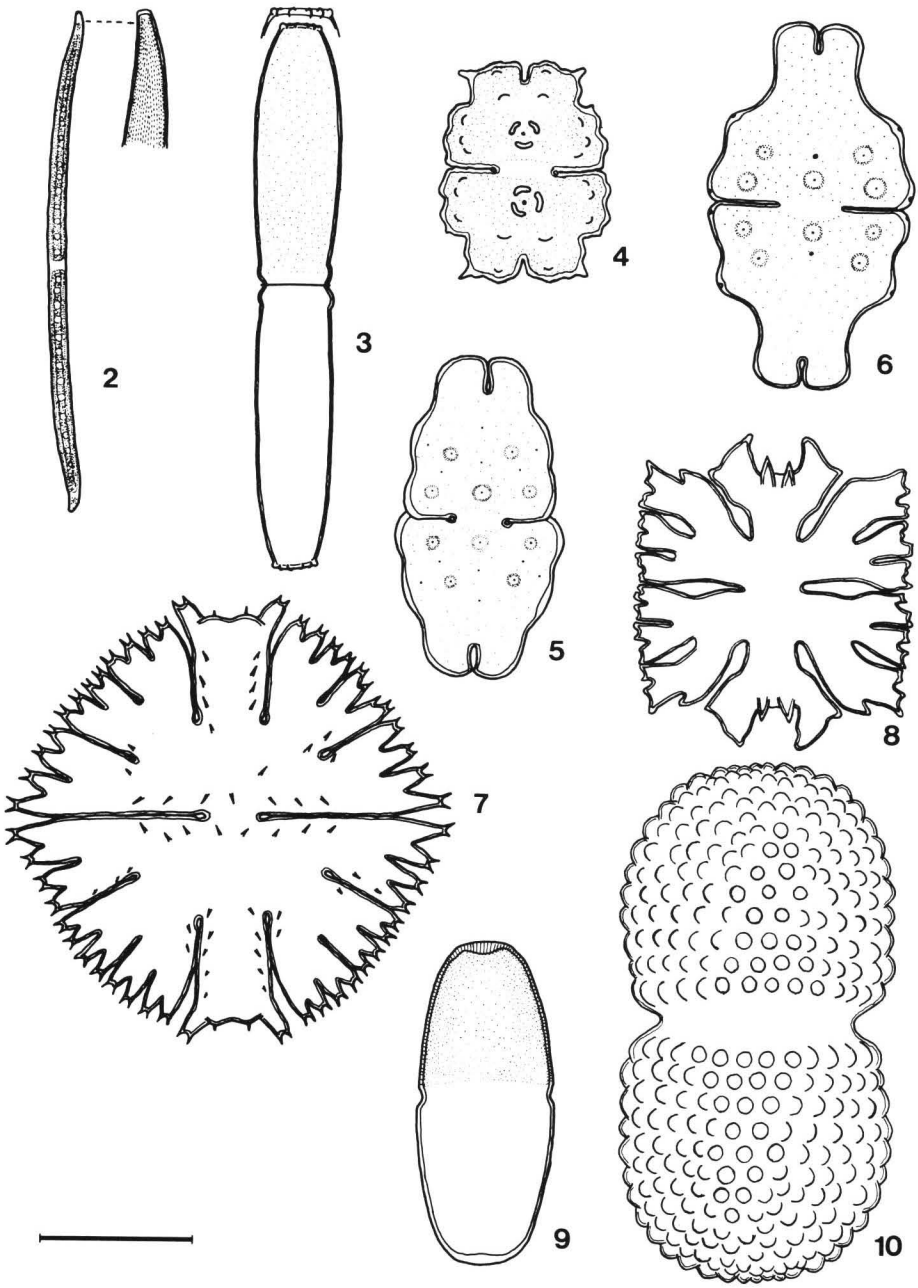
E. sinuosum var. *perforatum* Krieg. Fig. 6.

L 75 μm, W 42,5 μm, I 10 μm. Loc. 2.

This variety is new to Russia.

Micrasterias Ag. ex Ralfs
M. fimbriata Ralfs var. *spinosa* (Biss.) Croasd. Fig. 7.

L 273 μm, W 250 μm, I 37,5 μm. Loc. 2.



Figs. 2–10.

This form is reported for the first time in the eastern regions of Russia. The var. *fimbriata* has been reported from the Territory in two lakes situated on the eastern slopes of Sikhote-Aline Mts. (Medvedeva, 1986).

M. foliacea Bail. ex Ralfs Fig. 8.

L 53,6–63,3 μm, W 56 μm, I 13,8 μm. Loc. 2.

This species was found for the first time in the territory of Russia by Hahina (1948) in Bolon Lake (Amur riv. basin) but Kossinskaya (1960, p. 486) questioned this finding because of the lack of dimensions and illustrations in Hahina's paper. Bolon Lake is situated only 800 km north of the above mentioned localities and I think that the previous finding is not doubtful.

Actinotaenium Teil.

A. cucurbitinum (Biss.) Teil. Fig. 9.

L 65–72,5 μm, W 30 μm, I 27,5 μm. Loc. 2.

Although this species was found in some places in Western Siberia, it has never been reported in the far-eastern region of Russia.

A. tesellatum (Nordst.) Pal.-Mordv. Fig. 10.

Syn.: *Cosmarium tesellatum* (Delp.) Nordst.

L 102,5 μm, W 58 μm, I 45 μm. Loc. 1.

This species is new to Russia.

A. turgidum (Bréb.) Teil. Fig. 11.

Syn.: *Cosmarium turgidum Bréb.*

L 218 μm, W 105 μm, I 100 μm. Loc. 4.

In the far-eastern region of country, it was reported in the Khabarovsky Territory.

Cosmarium Corda ex Ralfs

C. bigemma Racib. Fig. 12.

L 32,5–38,8 μm, W 30–32 μm, I 8,3 μm. Loc. 1.

This species has never been found previously in Russia.

Figs. 2–10. —— 2. *Closterium praelongum* Bréb. 3. *Pleurotaenium truncatum* (Bréb.) Näg. 4. *Euastrum dubium* Näg. var. *ornatum* Wolosz. 5. *E. sinuosum* Lenorm. var. *aboënse* (Elfv.) Cedergr. 6. *E. sinuosum* var. *perforatum* Krieg. 7. *Micrasterias fimbriata* Ralfs var. *spinosa* Biss. 8. *M. foliacea* Bail. ex Ralfs. 9. *Actinotaenium cucurbitinum* (Biss.) Teil. 10. *A. tesellatum* (Nordst.) Pal.-Mordv. Scale bar fig. 2 = 200 μm, fig. 3 = 150 μm, fig. 4–6, 8–10 = 30 μm, fig. 7 = 90 μm.

C. botrytis Menegh. ex Ralfs var. *emarginatum* Hansg. Fig. 13.

L 42,5 μm, W 37,4 μm, I 12,5 μm. Loc. 2,4.

This variety is reported for the first time in the Primorsky Territory but var. *botrytis* is widely distributed in the waterbodies of the region (Kukharenko, 1989).

C. ceratophorum Lütkem. Fig. 14.

L 25–37,5 μm, W 25–32,4 μm, I 5–7,5 μm, T 12,5–15 μm. Loc. 2.

To date, this species has never been reported for Russia.

Specimens examined here well agree with Grönbladt's (1921, p. 33, Pl. 6, fig. 31–34) description and figure of this species. He put it as a "forma" of Lütkemüller's species (1911, p. 485, Taf. II, fig. 6–8). Both Grönbladt's specimens and those I studied have rounded granules (acute in diagnosis). All other features are the same as in original description.

C. clepsydra Nordst. var. *hoglandiae* Grönbl. Fig. 15.

L 22,5–23,8 μm, W 22,5–23,8 μm, I 7 μm. Loc. 1.

The variety under discussion has been known from only the north-western regions in Russia.

C. conspersum Ralfs var. *latum* (Bréb.) W. et G. S. West Fig. 27.

L 75 μm, W 57,5 μm, I 17,5 μm. Loc. 2.

This species is common in the western regions of Russia up to Western Siberia. However, it is new to the far-eastern region.

C. depressum (Näg.) Lund. var. *reniforme* W. et G. S. West Fig. 16.

L 20,5 μm, W 20 μm, I 4,3 μm. Loc. 2.

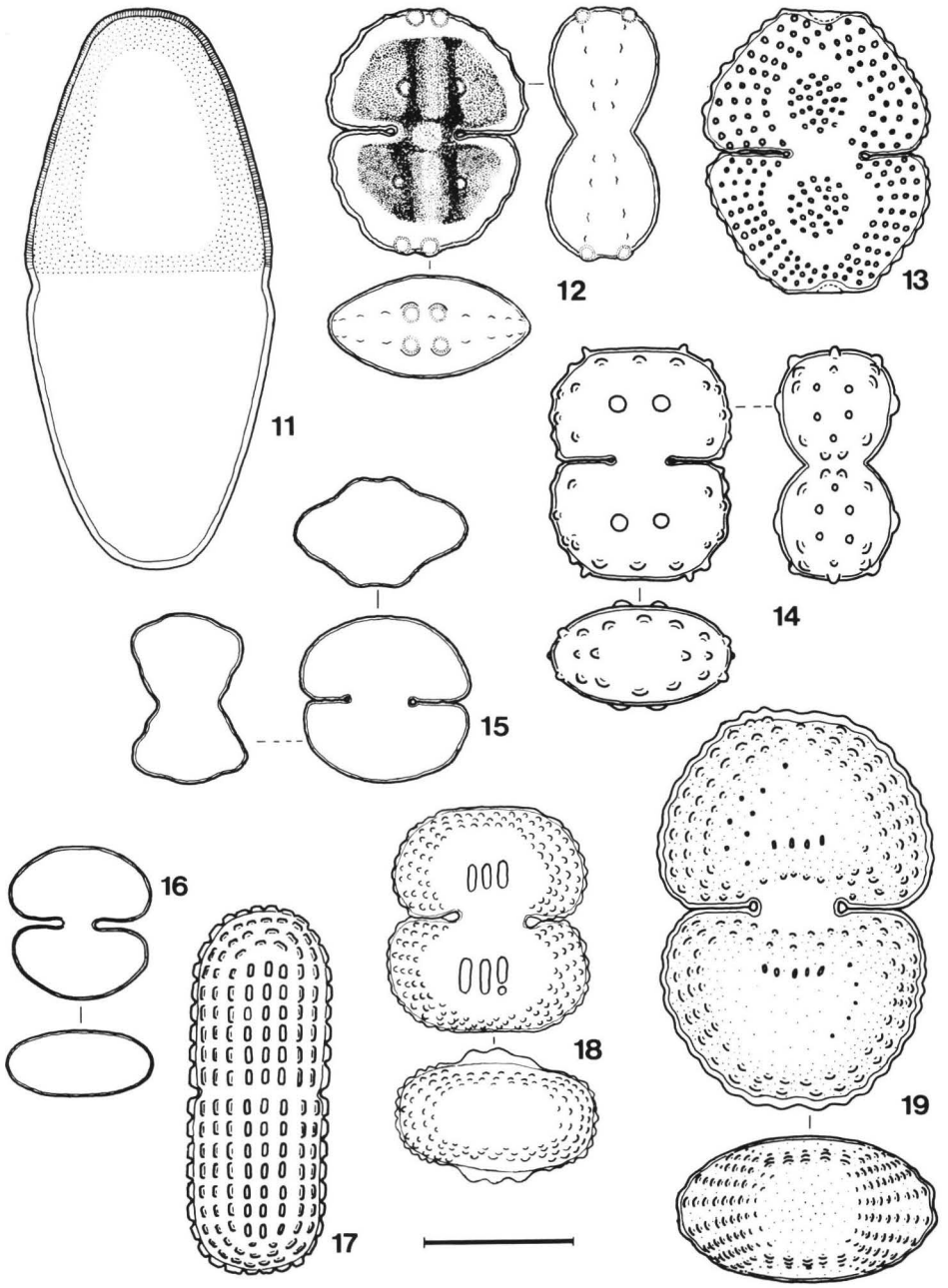
This variety is reported for the first time in the eastern regions of Russia.

C. elegantissimum Lund. var. *elegantissimum* Fig. 17.

L 80 μm, W 32,5 μm, I 25 μm. Loc. 2.

This is the first finding of this typical variety on Primorsky Territory and the whole far-eastern region of Russia. Previously, the var. *minor* W. et G. S. West has been reported in the Territory.

Figs. 11–19. — 11. *A. turgidum* (Bréb.) Teil. 12. *Cosmarium bigemma* Racib. 13. *C. botrytis* Menegh. ex ralfs var. *emarginatum* Hansg. 14. *C. ceratophorum* Lütkem. 15. *C. clepsydra* Nordst. var. *hoglandiae* Grönbl. 16. *C. depressum* (Näg.) Lund. var. *reniforme* W. et G. S. West. 17. *C. elegantissimum* Lund. 18. *C. fastidiosum* W. et G. S. West. 19. *C. hornavanense* Gutw. var. *dubovianum* (Lütkem.) Ruzicka. Scale bar fig. 11 = 60 μm, fig. 12–15, 16, 18 = 20 μm, fig. 15, 16, 19 = 30 μm.



Figs. 11–19.

C. fastidiosum W. et G. S. West Fig. 18.

L 23,8 μm, W 22 μm, I 8,8 μm. Loc. 1.

It seems to be the first finding of this species in the Far East.

Specimens examined are essentially smaller than that has been reported for this variety (37–38×33–36 μm (Prescott et al., 1981)) but the shape of the cells and characters of cell-wall ornamentation well agree with West's description and figure (West & West, 1897, p. 489, Pl. 6, fig. 11).

C. hornavanense Gutw. var. *dubovianum* (Lütkem.) Ruzicka Fig. 19.

L 77,5 μm, W 52,5–55 μm, I 16,3 μm. Loc. 2.

This is the first report of this variety in the territory of Russia.

C. incrassatoplicatum Hinode Fig. 20.

L 30–35,5 μm, W 22,5–27,5 μm, I 6,3–7,5 μm, T 17,5 μm. Loc. 2.

This appears to be the first finding of this species outside Japan.

The specimens from samples studied exhibit a wide variation in cell-shape and degree of cell-wall thickness.

C. laeve Rabenh. var. *depressum* Croasd. Fig. 21.

L 15–17,5 μm, W 16,3–18 μm, I 3,8–5 μm, T 8 μm. Loc. 4, 5.

This variety is new to Russia.

C. magnificum Nordst. var. *subsirculare* Skuja Fig. 22.

L 100 μm, W 72,5 μm, I 22,5 μm, T 45 μm. Loc. 1.

The variety is reported for the first time in Russia.

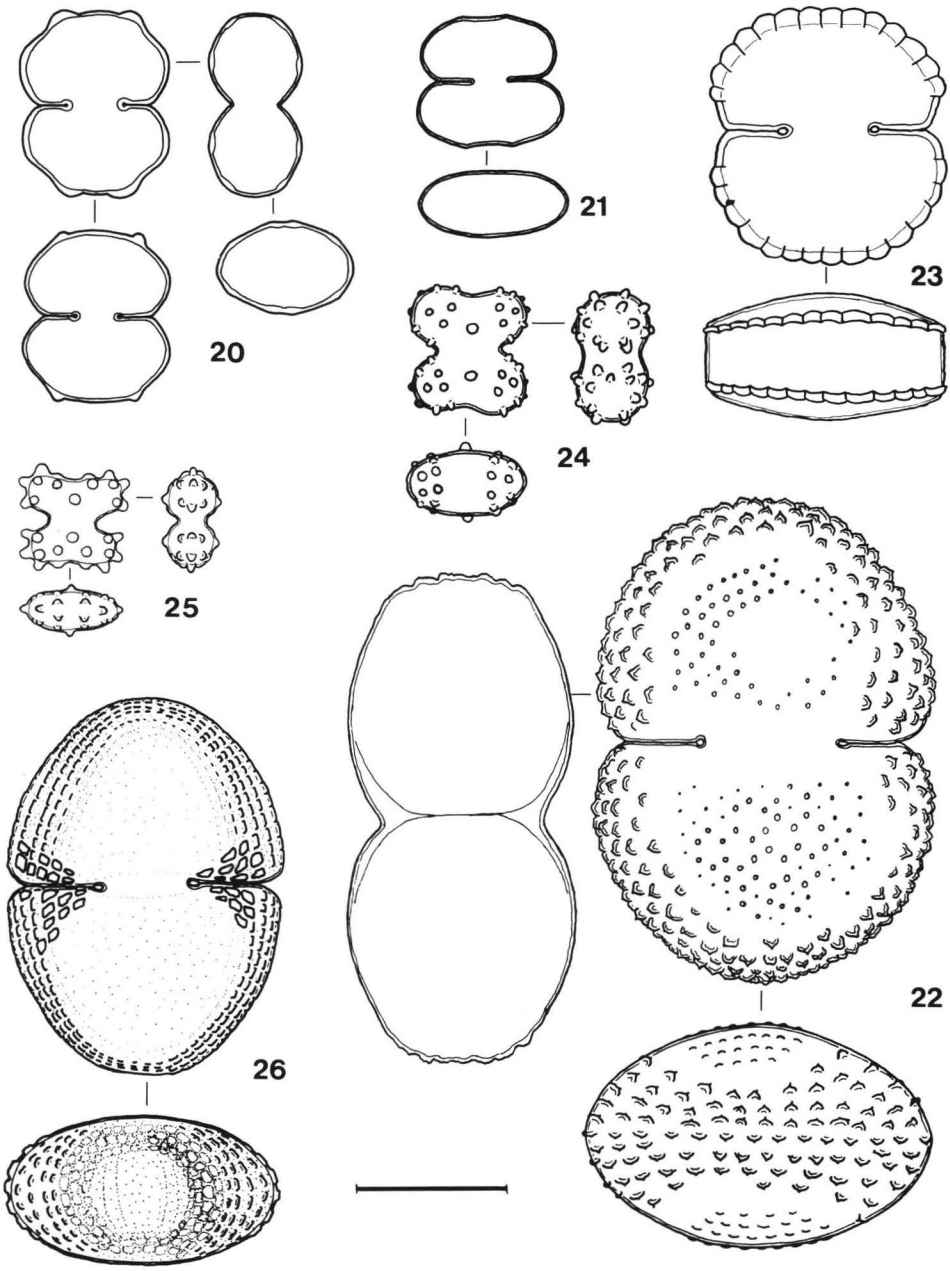
A very similar alga was illustrated by Hinode (1965, Fig. 9, 23, Pl. 6, 11) as *C. pseudomagnificum* Hinode.

C. malinvernianum (Racib.) Schmidle Fig. 28.

L 52,5–55 μm, W 42,5–47,5 μm, I 15 μm, T 27,5 μm. Loc. 2.

We can not estimate the real distribution of this alga in the territory of Russia because Palamar-Mordvintceva (1982, p. 456, fig. 121, 2–4) followed the Wests (1908) and treated it as a synonym of the very common species, *C. margaritiferum* Menegh. ex Ralfs. The differences between these two algae were discussed by Grönbladt (1921, p. 32–33) and I agree with his point of view.

Alga under discussion has also some resemblance to *C. trachypleurum* and some its varieties. Raciborsky (1889, p. 19, Tab. 1, fig. 40) compared his taxa to *C. trachypleurum* var. *verrucosum* Kirchn. Grönbladt et al. (1964) also stressed the similarity of *C. malinvernianum* and above-mentioned species. Both species have a very similar shape of cells and the same pattern of cell-wall granulation. However, they differ in the midregion granulation.



Figs. 20–26. —— 20. *C. incrassatoplicatum* Hinode. 21. *C. laeve* Rabenh. var. *depressum* Croasd. 22. *C. magnificum* Nordst. var. *subcirculare* Skuja. 23. *C. monomazum* Lund. var. *amazum* Wolosz. 24. *C. novae-semliae* Wille var. *granulatum* Schmidle. 25. *C. novae-semliae* var. *sibiricum* Boldt. 26. *C. ochthoides* Nordst. Scale bar fig. 20, 22, 26 = 30 μm, fig. 21, 23–25 = 20 μm.

C. monomazum Lund. var. *amazum* Wolosz. Fig. 23.

L 35 μm, W 31,5 μm, I 10–11 μm. Loc. 1.

This is the first finding of this variety in the waterbodies of the Primorsky Territory but the typical variety (Barinova, 1986) and var. *polymazum* Nordst. (Kukharenko, 1974 b, c) have been found there earlier.

C. novae-semliae Wille var. *granulatum* Schmidle Fig. 24.

I 16,3 μm, W 16,3 μm, I 7,5 μm, T 8,3 μm. Loc. 2.

This variety has never been reported in Russia. From my point of view, an alga in Kossinskaya's drawing in Palamar-Mordvintceva's monograph (1982, Fig. 85, 17) is similar to the var. *granulatum*, and thus indicating the distribution of this variety.

C. novae-semliae var. *sibiricum* Boldt Fig. 25.

L 12,5–13,8 μm, W 12,5–13,8 μm. I 6,3–7,5 μm, T 6,3–7,5 μm. Loc. 4.

The variety under discussion is reported for the first time in the far-eastern region of the country.

C. ochthoides Nordst. Fig. 26.

L 75–85 μm, W 52,5–62,5 μm, I 17,5 μm, T 33,5–35 μm. Loc. 2.

This species is widely distributed in Russia but is reported for the first time in the Primosky Territory.

C. pseudopyramidatum Lund. Fig. 29.

L 52,5 μm, W 35 μm, I 12,5 μm. Loc. 2.

This species is widely distributed in Russia but is reported for the first time in the Primosky Territory.

C. simplicius (W. et G. S. West) Grönbl. Fig. 30.

Syn.: *C. elegantissimum* Lund. var. *simplicius* W. et G. S. West

I 47,5 μm, W 20 μm, I 17,5 μm. Loc. 2.

This species is being reported for the first time in Russia.

C. sphagnicolum W. et G. S. West Fig. 31.

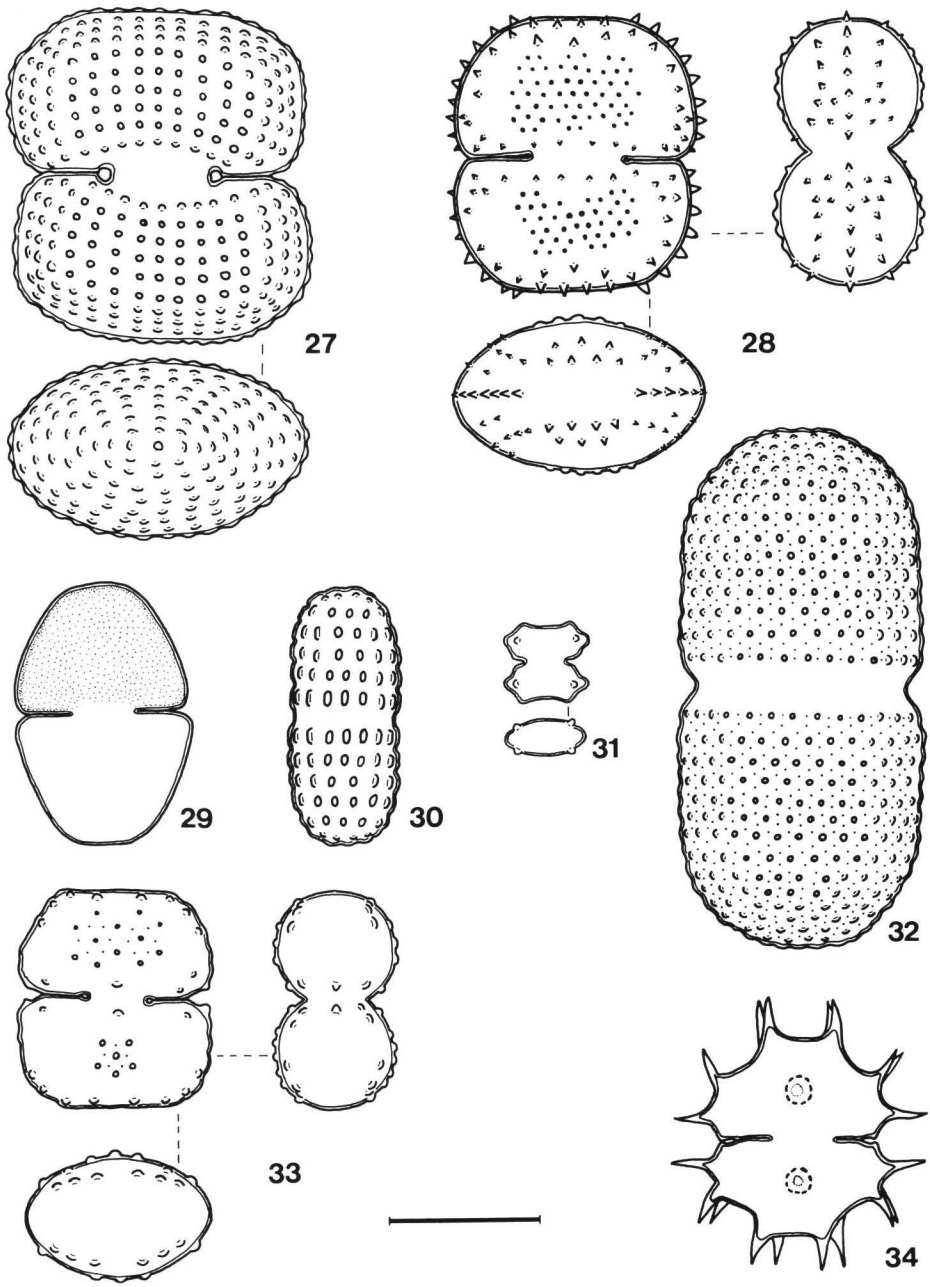
L 12,5 μm, W 12,5 μm. I 5 μm. Loc. 2.

This is the first finding of the species in the eastern regions of the country.

The cell shape of the specimens seen has a resemblance to *C. pygmaeum* Arch. but its vertical view is typical of *C. sphagnicolum.*

C. striolatum Näg. Fig. 32.

L 132,5–142,5 μm, W 58–67,5 μm. I 50–60 μm. Loc. 2.



Figs. 27–34. —— 27. *C. conspersum* Ralfs var. *latum* (Bréb.) W. et G. S. West. 28. *C. malinvernianum* (Racib.) Schmidle. 29. *C. pseudopyramidatum* Lund. 30. *C. simplicius* (W. et G. S. West) Grönbl. 31. *C. sphagnicolum* W. et G. S. West. 32. *C. striolatum* Näg. 33. *C. trachypleurum* Lund. var. *fallax Lütkem.* 34. *Xanthidium cristatum* Bréb. var. uncinatum Bréb. f. *polonicum* Gutw. Scale bar fig. 27–34 = 30 μm.

In Russia, the species was previously reported only a few times in the north-western regions.

C. trachypleurum Lund. var. *fallax* Lütkem. Fig. 33.

L 43,8 μm, W 32,5–38 μm, I 13,8 μm, T 23,8–25 μm. Loc. 2.

This is the first finding of the variety in the territory of Russia.

Specimens examined here had only one series of granules within the margins. The number of concentric series of granules in the midregion varies, either one or two. All other features agree completely with the original diagnosis. As was illustrated by Lütkemüller (1911, p. 495, Taf. III, fig. 1–4), the midregion granulation is a variable feature of this variety.

The taxon under discussion has a close resemblance to *C. miraculum* Grönbl. in the shape of cells and isthmus, pattern of intramarginal granulation and presence of one granule above the isthmus. Only triangular scrobiculations with no punctulation between the central granules differ the latter species. However, as was illustrated by Croasdale and Grönbladt (1964, p. 182. Pl. 14, fig. 14–17), this feature does not seem to be constant.

Grönbladt (1921, p. 33–34, Pl. 6, fig. 35–37) compared *C. miraculum* with *C. trachypleurum* var. *stellatum* Racib. and pointed out that these species differ in their granulation. From my point of view, *C. trachypleurum* var. *fallax* and *C. miraculum* are very closely related. The supraisthmal granulation is a rather distinctive feature which is absent in a typical variety of the former species and it may be better to raise var. *fallax* as a species and to consider *C. miraculum* within the last one as a variety.

Xanthidium Ehr. ex Ralfs

X. cristatum Bréb. var. *uncinatum* Bréb. f. *polonicum* Gutw. Fig. 34.

L ssp 55 μm, W ssp 47,5 μm, L and W csp 67,5 μm, I 15 μm. Loc. 2.

This form is reported for the firs time in this Territory.

Staurodesmus Teil.

S. grandis (Bulnh.) Teil. Fig. 35.

Syn.: *Staurastrum grande* Bulnh.

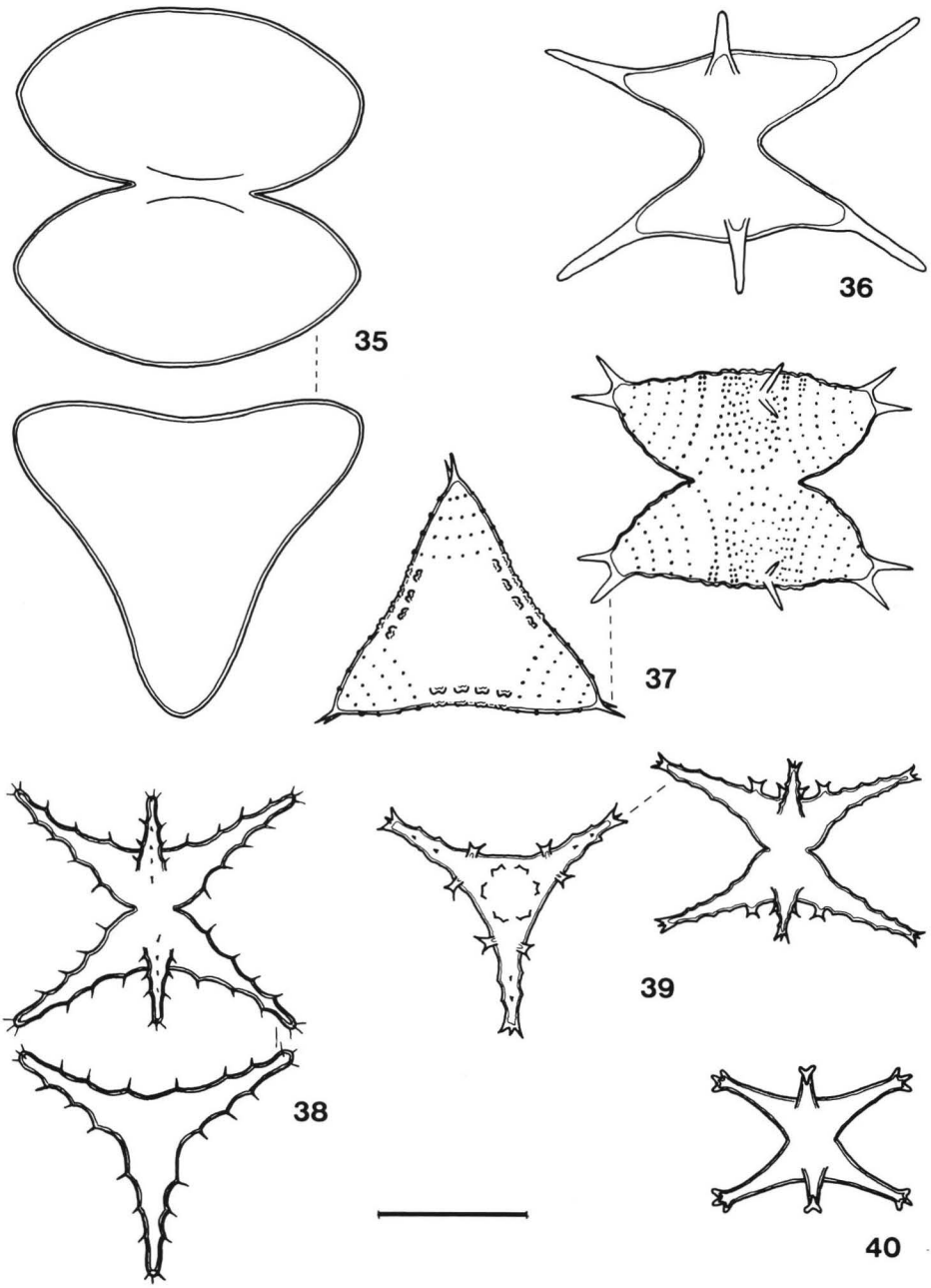
L 72,5 μm, W 70 μm, I 25 μm. Loc. 2.

The species seems not to be rare in the western part of Russia but this is the first record of it in the eastern regions of the country.

S. megacanthus (Lund.) Thunm. var. *scoticus* (West) Lillier Fig. 36.

Syn.: *Staurastrum megacanthum* Lund. var. *scoticum* W. et G. S. West.

L ssp 25 μm, L csp 35 m, W ssp 32,5 μm, W csp 47,5–52,5 μm, I 6,3 μm. Loc. 2.



Figs. 35–40. — 35. *Staurodesmus grandis* (Bulnh.) Teil. 36. *S. megacanthus* (Lund.) Thum. var. *scoticus* (WEst) Lillier. 37. *Staurastrum avicula* Bréb. var. *coronulatum* Wade. 38. *S. barbatum* W. et G. S. West. 39. *S. bicoronatum* Johns. 40. *S. brachiatun* Ralfs. Scale bar fig. 35 = 30 μm, 37–40 = 20 μm.

Previously, in the Primorsky Territory, only the var. *orientalis* (Scott et Prescott) Teil. of this species was reported.

Staurastrum Meyen ex Ralfs

S. avicula Bréb. var. *coronulatum* Wade Fig. 37.

L ssp 25–27,5 μm, W ssp 32,2–37,5 μm, I 12,5 μm. Loc. 2.

This variety is new to Russia.

A similar alga was illustrated by Nygaard (1977, p. 95, 96, Fig. 85) as a "forma" of *S. pelagicum* W. et G. S. West.

Some specimens with angles bearing a single spine were found. They have the same dimensions and the cell-wall ornamentation is not well developed. However, it has the same pattern as a typical specimens.

S. barbatum W. et G. S. West Fig. 38.

L spr 17,5 μm, W cpr 37,5 μm. I 5–6,3 μm. Loc. 3.

This species is reported for the first time in Russia.

All the specimens have processes with 3 spines-tipped nodulations (4 in original diagnosis (West & West, 1896, p. 265. Pl. 17, fig. 11) and are furnished with 3 spines (teeth in the diagnosis).

S. bicoronatum Johns Fig. 39.

L spr 25 μm, W cpr 30 μm, I 7,5 μm. Loc. 1.

Previously, this species was reported only in the north-western part of Russia.

The dimensions of the specimens examined are slightly bigger than that is usually reported for this species.

S. brachiatun Ralfs Fig. 40.

L spr 16,6 μm, W cpr 27,5 μm, I 7 μm. Loc. 3.

This species is widely distributed in the territory of Russia but, in the far-eastern part, it was known only in the Kuril Islands.

S clevei (Wittr.) Roy et Biss. Fig. 41.

L cpr 28,8 μm, W spr 20 μm, cpr 38,5–42,5 m, I 9 μm. Loc. 3.

In Russia, this species was reported only in the north-western territories.

S. depressipes Scott et Grönbl. Fig. 42.

L spr 10 μm, L cpr 25–30 μm, W spr 10 μm, W cpr 25–30 μm, I 5–6,3 μm. Loc. 4.

This species is reported for the first time in Russia and perhaps this is a first finding of the species in Asia.

I used this epithet for the specimens with some doubt. According to Scott and Grönbladt (1957), *S. depressipes* has a transverse series of short spines immediately above the isthmus. All varieties of the species possess this feature but the numbers of spines are different. Two taxa of the species, var. *depressipes* f. *protuberans* Scott et Grönbl. and var. *planiceps* Scott et Gronbl., have a mamillate protrusion on either side. A distinct feature of var. *depressipes* is the truncate protuberances at the base of the arms.

The specimens examined have only two pairs of spines at the lateral sides of the semicell's base; and the dorsal and lateral sides of the processes are furnished with relatively stout spines. To some extent, this alga exhibits an intermediate form between the typical variety and others, which do not have any decorations at the base of the processes. A vertical view of the alga under discussion is very similar to one of var. *planiceps*: cells are oval with a protrusion on either side furnished with 1 or 2 spines.

Thus, the specimens from studied locality have a resemblance to some varieties of *S. depressipes* but dissimilarities are also present. Perhaps, further study of the morphological variability of the above mentioned taxa will make the taxonomic position of this alga clear.

S. elaticeps Scott et Grönbl. var. *tenue* Scott et Grönbl. Fig. 43.

L spr 32,5–33,8 μm, W cpr 57,8–65 μm, I 15 μm, T 15 μm. Loc. 2.

The species is reported for the first time in Russia.

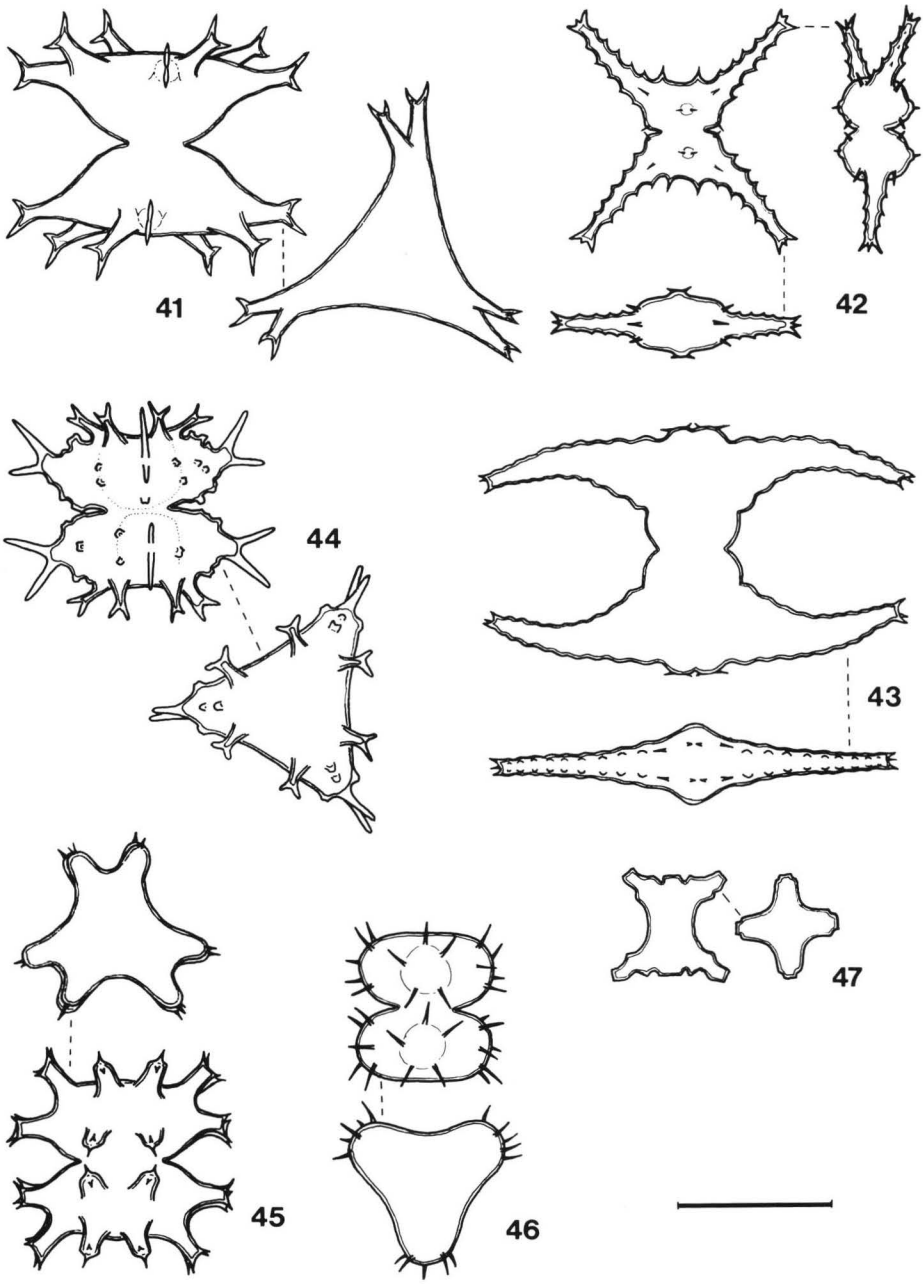
The specimens examined differ from the diagnosis (Scott & Grönbladt, 1957, p. 37, Pl. 27, fig. 5) in lacking granules on the elevated midsector of the apex. However, they have the same shape of cells and direction of processes as illustrated in this variety. In the vertical view, the specimens are obviously rhomboid with dilated and more or less rounded sides.

S. forficulatum Lund. Fig. 44.

L spr 37,5–45 μm, W spr 30–50 μm, L cpr 50 μm, W cpr 62,5 μm, I 16 μm. Loc. 1, 2, 3.

In Russia, this species was recorded mainly in the western and north-western regions and also in the Kuril Islands.

The specimens examined have stouter lateral spines than is usually pictured for this species and its varieties. There are various interpretations of this species by the modern taxonomists (Palamar-Mordvintceva, 1982; Prescott et al., 1982) but I follow the latter authors. As well it is possible to compare the studied material with *S. furcatum* (Ehr. ex Ralfs) Bréb. var. *pisciforme* (Turner) Irénée-Marie (Irénée-Marie, 1939, p. 329. Pl. 55, figs. 9, 10). However, the dimensions of the later alga is twice as small. From my point of view, complex *S. forficulatum-S. furcatum* and relevant species needs careful examination in terms



Figs. 41–47. —— 41. *S. clevei* (W. H.) Roy et Biss. 42. *S. depressipes* Scott et Grönbl. 43. *S. elaticeps* Scott et Gronbladt var. *tenue* Scott et Gronbladt. 44. *S. forficulatum* Lund. 45. *S. gemelliparum* Nordst. 46. *S. hystrix* (Ralfs.) Pal.-Mordv. 47. *S. inconspicuum* Nordst. Scale bar fig. 41, 43, 44, 46, 47 = 20 μm, 42 = 15 μm, 45, 46 = 30 μm.

of morphological variability.

Algae from locality 2 exhibit a very wide range of variation in cell-shape, cell-wall ornamentation, and length of apical processes.

S. gemelliparum Nordst. Fig. 45.

Syn.: *S. duplex* Wolle 1883, Bull. Torr. Bot. Club 10: 19. Pl. 27, fig. 10.

L spr 25–30 μm, W spr 25–27 μm. I 10 μm. Loc. 1.

Previously, this species was reported in Russia in the north-western territories.

The similarity of the taxon under discussion and *S. quadrangulare* (Bréb.) Ralfs was stressed by a few authors (West et al., 1923; Croasdale, 1957). However, from my point of view, the diagnosis and figures of *S. gemelliparum* (Nordstedt, 1870, p. 230. Pl. 4, fig. 54) and *S. duplex* Wolle are taxonomically identical and I propose to consider the latter one as being synonymous with *S. quadricornutum.*

Some of the specimens had 3 processes on each basal angle as in *S. hantzschii* Reinsch or its varieties. All processes of these algae were tipped with tree spines. However, the vertical view of these cells was clearly triangular with widely concaved margins between processes which is not typical for the mentioned species. The dimensions of such cells were 1.5 times smaller than that was indicated for *S. hantzschii.*

S. hystrix Ralfs. Fig. 46.

Syn.: *Cosmoastrum hystrix* (Ralfs.) Pal.-Mordv.

L ssp 37,5 μm, W ssp 30 μm, I 20 μm. Loc. 3.

This species is widely distributed throughout the whole territory of Russia including the nearest of our regions, i.e. Khabarovsky Territory, the Kuril Islands and Kamchatka.

S. inconspicuum Nordst. Fig. 47.

L spr 15 μm, W spr 11,5 μm, L cpr 15–16,5 μm, W cpr 15–18 μm, I 5–7 μm. Loc. 3.

This species is widely distributed in the territory of Russia but in the eastern region it was known only in the Kuril Islands. Moreover, I found it in the samples from Kamchatka (unpublished).

S. longebrachiatum (Borge) Gutw. var. *floridense* Scott et Grönbl. Fig. 48.

L spr 45 μm, W spr 17,5–20 μm, W cpr 90–95 μm, I 13,8 μm, T 15,5–20 μm. Loc. 2.

This species is reported for the first time in Russia.

All the specimens examined had tree granules in the isthmal region, one of

these granules was always within isthmal notch. The shape of the semicell base was not a constant feature of our specimens. It varies from a bowl-shape as typical for this variety to cylindrical with straight lateral sides or even subtrapeziform.

S. manfeldtii Delp. Fig. 49.

L spr 37,5–43,8 μm, W spr 17,5–20 μm, W cpr 65–75 μm, I 10–16 μm. Loc. 2.

In Russia, this species was reported only in the Volga river basin.

The taxonomy of this species is rather unclear (Teiling, 1947; Coesel, 1992; Sharf, 1995) and I used this ephitet with some doubt. The specimens examined well resemble Ruzicka's drawings (1973, Taf. 15, fig. 10–18, as *S. manfeldtii* var. *parvum* Messik.) but have processes tipped with 3 teeth. A few specimens with two spines at the base of the processes were found. This pattern of processes ornamentation also was illustrated by the previously mentioned author (Taf. 15, fig. 15, 16). The apex's ornamentation of the alga was the same as usually illustrated in this species. Sometimes six central granules form a distinct circle.

It should be mentioned that in one pond at the same locality, specimens possible to identify as *S. sebaldii* Reinsch var. *ornatum* Nordst. were found. They differ in dimensions (72,5 × 85 μm), stoutness of ornamentation of the processes and apex and have 4 granules opposite each processes above the isthmus in one row.

S. navigiolum Grönbl. Fig. 50.

Syn.: *Raphidiastrum navigiolum* (Grönbl.) Pal.-Mordv.

L ssp 50 μm, W ssp 52 μm, W csp 55 m, I 25 μm. Loc. 2.

This species has never been recorded in Russia but I found it previously in the samples from Kamchatka (unpublished).

S. saltans Joshua var. *miedzyrczecense* (Eichl.) Cedercreutz et Grönbl. Fig. 51.

L 30–32 μm, W cpr 32–36 μm, I 10–12,5 μm, T 12,5–17,5 μm. Loc. 1.

This species is new to Russia.

S. submonticulosum Roy et Biss. Fig. 52.

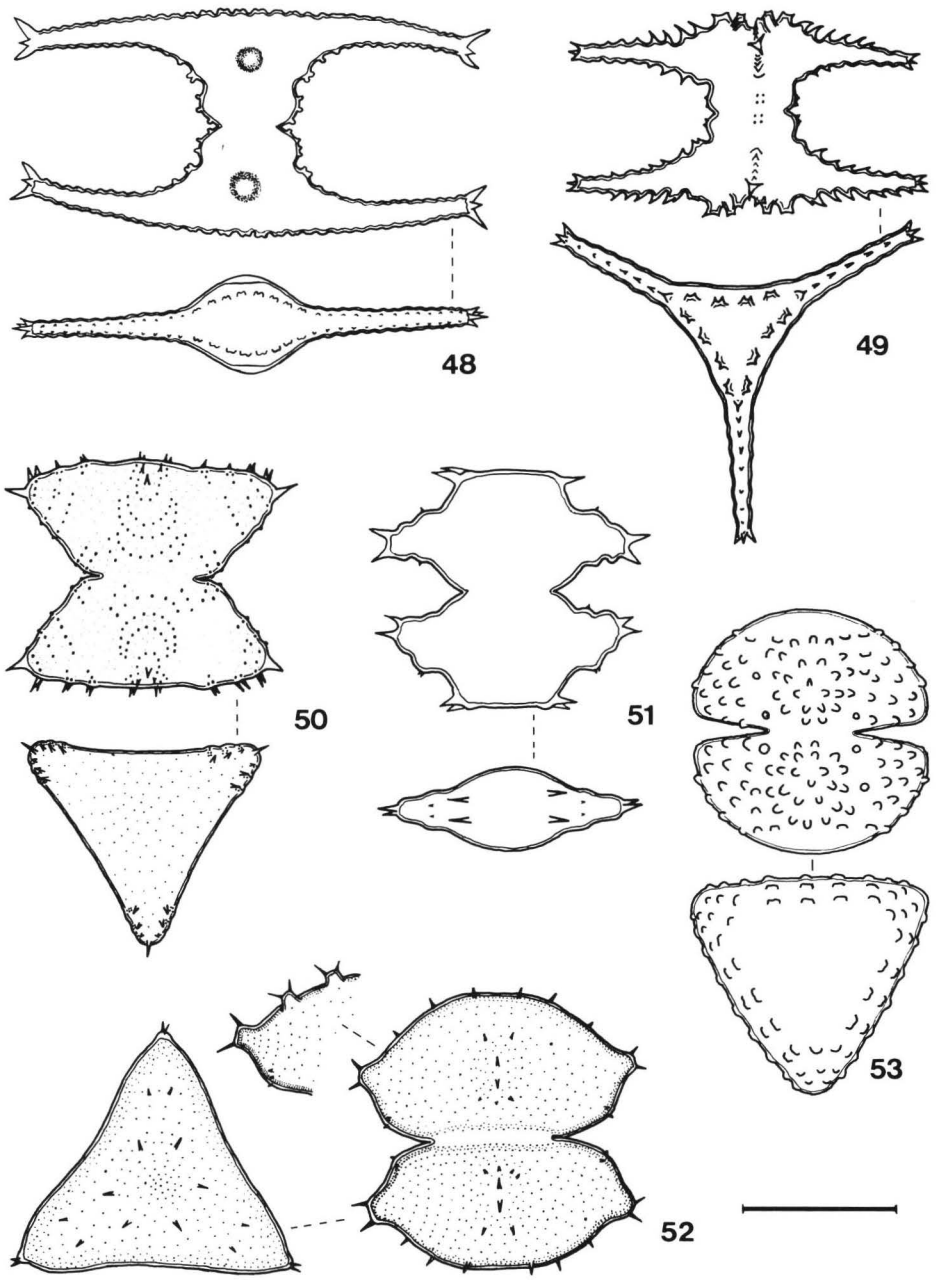
L 35–37,5 μm, W ssp 35–37,5 μm, I 12,5–15 μm. Loc. 2.

The species was reported in Russia in the north-western territories.

The alga exhibits a wide range of variation in the apical margin's decoration. Many specimens have spines or even teeth instead of the processes.

S. subscabrum Nordst. Fig. 53.

Syn.: *Cosmoastrum subscabrum* (Nordst.) Pal.-Mordv.



Figs. 48–53. —— 48. *S. longebrachiatum* (Borge.) Gutw. var. *floridens* Scott et Grönbl. 49. *S. manfeldtii* Delp. 50. *S. navigiolum* Grönbl. 51. *S. saltans* Joshua var. miedzyrczecense (Eichl.) Cedercreutz et Grönbl. 52. *S. submonticulosum* Roy et Biss. 53. *S. subscabrum* Nordst. Scale bar fig. 48–50 = 30 μm, 51–53 = 20 μm.

L 25 μm, W 30 μm, I 10–12 μm. Loc. 3.

In the territory of Russia, this was reported only in the western region.

Desmidium Ag. ex Ralfs

D. baileyi (Ralfs) Nordst. Fig. 54.

L 13,8–16,3 μm, W 18,8–22,5 μm. Loc. 1.

This species was found only in the eastern territories of Russia-Kamchatka and the Kurils.

D. graciliceps (Nordst.) Lagerh. Fig. 55.

L 20–21 μm, W 22–24 μm, I 19–20 μm. Loc. 2.

Previously, this species was reported only in Western Siberia.

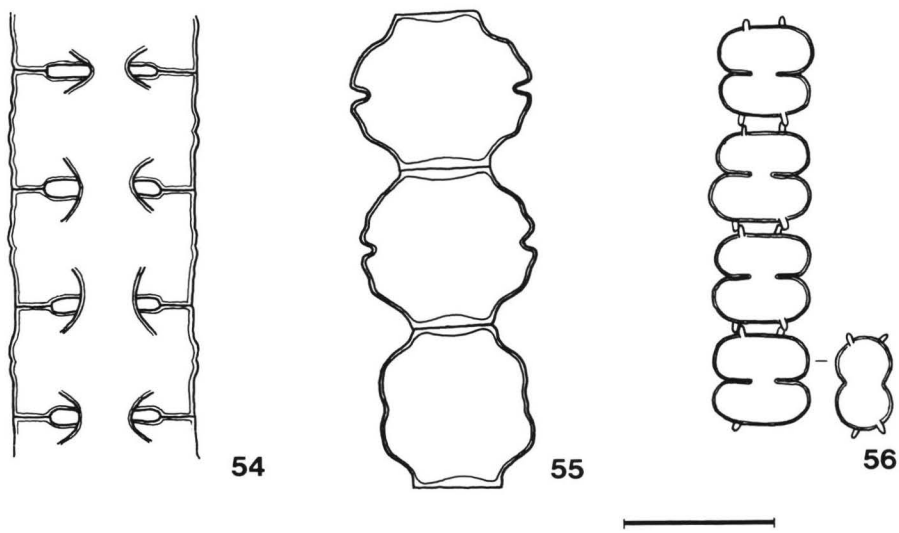
Sphaerozosma Corda ex Ralfs

S. externa Noda et Skvortz. Fig. 56.

L 12,5–15 μm, W 12,5–13,8 μm, I 2,5 μm. Loc. 2.

This species is reported for the first time in Russia. It was noted in the places adjacent to Primorsky Territory, i.e. Mongolia and China.

This alga combines some features of two genera, namely short apical processes with distinct mucilage between them as found in *Sphaerozosma*, and a closed linear sinus and remotely placed processes, found in *Onychonema* Wallich.



Figs. 54–56. —— 54. *Desmidium baileyi* (Ralfs) Nordst. 55. *D. graciliceps* (Nordst.) Lagerch. 56. *Sphaerozosma externa* Noda et Skvortz. Scale bar fig. 54–56 = 20 μm.

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