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DESMIDS OF THE TRANSITIONAL BOGS OF THE MIDDLE MAZOWSZE LOWLAND

Desmidie torfowisk przejściowych
Niziny Środkowomazowieckiej

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CONTENTS

Introduction	5
Location and description of bogs	5
Material and methods	9
List of the identified taxa	10
Streszczenie	80
Literature	81

ABSTRACT

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Abstract. The author presents the results of the studies of several years on the desmid flora of nine transitional bogs located in the environs of Warsaw. 226 taxa were found belonging to 20 genera. Moreover, 16 taxa of the *Mesotaeniaceae* family, representing 4 genera were identified. A few taxonomic corrections were made in relation to several taxa. The rank within the species was changed or it was transferred to another genus. Certain species and distinguished infraspecific taxa were criticized.

INTRODUCTION

Desmids are a group of algae which are interesting, very diversified in shape and with specific ecological requirements. Members of the most genera occur rather in stagnant, slightly acid waters with low calcium content. Therefore, a large number of taxa can be encountered in bogs, in small peaty pools or in lakes located in bogs. Eichler (1890) and Kozłowski (1895) were the first Polish authors who noticed that desmids were very abundant in these habitats.

So far, desmid flora has been described only for some bogs in Poland, and only when the whole algae flora has been studied. Most papers concern desmids of ombryotrophic bogs such as: Bielawskie Błoto (Krawiecowa et al. 1954), Nowy Targ Basin (Wasylik 1961a), Chlebowo (Gołowin 1964), and Bór na Czerwonym (Grzelewska 1974). Except for the investigations of Wysocka (1934) and Kadłubowska (1952) desmids of the transitional bogs have not been studied yet. Therefore, such studies are advisable and needed.

LOCATION AND DESCRIPTION OF BOGS

Nine transitional bogs (Biały Ług A, Biały Ług B, Celestynów, Konik, Bagno Jacka, Zieleniec, Grabiec A, Grabiec B and Mironowe Górki), located in the Middle Mazowsze Lowland, were studied. All of them, Celestynów bog located in the Garwolin Plain — except, were located in the Wołomin Plain mesoregion (Kondracki 1977).

Biały Ług A bog (stand 1) lies about 18 km southeast of Warsaw and about 2 km southwest of Wiązowna (Fig. 1). Its surface equals to app. 2 ha. It is surrounded by pine forest with the high contribution of lichens. The bog is intensively exploited. Peat excavations are mainly of different age. Old excavations are nearly completely regenerated. They are occupied by phytocenoses composed mainly of *Sphagnum apiculatum* and *Eriophorum angustifolium* as dominants and *Oxycoccus quadripetalus* and *Eriophorum vaginatum*. In new and deep excavations turfs of peat mosses draw from the margins inwards. In wide dykes and unexploited parts of the bog well-developed *Eriophoro-Sphagnetum re-*

curvi phytocenoses with high contribution of *Eriophorum vaginatum* and *Oxycoccus quadripetalus* occur. Here and there, pine and birch, more or less abundant, grow. Water in this bog is highly acid, pH 3.4-4.5.

Fig. 1. Distribution of bogs studied. 1 — Biały Ług A, 2 — Biały Ług B, 3 — Celestynów, 4 — Konik, 5 — Bagno Jacka, 6 — Zieleniec, 7 — Grabiec A, 8 — Grabiec B, 9 — Mironowe Góry

Biały Ług B bog (stand 2) lies beyond the dune bank, about 1 km east of the Biały Ług A bog (Fig. 1). Its surface equals to app. 2.5 ha. It is surrounded by pine forest. The bog is highly exploited, as a rule to the floor, at present it is actually one, big, branched peat excavation.

Most of the peat excavations are occupied by *Caricetum elatae* phytocenose, which in the bog margins is composed of *Eriophorum angustifolium* and *Sphagnum apiculatum*. *Utricularia minor* is very abundant in water. In the bridges between excavations and ditches, as well as in unexploited area small patches of *Eriophoro-Sphagnetum recurvi* phytocenoses occur. Single specimens of pine and birch also grow there. Water pH oscillates between 3.7 and 4.9.

Celestynów bog (stand 3) is located about 33 km southeast of Warsaw and app. 1.5 km west of Anielinek (Fig. 1). Its surface equals to 8 ha. It is surrounded by pine forest. The bog was intensively exploited, at present peat excavations are regenerated to a large extent. Amongst water plants *Nymphaea alba* (in some excavations very abundant) and *Utricularia minor* grow there. The bottom is covered with *Sphagnum cuspidatum*. Water blooming of filamentous algae, mainly *Mougeotia* sp., often takes place. Floating bog-moss turf in the margins is composed of *Sphagnum apiculatum*. In the regenerated excavations *Sph. apiculatum* is accompanied by *Rhynchospora alba*, *Eriophorum angustifolium* and *Drosera rotundifolia*, sometimes in large quantities. In the bridges and unexploited parts patches of bog pine forest with higher contribution of *Ledum palustre*, *Vaccinium uliginosum*, *Oxycoccus quadripetalus* and *Eriophorum vaginatum* occur. Water pH equals 3.4-4.8.

Konik bog (stand 4) lies 23 km southeast of Warsaw (Fig. 1). Its surface equals to app. 8 ha. It is surrounded by the young pine forest. It was intensively exploited in past. Most of the peat excavations are covered with floating bog-moss turf built mainly of *Sphagnum apiculatum* and *Eriophorum angustifolium*. Free water-level is maintained only in the youngest and deepest bodies. Amongst flowering plants *Utricularia minor* grows abundantly there. Periodically, turfs of filamentous algae, mainly *Spirogyra* sp. and *Mougeotia* sp., develop there in mass. In the excavations in the bog margin, where considerable inflow of eutrophic waters takes place, *Phragmitetum* and *Typhetum latifoliae* phytocenoses occur. In some old, regenerated excavations *Caricetum lasiocarpae* phytocenoses often grow. In the unexploited bog parts patches of *Eriophoro-Sphagnetum recurvi* are found. The bog is scarcely (mainly in the bridges between excavations) grown with *Betula pubescens*. In the margins larger clumps of *Salix cinerea* and *Frangula alnus* may be found. Water pH ranges from 3.5 to 5.0.

Bagno Jacka bog (stand 5) is located 14 km east of Warsaw (Fig. 1) and 1 km northwest of Wesola. Its surface equals to over 35 ha. It is surrounded by the forest complex (young pine forests). The bog was intensively exploited in past. Old excavations are nearly entirely shallowed and overgrown. In the young and shallow parts slightly compact phytocenoses of *Caricetum elatae* occur, in the deeper parts water-surface is free. In the margins of excavations, in shallowed parts, small-surface

patches of *Menyanthes trifoliata* and *Calla palustris* grow, as well as small bog-moss bridges, composed mainly of *Sphagnum apiculatum*, occur. In old, nearly entirely regenerated peat excavations moss layer is composed mainly of *Sphagnum apiculatum*, whereas amongst flowering plants *Carex rostrata*, *Eriophorum angustifolium* and *Oxycoccus quadripetalus* mostly grow. The unexploited part of the bog is occupied by classically developed *Eriophoro-Sphagnetum recurvi* phytocenoses with high contribution of young pine. In some spots they pass into bog pine forest. In some bog parts *Betula pubescens* occurs abundantly. Water pH amounts to 4.0-5.0.

Zieleniec bog (stand 6) is located 13 km northeast of Warsaw (Fig. 1) and 2 km north of Zielonka. Its surface exceeds 2.5 ha. It is surrounded by young pine forest. The bog has been highly exploited. Old excavations are overgrown with *Sphagnum apiculatum* accompanied by *Eriophorum angustifolium* and *E. vaginatum* in large quantities. In young excavations with free water-surface the bottom is covered with *Sphagnum cuspidatum*, whereas in the margins *Heleocharis palustris*, *Eriophorum angustifolium*, *Carex lasiocarpa* and *C. hudsonii* sometimes grow. In the bridges between excavations degenerated phytocenoses of bog pine forest with *Molinia coerulea* and *Calluna vulgaris* occur. *Vaccinium uliginosum*, *V. vitis-idaea*, *Carex canescens*, *Calamagrostis canescens*, *Betula pubescens*, *Populus tremula* and *Frangula alnus* grow in smaller quantities. Water pH oscillates between 3.7 and 4.8.

Grabicz A bog (stand 7) lies 17 km northeast of Warsaw and 1.5 km south of Wolomin (Fig. 1). Its surface equals to about 5 ha. It is surrounded by young pine forest. The bog hardly exploited, with the low peat depth. In water of the deepest, probably natural depression agglomerations of *Nymphaea alba*, *Potamogeton natans*, *Sphagnum subsecundum* var. *auriculatum* and *Phragmitetum* phytocenoses occur. The bog is mostly covered with *Caricetum lasiocarpae* phytocenoses with large amounts of *Sphagnum apiculatum*. The following species are mostly found within the bog: *Comarum palustre*, *Eriophorum angustifolium*, *Lysimachia vulgaris*, *Salix rosmarinifolia*, *Vaccinium uliginosum* and *Pinus sylvestris*. The bog vegetation is of the moss-sedge nature and refers to the *Scheuchzerio-Caricetea fuscae* class with the distinct developmental tendencies towards bog-moss communities of the *Oxycocco-Sphagnetum* class. Water is slightly acid, pH = 4.2-6.0.

Grabicz B bog (stand 8) lies beyond the dune bank, 1 km east of Grabicz A bog (Fig. 1). Its surface equals to 13 ha. It is nearly entirely surrounded by young pine forest. It is intensively exploited and in many parts the peat was skimmed to the floor. In the deeper parts of free peat excavations *Phragmitetum* phytocenoses occur, whereas in the shallow parts patches of *Caricetum elatae* grow. In water single specimens of *Nymphaea alba* may be found, while *Drepanocladus fluitans* occurs abun-

dantly. In the shallowed margin parts bog-moss bridges develop, composed mainly of *Sphagnum apiculatum* and with such species as: *Lysimachia vulgaris*, *L. thyrsiflora*, *Carex rostrata*, *Comarum palustre*, *Eriophorum angustifolium* and *Calamagrostis canescens*. In the bog bridges between excavations degenerated phytocenoses of the bog pine forest grow with high contribution of *Vaccinium uliginosum*, *Salix cinerea* and *Molinia coerulea*. The regeneration of the peat excavations goes in the direction of moss-sedge and bog-moss-sedge communities. Water pH equals to 3.8-5.0.

Mironowe Górki bog (stand 9) located 19 km northeast of Warsaw, in the Wołomin suburb (Fig. 1). Its surface equals to over 25 ha. The bog is surrounded by settlements and arable fields. It is highly exploited and large-surface peat excavations are of different age. Water vegetation is poorly developed, only single specimens of *Nymphaea alba* and *Potamogeton natans* occur. In some excavations *Utricularia minor* is more abundant. Fen vegetation is mostly represented by variously developed (more or less compact) *Caricetum elatae* phytocenoses. In some places the patches of *Phragmitetum* and *Caricetum rostratae* occur. In old shallowed peat excavations, with no free water-surface mainly communities composed of *Sphagnum apiculatum* — a dominant, and *Eriophorum angustifolium*, *Carex rostrata*, *C. hudsonii* grow. In the bridges and bog margins sometimes *Salix cinerea*, *Betula pubescens*, *B. verrucosa* occur in number accompanied by numerous species of fen plants and those confined to moist habitats. Water is slightly acid, pH = 4.2-5.6.

MATERIAL AND METHODS

The material was collected in the period from October 1971 to December 1976 in more or less month intervals, with the exception of winter months.

The samples in particular bogs were collected in various habitats and different ways, mostly:

a) the water was squeezed from submerged bog mosses, mats of filamentous algae (*Mougeotia* sp., *Spirogyra* sp.) and *Utricularia minor* agglomerations;

b) surface layer sediment was collected from the bottom of shallow peat excavations, drains and other depressions;

c) periphyton was scraped out of the partly submerged plants or of those with floating leaves (*Phragmites communis*, *Nymphaea alba*);

d) over 20 dm³ of water from peat excavations, drains and other depressions, constant or periodically dried were filtered through plankton-net No 25.

In aim to find large number of taxa in each bog samples were collected from at least 10 various points. The frequency of occurrence of

each taxon was determined as from each bog there were some scores of samples. The following system and abbreviations were assumed: cc — very often, c — often, r — relatively often, rr — rarely, rrr — sporadically.

In aim to cover variation in the size of individuals, minimum 10 specimens were measured for each taxon, moreover, a special attention was paid to the largest and the smallest specimens. In case of rare species all encountered specimens were measured.

LIST OF THE IDENTIFIED TAXA

In the taxa identification mainly following works were used: Ralfs (1848), West, West (1904, 1905, 1908, 1912), Migula (1907), West et al. (1923), Krieger (1933a, b, 1935, 1937a, b, 1939), Kossinskaya (1952, 1960), Teiling (1954, 1967), Hirano (1955, 1956, 1957a, b, 1959a, b, 1960), Krieger, Gerloff (1962, 1965, 1969), Bicudo (1969), Förster (1970, 1972), Růžicka (1972, 1973a, 1977, 1981), Palamar-Mordvintseva (1982). The following works were used as well: Raciborski (1895), Skuja (1928), Kanetsuna (1960), Thomasson (1960), Růžicka (1962, 1975b, 1976), Grönblad (1963), Ito (1965c, 1978), Scott et al. (1965), Dubois-Tylski (1966), Messikommer (1968/72), Lenzenweger (1970b, 1976), Coesel (1975), Palamar-Mordvintseva (1975b, 1977), Agarkar et al. (1979), Hirano (1979).

Abbreviations:

lg.	— cell length	pr.	— processes
br.	— cell breadth	ang.	— angular
br. max.	— maximum cell breadth	str.	— striae
isth.	— isthmus breadth	th.	— thickness of cell
lob. pol.	— polar lobe	occur.	— occurrence
ap.	— apex	1-9	— a stand (bog) number
sp.	— spine		

List of taxa contains additionally representatives of the family *Mesotaeniaceae*.

Order: *ZYGNEMATALES*

Family: *Mesotaeniaceae* Oltmanns 1904

Genus: *Mesotaenium* Nägeli 1849

Mesotaenium de-greyi Turn.

var. *de-greyi* f. *de-greyi* (Plate 1, Fig. 10-11)

Cells naked, without gelatinous envelope. They occur mainly in samples obtained through *Sphagnum* sp. squeezing.

Lg. 78.2-96.6 μm , br. 18.4-20.7 μm , lg.: br. 3.89-4.67 $\times$.

Occur.: 1rrr, 2rrr, 3rr, 4rrr, 5rrr, 6rrr, 8rrr, 9rrr.

f. *breve* (W. West) Kossinsk. (Plate 1, Fig. 8-9)

Entire cells filled with oil globules often (Plate 1, Fig. 9). Similar specimens have been described by West, West (1904) and Kossinskaya (1952). Individuals found both in plankton and in the *Sphagnum* sp. turf.

Lg. 36.8-59.8 μm , br. 16.1-23.0 μm , lg.: br. 1.70-3.00 $\times$.

Occur.: 1rrr, 2rrr, 3rr, 4rr, 5rr, 6rrr, 8rr, 9rrr.

Mesotaenium endlicherianum Näg.

var. *endlicherianum* f. *endlicherianum* (Plate 1, Fig. 3-5)

One specimen was found in the Bialy Ług A bog at the divisional stage (Plate 1, Fig. 5).

Lg. 32.2-46.0 μm , br. 9.2-11.5 μm , lg.: br. 2.85-4.02 $\times$.

Occur.: 1rrr, 3rr, 8rrr, 9rr.

f. *exiguum* (Hansg.) stat. nov. Plate 1, Fig. 6-7)

Basion.: *Mesotaenium endlicherianum* Näg. var. *exiguum* Hansgirg (1892), Prodrum der Algenflora von Böhmen, Archiv Naturwiss. Landesdurchf. Böhmen, 8, 4, p. 248.

Specimens slightly curved, larger than those described by Hansgirg (1892), and Migula (1907). Krieger (1933b) considers this taxon as a synonym of the typical variety. I take it for an individual taxonomic unit. Cells differ considerably in shape from the typical form. No intermediate forms have been found. Representatives of both taxa (f. *endlicherianum* and f. *exiguum*) were recorded in separate sites (stands).

I propose to give the taxon mentioned above the rank of a form, not a variety.

Lg. 45.7-47.1 μm , br. 11.5 μm , lg.: br. 3.97-4.09 $\times$.

Occur.: 2rrr.

f. *grande* (Nordst.) Kossinsk. (Plate 1, Fig. 1-2)

Lg. 46.0-94.3 μm , br. 9.2-16.1 μm , lg.: br. 4.71-5.81 $\times$.

Occur.: 1rrr, 3rr, 5rrr, 6rrr, 8rrr, 9rrr.

Mesotaenium macrococcum (Kütz.) Roy et Biss.

var. *macrococcum* (Plate 1, Fig. 12-13)

Solitary cells without gelatinous envelope. Specimens were found in the plankton of the excavation only.

Lg. 28.6-34.5 μm , br. 11.5-13.8 μm , lg.: br. 2.48-2.50 $\times$.

Occur.: 2rr.

Genus: *Spirotaenia* Brébisson in Ralfs 1848

Spirotaenia condensata Bréb.

var. *condensata* (Plate 1, Fig. 14)

Lg. 184.0-246.0 μm , br. 20.7-24.6 μm , lg.: br. 8.38-10.00 $\times$.

Occur.: 7rrr, 8rrr.

Spirotaenia obscura Ralfs

var. *obscura*, morpha (Plate 1, Fig. 15)

Cells fusiform. Chromatophore not reaching the cell poles. Chromatophore ridges spirally twisted in two directions: from the left to the right and from the right to the left, in end they fuse with each other.

The comparison of drawings of *Sp. obscura* in the works of: Lütke-müller (1895; after West, West 1904 and Kossinskaya 1952), Migula (1907), Krieger (1933b), Grönblad (1938), Hirano (1955), Růžička (1957b), Grönblad and Růžička (1959), Wasylik (1961a) and Bicudo (1969) shows high variation of individuals of this taxon, both in respect of cell shape and chromatophore structure. Drawings in many works e.g. those of Migula (1907; Plate 24, Fig. 2), Krieger (1933b), Grönblad (1938), Růžička (1957b) and Bicudo (1969) differ from those of Lütke-müller (1895) who has thoroughly analysed chromatophore structure on the grounds of the culture material.

In the specimens found chromatophore is slightly different from that described by Lütke-müller and similar to those described by: Migula (1907), Růžička (1957b), Grönblad and Růžička (1959).

Lg. 75.9-80.5 μm , br. 16.1-17.2 μm , lg.: br. 4.68-4.71 $\times$.

Occur.: 7rrr.

Genus: *Cylindrocystis* (Meneghini ex Ralfs) De Bary 1858

Cylindrocystis brebissonii (Mench. ex Ralfs) De Bary (Plate 2, Fig. 4-5)

Two varieties, *brebissonii* and *jenneri* have been distinguished within a present species. Both taxa can be identified on the grounds of the formation and appearance of zygospore. In the obtained material no individuals reproducing sexually were found. Therefore, their closer taxonomical affiliation could not be determined.

Lg. 39.1-75.9 μm , br. 13.8-23.0 μm , lg.: br. 2.00-4.16 $\times$.

Occur.: 1rrr, 2rr, 3rr, 4r, 5rrr, 6rrr, 8rrr.

Cylindrocystis crassa De Bary

var. *crassa* (Plate 2, Fig. 6)

Lg. 34.5-46.0 μm , br. 20.7-23.0 μm , lg.: br. 1.50-2.00 $\times$.

Occur.: 1rrr, 2rr, 3rrr, 4rr, 5rrr, 8rrr, 9rrr.

Genus: *Netrium* (Nägeli) Itzigsohn et Rothe 1856

Netrium digitus (Ehrenb. ex Bréb.) Itzigs. et Rothe

var. *digitus* f. *digitus* (Plate 1, Fig. 16)

Lg. 110.4-267.3 μm , br. 31.0-73.6 μm , ap. 16.1-32.2 μm , lg.: br. 3.10-4.76 $\times$.

Occur.: 1rr, 2rr, 3rr, 4r, 5rr, 6rr, 7rrr, 8rr, 9rr.

? f. *curtum* (Anderss.) Kossinsk. (Plate 1, Fig. 17)

Individuals differ in size from those described by Krieger (1933b) and Kossinskaya (1952). Cell dimensions are close to those of *f. digitus*, whereas length-breadth ratio is comparable to that of *f. curtum*.

Lg. 170.2-216.2 μm , br. 69.0-89.2 μm , ap. 25.3-32.2 μm , lg.: br. 2.33-2.56 $\times$.

Occur.: 4rrr, 5rrr.

f. parvum Borge (Plate 1, Fig. 18)

Cells fusiform. They fit their drawings of Parra and Gonzalez (1977; Fig. 8), slightly differ from others (Fig. 6-7 and 9), as well as from Borge's drawing reproduced in works of Krieger (1933b) and Kossinskaya (1952). The drawings mentioned there in their shape resemble a rhombus. It may well be that specimens found represent only juvenile stages of *f. digitus* and not separate taxon.

Lg. 69.0-87.4 μm , br. 27.6-32.2 μm , ap. 11.5-13.8 μm , lg.: br. 2.45-3.05 $\times$.

Occur.: 5rrr, 8rrr, 9rrr.

var. *lamellosum* (Bréb) Grönl. (Plate 1, Fig. 19-21)

Specimens found are morphologically diversified and can be divided into three groups:

a) Cells similar in shape and dimensions to the majority of described specimens of var. *lamellosum* e.g. Ito (1966a), Grönl. et al. (1968), Bicudo (1969), Förster (1970), Růžička (1973a), (Plate 1, Fig. 19)

Lg. 202.4-307.1 μm , br. 41.4-57.5 μm , ap. 18.4-29.9 μm , lg.: br. 4.55-6.52 $\times$.

Occur.: 2rrr.

b) morpha 1 (Plate 1, Fig. 20)

Cells small considerably differ in dimensions from those mentioned above. Small specimens of var. *lamellosum* have been described, among others, by Raciborski (1892), Krieger (1933a), Woronichin (1950 after Kossinskaya 1952), Croasdale (1955 after Förster 1972), Förster (1972) and Agarker, Agarkar (1977). Krieger (1933b) and Kossinskaya (1952) have included them in the present variety and do not form a special taxon of the lower rank. At the same time, they considerably widen the range of cell dimensions typical of var. *lamellosum* individuals. Förster (1972) has distinguished small specimens into formae minores. He has stated they differ not only in size, but also in more narrow apices and more shallow median constriction.

Lg. 121.9-160.0 μm , br. 27.6-32.2 μm , ap. 16.1-18.4 μm , lg.: br. 4.42-5.20 $\times$.

Occur.: 2rrr.

c) morpha 2 (Plate 1, Fig. 21)

Cells longitudinally fusiform, margins in the centre straight parallel, without median constriction. Specimens fit description and drawings of var. *lamellosum* in the papers of: Hirano (1955), Ito (1965b), Kanetsuna (1967) and Goto (1975).

PLATE 1

Lg. 240.7-257.6 μm , br. 44.8-46.0 μm , ap. 18.4-20.7 μm , lg.: br. 5.30-5.60 $\times$.

Occur.: 2rrr.

I classify all three groups into one taxon, considering differences between them to be caused by intrataxon variation. Representatives of all three groups were found in all samples.

Netrium oblongum (De Bary) Lütkeim.

var. *oblongum* (Plate 2, Fig. 1)

Lg. 117.3-121.9 μm , br. 31.0-36.8 μm , lg.: br. 3.22-3.79 $\times$.

Occur.: 3rrr.

var. *cylindricum* W. et G. S. West (Plate 2, Fig. 2-3)

a) Specimens fit those described in the relevant literature (Plate 2, Fig. 2)

Lg. 87.4-109.2 μm , br. 26.4-27.6 μm , lg.: br. 3.17-4.13 $\times$

Occur.: 3rrr.

b) morpha (Plate 2, Fig. 3)

Cells bigger and relatively longer than typical of var. *cylindricum*. Dimensions considerably differ from those described by: West, West (1904), Roll (1923), Taylor (1934), and Hirano (1955). Cell length similar to maximum dimensions given by Krieger (1933b) and Růžicka (1954).

Lg. 144.9-188.6 μm , br. 29.9-32.2 μm , lg.: br. 4.85-5.86 $\times$.

Occur.: 3rrr.

Order: **DESMIDIALES**

Suborder: **CLOSTERINEAE**

Family: **Gonatozygaceae** (Lütkeimüller) G. S. West et F. E. Fritsch 1927

Genus: **Gonatozygon** De Bary 1856

Gonatozygon brebissonii De Bary

var. *brebissonii* (Plate 2, Fig. 7)

Plate 1

Fig. 1-2. *Mesotaenium endlicherianum* var. *endlicherianum* f. *grande*. Fig. 3-5. *Mes. endlicherianum* var. *endlicherianum* f. *endlicherianum*. Fig. 6-7. *Mes. endlicherianum* var. *endlicherianum* f. *exiguum*. Fig. 8-9. *Mes. de-greyi* var. *de-greyi* f. *breve*. Fig. 10-11. *Mes. de-greyi* var. *de-greyi* f. *de-greyi*. Fig. 12-13. *Mes. macrococcum* var. *macrococcum*. Fig. 14. *Spirotaenia condensata* var. *condensata*. Fig. 15. *Sp. obscura* var. *obscura*, morpha. Fig. 16. *Netrium digitus* var. *digitus* f. *digitus*. Fig. 17. ?*N. digitus* var. *digitus* f. *curtum*. Fig. 18. *N. digitus* var. *digitus* f. *parvum*. Fig. 19. *N. digitus* var. *lamellosum*. Fig. 20. *N. digitus* var. *lamellosum*, morpha 1. Fig. 21. *N. digitus* var. *lamellosum*, morpha 2

Lg. 103.5-248.3 μm , br. 8.0-9.2 μm , ap. 6.9-8.0 μm , lg.: br. 11.25-26.99 $\times$.

Occur.: 7rrr, 8rrr.

var. *kjellmanii* (Wille) Racib. (Plate 2, Fig. 8)

Lg. 57.5-58.6 μm , br. 8.0 μm , ap. 5.7 μm , lg.: br. 7.19-7.33 $\times$.

Occur.: 7rrr.

Family: *Peniaceae* Haeckel 1894

Genus: *Penium* Brébisson in Ralfs 1848

Penium exiguum W. West

var. *exiguum* f. *exiguum* (Plate 2, Fig. 15)

Lg. 20.7-28.7 μm , br. 6.9-8.0 μm , ap. 5.7-6.9 μm , lg.: br. 3.00-4.16 $\times$.

Occur.: 2rrr, 8rrr, 9rrr.

f. *major* W. et G. S. West (Plate 2, Fig. 16)

Krieger (1935) and Ružička (1977) include this taxon into synonym of the typical taxon, whereas Kossinskaya (1960) treats it as a separate one.

In the material obtained no intermediate forms were found between specimens of f. *exiguum* and f. *major*. Individuals classified as f. *major* differ in dimensions from those classified as f. *exiguum*. Therefore, I accept Kossinskaya's (1960) view point and I distinguish f. *major*.

Lg. 57.5-67.8 μm , br. 11.5-13.8 μm , ap. 9.2-11.5 μm , lg.: br. 4.91-5.74 $\times$.

Occur.: 2rrr.

var. *capitatum* (Roll) Kossinsk. (Plate 2, Fig. 17)

Lg. 39.1-43.7 μm , br. 11.5-13.8 μm , ap. 9.2-11.5 μm , lg.: br. 3.08-3.47 $\times$.

Occur.: 2rrr.

Penium polymorphum (Perty) Perty

var. *polymorphum* (Plate 2, Fig. 11)

Lg. 42.5-43.7 μm , br. 24.2-25.3 μm , isth. 23.0-24.2 μm , lg.: br. 1.73-1.76 $\times$, str. 15-16/10 μm .

Occur.: 3rrr.

Penium silvae-nigrae Raban.

var. *silvae-nigrae* (Plate 2, Fig. 9)

Lg. 48.3-57.5 μm , br. 24.1-25.3 μm , isth. 21.8-24.1 μm , lg.: br. 2.00-2.39 $\times$, str. 7/10 μm .

Occur.: 1rrr, 3rrr.

var. *parallelum* W. Krieg. (Plate 2, Fig. 10)

Lg. 64.4 μm , br. 18.4 μm , isth. 17.2 μm , lg.: br. 3.50 $\times$, str. 10/10 μm .

Occur.: 1rrr.

Penium spirostriolatum Bark.

var. *spirostriolatum* (Plate 2, Fig. 12-13)

Lg. 133.4-220.8 μm , br. 18.4-23.0 μm , isth. 16.1-20.7 μm , ap. 11.5-17.2 μm , lg.: br. 6.56-10.67 $\times$.

Occur.: 7r, 8rrr, 9rrr.

var. *amplificatum* Schmidt (Plate 2, Fig. 14)

Specimens more slender than those described by Kossinskaya (1960).

Lg. 184.0-302.9 μm , br. 17.2-21.8 μm , isth. 17.2-18.4 μm , ap. 11.5-16.1 μm , lg.: br. 8.89-15.76 $\times$.

Occur.: 4rrr.

Family: *Closteriaceae* Pritchard 1852

Genus: *Closterium* Nitzsch ex Ralfs 1848

Closterium abruptum W. West

var. *abruptum* f. *angustissimum* Schmidle (Plate 4, Fig. 10)

Lg. 117.3-167.9 μm , br. 8.0-9.2 μm , ap. 3.4-4.6 μm , lg.: br. 14.66-19.55 $\times$.

Occur.: 7rrr, 8rrr, 9rrr.

Closterium acutum Bréb.

var. *acutum* (Plate 2, Fig. 23-24)

The most specimens in the samples were small (Plate 2, Fig. 24), so difficult to identify. I have never been sure if they belong to the typical variety, or if they are those of var. *tenuius* (Nordst.) W. Krieg. Lower limit of dimensions of var. *acutum* specimens is quoted differently by various authors e.g. West, West (1904), Krieger (1933a, 1935), Hirano (1955), Kossinskaya (1960), Růžicka (1972), Sarim, Faridi (1976) and Lind, Brook (1980).

There were no distinct habitat differences between the extreme (the smallest and the biggest) individuals. To the contrary, they occurred in the same samples in Grabicz A stand.

Just as Růžicka (1977), I consider that to maintain taxon var. *tenuius* as a distinct taxonomical unit is not justified. It should be treated as a synonym of var. *acutum*, at the same time variation range of the typical taxon ought to be widened.

Lg. 65.5-105.8 μm , br. 2.3-4.6 μm , ap. ~ 1 μm , lg.: br. 20.00-35.00 $\times$.

Occur.: 2rrr, 6rrr, 7c, 9rr.

var. *linea* (Perty) W. et G. S. West (Plate 2, Fig. 25-26)

In the bog Grabicz A, besides typical specimens some narrower specimens were observed. Therefore, within the taxon two groups of individuals were distinguished:

a) Specimens which fit the literature data (Plate 2, Fig. 25)

Lg. 82.8-151.8 μm , br. 3.4-4.6 μm , ap. ~ 1 μm , lg.: br. 21.50-35.18 $\times$.

Occur.: 1rrr, 2rrr, 3rrr, 4rr, 5rrr, 6rr, 7c, 8rr, 9c,

b) morpho (Plate 2, Fig. 26)

Cells straight, very narrow. In their dimensions they are close to some specimens of var. *tenuius* (Nordst.) W. Krieg., but differ from them in shape. Kossinskaya (1960) in taxon diagnosis stresses the fact that cells may be sometimes straight.

The specimens observed were classified as var. *linea* on the grounds of the cell shape — a differential feature between both taxa (var. *tenuius* and var. *linea*).

Lg. 87.4-88.5 μm , br. 2.3 μm , ap. ~ 1 μm , lg.: br. 38.00-38.48 $\times$.

Occur.: 7rr.

Closterium angustatum Kütz. ex Ralfs

var. *angustatum* (Plate 5, Fig. 1-2)

Some specimens (Plate 5, Fig. 2) fit taxon var. *gracile* Kossinsk. Růžička (1977) considers it as a synonym of the typical variety.

Lg. 282.2-581.0 μm , br. 18.4-23.0 μm , ap. 9.2-13.8 μm , lg.: br. 14.03-31.58 $\times$, str. 2-3/10 μm .

Occur.: 2rr, 3rrr, 4rrr, 5rrr, 7rrr, 8rrr, 9rrr.

Closterium archerianum Cleve

var. *archerianum* (Plate 6, Fig. 4)

Lg. 224.1-294.6 μm , br. 20.7-24.1 μm , ap. 4.6-6.9 μm , lg.: br. 9.74-12.83 $\times$, str. 5-6/10 μm .

Occur.: 7rrr, 9r.

Closterium baillyanum (Bréb.) Bréb.

var. *baillyanum* (Plate 4, Fig. 2)

Lg. 253.1-456.5 μm , br. 27.6-50.6 μm , ap. 16.1-18.4 μm , lg.: br. 7.60-11.38 $\times$.

Occur.: 4rrr, 5rrr, 6rrr, 7rrr, 8rrr, 9rrr.

var. *alpinum* (Viret) Grönl. (Plate 4, Fig. 1)

Lg. 381.8-556.1 μm , br. 25.3-34.5 μm , ap. 14.9-16.1 μm , lg.: br. 12.77-18.64 $\times$.

Occur.: 2rrr, 7rrr, 8rrr, 9rrr.

Plate 2

Fig. 1. *Netrium oblongum* var. *oblongum*. Fig. 2. *N. oblongum* var. *cylindricum*. Fig. 3. *N. oblongum* var. *cylindricum*, morpha. Fig. 4-5. *Cylindrocystis brebissonii*. Fig. 6. *C. crassa* var. *crassa*. Fig. 7. *Gonatozygon brebissonii* var. *brebissonii*. Fig. 8. *G. brebissonii* var. *kjellmanii*. Fig. 9. *Penium silvae-nigrae* var. *silvae-nigrae*. Fig. 10. *P. silvae-nigrae* var. *parallelum*. Fig. 11. *P. polymorphum* var. *polymorphum*. Fig. 12-13. *P. spirostriolatum* var. *spirostriolatum*. Fig. 14. *P. spirostriolatum* var. *amplificatum*. Fig. 15. *P. exiguum* var. *exiguum* f. *exiguum*. Fig. 16. *P. exiguum* var. *exiguum* f. *major*. Fig. 17. *P. exiguum* var. *capitatum*. Fig. 18. *Closterium tumidum* var. *tumidum*. Fig. 19. *Cl. tumidum*, morpha 1. Fig. 20. *Cl. tumidum*, morpha 2. Fig. 21. *Cl. toxon* var. *toxon*, morpha. Fig. 22. *Cl. lunula* var. *lunula*. Fig. 23-24. *Cl. acutum* var. *acutum*. Fig. 25. *Cl. acutum* var. *linea*. Fig. 26. *Cl. acutum* var. *linea*, morpha. Fig. 27-28. *Cl. idiosporum* var. *idiosporum*. Fig. 29. *Cl. exiguum* var. *exiguum*. Fig. 30. *Cl. navicula* var. *navicula*. Fig. 31. *Cl. cornu* var. *cornu*. Fig. 32. *Cl. cornu*, morpha

Closterium cornu Ehrenb. ex Ralfs

morpha (Plate 2, Fig. 32)

Cells nearly straight, only slightly curved at apices. Shape does not fit that of specimens of a typical variety (Plate 2, Fig. 31), whereas its breadth and length-breadth ratio especially do not correspond to those of var. *cornu* given by other authors: West, West (1904), Krieger (1933a, 1935), Taylor (1934), Hirano (1955), Bicudo (1969), Förster (1970), Islam (1970), Sarim, Faridi (1976), Parra, Gonzalez (1977), Oleksowicz (1978), Lind, Brook (1980) and others. Dimensions, proportions and partly a shape of cells are similar to those of *Cl. gracile* Bréb. ex Ralfs, but they differ from them in a cell gradually narrowed from median part towards apices. Also cell apices are not curved enough. Some characters correspond with those of individuals of *Cl. cornu* var. *javanicum* Gutw. Shape and dimensions nearly fit Hirano's (1972) description of this taxon. From Scott and Prescott's drawing (1961) it differs in the gentler narrowing towards apices and in dimensions (a cell is shorter and nearly 1.5 times narrower), whereas from Krieger's (1933a, 1935) drawing — in shape, as it is nearly straight, not curved.

Lg. 170.2 μm , br. 4.6 μm , ap. 2.3 μm , lg.: br. 37.00 $\times$.

Occur.: 8rrr.

var. *cornu* (Plate 2, Fig. 31)

Lg. 121.9-209.3 μm , br. 9.2-11.5 μm , ap. 2.3-3.4 μm , lg.: br. 13.25-18.20 $\times$.

Occur.: 7rrr, 8rrr, 9rrr.

Closterium costatum Corda ex Ralfs

var. *costatum* (Plate 5, Fig. 3)

Lg. 265.6-365.2 μm , br. 32.2-36.8 μm , ap. 9.2-11.5 μm , lg.: br. 7.82-9.98 $\times$, str. 2/10 μm .

Occur.: 4rrr, 7rrr, 8rrr, 9rr.

var. *borgei* (W. Krieg.) Růž. (Plate 5, Fig. 4)

Taxon var. *borgei* has been treated as a variety of *Cl. striolatum* Ehrenb. ex Ralfs. so far. Růžička (1972) has changed its taxonomical rank and classified it within *Cl. costatum* species. I think Růžička's view to be justified. It is confirmed, especially by a lack of girdle bands in the specimens of this taxon. Although shape of cell apices (one of diagnostic characters of the genus) corresponds with that of *Cl. striolatum* (angles rounded), but, as observed by Růžička (1972), this character is highly variable. Angles may be from markedly protruded to reduced (rounded).

Lg. 340.3-365.2 μm , br. 32.3 μm , ap. 9.2-10.3 μm , lg.: br. 10.57-11.34 $\times$, str. 5/10 μm .

Occur.: 7rrr.

Closterium cynthia De Not.

var. *cynthia* (Plate 4, Fig. 12-13)

a) Individuals typical. Cells strongly semicircularly curved (Plate 4, Fig. 12)

Lg. 80.5-140.3 μm , br. 11.5-16.1 μm , ap. 4.6 μm , lg.: br. 6.17-9.58 $\times$, str. 6-7/10 μm .

Occur.: 7rrr, 9rrr.

b) morpha (Plate 4, Fig. 13)

Cells slender, less curved than typical. Medium part nearly cylindrical. Förster (1970), Růžicka (1972, 1975a) and Coesel (1979a) describe similar cells.

Lg. 103.5-173.6 μm , br. 10.3-14.9 μm , ap. 3.4-4.6 μm , lg.: br. 9.00-11.80 $\times$, str. 8-10/10 μm .

Occur.: 5rrr, 6rrr, 7rrr, 8rrr, 9rrr.

Closterium diana Ehrenb. ex Ralfs

var. *diana* (Plate 3, Fig. 10)

Lg. 184.0-315.4 μm , br. 20.7-29.9 μm , ap. 4.6-6.9 μm , lg.: br. 8.89-11.97 $\times$.

Occur.: 3rrr, 4rrr, 5rrr, 7rrr, 8rrr, 9rr.

var. *pseudodiana* (Roy) W. Krieg. (Plate 3, Fig. 11)

Lg. 170.2-230.0 μm , br. 13.8-14.9 μm , ap. 2.3-3.4 μm , lg.: br. 12.33-16.67 $\times$.

Occur.: 4rrr, 7rrr, 8rrr, 9rr.

Closterium directum Arch.

var. *directum* (Plate 6, Fig. 2)

Lg. 230.0-448.2 μm , br. 13.8-18.4 μm , ap. 8.0-11.5 μm , lg.: br. 13.37-26.81 $\times$, str. 10-12/10 μm .

Occur.: 1rrr, 2c, 3c, 4cc, 5rr, 6rrr, 7rrr, 8cc, 9rrr.

Closterium exiguum W. et G. S. West

var. *exiguum* (Plate 2, Fig. 29)

Cell shape and dimensions fit description and drawings of *Cl. exiguum* from Kossinskaya's work (1960).

Taxonomic rank of *Cl. exiguum* W. et G. S. West 1902 has not been established yet. Krieger (1935) classifies it as a synonym of *Cl. parvulum* Näg. var. *angustum* W. et G. S. West 1900, whereas specimens described by Roll (1915) as *Cl. exiguum* (drawings in Kossinskaya's, 1960 work) identifies as *Cl. acutum* Bréb. var. *variabile* (Lemm.) W. Krieg.

Encountered by me specimens are similar in shape to *Cl. parvulum* var. *angustum*, but differ from them in acute and not rounded cell spines. They are narrower and usually shorter. They fit in that semicircularly curved individuals of *Cl. acutum* var. *variabile*. Therefore, specimens encountered may be classified as belonging to this taxon as well.

Lg. 62.1-92.0 μm , br. 2.3-4.6 μm , lg.: br. 14.50-27.00 $\times$.

Occur.: 4rrr, 7rrr.

Closterium gracile Bréb. ex Ralfs

var. *gracile* (Plate 3, Fig. 6)

Lg. 132.2-273.9 μm , br. 4.6-8.0 μm , ap. 2.3-3.4 μm , lg.: br. 26.00-50.52 $\times$.

Occur.: 2rrr, 4rr, 5rrr, 6rrr, 7rr, 8rr, 9r.

Closterium idiosporum W. et G. S. West

var. *idiosporum* (Plate 2, Fig. 27-28)

Mainly small specimens prevailed, corresponding to those described by Růžička (1973a).

Lg. 154.1-232.4 μm , br. 8.0-11.5 μm , ap. 2.3 μm , lg.: br. 16.75-20.41 $\times$, zygospore: lg. 42.5 μm , br. 26.4 μm .

Occur.: 1r, 2rr, 4r, 8rrr, 9rrr.

Closterium intermedium Ralfs

var. *intermedium* (Plate 5, Fig. 8)

Lg. 207.5-290.5 μm , br. 16.1-19.5 μm , ap. 5.7-10.3 μm , lg.: br. 11.28-15.79 $\times$, str. 5-6/10 μm .

Occur.: 2rrr, 3rrr, 4r, 5rrr, 6r, 7rr, 9rrr.

Closterium jenneri Ralfs

var. *jenneri* (Plate 3, Fig. 17)

Lg. 71.3-103.5 μm , br. 10.3-13.8 μm , ap. 3.4-4.6 μm , lg.: br. 5.66-9.38 $\times$.

Occur.: 3rrr, 7cc, 8rrr, 9rrr.

Closterium juncidum Ralfs

var. *juncidum* (Plate 6, Fig. 1)

Cells in their median part more or less curved. They fit Förster's (1970) and Lenzenweger's (1970a) drawings.

Lg. 244.8-265.6 μm , br. 9.2-11.5 μm , ap. 3.4-4.6 μm , lg.: br. 23.10-26.61 $\times$, str. 10-12/10 μm .

Occur.: 7rrr.

Closterium kuetzingii Bréb.

var. *kuetzingii* (Plate 4, Fig. 6)

Lg. 323.7-522.9 μm , br. 18.4-20.7 μm , ap. 2.3-3.4 μm , lg.: br. 16.44-28.42 $\times$, str. 10-11/10 μm .

Occur.: 7rr, 8rrr, 9rrr.

Closterium leibleinii Kütz. ex Ralfs

var. *leibleinii* (Plate 3, Fig. 13-14)

a) Specimens correspond descriptions in the relevant literature (Plate 3, Fig. 13)

Lg. 115.0-156.4 μm , br. 18.4-25.3 μm , ap. 2.3-3.4 μm , lg.: br. 5.89-7.56 $\times$.

Occur.: 7rrr, 8rrr, 9rrr.

b) morpha (Plate 3, Fig. 14)

Cells less curved than typical, less inflated ventrally. Length-breadth ratio higher than cited in literature for typical specimens.

Lg. 138.0-151.8 μm , br. 16.1-17.2 μm , ap. 2.3-3.4 μm , lg.: br. 8.49-9.43 $\times$.

Occur.: 7rrr, 9rrr.

Closterium limneticum Lemm.

var. *tenue* Lemm. (Plate 3, Fig. 7)

Lg. 197.8-207.0 μm , br. 3.4-4.6 μm , ap. ~ 1 μm , lg.: br. 43.50-58.18 $\times$.

Occur.: 5rr.

Closterium lineatum Ehrenb. ex Ralfs

var. *lineatum* (Plate 3, Fig. 3-4)

Lg. 282.2-581.0 μm , br. 16.1-20.7 μm , ap. 4.6-9.2 μm , lg.: br. 13.63-29.79 $\times$, str. 7-8/10 μm .

Occur.: 2rrr, 4rr, 5rrr, 7rr, 9rrr.

Closterium lunula (Müll.) Nitzsch ex Ralfs

var. *lunula* (Plate 2, Fig. 22)

Lg. 439.9-581.0 μm , br. 75.9-103.5 μm , ap. 11.5-16.1 μm , lg.: br. 5.36-6.69 $\times$.

Occur.: 4rrr, 6rrr, 7rrr, 8rrr, 9rrr.

Closterium macilentum Bréb.

var. *macilentum* (Plate 6, Fig. 3)

Lg. 261.4-456.5 μm , br. 11.5-18.4 μm , ap. 4.6-5.7 μm , lg.: br. 23.10-35.37 $\times$.

Occur.: 4rrr, 7rrr, 8rrr, 9rrr.

Closterium moniliferum (Bory) Ehrenb. ex Ralfs

var. *moniliferum* (Plate 3, Fig. 2)

Lg. 186.3-232.4 μm , br. 32.2-46.0 μm , ap. 5.7-8.0 μm , lg.: br. 4.20-6.79 $\times$.

Occur.: 7rr, 8rrr, 9rrr.

var. *conceavum* Klebs (Plate 3, Fig. 1)

Lg. 197.9-240.7 μm , br. 36.8-46.0 μm , ap. 5.7-6.9 μm , lg.: br. 5.11-5.38 $\times$.

Occur.: 7rrr.

Closterium navicula (Bréb.) Lütkem.

var. *navicula* (Plate 2, Fig. 30)

Lg. 31.9-69.0 μm , br. 9.2-16.1 μm , ap. 4.6-6.9 μm , lg.: br. 3.00-5.00 $\times$.

Occur.: 2rrr, 4rrr, 7rrr, 8rr, 9rr.

Closterium parvulum Näg.

var. *parvulum* f. *parvulum* (Plate 3, Fig. 15)

Lg. 105.8-156.4 μm , br. 10.3-16.1 μm , ap. 2.3-3.4 μm , lg.: br. 8.43-12.60 $\times$.

Occur.: 2rrr, 4r, 7rr, 8cc, 9rr.

f. *maius* Schmidle (Plate 3, Fig. 16)

According to Ružička (1973a), authorship of the form I confine to Schmidle and not to W. West as Kossinskaya (1960), Förster (1970) and others do.

Individuals of this form were found only in the water body which totally differed from others in habitat. In others only specimens of f. *parvulum* were encountered. Probably, ecological conditions of this water body determined a development of the first form.

Lg. 164.4-184.0 μm , br. 17.2-18.4 μm , ap. 2.3-3.4 μm , lg.: br. 9.38-10.16 $\times$.

Occur.: 7rrr.

Closterium praelongum Bréb.

var. *praelongum* (Plate 4, Fig. 8-9)

Amongst encountered individuals two groups which differ in cell shape and dimensions can be distinguished:

a) cells narrow, slender, dorsal margin convex, ventral margin concave. They fit a description of typical individuals (Plate 4, Fig. 8).

Lg. 348.6-485.5 μm , br. 11.5 μm , ap. 3.4-4.6 μm , lg.: br. 30.31-42.22 $\times$, str. 8/10 μm ,

Occur.: 7rr.

b) morpha (Plate 4, Fig. 9)

Cells long, thick, margins parallel at considerable length. Length-breadth ratio of some specimens smaller than that according to literature: West, West (1904), Krieger (1935), Hirano (1955), Kossinskaya (1960), Förster (1970), Růžicka (1973a). It rather corresponds with that given for specimens of var. *brevius*. On the other hand, their length considerably exceeds upper limit of this parameter given for the taxon mentioned above by: West, West (1904), Krieger (1935), Růžicka (1955, 1957a, 1973a, 1977), Förster (1970), and Sarim, Faridi (1976). If cell length, and not length-breadth ratio, is taken into account as a differentiating character between two taxons, (var. *praelongum* and var. *brevius*), present specimens should be classified as belonging to the typical variety.

Lg. 481.4-564.4 μm , br. 20.7-25.3 μm , ap. 4.6-5.7 μm , lg.: br. 19.98-26.46 $\times$.

Occur.: 7rrr.

var. *brevius* (Nordst.) W. Krieg. (Plate 4, Fig. 7)

Lg. 174.8-286.3 μm , br. 11.5-12.6 μm , ap. 3.4 μm , lg.: br. 15.20-22.72 $\times$.

Occur.: 7rr.

Specimens identified by many as var. *brevius* (Nordst.) W. Krieg. totally differ in shape from the holotype of f. *brevius* Nordst. 1888, draw-

Plate 3

Fig. 1. *Closterium moniliferum* var. *concavum*. Fig. 2. *Cl. moniliferum* var. *moniliferum*. Fig. 3-4. *Cl. lineatum* var. *lineatum*. Fig. 5. *Cl. pritchardianum* var. *pritchardianum*. Fig. 6. *Cl. gracile* var. *gracile*. Fig. 7. *Cl. limneticum* var. *tenuis*. Fig. 8. *Cl. pronum* var. *pronum* f. *brevius*. Fig. 9. *Cl. pronum* var. *pronum* f. *pronum*. Fig. 10. *Cl. diana* var. *diana*. Fig. 11. *Cl. diana* var. *pseudodiana*. Fig. 12. *Cl. venus* var. *venus*. Fig. 13. *Cl. leibleinii* var. *leibleinii*. Fig. 14. *Cl. leibleinii* var. *leibleinii*, morpha. Fig. 15. *Cl. parvulum* var. *parvulum* f. *parvulum*. Fig. 16. *Cl. parvulum* var. *parvulum* f. *maius*. Fig. 17. *Cl. jenneri* var. *jenneri*

Fig. 1. *Olosterium baillyanum* var. *alpinum*. Fig. 2. *Cl. baillyanum* var. *baillyanum*.
 Fig. 3. *Cl. ralsii* var. *hybridum*. Fig. 4. *Cl. rostratum* var. *rostratum* f. *rostratum*. Fig. 5.
Cl. rostratum var. *rostratum* f. *brevirostratum*. Fig. 6. *Cl. kuetzingii* var. *kuetzingii*.
 Fig. 7. *Cl. praelongum* var. *brevius*. Fig. 8. *Cl. praelongum* var. *praelongum*. Fig. 9.
Cl. praelongum var. *praelongum*, morpha. Fig. 10. *Cl. abruptum* var. *abruptum* f. *angustissimum*.
 Fig. 11. *Cl. setaceum* var. *setaceum*, morpha. Fig. 12. *Cl. cynthia* var. *cynthia*.
 Fig. 13. *Cl. cynthia* var. *cynthia*, morpha

ing in the Růžicka's work (1955). They rather correspond with specimens of var. *praelongum* and they differ from them merely in dimensions. It seems that taxonomy of *Cl. praelongum* Bréb. should be slightly corrected. And individuals (according to Růžicka (1955) in addition to Nordstedt's diagnosis) with dorsal margin uniformly curved and ventral margin straight or slightly convex should belong to var. *brevius* (Nordst.) W. Krieg. Those specimens are usually small. Whereas, small individuals with parallel margins in the midregion, or dorsal margin convex and ventral margin concave should belong to var. *praelongum* with the wider taxon variation in dimensions. If any differences in ecological requirements are discovered between small and large specimens, the latter ought to be treated as var. *praelongum* f. *brevius* (in a new and not Nordstedt's sense).

Closterium pritchardianum Arch.

var. *pritchardianum* (Plate 3, Fig. 5)

Lg. 315.4-336.1 μm , br. 27.6 μm , ap. 6.9-8.0 μm , lg.: br. 11.42-12.18 $\times$, str. 12/10 μm .

Occur.: 7rrr.

Closterium pronum Bréb.

var. *pronom* f. *pronom* (Plate 3, Fig. 9)

Lg. 298.8-385.9 μm , br. 6.9-9.2 μm , ap. 2.3 μm , lg.: br. 33.38-48.12 $\times$.

Occur.: 1rrr, 2rrr, 3rrr, 4r, 5rr, 6rrr, 7rrr, 8rrr, 9rr.

f. *brevius* W. West (Plate 3, Fig. 8)

Lg. 186.3-290.5 μm , br. 5.7-9.2 μm , ap. 1.1-2.3 μm , lg.: br. 22.25-39.74 $\times$.

Occur.: 1r, 2rr, 3cc, 4cc, 5c, 6cc, 7rrr, 8cc, 9c.

Both forms are similar in shape, but differ in their dimensions. Krieger (1935) and Růžicka (1977) treat them as one taxon.

In the present paper both forms have been distinguished. On the grounds of my observations they seem to occupy rather distinct ecological niches. Specimens of f. *brevius* were more often found in samples than those of f. *pronom*. Cells of f. *brevius* occurred in large numbers mainly in plankton, while those of f. *pronom* — in squeezes from shallow basins and excavation margins.

Sometimes it was quite difficult to classify a specimen to one of these forms. Then cell length was assumed as a criterion, as cells did not differ in breadth.

Closterium ralfsii Bréb. ex Bréb.

var. *hybridum* Rabenh. (Plate 4, Fig. 3)

Lg. 340.3-572.7 μm , br. 29.9-41.4 μm , ap. 6.9-9.2 μm , lg.: br. 9.86-18.32 $\times$, str. 7-9/10 μm .

Occur.: 7rrr.

Closterium rostratum Ehrenb. ex Ralfs

var. *rostratum* f. *rostratum* (Plate 4, Fig. 4)

Lg. 282.2-385.9 μm , br. 18.4-25.3 μm , ap. 3.4-4.6 μm , lg.: br. 12.81-15.34 $\times$, str. 10/10 μm .

Occur.: 7rr.

f. *brevirostratum* (W. West) Kossinsk. (Plate 4, Fig. 5)

Cell dimensions correspond with those of f. *rostratum*, whereas short apical processes indicate f. *brevirostratum* as the proper one.

Krieger (1935) considers this taxon as a synonym of f. *rostratum*, while Kossinskaya (1960) and Růžička (1977) distinguish it. Kossinskaya stresses the differences between this taxon and typical form, though some intermediate forms may be also found.

Lg. 402.5 μm , br. 26.4 μm , ap. 4.6 μm , lg.: br. 15.25 $\times$, str. 8/10 μm .

Occur.: 7rrr.

Closterium setaceum Ehrenb. ex Ralfs

var. *setaceum*, morpha (Plate 4, Fig. 11)

Specimens differ in shape from those described by: Migula (1907), Krieger (1935), Hirano (1955), Ito (1974), Růžička (1977) and Coesel (1979a). Cell ventral margin is more convex than dorsal, midregion is elongated and forms 1/3 of the cell length. Similar drawings of this taxon may be found in works of: Kossinskaya (1960), Grönblad et al. (1968), Förster (1970) and others. Specimens described by Grönblad et al. (1968) have got smooth cell wall.

Lg. 207.5-307.1 μm , br. 9.2-11.5 μm , ap. 1.1-2.3 μm , lg.: br. 23.10-30.67 $\times$, str. 11-12/10 μm .

Occur.: 4rr, 5rrr, 6rrr, 7rrr, 8rrr, 9r.

Closterium striolatum Ehrenb. ex Ralfs

var. *striolatum* (Plate 5, Fig. 5-6)

a) Cells stout, dorsal margin markedly convex, they fit description, of typical individuals (Plate 5, Fig. 5).

Lg. 219.9-365.2 μm , br. 26.4-39.1 μm , ap. 10.3-12.6 μm , lg.: br. 7.23-11.94 $\times$, str. 6-7/10 μm .

Occur.: 1rrr, 2cc, 3cc, 4c, 5c, 6c, 7rrr, 8rr, 9rr.

b) morpha (Plate 5, Fig. 6)

Cells slender, slightly resemble cells of *Cl. striolatum* var. *erectum* Klebs, but differ from them in slightly convex dorsal margin and less curved apices.

Plate 5

Fig. 1-2. *Closterium angustatum* var. *angustatum*. Fig. 3. *Cl. costatum* var. *costatum*. Fig. 4. *Cl. costatum* var. *borgei*. Fig. 5. *Cl. striolatum* var. *striolatum*. Fig. 6. *Cl. striolatum* var. *striolatum*, morpha. Fig. 7. *Cl. striolatum* var. *erectum*. Fig. 8. *Cl. intermedium* var. *intermedium*. Fig. 9. *Pleurotaenium tridentulum* var. *tridentulum*. Fig. 10. *Pl. trabecula* var. *trabecula*. Fig. 11. *Pl. trabecula* var. *crassum*. Fig. 12-14. *Pl. minutum* var. *minutum* f. *minutum*. Fig. 15. *Pl. minutum* var. *latum*

PLATE 5

Lg. 323.7-406.7 μm , br. 25.3-29.9 μm , ap. 9.2-12.6 μm , lg.: br. 11.38-14.58 $\times$, str. 7/10 μm .

Occur.: 5rrr, 6rrr.

var. *erectum* Klebs (Plate 5, Fig. 7)

Lg. 286.3-473.1 μm , br. 23.0-31.0 μm , ap. 9.2-11.5 μm , lg.: br. 11.10-15.82 $\times$, str. 7/10 μm .

Occur.: 2c, 3cc, 4rr, 5c, 6c, 7rrr, 8rrr, 9rrr.

Closterium toxon W. West

var. *toxon*, morpha (Plate 2, Fig. 21)

Individuals slightly differ from those described by: West, West (1904), Kossinskaya (1960), Förster (1970), Lind, Brook (1980) and others. Cells margins are parallel at rather short distance, then narrowed towards apices. Some specimens are broader than those described in papers mentioned above. They are similar to drawing in Krieger's (1935) work (Plate 23, Fig. 4). They only differ in the length of cell part with parallel sides, it was usually very short in the specimens encountered.

Lg. 232.4-298.8 μm , br. 11.5-19.5 μm , ap. 5.7-6.9 μm , lg.: br. 14.05-20.21 $\times$.

Occur.: 5rrr, 6rrr, 8rrr, 9rrr.

Closterium tumidum Johns.

a) morpha 1 (Plate 2, Fig. 19)

Cells longer than those of var. *tumidum*, they also have got broader apices, are less tumid in the midregion and have more pyrenoids (8-10). They fit Förster's (1970) drawing of *Cl. tumidum* var. *nylandicum* Grönl. form (Plate 2, Fig. 17). If compared to the holotype var. *nylandicum* Grönl. 1921, specimens are longer, broader for the whole cell length, more gently attenuated from median part towards apices, cell pole shorter (from the chromatophore end to the cell apex), vacuole with vibrating crystals is located nearer cell apex.

From the differences mentioned above it may be inferred that specimens described are more similar to those of var. *tumidum*, than to those of var. *nylandicum*. Therefore, they probably represent a form of this taxon.

Lg. 207.0-298.8 μm , br. 16.1-18.4 μm , ap. 6.9 μm , lg.: br. 11.68-18.56 $\times$.

Occur.: 2r, 6rr, 8rrr.

b) morpha 2 (Plate 2, Fig. 20)

Cells slightly sigmoid at the considerable cell length. This is the only difference between them and those of morpha 1. They also somewhat resemble encountered specimens of *Cl. toxon* W. West. They differ from them in more in curved median part, straight cell apices, and larger number of pyrenoids. Förster (1970, Plate 2, Fig. 16) has described the same individuals and classified them as *Cl. tumidum* var. *nylandicum*, form.

Sigmoid cells are not rare within genus *Closterium*. Such forms have

been encountered, among others, in? *Cl. venus* Kütz. ex Ralfs (Wołoszyńska 1914), *Cl. acerosum* (Schr.) Ehrenb. ex Ralfs and *Cl. leibleinii* Kütz. ex Ralfs (Deflandre 1925), *Cl. littorale* Gay (Růžička 1973b).

Lg. 249.0 μm , br. 18.4 μm , ap. 6.9 μm , lg.: br. 13.53 $\times$.

Occur.: 2rrr.

var. *tumidum* (Plate 2, Fig. 18)

Lg. 115.0-171.3 μm , br. 12.6-19.5 μm , ap. 4.6-5.7 μm , lg.: br. 7.70-10.29 $\times$.

Occur.: 1rrr, 2rr, 3rrr, 4r, 5rrr, 6rrr, 8rr, 9rrr.

Closterium venus Kütz. ex Ralfs

var. *venus* (Plate 3, Fig. 12)

Lg. 48.3-85.1 μm , br. 6.9-11.5 μm , ap. 2.3 μm , lg.: br. 5.50-9.25 $\times$.

Occur.: 2rrr, 4rrr, 5rrr, 7c, 8rrr, 9c.

Suborder: **DESMIDIINEAE**

Family: **Desmidiaceae** Ralfs 1848

Genus: **Pleurotaenium** Nägeli 1849

Pleurotaenium ehrenbergii (Bréb.) De Bary

var. *ehrenbergii* (Plate 6, Fig. 5)

Lg. 307.1-527.0 μm , br. max. 25.3-31.0 μm , isth. 21.8-25.3 μm , ap. 18.4 μm , lg.: br. 11.13-18.70 $\times$.

Occur.: 7rr.

Pleurotaenium minutum (Ralfs) Delp.

var. *minutum* f. *minutum* (Plate 5, Fig. 12-14)

Cell dimensions and proportions are main criteria in distinguishing infraspecific taxa within *Pl. minutum*. It has resulted in many small taxa which are sometimes very difficult to identify.

When mentioned-above criteria are taken into account, following forms may be distinguished in the material studied: typical individuals (Plate 5, Fig. 12), small individuals (Plate 5, Fig. 14) — according to those described f. *minus* (Racib.) Kossinsk., and individuals (Plate 5, Fig. 13) "intermediate" between these taxa. I think that all of them belong to one taxon only i.e. f. *minutum*, therefore, f. *minus* should be liquidated.

Lg. 73.6-167.9 μm , br. max. 10.3-17.2 μm , isth. 9.2-16.1 μm , ap. 6.9-11.5 μm , lg.: br. 6.40-12.00 $\times$.

Occur.: 1rrr, 2rrr, 3rr, 4rr, 5rrr, 7rrr, 8rrr, 9rrr.

var. *latum* Kaiser (Plate 5, Fig. 15)

Lg. 172.5 μm , br. max. 19.5 μm , isth. 14.9 μm , ap. 11.5 μm , lg.: br. 8.85 $\times$.

Occur.: 3rrr.

Plerotaenium rectum Delp.

var. *rectum* (Plate 6, Fig. 6-7)

Lg. 232.4-324.5 μm , br. max. 18.4-20.7 μm , isth. 12.6-18.4 μm , ap. 12.6-16.1 μm , lg.: br. 11.23-17.64 $\times$.

Occur.: 1rrr, 2rrr, 3rr, 4rrr, 7rrr, 9rrr.

Plerotaenium trabecula Ehrenb. ex Näg.

var. *trabecula* (Plate 5, Fig. 10)

Lg. 276.0-373.5 μm , br. max. 25.3-32.2 μm , isth. 20.7-25.3 μm , ap. 16.1-18.4 μm , lg.: br. 8.57-13.01 $\times$.

Occur.: 4rrr, 7r, 8rrr, 9rrr.

var. *crassum* Wittr. (Plate 5, Fig. 11)

Lg. 373.5-432.4 μm , br. max. 48.3-50.6 μm , isth. 39.1-43.7 μm , ap. 23.0-25.3 μm , lg.: br. 7.38-8.95 $\times$.

Occur.: 4rrr, 7rrr.

Pleurotaenium tridentulum (Wolle) W. West

var. *tridentulum* (Plate 5, Fig. 9)

Lg. 192.0-209.3 μm , br. max. 14.9-16.1 μm , isth. 12.6-13.8 μm , ap. 6.9-8.0 μm , lg.: br. 12.40-14.05 $\times$.

Occur.: 1rrr, 4rr, 9rrr.

Genus: *Tetmemorus* Ralfs ex Ralfs 1848

Tetmemorus brebissonii (Menegh.) Ralfs ex Ralfs

var. *brebissonii* (Plate 6, Fig. 9)

Lg. 105.8-138.0 μm , br. max. 20.7-25.3 μm , isth. 16.1-18.4 μm , ap. 16.1-20.7 μm , lg.: br. 4.60-6.00 $\times$.

Occur.: 1rr, 2rrr, 3rrr, 4r, 5rrr, 6rrr, 7rrr, 9rr.

var. *minor* De Bary (Plate 6, Fig. 8)

Lg. 67.8-97.7 μm , br. max. 16.1-21.8 μm , isth. 13.8-18.4 μm , ap. 16.1-21.8 μm , lg.: br. 3.50-4.48 $\times$.

Occur.: 1rrr, 2rrr, 3rrr, 4rrr, 6rrr.

Tetmemorus granulatus (Bréb.) Ralfs ex Ralfs

var. *granulatus* (Plate 6, Fig. 15-17)

In the study area two groups of individuals which differ in dimensions may be distinguished within this taxon:

a) Individuals of average size (Plate 6, Fig. 15)

Lg. 115.0-133.4 μm , br. max. 25.3-28.7 μm , isth. 21.8-26.4 μm , ap. 11.5-16.1 μm , lg.: br. 4.00-5.18 $\times$.

Occur.: 1rrr, 2rrr, 3rr, 4rr, 5rrr, 8rrr, 9rrr.

A specimen with abnormally formed apex of one semicell — teratologic form was encountered (Plate 6, Fig. 16)

b) large individuals (Plate 6, Fig. 17)

Lg. 207.0-240.7 μm , br. max. 41.4-47.1 μm , isth. 39.1-41.4 μm , ap. 20.7-23.0 μm , lg.: br. 5.00-5.11 $\times$.

Occur.: 3rrr.

var. *attenuatus* W. West (Plate 6, Fig. 13-14)

In two different sites specimens of different size were found:

a) morpha 1 (Plate 6, Fig. 13)

Cells small, their dimensions oscillate around the lower limit noted for the individuals of var. *attenuatus*.

Lg. 138.0-140.3 μm , br. max. 27.6-32.2 μm , isth. 26.4-27.6 μm , ap. 13.8-17.2 μm , lg.: br. 4.36-5.00 $\times$.

Occur.: 5rrr.

b) morpha 2 (Plate 6, Fig. 14)

Cells big, slightly wider than those described in the relevant literature.

Lg. 262.2-265.6 μm , br. max. 50.6-51.7 μm , isth. 41.4-43.7 μm , ap. 19.5 μm , lg.: br. 5.14-5.18 $\times$.

Occur.: 3rrr.

Tetmemorus laevis Kütz. ex Ralfs

var. *laevis* (Plate 6, Fig. 10)

Lg. 64.4-80.5 μm , br. max. 17.2-21.8 μm , isth. 14.9-20.7 μm , ap. 13.8-18.4 μm , lg.: br. 3.44-4.28 $\times$.

Occur.: 1rrr, 2rrr, 3rrr, 4rr, 5rr, 6rrr, 9rrr.

var. *intermedius* (Voron.) Růž. (Plate 6, Fig. 11)

Lg. 58.6-69.0 μm , br. max. 19.5 μm , isth. 18.4 μm , ap. 16.1 μm , lg.: br. 3.01-3.54 $\times$.

Occur.: 1rrr, 9rrr.

var. *minutus* (De Bary) W. Krieg. (Plate 6, Fig. 12)

Lg. 55.2-69.0 μm , br. max. 18.4-20.7 μm , isth. 17.2-18.4 μm , ap. 10.3-13.8 μm , lg.: br. 3.00-3.33 $\times$.

Occur.: 3rrr, 4rrr.

Systematic affiliation of both taxa of *Tetmemorus laevis* (var. *intermedius* and var. *minutus*) has not been, hitherto, elucidated. Firstly, they were treated as units of the species rank, next they were included in *Tetmemorus laevis* as varieties. Recently, Förster (1970) has considered them as synonymes of var. *laevis*. He believes that differences between them fall within the variation limits of the typical variety. Simultaneously, he reminds according to Růžička (1959) differences between these taxa, although distinguished by the latter, and var. *laevis* are of little taxonomic value.

In this paper I have decided to distinguish both taxa within var. *laevis*, as distinct morphological differences between representatives of these three taxa enable to identify them easily (a size of individuals, a cell shape, a number of pyrenoids, cell side view). In the material studied I have not found any intermediate forms.

Euastrum affine Ralfs ex Ralfs

var. *affine* (Plate 7, Fig. 1)

Lg. 105.8-117.3 μm , br. 55.2-66.7 μm , isth. 16.1-17.2 μm , lob. pol. br. 25.3-34.5 μm , th. 41.4 μm , lg.: br. 1.76-2.00 $\times$.

Occur.: 2rrr, 3rrr, 4rr.

Euastrum ampullaceum Ralfs

var. *ampullaceum* (Plate 7, Fig. 2)

Lg. 87.4-98.9 μm , br. 50.6-59.8 μm , isth. 16.1-20.7 μm , lob. pol. br. 23.0-29.9 μm , th. 34.5 μm , lg.: br. 1.65-1.75 $\times$.

Occur.: 3rrr.

Euastrum ansatum Ehrenb. ex Ralfs

var. *ansatum* (Plate 7, Fig. 3)

Lg. 80.5-96.6 μm , br. 42.5-48.3 μm , isth. 11.5-13.8 μm , lob. pol. br. 19.5-23.0 μm , th. 27.6 μm , lg.: br. 1.75-2.16 $\times$.

Occur.: 4rrr, 5rrr, 6rrr, 7rrr, 8rrr, 9rr.

Euastrum bidentatum Näg.

var. *speciosum* (Boldt) Schmidle (Plate 7, Fig. 10)

Granules on the central protuberance of more or less the same size. Specimen appearance according to Wasylik's (1961a) drawing.

Some authors such as: West, West (1905), Kossinskaya (1960), Förster (1970) consider this taxon as a synonym of the typical variety, whereas the others (Krieger 1937b, Wasylik 1961a, Dubois-Tylski 1969) distinguish it.

Lg. 48.3-50.6 μm , br. 32.2 μm , isth. 6.9-9.2 μm , lob. pol. br. 23.0-26.4 μm , lg.: br. 1.50-1.57 $\times$.

Occur.: 2rrr, 7rrr, 8rrr, 9rrr.

Euastrum binale (Turp.) Ehrenb. ex Ralfs

var. *binale* f. *binale* (Plate 7, Fig. 13-14)

Lg. 18.4-23.0 μm , br. 13.8-18.4 μm , isth. 3.4-4.6 μm , lob. pol. br. 9.2-11.5 μm , lg.: br. 1.25-1.42 $\times$.

Occur.: 1rrr, 3rrr, 4r, 5rrr, 8rrr, 9rrr.

f. *gutwinskii* Schmidle (Plate 7, Fig. 15-22)

The specimens found express high morphological variation. Some have only biundulate basal angles of semicells while the third lower undu-

Plate 6

Fig. 1. *Closterium juncidum* var. *juncidum*. Fig. 2. *Cl. directum* var. *directum*. Fig. 3. *Cl. macilentum* var. *macilentum*. Fig. 4. *Cl. archerianum* var. *archerianum*. Fig. 5. *Pleurotaenium ehrenbergii* var. *ehrenbergii*. Fig. 6-7. *Pl. rectum* var. *rectum*. Fig. 8. *Tetmemorus brebissonii* var. *minor*. Fig. 9. *T. brebissonii* var. *brebissonii*. Fig. 10. *T. laevis* var. *laevis*. Fig. 11. *T. laevis* var. *intermedius*. Fig. 12. *T. laevis* var. *minutus*. Fig. 13. *T. granulatus* var. *attenuatus*, morpha 1. Fig. 14. *T. granulatus* var. *attenuatus*, morpha 2. Fig. 15-17. *T. granulatus* var. *granulatus*

lation is lacking (Plate 7, Fig. 17). In others all undulations are slightly marked (Plate 7, Fig. 18). Similar individuals are described by Růžicka (1954).

In Biały Ług A bog I found numerous specimens with triundulate basal angles of one semicell (it corresponds to *f. gutwinskii*), and entire basal angles of another semicell (it corresponds with typical taxon — *f. binale*, Plate 7, Fig. 19). Also intermediate forms with biundulate basal angles of one semicell (Plate 7, Fig. 20) were encountered. Therefore, distinguishment of the typical taxon is disputable. It seems to constitute only a developmental stage of *f. gutwinskii*. Then taxon *Eu. binale* var. *binale f. gutwinskii* should be raised in rank to a species and, at the same time it should represent the typical taxon.

Sometimes I observed cells in the course of their division (Plate 7, Fig. 21), as well as those whose division was slightly interrupted (Plate 7, Fig. 22). Abnormal division in this taxon is noted fairly often (Kossinskaya 1960, Förster 1970, Palamar-Mordvintseva 1975a and others).

Lg. 24.1-27.6 μm , br. 18.4-20.7 μm , isth. 4.6-5.7 μm , lob. pol. br. 11.5-13.8 μm , th. 12.6 μm , lg.: br. 1.22-1.43 $\times$.

Occur.: 1r, 2rr, 3rr, 4cc, 5rrr, 6c, 7rrr, 8rr, 9rrr.

Euastrum denticulatum (Kirchn.) Gay

var. *denticulatum* (Plate 7, Fig. 11)

Lg. 31.0-32.2 μm , br. 24.1-25.3 μm , isth. 5.7 μm , lob. pol. br. 18.4-20.7 μm , lg.: br. 1.27-1.29 $\times$.

Occur.: 4rrr, 9rrr.

Euastrum elegans (Bréb.) Kütz. ex Ralfs

var. *elegans* (Plate 7, Fig. 23)

Lg. 25.3-42.5 μm , br. 18.4-27.6 μm , isth. 3.4-6.9 μm , lob. pol. br. 13.8-18.4 μm , lg.: br. 1.38-1.56 $\times$.

Occur.: 4rr, 7rrr, 9rrr.

Euastrum gayanum De Toni

var. *gayanum* (Plate 7, Fig. 7)

Lg. 11.5-16.1 μm , br. 10.3-12.6 μm , isth. 2.3-4.6 μm , lob. pol. br. 9.2-10.3 μm , th. 8.0 μm , lg.: br. 1.10-1.28 $\times$.

Occur.: 7rrr, 8rrr, 9rrr.

Plate 7

Fig. 1. *Euastrum affine* var. *affine*. Fig. 2. *E. ampullaceum* var. *ampullaceum*. Fig. 3. *E. ansatum* var. *ansatum*. Fig. 4. *E. insulare* var. *insulare*. Fig. 5-6. *E. insulare* var. *silesiacum*. Fig. 7. *E. gayanum* var. *gayanum*. Fig. 8. *E. sublobatum* var. *sublobatum*. Fig. 9. *E. oblongum* var. *oblongum*. Fig. 10. *E. bidentatum* var. *speciosum*. Fig. 11. *E. denticulatum* var. *denticulatum*. Fig. 12. *E. insigne* var. *insigne*. Fig. 13-14. *E. binale* var. *binale f. binale*. Fig. 15-22. *E. binale* var. *binale f. gutwinskii*. Fig. 23. *E. elegans* var. *elegans*. Fig. 24. *Micrasterias crux-melitensis* var. *crux-melitensis*

PLATE 7

Euastrum insigne Hass. ex Ralfs

var. *insigne* (Plate 7, Fig. 12)

Lateral lobes in midregion with distinct depression. The specimens fit those found by Ryprowa (1927) and Grönblad (1921), who treats them as a form.

Lg. 102.3-133.4 μm , br. 50.6-64.4 μm , isth. 13.8-20.7 μm , lob. pol. br. 27.6-35.6 μm , lg.: br. 1.79-2.15 $\times$.

Occur.: 3rrr.

Euastrum insulare (Wittr.) Roy

var. *insulare* (Plate 7, Fig. 4)

Lg. 23.0-25.3 μm , br. 16.1-18.4 μm , isth. 4.6 μm , lob. pol. br. 11.5-13.8 μm , th. 9.2-10.3 μm , lg.: br. 1.34-1.50 $\times$.

Occur.: 1rr, 2rrr, 3r, 4cc, 5rrr, 6c, 8rrr, 9rrr.

var. *silesiacum* (Grönbl.) W. Krieg. (Plate 7, Fig. 5-6)

In some specimens lateral lobes of each semicell are differently formed. (Plate 7, Fig. 6)

Lg. 20.7-23.0 μm , br. 14.9-18.4 μm , isth. 3.4-4.6 μm , lob. pol. br. 10.3-13.8 μm , th. 12.6 μm , lg.: br. 1.20-1.29 $\times$.

Occur.: 1rrr.

Euastrum oblongum (Grev.) Ralfs ex Ralfs

var. *oblongum* (Plate 7, Fig. 9)

Lg. 144.9-159.8 μm , br. 75.9-86.2 μm , isth. 20.7-26.4 μm , lob. pol. br. 41.4-46.0 μm , lg.: br. 1.80-1.97 $\times$.

Occur.: 3rrr, 7rrr, 8rrr, 9rrr.

Euastrum sublobatum Bréb.

var. *sublobatum* (Plate 7, Fig. 8)

Lg. 18.4-19.5 μm , br. 13.8-16.1 μm , isth. 4.6 μm , lob. pol. br. 11.5-12.6 μm , lg.: br. 1.21-1.33 $\times$.

Occur.: 8rrr, 9rrr.

Genus: *Micrasterias* Agardh ex Ralfs 1848

Micrasterias americana Ehrenb. ex Ralfs

var. *americana* (Plate 11, Fig. 17)

Lg. 126.5-159.8 μm , br. 112.7-132.2 μm , isth. 23.0-27.6 μm , lob. pol. br. 59.8-73.6 μm , lg.: br. 1.10-1.25 $\times$.

Occur.: 7rr, 8rrr, 9rrr.

Micrasterias crux-melitensis (Ehrenb.) Hass. ex Ralfs

var. *crux-melitensis* (Plate 7, Fig. 24)

Lg. 102.3-105.8 μm , br. 90.8-96.6 μm , isth. 13.8-21.8 μm , lob. pol. br. 34.5-39.1 μm , lg.: br. 1.10-1.12 $\times$.

Occur.: 7rrr.

Micrasterias jenneri Ralfs

var. *jenneri* (Plate 9, Fig. 1-5; Plate 10, Fig. 1)

Shape of semicells in vertical view fits Grönblad's (1924; Plate 2, Fig. 21) drawing. It is similar to Ralfs's (1848) drawing (Plate 11, Fig. 1d), on the other hand, it differs from the data of West, West (1905; Plate 43, Fig. 2)

From the observations on relatively numerous population of *M. jenneri* it may be inferred that the distinguished taxon — var. *simplex* W. West (Plate 9, Fig. 1) is a developmental stage of the cell of var. *jenneri*, derived from generative reproduction. Therefore, it should be treated as a synonym of the typical variety (Plate 10, Fig. 1). Thorough motivation of this statement may be found in Tomaszewicz's (1977) work. In this respect the diagnosis of *M. jenneri* Ralfs var. *jenneri* should be completed with a note that lateral lobes at early developmental stages may be divided to the second or, third order, whereas cell wall may be smooth or punctate.

Lobi laterales cellularum in stadiis juvenalibus cum 2 vel 4 lobuletis sunt. Membrana cellularis glabra vel punctata est.

In some specimens apices of polar lobes have got not only median retuse, but also two distinct lateral ones (Plate 9, Fig. 5). Similar specimens have been reported by Krieger (1933a).

Lg. 135.7-172.5 μm , br. 92.0-118.4 μm , isth. 16.1-25.3 μm , lob. pol. br. 55.2-74.8 μm , th. 51.7 μm , lg.: br. 1.33-1.50 $\times$.

Occur.: 1rrr, 2rrr, 3rr.

Micrasterias papillifera Bréb.

var. *papillifera* (Plate 8, Fig. 4)

Lg. 121.9-125.4 μm , br. 115.0-116.1 μm , isth. 18.4-20.7 μm , lob. pol. br. 36.8-46.0 μm , lg.: br. 1.06-1.08 $\times$.

Occur.: 7rrr, 8rrr, 9rrr.

var. *glabra* Nordst. (Plate 8, Fig. 5)

Lg. 123.0 μm , br. 119.6 μm , isth. 19.5 μm , lob. pol. br. 36.8 μm , lg.: br. 1.03 $\times$.

Occur.: 8rrr, 9rrr.

Micrasterias rotata (Grev.) Ralfs ex Ralfs

var. *rotata* f. *rotata* (Plate 8, Fig. 1)

Lg. 204.7-257.3 μm , br. 185.1-240.7 μm , isth. 23.0-35.6 μm , lob. pol. br. 44.8-59.8 μm , th. 51.7 μm , lg.: br. 1.00-1.26 $\times$.

Occur.: 4rrr, 5rrr, 6rrr, 7rrr, 8rrr, 9rrr.

f. *evoluta* Turn. (Plate 8, Fig. 3)

Lg. 244.8-265.6 μm , br. 224.1-244.8 μm , isth. 27.6-36.8 μm , lob. pol. br. 57.5-70.1 μm , lg.: br. 1.08-1.15 $\times$.

Occur.: 4rrr, 7rrr, 8rrr, 9rrr.

f. *granulata* W. West (Plate 8, Fig. 2)

A cell smaller with slightly wider polar lobes than those given by Roll (1924, after Kossinskaya 1960).

Lg. 278.0 μm , br. 249.0 μm , isth. 26.4 μm , lob. pol. br. 72.4 μm , lg.: br. 1.12 $\times$.

Occur.: 9rrr.

Micrasterias thomasiana Arch.

var. *thomasiana* (Plate 8, Fig. 6)

Lg. 197.8-236.5 μm , br. 177.1-209.3 μm , isth. 20.7-26.4 μm , lob. pol. br. 43.7-52.9 μm , lg.: br. 1.09-1.14 $\times$.

Occur.: 1rrr, 5rrr, 6rr, 7rrr, 8rrr, 9rrr.

var. *notata* (Nordst.) Grönbl. (Plate 8, Fig. 7-8)

Individuals morphologically varied. Two groups may be distinguished among them:

a) Cells usually fit the description of var. *notata*. Incisions between polar and lateral lobes and between lateral lobes of the second and third order are closed and only slightly open in the ends. At the semicells base three distinct papillae are visible. Number of the end lobules — 16. Such specimens are described by: Krieger (1939), Lenzenweger (1965) and Förster (1970), (Plate 8, Fig. 7).

Lg. 208.1-249.0 μm , br. 179.4-220.8 μm , isth. 20.7-29.9 μm , lob. pol. br. 46.0-50.6 μm , th. 46.0 μm , lg.: br. 1.10-1.19 $\times$.

Occur.: 5rrr, 6r, 7rrr, 8rrr, 9rrr.

b) morpha (Plate 8, Fig. 8)

Incisions between polar lobe and lateral lobes halfly open, those between lateral lobes of the second order open in the ends, whereas those between lobes of the third order wholly open. No papillae were observed. Number of the end lobules — 15. Specimens similar to those described by West, West (1905). However, their incisions between polar and lateral lobes are differently formed.

Lg. 218.5-232.4 μm , br. 189.7-199.2 μm , isth. 27.6 μm , lob. pol. br. 54.0 μm , lg.: br. 1.15-1.17 $\times$.

Occur.: 8rrr.

In the studies no numerous populations were found. Only single specimens were usually encountered. Therefore, it is difficult to decide whether two groups distinguished above are two distinct taxonomical units, or difference in their shape lies in the intrapopulational variation.

Micrasterias truncata Corda ex Bréb.

var. *truncata* (Plate 10, Fig. 2-4)

On the grounds of Tomaszewicz's (1973b) work I have included all found representatives of var. *crenata* (Bréb.) Grönbl. (Table 10, Fig. 3)

Plate 8

Fig. 1. *Micrasterias rotata* var. *rotata* f. *rotata*. Fig. 2. *M. rotata* var. *rotata* f. *granulata*. Fig. 3. *M. rotata* var. *rotata* f. *evoluta*. Fig. 4. *M. papillifera* var. *papillifera*. Fig. 5. *M. papillifera* var. *glabra*. Fig. 6. *M. thomasiana* var. *thomasiana*. Fig. 7. *M. thomasiana* var. *notata*. Fig. 8. *M. thomasiana* var. *notata*, morpha

PLATE 8

and var. *neodamensis* (A. Braun) W. Krieg. (Plate 10, Fig. 4,) in the typical variety.

Lg. 87.4-109.2 μm , br. 79.3-98.9 μm , isth. 13.8-25.3 μm , lob. pol. br. 52.9-73.6 μm , th. 35.6 μm , lg.: br. 1.00-1.18 $\times$.

Occur.: 1rr, 2rr, 3rr, 4c, 5rr, 6cc, 7rr, 8rr, 9rr.

var. *bahusiensis* Wittr. (Plate 10, Fig. 5)

Lg. 90.8-119.6 μm , br. 72.4-92.0 μm , isth. 18.4-23.0 μm , lob. pol. br. 57.5-69.0 μm , lg.: br. 1.21-1.30 $\times$.

Occur.: 4rr.

Genus: *Actinotaenium* (Nägeli) Teiling 1954

Actinotaenium cruciferum (De Bary) Teil.

var. *cruciferum* (Plate 9, Fig. 9)

Specimens with a shallow median constriction.

Lg. 25.3 μm , br. 11.5 μm , isth. 10.3 μm , lg.: br. 2.20 $\times$.

Occur.: 8rrr.

Actinotaenium cucurbita (Bréb. ex Ralfs) Teil. ex Růž. et Pouz

var. *cucurbita* f. *cucurbita* (Plate 9, Fig. 10)

Lg. 39.1-43.7 μm , br. 19.5-23.0 μm , isth. 17.2-20.7 μm , lg.: br. 1.85-2.00 $\times$.

Occur.: 1rrr, 2rrr, 3c, 4c, 5rrr, 6cc, 8rrr, 9rrr.

f. *inflatum* (Gutw.) comb. nov. et stat. nov. (Plate 9, Fig. 11)

Basion.: *Disphinctium cucurbita* (Bréb.) Reinsch var. *inflatum* Gutwiński (1909), Flora algarum montium Tatrensiensium, Bull. Acad. Sci. Cracovie, Cl Sci. Math.-Nat., p. 448, pl. 7:11.

Semicells slightly inflated at the base. Lateral margins slightly convergent, concave above basal angles. Apices flattened with rounded angles. Similar specimens are described by Förster (1970), who identified them as *Act. cucurbita*, morpha.

Specimens with a inflation at the base of semicells were first described by Gutwiński (1909). He considered them as a variety (var. *inflatum*)

Plate 9

Fig. 1-5. *Micrasterias jenneri* var. *jenneri*. Fig. 6. *Actinotaenium cucurbitinum* var. *cucurbitinum*. Fig. 7. *Act. cucurbitinum* var. *minutum*. Fig. 8. *Act. cucurbitinum* var. *subpolymorphum*. Fig. 9. *Act. cruciferum* var. *cruciferum*. Fig. 10. *Act. cucurbita* var. *cucurbita* f. *cucurbita*. Fig. 11. *Act. cucurbita* var. *cucurbita* f. *inflatum*. Fig. 12. *Act. cucurbita* var. *cucurbita* f. *rotundatum*. Fig. 13. *Act. cucurbita* var. *cucurbita* f. *latius*. Fig. 14. *Act. cucurbita* var. *attenuatum*. Fig. 15. *Act. wollei* var. *wollei* f. *longior*. Fig. 16. *Cosmarium quadratulum*. Fig. 17. *Co. impressulum* var. *cosandeyi*. Fig. 18. *Co. tinctum* var. *tinctum*. Fig. 19. *Co. globosum* var. *globosum* f. *minor*. Fig. 20. *Co. exiguum* var. *exiguum*

of *Disphinctium cucurbita* (Bréb.) Reinsch. On the other hand, Teiling (1954) did not classify them as a separate taxon, but only as a synonym of var. *attenuatum* (G. S. West) Teil.

In the encountered specimens shapes of semicells are more close to that of typical variety and not to var. *attenuatum*. As it has been already mentioned, lateral margins are only slightly convergent, which also corresponds to Gutwiński's (1909) and Förster's (1970) drawings.

I think that specimens described above should be classified as a separate taxon, but of the rank of form and not variety.

Lg. 34.5-43.7 μm , br. 19.5-23.0 μm , isth. 17.2-18.4 μm , lg.: br. 1.67-2.00 $\times$.

Occur.: 2rrr, 3rrr, 4rrr, 6rrr.

f. *latus* (W. et G. S. West) Teil. (Plate 9, Fig. 13)

Lg. 39.1 μm , br. 24.1-25.3 μm , isth. 23.0-24.1 μm , lg.: br. 1.55-1.62 $\times$.

Occur.: 4rrr.

f. *rotundatum* (W. Krieg.) Teil. (Plate 9, Fig. 12)

Lg. 26.4-27.6 μm , br. 13.8 μm , isth. 11.5-12.6 μm , lg.: br. 1.91-2.00 $\times$.

Occur.: 3rrr.

var. *attenuatum* (G. S. West) Teil. (Plate 9, Fig. 14)

Lg. 33.3-35.6 μm , br. 16.1-19.5 μm , isth. 13.8-18.4 μm , lg.: br. 1.71-2.14 $\times$.

Occur.: 3rrr.

Actinotaenium cucurbitinum (Biss.) Teil.

var. *cucurbitinum* (Plate 9, Fig. 6)

Specimens of medium size. They correspond to the upper dimension limit of *Penium cucurbitinum* Biss. f. *minor* W. et G. S. West. Krieger, Gerloff (1969) treat the above taxon as a synonym of *Cosmarium cucurbitinum* (Biss.) Lütken. var. *minutum* Presc., while Růžicka (1981) includes it in the synonyms of *Actinotaenium cucurbitinum* (Biss.) Teil. var. *cucurbitinum*.

Lg. 55.2-62.1 μm , br. 25.3-26.4 μm , isth. 20.7-24.1 μm , lg.: br. 2.18-2.35 $\times$.

Occur.: 1rrr, 3rrr.

var. *minutum* (Presc.) Teil. comb. nov. et stat. nov (Plate 9, Fig. 7)

Basion.: *Penium cucurbitinum* Biss. f. *minutum* Prescott in Prescott et Magnotta (1935), Notes on Michigan Desmids with descriptions of some species and varieties new to science, Pap. Mich. Acad. Sci. Arts Letters, 20, p. 158, pl. 25 : 9.

Actinotaenium cucurbitinum (Biss.) Teil. var. *minutum* (Presc.) Teiling 1954, p. 400; combination unvalidly published, Art. 33 Int. Code.

Lg. 33.3-34.5 μm , br. 14.9-16.1 μm , isth. 12.6-13.8 μm , lg.: br. 2.07-2.23 $\times$.

Occur.: 4rrr.

var. *subpolymorphum* (Nordst.) Teil. (Plate 9, Fig. 8)

Semicells with markedly convergent lateral margins, rounded apices and rarely porous cell wall. Similar specimens described by: Krieger (1933a), Teiling (1954), Krieger, Gerloff (1969) and Förster (1972).

Lg. 66.7-67.8 μm , br. 27.6-28.7 μm , isth. 25.3-26.4 μm , lg.: br. 2.36-2.42 $\times$.

Occur.: 4rrr.

Actinotaenium wollei (W. et G. S. West) Teil. ex Růž. et Pouz.

var. *wollei* f. *longior* (Grönbl.) comb. nov. (Plate 9, Fig. 15)

Basion.: *Cosmarium wollei* (W. et G. S. West) Grönbl. f. *longior* Grönblad (1947), Desmidiaceen aus Salmi, Acta Soc. pro Fauna et Flora Fenn., 66, 1, p. 25, pl. 1: 8-9.

Krieger, Gerloff (1969) quote inadequate Grönblad's work (1947), in which a holotype of this taxon is supposed to be given.

Lg. 36.8 μm , br. 24.1-25.3 μm , isth. 23.0-24.1 μm , lg.: br. 1.45-1.53 $\times$.

Occur.: 3rrr.

Genus: *Cosmarium* Corda ex Ralfs 1848

Cosmarium amoenum Bréb.

var. *amoenum* (Plate 11, Fig. 10-11)

a) Individuals with regularly granulate cell wall, according to the descriptions in the relevant literature (Plate 11, Fig. 10)

Lg. 42.5-57.5 μm , br. 20.7-32.2 μm , isth. 13.8-20.7 μm , th. 18.4 μm , lg.: br. 1.79-2.11 $\times$.

Occur.: 1rrr, 2rrr, 4r, 5rrr, 7rrr, 8rrr, 9rr.

b) morpha (Plate 11, Fig. 11)

Cell wall in the poles with unregular granules. Across a base of semi-cells a series of longitudinal granules. Specimens similar to *Co. pseudo-amoenum* Wille var. *basilare* Nordst. They differ in a number of granule series across a semicell base and in their shape.

Lg. 41.4-44.8 μm , br. 24.1-25.3 μm , isth. 14.9-17.2 μm , lg.: br. 1.72-1.77 $\times$.

Occur.: 5rrr.

Cosmarium angulosum Bréb.

var. *angulosum* (Plate 10, Fig. 18)

Lg. 19.5-21.8 μm , br. 12.6-13.8 μm , isth. 3.4-5.7 μm , lg.: br. 1.50-1.58 $\times$.

Occur.: 7rrr, 8rrr, 9rrr.

Cosmarium asphaerosporum Nordst.

var. *strigosum* Nordst. (Plate 10, Fig. 8)

Lg. 11.5 μm , br. 10.3 μm , isth. 4.6 μm , th. 5.7 μm , lg.: br. 1.12 $\times$.

Occur.: 1rrr.

Cosmarium bioculatum Bréb.

var. *bioculatum* f. *bioculatum* (Plate 10, Fig. 11)

Lg. 14.9-18.4 μm , br. 13.8-17.2 μm , isth. 4.6-6.9 μm , th. 6.9 μm , lg.: br. 1.00-1.08 $\times$.

Occur.: 2rrr, 4r, 7rr, 8rrr, 9rrr.

f. *depressum* Schaarschm. (Plate 10, Fig. 10)

Lg. 12.6-13.8 μm , br. 13.8-14.9 μm , isth. 3.4-4.6 μm , th. 5.7 μm , lg.: br. 0.91-1.00 $\times$.

Occur.: 9rr.

Cosmarium blyttii Wille

var. *novae-sylvae* W. et G. S. West (Plate 11, Fig. 8)

Cells with two series of granules within each marginal crenation. Drawings similar to those of Hirano (1972) and Růžička (1973a).

Lg. 20.7-21.8 μm , br. 17.2-19.5 μm , isth. 4.6-5.7 μm , lg.: br. 1.12-1.20 $\times$.

Occur.: 7rrr, 9rr.

Cosmarium contractum Kirchn.

var. *contractum* (Plate 11, Fig. 1)

Semicells in vertical view more widely elliptic than those of West, West (1905) and rather similar to those of Grönblad (1960; Plate 3, Fig. 48).

Lg. 39.1-42.5 μm , br. 25.3-27.6 μm , isth. 6.9-9.2 μm , th. 23.0 μm , lg.: br. 1.42-1.55 $\times$.

Occur.: 4r.

var. *minutum* (Delp.) W. et G. S. West (Plate 11, Fig. 2)

Semicells in vertical view narrowly elliptic.

Lg. 23.0-25.3 μm , br. 18.4-20.7 μm , isth. 4.6-6.9 μm , th. 12.6 μm , lg.: br. 1.22-1.25 $\times$.

Occur.: 7rrr, 9rrr.

Cosmarium elegantissimum Lund.

var. *simplicius* W. et G. S. West (Plate 11, Fig. 12)

Cell wall sculpture fits Růžička's (1973a; Plate 10, Fig. 5) drawing. Förster (1970), on the grounds of Grönblad's (1931) work, treats this taxon as a unit of the species rank — *Cosmarium simplicius* (W. et G. S. West) Grönbl.

Lg. 43.7-48.3 μm , br. 20.7-23.0 μm , isth 18.4 -20.7 μm , lg.: br. 2.04-2.11 $\times$.

Occur.: 7rrr, 9rrr.

Cosmarium exiguum Arch.

var. *exiguum* (Plate 9, Fig. 20)

Semicell apices markedly convex. In face view the specimens fit the drawing of *Co. exiguum*, form in Grönblad's et al. (1968; Plate 6, Fig. 87) work. They differ in somewhat smaller dimensions and narrower semicells in side view.

Lg. 16.1-17.2 μm , br. 9.2 μm , isth 4.6-5.7 μm , th. 6.9-8.0 μm , lg.: br. 1.75-1.87 $\times$.

Occur.: 9rrr.

Cosmarium formosulum Hoff

var. *formosulum* (Plate 11, Fig. 9)

Lg. 40.2-43.7 μm , br. 36.8 μm , isth. 9.2-11.5 μm , ap. 14.9-16.1 μm , lg.: br. 1.09-1.19 $\times$.

Occur.: 5rrr.

Cosmarium globosum Bulnh.

var. *globosum* f. *minor* Boldt (Plate 9, Fig. 19)

Lg. 16.1-20.7 μm , br. 10.3-12.6 μm , isth. 8.0-10.3 μm , lg.: br. 1.56-1.64 $\times$.

Occur.: 9rrr.

Cosmarium impressulum Elfv.

var. *cosandeyi* Růž. (Plate 9, Fig. 17)

Cells smaller than in the typical variety, they fit those of var. *cosandeyi* in Růžička's (1972, 1973a) works.

Specimens with dimensions below lower limit of those for var. *impressulum* (West, West 1908) are described by many authors (Taylor 1934, Hirano 1957a, Palamar 1960, Islam 1970, Mix 1970).

I think if big (that correspond to var. *impressulum*) and small (that correspond to var. *cosandeyi*) individuals are found in the same habitat, they occupy the same ecological niche and the difference between them lies (according to Růžička 1972) only in size (I do not have neither original diagnosis, nor holotype — var. *minor* Cosandey (1934), then var. *cosandeyi* (= var. *minor* Cosandey 1934) ought to be treated as a synonym of var. *impressulum*.

In the area studied I observed only small individuals, and scarce.

Lg. 20.7 μm , br. 14.9-16.1 μm , isth. 3.4-4.6 μm , lg.: br. 1.29-1.39 $\times$.

Occur.: 7rrr.

Cosmarium margaritiferum Menegh. ex Ralfs

var. *margaritiferum*, morpha (Plate 11, Fig. 13)

Individual size slightly smaller than literature data. Semicells more pyramidal than those in drawings of: West, West (1912), Wasylik (1961a), Prescott (1966), Förster (1970), Růžička (1973a) and Coesel (1979b). On the other hand, they fit descriptions of: Migula (1907), Hirano (1957b) and Lind, Brook (1980).

Lg. 40.2-47.1 μm , br. 29.9-35.6 μm isth. 9.2-11.5 μm , th. 21.8 μm , lg.: br. 1.31-1.34 $\times$.

Occur.: 4r.

Cosmarium minimum W. et G. S. West

var. *minimum* (Plate 10, Fig. 12-13)

a) morpha 1 (Plate 10, Fig. 12)

Cells relatively longer than those described in the literature by: West, West (1908), Hirano (1957a, 1974), and Krieger, Gerloff (1969). Length-breadth ratio fits rather that of var. *subrotundatum* W. et G. S. West, whereas shape that of var. *minimum*.

Lg. 11.5-14.9 μm br. 9.2-12.6 μm , isth. 3.4 μm , th. 5.7 μm , lg.: br. 1.18-1.25 $\times$.

Occur.: 7rrr, 9rrr.

b) morpha 2 (Plate 10, Fig. 13)

Individuals closest to the encountered specimens of *Co. minimum* var. *minimum*, morpha 1. They differ from them in more open, acute-angled sinus and wider isthmus. In their appearance they resemble the drawing of *Co. coarctatum* W. West in Grönblad's (1942; Plate 2, Fig. 17) work. I consider this drawing to differ from the diagnosis of above taxon given by West, West (1908) and Krieger, Gerloff (1965).

Lg. 9.2-13.8 μm , br. 10.3-12.6 μm , isth. 5.7 μm , th. 5.7 μm , lg.: br. 0.89-1.12 $\times$.

Occur.: 4rr, 7rr.

Cosmarium moniliforme Turp. ex Ralfs

var. *moniliforme* (Plate 10, Fig. 17)

Lg. 32.2 μm , br. 17.2-18.4 μm , isth. 9.2 μm , th. 17.2-18.4 μm , lg.: br. 1.75-1.87 $\times$.

Occur.: 4rrr.

var. *panduriforme* (Heimerl) Schmidle (Plate 10, Fig. 16)

Lg. 18.4-20.7 μm , br. 10.3-11.5 μm , isth. 6.9-9.2 μm , th. 10.3-11.5 μm , lg.: br. 1.79-1.80 $\times$.

Occur.: 8rrr.

Cosmarium praemorsum Bréb.

var. *praemorsum* (Plate 11, Fig. 14)

Cell wall sculpture according to drawings of: West, West (1908), Förster (1970) and Lind, Brook (1980).

Lg. 36.8-41.4 μm , br. 31.0-36.8 μm , isth. 9.2-14.9 μm , th. 20.7 μm , lg.: br. 1.12-1.19 $\times$.

Occur.: 9rrr.

Cosmarium pseudoornatum Eichl. et Gutw.

var. *pseudoornatum* (Plate 11, Fig. 16)

Lg. 29.9-34.5 μm , br. 31.0-32.2 μm , isth. 9.2-10.3 μm , th. 16.1 μm , lg.: br. 0.96-1.07 $\times$.

Occur.: 5rrr, 7rrr.

Plate 10

Fig. 1. *Micrasterias jenneri* var. *jenneri*. Fig. 2-4. *M. truncata* var. *truncata*. Fig. 5. *M. truncata* var. *bahusiensis*. Fig. 6. *Cosmarium regnellii* var. *regnellii*. Fig. 7. *Co. regnellii* var. *pseudoregnellii*. Fig. 8. *Co. asphaerosporum* var. *strigosum*. Fig. 9. *Co. subarctoum* var. *subarctoum*, morpha. Fig. 10. *Co. bioculatum* var. *bioculatum* f. *depressum*. Fig. 11. *Co. bioculatum* var. *bioculatum* f. *bioculatum*. Fig. 12. *Co. minimum* var. *minimum*, morpha 1. Fig. 13. *Co. minimum* var. *minimum*, morpha 2. Fig. 14-15. *Co. spec.* Fig. 16. *Co. moniliforme* var. *panduriforme*. Fig. 17. *Co. moniliforme* var. *moniliforme*. Fig. 18. *Co. angulosum* var. *angulosum*

Cosmarium pseudopyramidatum Lund.

var. *pseudopyramidatum*, morpha (Plate 11, Fig. 5)

Cells relatively longer than typical specimens. Semicells widened toward a base, sides straight, apices and angles rounded. Cell shape fits that of specimens found by Förster (1970) and Oleksowicz (1978). Individual appearance is nearly identical with drawings of Ito (1965a) and Watanabe et al. (1979), the only difference lies in the apex shape truncate not rounded as in my specimens.

Lg. 55.2-58.6 μm , br. 31.0-32.2 μm , isth. 9.2 μm , lg.: br. 1.78-1.82 $\times$.

Occur.: 3rrr.

Cosmarium pyramidatum Bréb.

var. *pyramidatum* (Plate 11, Fig. 6)

Semicell shape in a side view differs from that described by West, West (1905). Semicells are widely not longitudinally elliptic and fit Hirano's (1957a) drawing. Its appearance fits also the drawing of *Co. pyramidatum* Bréb. var. *maximum* (Borge) W. Krieg. et Gerloff by Borge published in the work of Krieger and Gerloff (1965).

Lg. 64.4-73.6 μm , br. 42.5-47.1 μm , isth. 11.5-16.1 μm , th. 25.3 μm , lg.: br. 1.47-1.62 $\times$.

Occur.: 1rrr, 2rrr, 3rrr, 4rr, 5rrr, 6rrr, 7rrr, 8rrr, 9rrr.

Cosmarium quadratum (Gay) De Toni (Plate 9, Fig. 16)

West, West (1908) drew various drawings of *Co. quadratum* (Plate 72, Fig. 33 and Plate 93, Fig. 4). According to Grönblad (1921) only specimens in Plate 72, Fig. 33 fit Gay's holotype, whereas those in Plate 93, Fig. 4 differ from it especially in the lack of open sinus. The specimens encountered by me are similar to a drawing from Plate 93, Fig. 4 (West, West 1908). They differ in longer cells, apical angles rather rounded and somewhat convex apices, without retuse. Similar specimens are described by Hirano (1957a, 1974).

Probably, individuals of *Co. quadratum*, described by Wests that differ from the Gay's holotype are its variety. It is possible that both

Plate 11

Fig. 1. *Cosmarium contractum* var. *contractum*. Fig. 2. *Co. contractum* var. *minutum*. Fig. 3. *Co. subtumidum* var. *subtumidum*. Fig. 4. *Co. quadratum* var. *quadratum*, morpha. Fig. 5. *Co. pseudopyramidatum* var. *pseudopyramidatum*, morpha. Fig. 6. *Co. pyramidatum* var. *pyramidatum*. Fig. 7. *Co. ralfsii* var. *ralfsii*. Fig. 8. *Co. blyttii* var. *novae-sylvae*. Fig. 9. *Co. formosulum* var. *formosulum*. Fig. 10. *Co. amoenum* var. *amoenum*. Fig. 11. *Co. amoenum* var. *amoenum*, morpha. Fig. 12. *Co. elegantissimum* var. *simplicius*. Fig. 13. *Co. margaritifera* var. *margaritifera*, morpha. Fig. 14. *Co. praemorsum* var. *praemorsum*. Fig. 15. *Co. tetraophthalmum* var. *tetraophthalmum*. Fig. 16. *Co. pseudoornatum* var. *pseudoornatum*. Fig. 17. *Micrasterias americana* var. *americana*. Fig. 18. *Arthrodesmus tenuissimus* var. *tenuissimus*. Fig. 19. ?*Art. trispinatus* var. *trispinatus*. Fig. 20. *Art. octocornis* var. *octocornis*. Fig. 21. *Xanthidium concinnum* var. *boldtianum*. Fig. 22. *X. fasciculatum* var. *basidentatum*

PLATE 11

them and those found by me should be classified as var. *applanatum* Insam et W. Krieg. 1936 (I found its drawings in the works of: Grönblad et al. (1964), and Krieger and Gerloff (1965)). However, as I do not have original diagnosis and drawing, I am not justified, on the grounds of descriptions and drawings mentioned above, to decide whether encountered specimens represent the taxon discussed. I am only sure they cannot be classified as representatives of the typical variety. Therefore, they are classified only to the species rank.

Lg. 16.1-17.2 μm , br. 13.8 μm , isth. 3.4-4.6 μm , th. 8.0 μm , lg.: br. 1.17-1.25 $\times$.

Occur.: 7rrr, 9rrr.

Cosmarium quadratum Ralfs ex Ralfs

var. *quadratum*, morpha (Plate 11, Fig. 4)

Cells longitudinally elliptic, apex convex, sides straight, but above rounded basal angles slightly depressed.

Semicell outline fits that of individuals found by: Růžicka (1956), Hirano (1957a; Plate 24, Fig. 5) and Ito (1968). They are similar to the drawings of Ito (1966a), Růžicka (1972: Plate 61, Fig. 5, 1973a; Plate 9, Fig. 9), Agarker, Agarkar (1977), and Hinode (1977). Cell apex of these specimens is less convex than of those found by me.

Lg. 50.6-55.2 μm , br. 27.6-31.0 μm , isth. 12.6-16.1 μm , lg.: br. 1.69-1.92 $\times$.

Occur.: 9rrr.

Cosmarium ralfsii Bréb.

var. *ralfsii* (Plate 11, Fig. 7)

Lg. 110.4-123.0 μm , br. 95.4-104.6 μm , isth. 19.5-27.6 μm , th. 51.7-53.0 μm , lg.: br. 1.16-1.21 $\times$.

Occur.: 2rrr, 3rrr.

Cosmarium regnellii Wille

var. *regnellii* (Plate 10, Fig. 6)

Lg. 13.8-16.1 μm , br. 12.6-14.9 μm , isth. 3.4-4.6 μm , th. 6.9 μm , lg.: br. 1.08-1.10 $\times$.

Occur.: 5rrr, 6rrr, 7rrr, 8rrr, 9rrr.

var. *pseudoregnellii* (Messik.) W. Krieg. (Plate 10, Fig. 7)

Specimen appearance fits the drawing of *Co. braunii* (Reinsch) Wille var. *pseudoregnellii* Messik. in Laporte's (1931; Plate 11, Fig. 132-134) work. Krieger, Gerloff (1965) classify this drawing as belonging to *Co. meneghinii* Bréb. var. *meneghinii*. If compared to the descriptions and drawings of this taxon in works of: West, West (1908), Grönblad (1921), Hirano (1957a) and Messikommer (1971a), cells of the specimens encountered and those of Laporte are relatively shorter, the upper part of their sides is wider and shorter, apices are straight. Thus, they differ from the typical specimens of *Co. meneghinii*. Therefore, after Laporte, I classify them as *Co. regnellii* (= *Co. braunii*) var. *pseudoregnellii*.

Lg. 13.8-16.1 μm , br. 11.5-13.8 μm , isth. 3.4-4.6 μm , th. 6.9 μm , lg.: br. 1.17-1.20 $\times$.

Occur.: 7rr, 8rrr, 9r.

Cosmarium subarctoum (Lagerh.) Racib.

var. *subarctoum*, morpha (Plate 10, Fig. 9)

Cell apex flattened, sinus widely open. They are similar to those described by Grönblad (1960), Suxena, Venkateswarlu (1968). Apex in the specimens described by Suxena and Venkateswarlu (1968) had a shallow, hardly visible depression.

Lg. 11.5-12.6 μm , br. 9.2-10.3 μm , isth. 6.9 μm , lg.: br. 1.22-1.25 $\times$.

Occur.: 5rrr, 7rr.

Cosmarium subtumidum Nordst.

var. *subtumidum* (Plate 11, Fig. 3)

Lg. 27.6-34.5 μm , br. 23.0-29.9 μm , isth. 6.9-11.5 μm , th. 16.1 μm , lg.: br. 1.15-1.23 $\times$.

Occur.: 2rrr, 4r, 6cc, 7rrr, 8rrr, 9rrr.

Cosmarium tetraophthalmum Bréb.

var. *tetraophthalmum* (Plate 11, Fig. 15)

Lg. 105.8-113.7 μm , br. 73.6-78.2 μm , isth. 23.0-29.9 μm , lg.: br. 1.44-1.47 $\times$.

Occur.: 1rrr, 7rrr.

Cosmarium tinctum Ralfs

var. *tinctum* (Plate 9, Fig. 18)

Lg. 13.8-16.1 μm , br. 11.5 μm , isth 6.9-8.0 μm , th. 6.9 μm , lg.: br. 1.20-1.40 $\times$.

Occur.: 2rrr, 7rrr, 8rrr, 9rrr.

Cosmarium sp. (Plate 10, Fig. 14-15)

Semicells rectangular, apical angles markedly truncate, apices straight, sides straight parallel, sinus open, acute-angled, in vertical view semicells elliptic.

Cell shape similar to specimens of *Co. minimum* W. et G. S. West var. *minimum*, morpha 2, encountered by me. They differ only in the truncate apical angles. They are also similar to individuals of *Co. asphaerosporum* Nordst. var. *asphaerosporum*, but their outline is more straight and cells are different in vertical view.

Lg. 10.3-12.6 μm , br. 9.2-11.5 μm , isth. 5.7-6.9 μm , th. 5.7 μm , lg.: br. 1.10-1.12 $\times$.

Occur.: 1rrr, 4rrr.

Genus: *Xanthidium* Ehrenberg ex Ralfs 1848

Xanthidium antilopaeum Bréb. ex Kütz.

var. *antilopaeum* (Plate 12, Fig. 1-6)

a) fac. 2 (Plate 12, Fig. 1-2)

Cell shape in vertical view differs from that of Migula (1907), West, West (1912) and Hirano (1957b). Semicells six-angled, poles straight or faintly concave, they fit descriptions of Grönblad, Růžicka (1959), Bourrelly (1966) and Růžicka (1973a, 1973b). Sometimes encountered specimens immersed in gelatinous envelope (Plate 12, Fig. 2).

Lg. 62.1-73.6 μm , br. 51.7-62.1 μm , isth. 13.8-23.0 μm , sp. 10.3-14.9 μm , th. 34.5-39.1 μm , lg.: br. 1.08-1.25 $\times$.

Occur.: 1rrr, 2rr, 3rrr, 4r, 5rr, 6rrr, 7rrr, 8rrr, 9rrr.

b) fac. 2 morpha (Plate 12, Fig. 3-5)

Cell shape fits that of encountered specimens of var. *antilopaeum*, fac. 2, but spines at all (Plate 12, Fig. 3-4), or three (Plate 12, Fig. 5) angles are reduced. Cell size oscillates around lower limit of dimensions for var. *antilopaeum*, fac. 2. I think all these specimens may be classified as reduced individuals of the typical variety, fac. 2. Moreover, they were found only once and in a small number.

Reduced spines and processes are not rare in desmids. They have been described: for *Xanthidium armatum* Bréb. ex Bréb. (West, West 1912; Kondo 1975), for *Xanthidium subhastiferum* W. West (Rosenberg 1944) and for *Staurostrum furcatum* (Ehrenb. ex Ralfs) Bréb. (Palamar-Mordvintseva 1970).

Lg. 54.0-66.7 μm , br. 46.0-52.9 μm , isth. 10.3-20.7 μm , sp. 2.3-3.4 μm , th. 32.2-35.6 μm , lg.: br. 1.13-1.30 $\times$.

Occur.: 1rrr, 2rrr.

c) fac. 3 (Plate 12, Fig. 6)

Cells smaller than those of West, West (1912), Wasylik (1961b) and Oleksowicz (1978). Even smaller specimens were described by Eichler (1892).

The rank of a taxon is not established yet. Migula (1907) classifies it as a form — f. *triquetrum* Lund., West, West (1912), Tomaszewicz (1973a, 1974) and Oleksowicz (1978) as a variety — var. *triquetrum* Lund., whereas Růžicka (1973b) — as facies 3. These discrepancies arise from the question whether differential character — triangular cells in vertical view — is constant (hereditary) or labile.

Lg. 50.6-57.5 μm , br. 46.0-50.6 μm , isth. 11.5-19.5 μm , sp. 10.3-16.1 μm , lg.: br. 1.07-1.22 $\times$.

Occur.: 4rr, 5rrr, 6rrr, 7rrr, 8rrr, 9rrr.

Xanthidium armatum Bréb. ex Bréb.

var. *armatum* (Plate 12, Fig. 7)

Lg. 105.8-126.5 μm , br. 62.1-78.2 μm , isth. 28.7-36.8 μm , sp. 5.7-11.5 μm , th. 52.9-55.2 μm , lg.: br. 1.53-1.83 $\times$.

Occur.: 1rrr, 2rrr, 3rr, 4r, 6cc, 7rrr, 8rrr, 9rrr.

Xanthidium concinnum Arch.

var. *boldtianum* W. West (Plate 11, Fig. 21)

Lg. 11.5 μm , br. 11.5-13.8 μm , isth. 4.6 μm , sp. ~ 1 μm , lg.: br. 0.83-1.00 $\times$.

Occur.: 7r.

Xanthidium fasciculatum Ehrenb. ex Ralfs

var. *basidentatum* (Börjes.) Růž. (Plate 11, Fig. 22)

Lg. 55.2-66.7 μm , br. 54.0-62.1 μm , isth. 16.1-21.8 μm , sp. 9.2-10.3 μm , lg.: br. 1.02-1.07 $\times$.

Occur.: 7rrr.

Genus: *Arthrodesmus* Ehrenberg ex Ralfs 1848

Arthrodesmus octocornis Ehrenb. ex Arch.

var. *octocornis* (Plate 11, Fig. 20)

Lg. 16.1-23.0 μm , br. 12.6-18.4 μm , isth. 4.6-6.9 μm , sp. 5.7-9.2 μm , lg.: br. 1.00-1.43 $\times$.

Occur.: 2rrr, 4rr, 7rrr, 8rr, 9rr.

Arthrodesmus tenuissimus Arch.

var. *tenuissimus* (Plate 11, Fig. 18)

Lg. 9.2-10.3 μm , br. 9.2-11.5 μm , isth. 5.7 μm , sp. 2.3 μm , th. 5.7 μm , lg.: br. 0.90-1.00 $\times$.

Occur.: 8rrr.

? *Arthrodesmus trispinatus* W. et G. S. West

var. *trispinatus* (Plate 11, Fig. 19)

Specimens found are symmetrical, spines located regularly. They fit the description and drawing of *Arthrodesmus trispinatus* of West, West (1912; Plate 117, Fig. 7). The authors mentioned that they did not find any living cell and they could not determine a kind of a chromatophore. Therefore, the above taxon may also belong to genus *Tetraëdron*.

Teiling (1946) has described asymmetrical individuals with unregularly distributed spines, which fit the drawing of *Art. trispinatus* by Gutwiński (1909), but with chromatophore of *Tetraëdron* type. He classifies them to *Tetraëdron trispinatum* (W. et G. S. West) Hub.-Pestal. At the same time he questions affiliation of West's specimens to genus *Arthrodesmus*, because the diagnosis was formed on the grounds of empty cells with the incidental symmetry.

On the grounds of two specimens found, moreover without chromatophores it is difficult to affiliate them properly. I classify them in genus *Arthrodesmus* as their appearance fits the description and drawing of Wests and differs from that of Teiling. Taxa described by Wests and Teiling belong to two different orders. Merely on the grounds of cell shape one cannot decide about its affiliation and about synonymity of both taxa, moreover as some *Tetraëdron* species have cells of similar shape as *Arthrodesmus* species.

Lg. 9.2-11.5 μm , br. 11.5 μm , isth. 6.9 μm , sp. 2.3-3.4 μm , th. 6.9 μm ,
lg.: br. 0.80-1.00 $\times$.

Occur.: 8rrr.

Genus: *Staurodesmus* Teiling 1948

Staurodesmus connatus (Lund.) Thom.

var. *connatus* (Plate 12, Fig. 14)

Lg. 20.7 μm , br. 19.5-20.7 μm , isth. 6.9 μm , sp. 6.9 μm , lg.: br. 1.00-1.06 $\times$.

Occur.: 7rrr, 9rrr.

Staurodesmus dejectus (Bréb. ex Bréb.) Teil.

var. *dejectus* (Plate 12, Fig. 15-16)

Sometimes individuals with nearly straight apices or very short spines were observed (Plate 12, Fig. 16). They fit drawing of West et al. (1923; Plate 129, Fig. 7), while their dimensions, according to Teiling (1967), fit formae majores.

Lg. 18.4-27.6 μm , br. 18.4-25.3 μm , isth. 4.6-6.9 μm , sp. 1.1-2.3 μm , lg.: br. 1.00-1.09 $\times$.

Occur.: 1rrr, 2rrr, 7rrr, 8rr, 9rr.

var. *apiculatus* (Bréb.) Teil. (Plate 12, Fig. 10)

Lg. 17.2-24.1 μm , br. 17.2-23.0 μm , isth. 5.7 μm , sp. 1.1-2.3 μm , lg.: br. 0.93-1.07 $\times$.

Occur.: 7rrr, 8rrr, 9rr.

Staurodesmus dickiei (Ralfs) Lillier.

var. *dickiei* (Plate 13, Fig. 18)

Lg. 20.7-24.1 μm , br. 18.4-24.1 μm , isth. 6.9-8.0 μm , sp. 2.3-3.4 μm , lg.: br. 0.95-1.13 $\times$.

Occur.: 2rrr.

var. *rhomboides* (W. et G. S. West) Lillier. (Plate 13, Fig. 19)

Cells with more flattened apices and wider open sinus than given by Teiling (1967). They correspond to specimens found by: Bicudo (1969), Mix (1970), Lind (1971) and Ružička (1972).

Lg. 23.0-27.6 μm , br. 25.3-29.9 μm , isth. 6.9-9.2 μm , sp. 5.7-6.9 μm , lg.: br. 0.91-0.96 $\times$.

Occur.: 7rrr, 8rrr, 9rrr.

Plate 12

Fig. 1-2. *Xanthidium antilopaeum* var. *antilopaeum* fac. 2. Fig. 3-5. *X. antilopaeum* var. *antilopaeum* fac. 2, morpha. Fig. 6. *X. antilopaeum* var. *antilopaeum* fac. 3. Fig. 7. *X. armatum* var. *armatum*. Fig. 8. *Staurodesmus patens* var. *patens*. Fig. 9. *Std. mamillatus* var. *mamillatus*. Fig. 10. *Std. dejectus* var. *apiculatus*. Fig. 11-12. *Std. o'mearae* var. *o'mearae* fac. 3. Fig. 13. *Std. o'mearae* var. *o'mearae* fac. 2. Fig. 14. *Std. connatus* var. *connatus*. Fig. 15-16. *Std. dejectus* var. *dejectus*

PLATE 12

Staurodesmus extensus (Anderss.) Teil.

Species very morphologically varied.

a) morpha 1 (Plate 13, Fig. 9)

Cells with straight apices, concave sides, parallel spines. They resemble the drawing of *Std. extensus* var. *joshuae* (Gutw.) Teil. given in Teiling's work (1967; Plate 5, Fig. 23). They differ from it in shorter spines, more concave sides and rounded sinus.

Lg. 17.2-19.5 μm , br. 14.9-16.1 μm , isth. 5.7 μm , sp. 8.0-9.2 μm , lg.: br. 1.15-1.21 $\times$.

Occur.: 3rrr, 4rr, 6rr, 7rr, 9rrr.

b) morpha 2 (Plate 13, Fig. 10)

Cells with slightly convex, depressed in the middle apices, concave sides and parallel spines. Semicells appearance fits the drawing and description of *Arthrodesmus* (= *Staurodesmus*) *extensus* (Anderss.) Hirano var. *malaccensis* (Bernard) Hirano given by Hirano (1957b). Teiling (1967) affiliates the above-mentioned taxon holotype to the synonyms of *Std. triangularis* (Lagerh.) Teil. var. *triangularis*, fac. 2. I consider this opinion as unjustified as description and drawing in Hirano's work differs from specimens identified as *Std. triangularis*.

Semicells shape in the specimens found, as well as spine distribution also agree with the specimen of *Art. incus* var. *extensus*, form given by Scott and Grönblad (1957; Plate 9, Fig. 13), but sinus and isthmus part are formed differently. In the specimens studied sinus apex rounded, whereas isthmus part is elongated, which fits description of *Std. extensus*. According to Scott, Grönblad (1957), isthmus part is cup-shaped, whereas sinus slightly notch which agrees with *Std. indentatus* (W. et G. S. West) Teil.

Lg. 17.2-21.8 μm , br. 14.9-18.4 μm , isth. 5.7-8.0 μm , sp. 5.7-11.5 μm , lg.: br. 1.00-1.29 $\times$.

Occur.: 7cc.

var. *extensus* (Plate 13, Fig. 11)

Typical individuals, they fit drawings in works of: Borge (1913), Grönblad (1920), Taft (1937) given in Teiling's (1967; Plate 5, Fig. 18) work, Hinode (1971) and others.

Lg. 16.1-21.8 μm , br. 13.8-20.7 μm , isth. 5.7-8.0 μm , sp. 5.7-10.3 μm , th. 6.9 μm , lg.: br. 1.00-1.17 $\times$.

Occur.: 1rrr, 2rrr, 3rrr, 4r, 5rrr, 6c, 7rrr, 8cc, 9rrr.

var. *retusus* (Hirano) comb. nov. (Plate 13, Fig. 12)

Basion.: *Arthrodesmus extensus* (Anderss.) Hirano var. *retusus* Hirano (1957), Flora Desmidiarum Japonicarum, Biol. Lab. Kyoto Univ., p. 211, pl. 29 : 38.

Teiling (1967) includes this taxon in *Std. indentatus* (W. et G. S. West) Teil. I think it should be affiliated to *Std. extensus* as shape of the isthmus part and sinus fits description of the latter.

Lg. 16.1-20.7 μm , br. 13.8-16.1 μm , isth. 4.6-6.9 μm , sp. 4.6-6.9 μm , th. 8.0 μm , lg.: br. 1.17-1.29 $\times$.

Occur.: 7c, 8rrr, 9rrr.

var. *vulgaris* (Eichl. et Racib.) Croas. (Plate 13, Fig. 13)

Messikommer (1971b) quotes specimens with longer spines.

Lg. 13.8-19.5 μm , br. 11.5-16.1 μm , isth. 4.6-8.0 μm , sp. 2.3-4.6 μm , lg.: br. 1.00-1.25 $\times$.

Occur.: 4r, 6rr, 7rr, 9rrr.

Specimens of morpha 1 and 2, as well as var. *retusus* were the most abundant in planktonic samples in Grabicz A bog. Ecological conditions of this site differ from the other bogs (see p. 5). Probably, they favour development of such *Std. extensus* forms.

Individuals of morpha 1 and 2, as well as var. *retusus* were observed three-fold in the same samples. Therefore, one may suppose that differences between them are of no essential taxonomical value and lie in the intrapopulational variation.

Amongst individuals of the above species I encountered some specimens with only one small spine (Plate 13, Fig. 14).

Staurodesmus glabrus (Ehrenb. ex Ralfs) Teil.

var. *glabrus* (Plate 13, Fig. 7).

Lg. 18.4-21.8 μm , br. 17.2-20.7 μm , isth. 6.9-8.0 μm , sp. 4.6-6.9 μm , lg.: br. 0.89-1.13 $\times$.

Occur.: 2rrr, 4rr, 6rrr, 7rr, 8rrr, 9rrr.

var. *debaryanus* (Nordst.) Teil. (Plate 13, Fig. 5-6)

a) Individual appearance agrees with drawings of this variety in works of: Teiling (1967; Plate 14, Fig. 3) and Förster (1970), (Plate 13, Fig. 5).

Lg. 18.4-19.5 μm , br. 16.1-17.2 μm , isth. 5.7-6.9 μm , sp. 5.7-6.9 μm , lg.: br. 1.06-1.14 $\times$.

Occur.: 6rr, 7rr, 8rr, 9rrr.

b) morpha (Plate 13, Fig. 6)

Cells small with very short spines. Their shape and size similar to small specimens of *Std. dickiei* (Ralfs) Lillier. var. *dickiei*, but their ventral margin is less convex than dorsal margin.

Lg. 14.9-16.1 μm , br. 14.9 μm , isth. 6.9 μm , sp. 2.3 μm , lg.: br. 1.00-1.08 $\times$.

Occur.: 7rrr.

var. *limnophilus* (Teil.) Teil. (Plate 13, Fig. 8)

Specimens with spines shorter than those given by Teiling (1967).

Lg. 18.4-19.5 μm , br. 18.4 μm , isth. 6.9 μm , sp. 10.3-11.5 μm , lg.: br. 1.00-1.07 $\times$.

Occur.: 8rrr.

Staurodesmus incus (Bréb. ex Ralfs) Teil.

var. *incus* f. *incus* (Plate 13, Fig. 1)

Lg. 16.1-18.4 μm , br. 13.8-16.1 μm , isth. 6.9-9.2 μm , sp. 10.3-11.5 μm , th. 6.9-8.0 μm , lg.: br. 1.14-1.17 $\times$.

Occur.: 1rrr, 2rrr, 4r, 6rrr, 9rrr.

f. *minor* (W. et G. S. West) Teil. (Plate 13, Fig. 2)

Lg. 13.8-14.9 μm , br. 13.8-14.9 μm , isth. 4.6-8.0 μm , sp. 6.9 μm , th. 6.9 μm , lg.: br. 1.00 $\times$.

Occur.: 4rrr, 9rrr.

? *Staurodesmus indentatus* (W. et G. S. West) Teil., morpha (Plate 13, Fig. 23)

Specimens smaller than those described in the relevant literature. Their shape agrees with the drawing of *Std. indentatus* in Teiling's (1967; Plate 7, Fig. 12) work, but slightly differs from that in work of Croasdale, Scott (1976). Specimens encountered by Croasdale and Scott and identified as *Std. indentatus* are characterized by apices very slightly elevated, horizontal spines and less widen sinus. The shape and size of individuals also fit *Std. extensus*, but isthmus part and sinus are formed differently. One cannot be sure which character to consider as more taxonomically valuable — size or shape of isthmus part and sinus. Some authors such as Scott, Grönblad (1957), Růžicka (1973a), Coesel, Hoogendijk (1975) and Lenzenweger (1977) all specimens with isthmus and sinus formed as in *Std. indentatus*, but with different distribution and size of spines classify as *Std. extensus*.

Therefore, I am not sure whereas the specimens encountered are representatives of a small form of *Std. indentatus*, or whether they should be classified as *Std. extensus*.

Lg. 16.1-19.5 μm , br. 13.9-17.2 μm , isth. 4.6-5.7 μm , sp. 4.6-9.2 μm , lg.: br. 1.13-1.17 $\times$.

Occur.: 7rr.

Staurodesmus isthmus (Heimerl) Croas.

var. *isthmus* (Plate 13, Fig. 15-17)

In some specimens apices slightly depressed, spines somewhat divergent (Plate 13, Fig. 16). In Biały Ług B bog a specimen with an additional spine at a base of one semicell was encountered (Plate 13, Fig. 17).

Lg. 16.1-18.4 μm , br. 14.9-19.5 μm , isth. 4.6-8.0 μm , sp. 5.7-6.9 μm , lg.: br. 0.93-1.07 $\times$.

Occur.: 1rrr, 2rr, 3rrr, 4c, 6r, 7rr, 8r, 9rr.

Staurodesmus mamillatus (Nordst.) Teil.

var. *mamillatus* (Plate 12, Fig. 9)

Lg. 18.4-23.0 μm , br. 18.4-21.8 μm , isth. 5.7-6.9 μm , sp. 9.2-11.5 μm , lg.: br. 0.84-1.25 $\times$.

Occur.: 8rrr, 9rrr.

Staurodesmus mucronatus (Ralfs ex Bréb.) Croas.

var. *mucronatus* (Plate 13, Fig. 20)

Lg. 20.7-25.3 μm , br. 20.7-25.3 μm , isth. 6.9-8.0 μm , sp. 3.4-4.6 μm , lg.: br. 0.91-1.00 $\times$.

Occur.: 6rrr.

var. *subtriangularis* (W. et G. S. West) Croas. (Plate 13, Fig. 21)

A shape and size of individuals are very close to, or completely agree with drawings of *Std. mucronatus* (= *Staurastrum*) var. *subtriangularis* in works of: Borge (1913), Teiling (1967; Plate 18, Fig. 13) and Hirano (1968). Apices are more convex than in specimens described by West et al. (1923) and Hirano (1972). They also fit drawings of *Staurodesmus* (= *Staurastrum*) *megacanthus* (Lund.) Thunm. var. *megacanthus* given by Scott, Prescott (1961) and Förster (1970). Teiling (1967) classifies a drawing in Scott, Prescott's (1961) work both to the typical variety of *Std. megacanthus* and to *Std. mucronatus* var. *subtriangularis* (p. 553 and 570).

Appearance and size of the specimens encountered differ from typical individuals of *Std. megacanthus*, described by: West et al. (1923), Hirano (1959b), Teiling (1967) and others. Cells are smaller, spines shorter and less massive.

I think that the specimens encountered have more characters in common with those of *Std. mucronatus* var. *subtriangularis*, than with those of *Std. megacanthus* var. *megacanthus*.

Lg. 25.3-26.4 μm , br. 25.3 μm , isth. 6.9 μm , sp. 3.4-4.6 μm , lg.: br. 1.00-1.04 $\times$.

Occur.: 7rr.

Staurodesmus o'mearae (Arch.) Teil.

var. *o'mearae* (Plate 12, Fig. 11-13)

a) fac. 2 (Plate 12, Fig. 13)

Lg. 13.8-16.1 μm , br. 11.5-13.8 μm , isth. 8.0-9.2 μm , sp. 6.9-8.0 μm , lg.: br. 1.17-1.20 $\times$.

Occur.: 6cc.

b) fac. 3 (Plate 12, Fig. 11-12)

Amongst individuals of fac. 3 specimens with parallel spines (Plate 12, Fig. 12) were encountered. They agree with a drawing of *Staurastrum o'mearae* f. *parallela* Ström. from Hirano's (1959b) work. Teiling (1967) considers the taxon mentioned above as a synonym of the typical variety.

Lg. 14.9-18.4 μm , br. 13.8-18.4 μm , isth. 6.9-9.2 μm , sp. 4.6-6.9 μm , lg.: br. 0.88-1.08 $\times$.

Occur.: 4r, 6rr, 7rrr, 8rrr, 9rrr.

Staurodesmus patens (Nordst.) Croas.

var. *patens* (Plate 12, Fig. 8)

Lg. 18.4 μm , br. 17.2 μm , isth. 6.9 μm , sp. 3.4 μm , lg.: br. 1.07 $\times$.

Occur.: 7rrr.

? *Staurodesmus quiriferus* (W. et G. S. West) Teil., morpha (Plate 13, Fig. 3-4)

In specimens apices are straight or slightly convex, spines short, isthmus elongated, sinus widely open, rounded at the extremity. Cell size and shape similar to those of *Arthrodesmus quiriferus* W. et G. S. West var. *brevispinis* Okada from Hirano's (1957b) drawing. They differ from var. *brevispinis* in an apex shape, which in this variety and in other taxa of *Staurodesmus* (= *Arthrodesmus*) *quiriferus* are concave.

Specimen appearance also agrees with drawings of *Arthrodesmus incus* (Bréb.) Hass. ex Ralfs var. *incus* f. *minor* W. et G. S. West from Wests' (1912) work (Plate 113, Fig. 16, 18). The only difference lies in the fact that isthmus is more elongated and sinus with distinctly rounded apex in the encountered specimens. In specimens identified by the author as *Std. incus* var. *incus* f. *minor*, which fit drawings of present taxon in works of West, West (1912; Plate 113, Fig. 17) and Lenzenweger (1967), isthmus is not elongated and sinus acuminate at the apex. I suppose that drawings of *Art. incus* var. *incus* f. *minor* by Wests represent two different taxa.

It has not been learned yet which morphological character studied — isthmus and sinus shape or apices shape — is more stabile thus more valuable in the taxonomy of both taxa (*Std. incus* and *Std. quiriferus*). I assumed the first one as the more important and therefore, I identify specimens as *Std. quiriferus*.

Hirano in Yamagishi, Hirano's (1973) work distinguishes within *Arthrodesmus* (= *Staurodesmus*) *quiriferus* a new taxon — var. *minus*. Unfortunately, he does not give any drawing or more detailed description. Encountered specimens might be treated as representatives of this taxon.

Lg. 11.5-14.9 μm , br. 10.3-13.8 μm , isth. 4.6-5.7 μm , sp. 3.4-8.0 μm , th. 3.4-5.7 μm , lg.: br. 1.00-1.20 $\times$.

Occur.: 4c, 6c.

Staurodesmus ralfsii (W. West) comb. nov.

Basion.: *Arthrodesmus ralfsii* W. West (1892), A contribution to the freshwater algae of West Ireland, J. Linn. Soc. Bot., 29, p. 168.

var. *ralfsii*, morpha (Plate 13, Fig. 22)

I think the present taxon should be treated as an unit of the species rank, given it by W. West and not as a variety of *Std. incus* according to Teiling (1967)

In the specimens encountered semicells are trapeziform, their sides are convergent, apices convex, spines short slightly divergent. Size and setting of spines differ from those in the drawings of this taxon in work of West, West (1912). The shape of specimens encountered totally agrees with a drawing of *Arthrodesmus incus* (Bréb.) Hass. ex Ralfs f. Ralfs from Turner's (1892) (Plate 12, Fig. 6a). Teiling (1967) considers this taxon as a synonym of *Staurodesmus* (= *Arthrodesmus*) *incus*

var. *ralfsii*. However, West, West (1912) do not quote Turner's work in the lists of synonyms of *Arthrodesmus incus* (Bréb.) Hass. ex Ralfs var. *ralfsii* W. et G. S. West. Cells also fit the drawing of *Arthrodesmus incus* f. *isthmosa* Heimerl with short spines given by Huber-Pestalozzi (1928; Plate 13, Fig. 2).

Lg. 16.1-18.4 μm , br. 12.6-14.9 μm , isth. 5.7-6.9 μm , sp. 3.4-8.0 μm , lg.: br. 1.23-1.28 $\times$.

Occur.: 6rr.

Staurodesmus spencerianus (Mask.) Teil.

var. *spencerianus* (Plate 13, Fig. 24-25)

a) Typical specimens, their character agrees with data from relevant literature (Plate 13, Fig. 24)

Lg. 17.2-23.0 μm , br. 16.1-20.7 μm , isth. 6.9 μm , sp. 8.0-9.2 μm , lg.: br. 1.06-1.11 $\times$.

Occur.: 2rr, 3rr, 4c, 5rrr, 6cc, 7rrr, 8cc, 9rr.

b) morpha (Plate 13, Fig. 25)

Individuals differ from typical specimens in longer and parallel spines. Cells shape similar to that described by Krieger (1933a; Plate 14, Fig. 11) as *Staurostrum dejectum* Bréb. ex Bréb., form and which has been described by Teiling (1967) as *Std. spencerianus* — typical variety. If compared, in specimens encountered sides and apices are more convex.

Lg. 20.7 μm , br. 18.4-19.5 μm , isth. 5.7-6.9 μm , sp. 11.5-13.8 μm , lg.: br. 1.06-1.12 $\times$.

Occur.: 8rr.

Staurodesmus triangularis (Lagerh.) Teil.

In the area studied the species is highly morphologically varied. The following taxa and morphological groups have been distinguished: morpha (Plate 13, Fig. 26)

Cells small, with markedly elongated isthmus and convergent spines. A shape of specimens close to that in drawings of *Arthrodesmus* (= *Staurodesmus*) *triangularis* Lagerh. in Ružička's (1972) work. They differ from it in elongated isthmus. Isthmus shape resembles that of *Std. cuspidatus* (Bréb. ex Bréb.) Teil., but encountered specimens are smaller with concave apices and semicells triangular in face view.

Lg. 12.6-13.8 μm , br. 11.5 μm , isth. 3.4 μm , sp. 4.6-6.9 μm , lg.: br. 1.10-1.20 $\times$.

Occur.: 7rr, 8rrr, 9rrr.

var. *triangularis* (Plate 13, Fig. 27-29)

a) Cells fit the described specimens of typical variety with the exception of spines shorter than those given by: West, West (1912), Teiling (1967), Thomasson (1973), and Lenzenweger (1974) (Plate 13, Fig. 27-28).

Lg. 18.4-21.8 μm , br. 16.1-20.7 μm , isth. 4.6-6.9 μm , sp. 6.9-8.0 μm , th. 6.9 μm , lg.: br. 1.05-1.14 $\times$.

Occur.: 2rrr, 7rrr, 9rr.

b) morpha (Plate 13, Fig. 29)

Cells small, without elongated isthmus part. Their size slightly above upper limit of dimensions given by Teiling (1967) for *Std. triangularis, formae minores*.

Lg. 12.6-13.8 μm , br. 11.5-13.8 μm , isth. 4.6 μm , sp. 4.6-5.7 μm , lg.: br. 1.00-1.10 $\times$.

Occur.: 6rrr, 7rr.

var. *subhexagonus* (W. et G. S. West) Teil. (Plate 13, Fig. 30)

Lg. 11.5-16.1 μm , br. 10.3-14.9 μm , isth. 4.6-6.9 μm , sp. 2.3-3.4 μm , th. 5.7-6.9 μm , lg.: br. 1.08-1.22 $\times$.

Occur.: 2rrr.

Genus: *Cosmoastrum* Palamar-Mordvintseva 1976

Cosmoastrum alternans (Bréb.) Pal.-Mordv.

var. *alternans* (Plate 13, Fig. 38)

Specimens with straight apices, widely open sinus and densely granulate cell wall. They fit drawings in works of: Grönblad (1960), Grönblad, Croasdale (1971) and Růžička (1973a).

Lg. 21.8-25.3 μm , br. 24.1-27.6 μm , isth. 9.2-10.3 μm , lg.: br. 0.86-0.95 $\times$.

Occur.: 7rrr, 9rrr.

Cosmoastrum brebissonii (Arch.) Pal.-Mordv.

var. *brebissonii* (Plate 13, Fig. 40)

Lg. 32.2-48.3 μm , br. 32.2-46.0 μm , isth. 11.5-13.8 μm , sp. 2.3-3.4 μm , lg.: br. 1.00-1.07 $\times$.

Occur.: 1rrr, 7rrr, 9rrr.

Cosmoastrum gladiusum (Turn.) Pal.-Mordv.

var. *gladiusum* (Plate 13, Fig. 41)

Lg. 33.3-35.6 μm , br. 28.7-31.0 μm , isth. 9.2-11.5 μm , sp. 4.6-5.7 μm , lg.: br. 1.11-1.15 $\times$.

Occur.: 2rrr, 8rrr, 9rrr.

Cosmoastrum hirsutum (Ehrenb. ex Bréb.) Pal.-Mordv.

var. *hirsutum* (Plate 13, Fig. 37)

Lg. 34.5-41.4 μm , br. 27.6-33.3 μm , isth. 8.0-13.8 μm , sp. 1.1-2.3 μm , lg.: br. 1.15-1.28 $\times$.

Occur.: 1rrr, 2rrr, 3rrr, 4r, 5rr, 6r, 7rrr, 8rr, 9rr.

Cosmoastrum hystrix (Ralfs) Pal.-Mordv.

var. *pannonicum* (Lütkem.) comb. nov. (Plate 14, Fig. 9)

Basion.: *Stauroastrum hystrix* Ralfs var. *pannonicum* Lütkemüller (1900), Desmidiaceen aus der Umgebung des Millstättersees in Kärnten, Verh. k. k. zool.-bot. Ges. Wien, 50, p. 80, pl. 1: 52-53.

Spines longer less curved, besides it fits Grönblad's (1920) drawing.

Lg. 21.8-25.3 μm , br. 18.4-23.0 μm , isth. 9.2 μm , sp. 5.7 μm , lg.: br. 1.10-1.18 $\times$.

Occur.: 1rrr, 2rrr, 3rrr, 6rrr.

Cosmoastrum lapponicum (Schmidle) Pal.-Mordv. comb. nov.

Basion.: *Stauroastrum punctulatum* Bréb. var. *muricatiforme* Schmidle f. *lapponica* Schmidle (1898), Über einige von Knut Bohlin in Pite Lappmark und Vesterbotten gesammelten Süßwasseralgen, Bih. K. Sv. Vet. Akad. Handl., 24, p. 57, pl. 3: 5.

Cosmoastrum lapponicum (Schmidle) Palamar-Mordvintseva 1982, p. 94 and 579; combination not validly published, Art. 33 Int. Code.

var. *lapponicum* (Plate 13, Fig. 46)

Lg. 31.0-33.3 μm , br. 32.2 μm , isth. 9.2-11.5 μm , lg.: br. 0.96-1.03 $\times$.

Occur.: 4rrr, 9rrr.

Cosmoastrum muricatiforme (Schmidle) comb. nov.

Basion.: *Stauroastrum muricatiforme* Schmidle (1895), Beiträge zur alpinen Algenflora, Österr. bot. Zeitschr., 45, p. 162, pl. 16: 14-15.

var. *muricatiforme* (Plate 13, Fig. 35)

A shape of specimens and cell wall sculpture agree with description of this taxon in works of: Migula (1907) and West, West (1912), but totally differs from that of Hirano (1968). Size of most individuals exceeds dimension upper limit given in the above-mentioned works. They fit specimens described by Růžička (1954).

I think that species rank given by Schmidle (1895; after West, West 1912) should be maintained. It may be also treated as a variety of *Cosmoastrum* (= *Stauroastrum*) *muricatum*. It definitely should not be considered as a variety of *Cosmoastrum* (= *Stauroastrum*) *punctulatum*, some years after taxon description Schmidle (1898; after West, West 1912) affiliated it in this way.

Both taxa differ morphologically:

1) In *Cos. muricatiforme* semicells are elliptic to nearly semicircular, in *Cos. punctulatum* — nearly rhomboid-elliptic;

2) Sinus open in both taxa, but in *Cos. muricatiforme* acute-angle of 10-30°, while in *Cos. punctulatum* — of about 70°;

3) In *Cos. muricatiforme* cell wall is coarsely granulate, in *Cos. punctulatum* — finely granulate.

Lg. 34.5-50.6 μm , br. 29.9-43.7 μm , isth. 9.2-16.1 μm , lg.: br. 1.05-1.31 $\times$.

Occur.: 1c, 2rr, 3rr, 4c, 5r, 6rr, 7rrr, 8rr, 9rrr.

Cosmoastrum muricatum (Bréb. ex Ralfs) Pal.-Mordv.

var. *muricatum* (Plate 13, Fig. 36)

Förster (1970) classifies the taxon present as a variety of *Staurastrum hirsutum* Ehrenb. ex Bréb.

Lg. 39.1-48.3 μm , br. 32.2-43.7 μm , isth. 11.5-16.1 μm , lg.: br. 1.06-1.29 $\times$.

Occur.: 1rrr, 2rrr, 3rrr, 4r, 5r, 6r, 7rrr, 8r, 9rrr.

Cosmoastrum muticum (Bréb. ex Bréb.) Pal.-Mordv.

Basion.: *Stauroastrum muticum* Bréb. ex Brébisson in Ralfs (1848), The British Desmidiaceae, London, p. 125, pl. 21: 4.

var. *muticum* (Plate 13, Fig. 31)

Lg. 20.7-21.8 μm , br. 20.7-23.0 μm , isth. 5.7-6.9 μm , lg.: br. 0.95-1.00 $\times$.

Occur.: 7rrr.

Cosmoastrum orbiculare (Ralfs ex Ralfs) Pal.-Mordv. comb. nov.

Basion.: *Stauroastrum orbiculare* Ralfs ex Ralfs (1848), The British Desmidiaceae, London, p. 125, pl. 21: 5.

Cosmoastrum orbiculare (Ralfs) Palamar-Mordvintseva 1982, p. 83 and 577; combination not validly published, Art. 33 Int. Code.

var. *depressum* (Roy et Biss.) Pal.-Mordv. (Plate 13, Fig. 33)

Cells less flattened than those described in the relevant literature.

Lg. 26.4 μm , br. 24.1 μm , isth. 6.9-8.0 μm , lg.: br. 1.10 $\times$.

Occur.: 7rrr, 9rrr.

Cosmoastrum punctulatum (Bréb.) Pal.-Mordv.

var. *punctulatum* (Plate 13, Fig. 44)

Lg. 25.3-29.9 μm , br. 23.0-27.6 μm , isth. 9.2-11.5 μm , lg.: br. 1.04-1.18 $\times$.

Occur.: 3c, 6cc, 7rrr, 9rrr.

var. *kjellmanii* (Wille) Pal.-Mordv. (Plate 13, Fig. 45)

Basion.: *Stauroastrum kjellmanii* Wille (1879), Ferskvandsalger fra Novaja Semlja samlede af Dr F. Kjellman paa Nordenskiölds Expedition 1875, Öfvers. K. Vet.-Akad. Förh., 5, p. 50, pl. 13: 50-53.

Plate 13

Fig. 1. *Staurodesmus incus* var. *incus* f. *incus*. Fig. 2. *Std. incus* var. *incus* f. *minor*. Fig. 3-4. ? *Std. quiriferus*, morpha. Fig. 5. *Std. glabrus* var. *debaryanus*. Fig. 6. *Std. glabrus* var. *debaryanus*, morpha. Fig. 7. *Std. glabrus* var. *glabrus*. Fig. 8. *Std. glabrus* var. *limnophilus*. Fig. 9. *Std. extensus*, morpha 1. Fig. 10. *Std. extensus*, morpha 2. Fig. 11. *Std. extensus* var. *extensus*. Fig. 12. *Std. extensus* var. *retusus*. Fig. 13. *Std. extensus* var. *vulgaris*. Fig. 14. *Std. extensus* (reduced form). Fig. 15-17. *Std. isthmus* var. *isthmus*. Fig. 18. *Std. dickiei* var. *dickiei*. Fig. 19. *Std. dickiei* var. *rhomboides*. Fig. 20. *Std. mucronatus* var. *mucronatus*. Fig. 21. *Std. mucronatus* var. *subtriangularis*. Fig. 22. *Std. ralfsii* var. *ralfsii*, morpha. Fig. 23. ? *Std. indentatus*, morpha. Fig. 24. *Std. spencerianus* var. *spencerianus*. Fig. 25. *Std. spencerianus* var. *spencerianus*, morpha. Fig. 26. *Std. triangularis*, morpha. Fig. 27-28. *Std. triangularis* var. *triangularis*. Fig. 29. *Std. triangularis* var. *triangularis*, morpha. Fig. 30. *Std. triangularis* var. *subhexagonus*. Fig. 31. *Cosmoastrum muticum* var. *muticum*. Fig. 32. *Cos. wellipticum* var. *wellipticum*. Fig. 33. *Cos. orbiculare* var. *depressum*. Fig. 34. *Cos. turgescens* var. *sparsigranulatum*. Fig. 35. *Cos. muricatiforme* var. *muricatiforme*. Fig. 36. *Cos. muricatum* var. *muricatum*. Fig. 37. *Cos. hirsutum* var. *hirsutum*. Fig. 38. *Cos. alternans* var. *alternans*. Fig. 39. *Cos. scabrum* var. *scabrum*. Fig. 40. *Cos. brebissonii* var. *brebissonii*. Fig. 41. *Cos. gladiosum* var. *gladiosum*. Fig. 42. *Cos. teliferum* var. *teliferum*. Fig. 43. *Cos. teliferum* var. *pecten*. Fig. 44. *Cos. punctulatum* var. *punctulatum*. Fig. 45. *Cos. punctulatum* var. *kjellmanii*. Fig. 46. *Cos. lapponicum* var. *lapponicum*. Fig. 47. *Raphidiastrum avicula* var. *avicula*, morpha

PLATE 13

20 μm

Lg. 25.3-32.2 μm , br. 18.4-25.3 μm , isth. 9.2-12.6 μm , lg.: br. 1.20-1.44 $\times$.

Occur.: 1rrr, 2rrr, 4rrr, 8rrr.

Cosmoastrum scabrum (Bréb.) Pal.-Mordv.

var. *scabrum* (Plate 13, Fig. 39)

Lg. 33.3-35.6 μm , br. 31.0-32.2 μm , isth. 11.5-14.9 μm , lg.: br. 1.07-1.15 $\times$.

Occur.: 2rrr, 3rrr, 6rrr, 7rrr, 8rrr, 9rrr.

Cosmoastrum setigerum (Cleve) Pal.-Mordv.

var. *setigerum*, morpha (Plate 14, Fig. 1)

Angular spines only slightly longer and more massive than the others. Similar individuals are described by Scott, Prescott (1961).

Lg. 43.7-48.3 μm , br. 41.4-43.7 μm , isth. 13.8-16.1 μm , ang. sp. 9.2-10.3 μm , sp. 8.0-9.2 μm , lg.: br. 1.06-1.07 $\times$.

Occur.: 7rrr, 9rrr.

Cosmoastrum teliferum (Ralfs) Pal.-Mordv.

var. *teliferum* (Plate 13, Fig. 42)

Lg. 39.1-41.4 μm , br. 34.5-37.9 μm , isth. 12.6-14.9 μm , sp. 5.7-6.9 μm , lg.: br. 1.06-1.13 $\times$.

Occur.: 2rrr, 7rrr, 8rr, 9rrr.

var. *pecten* (Perty) comb. nov. (Plate, 13, Fig. 43)

Basion.: *Phycastrum pecten* Perty (1852), Zur Kenntniss kleinster Lebensformen nach Bau, Funktionen, Systematik, mit Specialverzeichnis der in der Schweiz beobachteten, Bern, p. 210, pl. 16: 32.

Specimens fit some of Grönblad's (1945) drawings (Plate 14, Fig. 295), but differ from other (Plate 14, Fig. 294) and from those of Förster (1972). In the specimens encountered cell sides are more rounded in a frontal view.

Lg. 21.8-23.0 μm , br. 18.4-19.5 μm , isth. 6.9 μm , sp. 2.3 μm , lg.: br. 1.18-1.25 $\times$.

Occur.: 7c, 9r.

Cosmoastrum turgescens (De Not.) Pal.-Mordv.

var. *sparsigranulatum* (Scott et Grönbl.) comb. nov. (Plate 13, Fig. 34)

Basion.: *Stauroastrum turgescens* De Not. var. *sparsigranulatum* Scott et Grönblad (1957), New and interesting Desmids from the Southeastern United States, Acta Soc. Scien. Fenn., Nov. Ser. B., 2, 8, p. 48, pl. 25: 8.

Cells smaller than those described by Scott, Grönblad (1957), but they fit some specimens found by Förster (1970).

Lg. 24.1-25.3 μm , br. 23.0 μm , isth. 9.2-10.3 μm , lg.: br. 1.05-1.10 $\times$.

Occur.: 2rrr.

Cosmoastrum wellipticum (Wille) comb. nov. et nom. nov.

Basion.: *Stauroastrum bieneanum* Rabenh. var. *ellipticum* Wille (1879), Ferskvandsalger fra Novaja Semlja samlede af Dr F. Kjellman paa Nor-

denskiölds Expedition 1875, Öfvers K. Vet.-Akad. Förh., 5 p. 50, pl. 13: 49.

var. *wellicpticum* (Plate 13, Fig. 32)

Lg. 32.2-36.8 μm , br. 31.0-33.3 μm , isth. 9.2-11.5 μm , lg.: br. 0.97-1.14 $\times$.

Occur.: 7rrr, 8rrr, 9rrr.

Genus: *Raphidiastrum* (Turner) Palamar-Mordvintseva 1976

Raphidiastrum avicula (Bréb.) Pal.-Mordv.

var. *avicula*, morpha (Plate 13, Fig. 47)

Cells shape and length-breadth ratio differ from those of var. *avicula* given by West et al. (1923), Hirano (1959b, 1969), Förster (1970) and Coesel (1979b), but they agree with those of var. *subarcuatum* (Wolle) Pal.-Mordv. Grönblad (1948) stresses an important taxonomical character differentiating both mentioned above taxa i.e. cell wall sculpture, which has been omitted in the work of West et al. (1923). In var. *avicula* it is markedly granulate, in var. *subarcuatum* — verrucose.

In the encountered specimens the cell wall was granulate. Therefore, in spite of differences they were classified as var. *avicula*. Found individuals fit drawings of var. *avicula* in works of: Migula (1907, 1911), Thomasson (1972) and Růžička (1973a).

Lg. 23.0-24.1 μm , br. 25.3 μm , isth. 6.9-8.0 μm , sp. 3.4-4.6 μm , lg.: br. 0.91-0.95 $\times$.

Occur.: 7rrr.

Raphidiastrum denticulatum (Näg.) Pal.-Mordv.

var. *denticulatum* (Plate 14, Fig. 10)

The specimens smaller than those described by Migula (1907, 1911), Gutwiński (1909), West et al. (1923) and Hirano (1959b),

Lg. 20.7-23.0 μm , br. 20.7-23.0 μm , isth. 6.9-9.2 μm , sp. 2.3 μm , lg.: br. 0.95-1.00 $\times$.

Occur.: 4rrr, 8rrr, 9rrr.

Raphidiastrum granulosum (Ehrenb. ex Ralfs) Pal.-Mordv.

var. *granulosum* (Plate 14, Fig. 8)

Cell wall sculpture slightly differs from that in the drawing of West, West (1912). Each angle only with four rows of concentric granules.

Lg. 28.7-29.9 μm , br. 26.4-27.6 μm , isth. 9.2-10.3 μm , sp. 1.1-2.3 μm , lg.: br. 1.08-1.09 $\times$.

Occur.: 6rrr.

Raphidiastrum lunatum (Ralfs) Pal.-Mordv.

var. *lunatum* (Plate 14, Fig. 7)

Lg. 34.5-40.2 μm , br. 34.5-42.5 μm , isth. 13.8-14.9 μm , sp. 3.4-4.6 μm , lg.: br. 0.95-1.00 $\times$.

Occur.: 7rrr, 9rrr.

Raphidiastrum simonyi (Heimerl) Pal.-Mordv.

var. *simonyi* (Plate 14, Fig. 2)

Lg. 19.5-25.3 μm , br. 17.2-23.0 μm , isth. 6.9-9.2 μm , sp. 2.3 μm , lg.: br. 1.00-1.16 $\times$.

Occur.: 1rrr, 2rrr, 3rrr, 4c, 5rrr, 6c, 8rrr, 9rrr.

Genus: *Staurastrum* Meyen ex Ralfs emend. Palamar-Mordvintseva 1976

Staurastrum aciculiferum (W. West) Anderss.

var. *pulchrum* (W. et G. S. West) Först. (Plate 14, Fig. 3-4)

a) Specimens agree with those described in the literature. (Plate 14, Fig. 3)

Lg. 24.1-26.4 μm , br. 20.7-23.0 μm , br. with pr. 26.4-32.2 μm , isth. 9.2-10.3 μm , lg.: br. 1.11-1.16 $\times$.

Occur.: 1rrr, 2rrr, 4rrr, 5rrr.

b) morpha (Plate 14, Fig. 4)

Cell shape slightly differs from that of encountered typical specimens, as well as from those given by West et al. (1923) and Wysocka (1934). Processes are somewhat divergent, located at the upper angle, apices in most specimens slightly convex. The drawings of similar individuals, but belonging to different taxa, have been found in works of: West et al. (1923; Plate 154, Fig. 11) — ?? *St. monticulosum* Bréb. ex Ralfs, Lind (1967) — *St. subavicula* W. et G. S. West, Förster (1970) — *St. aciculiferum* var. *pulchrum*, and Thomasson, Tyler (1971; Fig. 10j) — ? *St. aciculiferum*.

I think that most of characters of the specimens found are in common with those of *St. aciculiferum* (= *St. monticulosum*) var. *pulchrum*, therefore they were so classified.

Lg. 23.0-28.7 μm , br. 20.7-25.3 μm , br. with pr. 28.7-37.9 μm , isth. 8.0-9.2 μm , lg.: br. 1.00-1.13 $\times$.

Occur.: 1rrr, 2rrr, 3rrr, 4c, 5rr, 6cc, 8rrr, 9rrr.

Staurastrum anatinum Cooke et Wills, morpha (Plate 14, Fig. 16)

An appearance of the specimens encountered is most close to the drawing of a small form of *St. anatinum* from the work of West et al. (1923; Plate 147, Fig. 1). Semicells are more cup-shaped. Their shape agrees more with that of var. *pelagicum* W. et G. S. West also given in the work of West et al. (1923). In the specimens encountered only one row of inner emarginate verrucae was observed. It is clearly visible in a vertical view of semicells and agrees with drawings of a small form of *St. anatinum* and not those of var. *pelagicum*.

Lg. 37.9-39.1 μm , br. 25.3-29.9 μm , br. with pr. 80.5-82.8 μm , isth. 12.6 μm , lg.: br. with pr. 0.47 $\times$.

Occur.: 8rrr, 9rrr.

Staurostrum brachiatum Ralfs

var. *brachiatum* (Plate 14, Fig. 17-18)

a) Typical specimens, their characters agree with those given in the relevant literature (Plate 14, Fig. 17).

Lg. 16.1-18.4 μm , br. with pr. 25.3-32.2 μm , isth. 5.7-9.2 μm , lg.: br. with pr. 0.50-0.67 $\times$.

Occur.: 2rrr 6cc, 8rr, 9rrr.

b) *morpha* (Plate 14, Fig. 18)

Cells of an average size, sinus acute-angled, sides nearly straight, apices convex, processes slightly divergent — bifid at the end ultimate divisions bluntly rounded. In a vertical view cells 3-4-angular, sides concave processes narrowing. Thomasson (1963) gives a photograph of a similar specimen.

Morpha cells shape markedly differs from that of typical specimens. West et al. (1923) stress high variation of individual morphology in var. *brachiatum*. It is possible that the specimens described as *morpha* constitute some ecological type of var. *brachiatum*.

Lg. 20.7-27.6 μm , br. with pr. 32.2-50.6 μm , isth. 10.3-13.8 μm , lg.: br. with pr. 0.54-0.64 $\times$.

Occur.: 7rrr, 9rrr.

Staurostrum controversum Bréb. ex Bréb.

var. *controversum* (Plate 15, Fig. 6)

Specimens agree with those given by Hirano (1959b) and Wasylik (1961a), but from those of West et al. (1923) and Růžička (1973a) differ in smaller number of bifurcate spines.

Lg. 23.0-27.6 μm , br. with pr. 34.5-41.4 μm , isth. 9.2-11.5 μm , lg.: br. with pr. 0.56-0.73 $\times$.

Occur.: 4rrr.

Staurostrum furcatum (Ehrenb. ex Ralfs) Bréb.

var. *furcatum* f. *furcatum* (Plate 14, Fig. 5)

Cell shape and dimensions of some individuals agree with those in the description and drawing of *St. pseudofurcigerum* Reinsch f. *minor* nob. in the Eichler's work (1896; Plate 4, Fig. 54). In my opinion this taxon should be considered as a synonym of *Staurostrum furcatum*.

Lg. 20.7-27.6 μm , lg. with pr. 25.3-34.5 μm , br. 16.1-25.3 μm , br. with pr. 24.1-32.2 μm , isth. 6.9-11.5 μm , lg. with pr.: br. with pr. 1.00-1.08 $\times$.

Occur.: 1rrr, 2rrr, 4r, 5rrr, 6r, 8rrr, 9rrr.

f. *spinosum* (Bréb.) Nordst. (Plate 14, Fig. 6)

Lateral processes more massive than apical, other characters close to those in the drawings of Grönblad (1920) and Hirano (1959b). West et al. (1923) include *Staurostrum spinosum* Bréb. in synonyms of typical variety of *Staurostrum furcatum*.

Lg. 25.3-27.6 μm , lg. with pr. 34.5-36.8 μm , br. 20.7 μm , br with pr. 34.5-36.8 μm , isth. 9.2-11.5 μm , lg. with pr.: br. with pr. 1.00 $\times$.

Occur.: 7rrr, 9rrr.

Staurostrum hexacerum (Ehrenb. ex Kütz.) Wittr.

var. *hexacerum* (Plate 15, Fig. 4)

Lg. 23.0-25.3 μm , br. with pr. 27.6-29.9 μm , isth. 6.9-9.2 μm , lg.: br. with pr. 0.81-0.85 $\times$.

Occur.: 6rrr, 7rrr, 8rrr, 9rrr.

Staurostrum inflexum Bréb.

var. *inflexum* (Plate 15, Fig. 5)

In a vertical view semicells quadrangular.

Lg. 21.8 μm , br. 12.6-14.9 μm , br. with pr. 26.4-27.6 μm , isth. 5.7-8.0 μm , lg.: br. with pr. 0.79-0.83 $\times$.

Occur.: 7rrr, 9rr.

Staurostrum margaritaceum (Ehrenb.) Menegh. ex Ralfs

var. *margaritaceum* (Plate 14, Fig. 19-20)

Mostly semicells in a vertical view 4-angular, rarely — 3-5-6-angular.

Lg. 24.1-32.2 μm , br. with pr. 21.8-29.9 μm , isth. 6.9-9.2 μm , lg.: br with pr. 1.00-1.29 $\times$.

Occur.: 1r, 2rr, 3rrr, 4cc, 5r, 6rr, 7rrr, 8r, 9rr.

Staurostrum oxyacanthum Arch.

var. *oxyacanthum* (Plate 15, Fig. 7)

Lg. 27.6-33.3 μm , br. with pr. 39.1-41.4 μm , isth. 10.3-11.5 μm , lg.: br. with pr. 0.71-0.81 $\times$.

Occur.: 7rrr, 9rrr.

Staurostrum paradoxum Meyen ex Ralfs

var. *paradoxum* (Plate 14, Fig. 12-15)

The specimens encountered highly vary morphologically. Three groups may be distinguished amongst them:

a) Individuals with cuneate semicells, in a vertical view 4-angular. They fit the drawing of West et al. (1923; Plate 145, Fig. 1) and of Ito (1966b), (Plate 14, Fig. 12)

Plate 14

Fig. 1. *Cosmoastrum setigerum* var. *setigerum*, morpha. Fig. 2. *Raphidiastrum simonyi* var. *simonyi*. Fig. 3. *Staurostrum aciculiferum* var. *pulchrum*. Fig. 4. *St. aciculiferum* var. *pulchrum*, morpha. Fig. 5. *St. furcatum* var. *furcatum* f. *furcatum*. Fig. 6. *St. furcatum* var. *furcatum* f. *spinosum*. Fig. 7. *Raphidiastrum lunatum* var. *lunatum*. Fig. 8. *Raph. granulosum* var. *granulosum*. Fig. 9. *Cosmoastrum hystrix* var. *pannonicum*. Fig. 10. *Raphidiastrum denticulatum* var. *denticulatum*. Fig. 11. *Staurostrum proboscideum* var. *proboscideum*. Fig. 12-15. *St. paradoxum* var. *paradoxum*. Fig. 16. *St. anatinum*, morpha. Fig. 17. *St. brachiatum* var. *brachiatum*. Fig. 18. *St. brachiatum* var. *brachiatum*, morpha. Fig. 19-20. *St. margaritaceum* var. *margaritaceum*. Fig. 21. *St. pseudotetracerum* var. *pseudotetracerum*. Fig. 22. *St. tetracerum* var. *tetracerum* fac. 2. Fig. 23. *St. tetracerum* var. *tetracerum* fac. 3. Fig. 24. *St. polymorphum* var. *polymorphum*

20 μm

Lg. 27.6-29.9 μm , br. with pr. 41.4-44.8 μm , isth. 9.2-11.5 μm , lg.: br. with pr. 0.62-0.72 $\times$.

Occur.: 4rrr, 9rrr.

b) Semicells cup-shaped, in a vertical view triangular. Processes of a variable length, a row of short spines on each lateral margin terminated in 3 long spines. They fit a drawing of West et al. (1923; Plate 145, Fig. 4), (Plate 14, Fig. 13-14)

Lg. 23.0-29.9 μm , br. with pr. 32.2-49.4 μm , isth. 8.0-10.3 μm , lg.: br. with pr. 0.58-0.75 $\times$.

Occur.: 2rr, 4rrr, 5rrr, 6rrr, 7rrr, 8r, 9rr.

c) Cells small. Processes narrow, markedly divergent. A shape of specimens agrees with a drawing of West et al. (1923; Plate 145, Fig. 2), (Plate 14, Fig. 15)

Lg. 17.2-20.7 μm , br. with pr. 35.6-40.2 μm , isth. 5.7-8.0 μm , lg.: br. with pr. 0.47-0.55 $\times$.

Occur.: 4r.

Staurastrum polymorphum Bréb.

var. *polymorphum* (Plate 14, Fig. 24)

Lg. 23.0-29.9 μm , br. with pr. 24.1-36.8 μm , isth. 8.0-11.5 μm , lg.: br. with pr. 0.75-1.00 $\times$.

Occur.: 1rrr, 2rrr, 3rrr, 4cc, 5rr, 6cc, 7rrr, 8rrr, 9rrr.

Staurastrum proboscideum (Bréb.) Arch.

var. *proboscideum* (Plate 14, Fig. 11)

Lg. 34.5-39.1 μm , br. with pr. 33.3-39.1 μm , isth. 11.5-13.8 μm , lg.: br. with pr. 1.00-1.06 $\times$.

Occur.: 2rrr, 4rrr, 6rrr, 7r, 8rr, 9rr.

Staurastrum pseudotetracerum (Nordst.) W. et G. S. West

var. *pseudotetracerum* (Plate 14, Fig. 21)

Cell wall smooth. Specimens found by Grönblad (1948) and Grönblad et al. (1964) also have a smooth cell wall, but their processes are longer.

Lg. 12.6-18.4 μm , br. 8.0-11.5 μm , br. with pr. 19.5-27.6 μm , isth. 4.6-6.9 μm , lg.: br. with pr. 0.65-0.72 $\times$.

Occur.: 7c.

Staurastrum sexcostatum Bréb. ex Bréb.

var. *productum* W. West (Plate 15, Fig. 3)

Lg. 35.6-39.1 μm , br. with pr. 40.2-43.7 μm , isth. 13.8-16.1 μm , lg.: br. with pr. 0.89-0.94 $\times$.

Occur.: 8rrr, 9rrr.

Staurastrum tetracerum (Kütz.) Ralfs ex Ralfs

var. *tetracerum* (Plate 14, Fig. 22-23)

a) fac. 2 (Plate 14, Fig. 22)

Lg. 9.2-10.3 μm , br. with pr. 26.4-27.6 μm , isth. 4.6 μm , lg.: br. with pr. 0.35-0.37 $\times$.

Occur.: 7rrr, 9rrr.

b) fac. 3 (Plate 14, Fig. 23)

Lg. 10.3-11.5 μm , br. with pr. 20.7-21.8 μm , isth. 5.7-6.9 μm , lg.: br. with pr. 0.50-0.56 $\times$.

Occur.: 7r, 8rrr, 9rr.

Staurostrum vestitum Ralfs

var. *vestitum* (Plate 15, Fig. 1)

Semicells cup-shaped. They fit the description of West et al. (1923; Plate 151, Fig. 9-10)

Lg. 32.3-39.1 μm , br. 27.6-36.8 μm , br. with pr. 59.8-82.8 μm , isth. 11.5-16.1 μm , lg.: br. with pr. 0.45-0.62 $\times$.

Occur.: 2rr, 3rrr, 4r, 5rrr, 6c, 7rrr, 8rrr, 9rrr.

var. *splendidum* Grönb. (Plate 15, Fig. 2)

Lg. 34.5-37.9 μm , br. with pr. 64.4-69.0 μm , isth. 13.8-17.2 μm , lg.: br. with pr. 0.53-0.55 $\times$.

Occur.: 5rrr, 6rrr, 7rrr, 8rrr, 9rrr.

Genus: **Bambusina** Kützing 1845 nom. cons.

Bambusina brebissonii Kütz. ex Kütz.

var. *brebissonii* (Plate 15, Fig. 8-10)

a) Cells rather slender. Cell wall sometimes striated (Plate 15, Fig. 10). They fit a description of the typical taxon, (Plate 15, Fig. 9-10)

Lg. 21.8-28.7 μm , br. max. 16.1-20.7 μm , isth. 13.8-19.5 μm , ap. 11.5-13.8 μm , th. 18.4 μm , lg.: br. 1.22-1.43 $\times$.

Occur.: 1cc, 2r, 3r, 4cc, 5rr, 6cc, 7rrr, 8r, 9rrr.

b) Cells stout, relatively shorter than those described above. (Plate 15, Fig. 8)

Lg. 21.8-27.6 μm , br. max. 21.8-23.0 μm , isth. 18.4-21.8 μm , ap. 13.8-16.1 μm , lg.: br. 1.00-1.11 $\times$.

Occur.: 4rrr, 6rrr.

var. *gracilescens* (Nordst.) Wolle (Plate 15, Fig. 11-12)

Lg. 20.7-23.0 μm , br. max. 12.6-14.9 μm , isth. 11.5-13.8 μm , ap. 8.0-11.5 μm , lg.: br. 1.46-1.64 $\times$; zygospor. lg. 34.5 μm , br. 18.4 μm .

Occur.: 2rrr, 4rrr.

Genus: **Desmidium** Agardh ex Ralfs 1848

Desmidium cylindricum Grev. ex Nordst.

var. *cylindricum* (Plate 15, Fig. 13)

Lg. 23.0-27.6 μm , br. 39.1-50.6 μm , isth. 33.3-46.0 μm , ap. 26.4-35.6 μm , th. 28.7 μm , lg.: br. 0.48-0.71 $\times$.

Occur.: 4rrr, 7rrr, 9rrr.

Desmidiium swartzii (Ag.) Ag. ex Ralfs

var. *swartzii* (Plate 15, Fig. 14)

Lg. 13.8-19.5 μm br. 35.6-39.1 μm , isth. 28.7-32.2 μm , lg.: br. 0.35-0.53 $\times$.

Occur.: 7rrr, 9rrr.

Genus: *Hyalotheca* Ehrenberg ex Ralfs 1848

Hyalotheca dissiliens J. E. Smith ex Bréb.

var. *dissiliens* (Plate 15, Fig. 18-20)

My and Růžička's (1972) observations indicate high range of cell dimensions.

Cells without papillae in vertical view (fac. *circularis* — Plate 15, Fig. 18), as well as with three small equidistant papillae (fac. *tridentula* — Plate 15, Fig. 19). Sometimes filaments enclosed in a wide gelatinous sheath (Plate 15, Fig. 20).

Lg. 12.6-23.0 μm , br. 18.4-34.5 μm , isth. 17.2-31.0 μm , lg.: br. 0.62-0.88 $\times$.

Occur.: 1rrr, 2rrr, 4r, 5rrr, 6c, 7rrr, 8rrr, 9rrr.

var. *minor* Delp. (Plate 15, Fig. 22-23)

Cells in vertical view circular — fac. *circularis* (Plate 15, Fig. 22), or with two opposite papillae fac. *bidentula* (Plate 15, Fig. 23)

Lg. 16.1-17.2 μm , br. 16.1-18.4 μm , isth. 14.9-16.1 μm , lg.: br. 0.93-1.00 $\times$.

Occur.: 1rrr, 2rrr, 3rrr, 4rrr, 6rrr, 7rrr, 8rrr, 9rrr.

var. *tatica* Racib. (Plate 15, Fig. 21)

Lg. 18.4-19.5 μm , br. 17.2-19.5 μm , isth. 16.1 μm , lg.: br. 1.00-1.07 $\times$.

Occur.: 2r.

? *Hyalotheca indica* Turn.

var. *indica*, morpha (Plate 15, Fig. 24)

Cells bigger, excavation at the joints more visible than described by Turner (1892), West et al. (1923), Hirano (1960), Bicudo (1969)

Plate 15

Fig. 1. *Staurostrum vestitum* var. *vestitum*. Fig. 2. *St. vestitum* var. *splendidum*. Fig. 3. *St. sexcostatum* var. *productum*. Fig. 4. *St. hexacerum* var. *hexacerum*. Fig. 5. *St. inflexum* var. *inflexum*. Fig. 6. *St. controversum* var. *controversum*. Fig. 7. *St. oxyacanthum* var. *oxyacanthum*. Fig. 8-10. *Bambusina brebissonii* var. *brebissonii*. Fig. 11-12. *B. brebissonii* var. *gracilescens*. Fig. 13. *Desmidiium cylindricum* var. *cylindricum*. Fig. 14. *D. swartzii* var. *swartzii*. Fig. 15. *Spondylosium planum* var. *planum*. Fig. 16. *S. pulchellum* var. *pulchellum*. Fig. 17. *Teilingia excavata* var. *excavata*. Fig. 18-20. *Hyalotheca dissiliens* var. *dissiliens*. Fig. 21. *H. dissiliens* var. *tatica*. Fig. 22-23. *H. dissiliens* var. *minor*. Fig. 24. ? *H. indica* var. *indica*, morpha. Fig. 25. *H. mucosa* var. *mucosa*

PLATE 15

and Förster (1972). They are similar in their shape and dimensions to *Hyalotheca dissiliens* J. E. Smith ex Bréb. var. *hians* Wolle, but they differ from them in their cell wall sculpture and body proportions.

Lg. 19.5-21.8 μm , br. 18.4-19.5 μm , isth. 16.1-18.4 μm , lg.: br. 1.06-1.18 $\times$.

Occur.: 2rrr.

Hyalotheca mucosa (Mert.) Ehrenb. ex Ralfs

var. *mucosa* (Plate 15, Fig. 25)

Cells cylindrical, slightly constricted in the midregion. They fit Prescott's (1940) drawing.

Lg. 19.5-21.8 μm , br. 16.1-17.2 μm , isth. 14.9-16.1 μm , lg.: br. 1.13-1.35 $\times$.

Occur.: 7rrr, 9rrr.

Genus: *Spondylosium* Brébisson ex Kützing 1849

Spondylosium planum (Wolle) W. et G. S. West

var. *planum* (Plate 15, Fig. 15)

Cells smaller, sinus wider open, than it is given by West et al. (1923). Both dimensions and shape agree with those in drawings of: Scott, Grönblad (1957; Plate 35, Fig. 7), Hirano (1960), Bourrelly (1966), Bharati, Pai (1972) and Agarker, Agarkar (1977).

Lg. 8.0-9.2 μm , br. 9.2-11.5 μm , isth. 4.6-6.9 μm , lg.: br. 0.78-1.00 $\times$.

Occur.: 2rrr, 3rrr, 4rrr, 7rr, 8rrr, 9rrr.

Spondylosium pulchellum (Arch.) Arch.

var. *pulchellum* (Plate 15, Fig. 16)

Lg. 11.5-17.2 μm , br. 11.5-13.8 μm , isth. 2.3-4.6 μm , ap. 5.7-9.2 μm , lg.: br. 1.00-1.25 $\times$.

Occur.: 1rrr, 2rrr, 3rrr, 4r, 5c, 6r, 7rrr, 8c, 9rrr.

Genus: *Teilingia* Bourrelly 1964

Teilingia excavata (Ralfs ex Ralfs) Bourr.

var. *excavata* (Plate 15, Fig. 17)

Sometimes, within one filament cells slightly wider than longer were encountered besides cells with the same length and breadth. The former differ in dimensions and length-breadth ratio from those described in the relevant literature (e.g. Migula 1907, 1911, Grönblad et al. 1958, 1968). Whereas Wysocka (1934) describes specimens with the similar dimensions as mine.

Lg. 8.0-9.2 μm , br. 9.2-10.3 μm , isth. 4.6-5.7 μm , lg.: br. 0.87-1.00 $\times$.

Occur.: 7rrr, 9rrr.

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STRESZCZENIE

W pracy przedstawiono wykaz gatunków desmidiów zebranych w latach 1971-1976 na dziewięciu torfowiskach przejściowych, położonych na obszarze Niziny Środkowomazowieckiej. Na ośmiu torfowiskach dominowały fitocenozy zespołu *Eriophoro-Sphagnetum recurvi*, zaś jedno (Grabiec A — stanowisko 7) było typu mszysto-turzycowego z roślinnością nawiązującą do zbiorowisk z klasy *Scheuchzerio-Caricetea fuscae*, z wyraźnie zaznaczającymi się tendencjami rozwojowymi w kierunku zbiorowisk torfowcowych z klasy *Oxycocco-Sphagnetea*.

W zebranych materiale zidentyfikowano 226 jednostek taksonomicznych desmidiów reprezentujących 20 rodzajów. Poza tym stwierdzono występowanie 16 taksonów z rodziny *Mesotaeniaceae* należących do 4 rodzajów.

W stosunku do kilkunastu taksonów dokonano pewnych zmian taksonomicznych, mianowicie, przeniesiono do innego rodzaju, zmieniono rangę w obrębie gatunku, bądź jedno i drugie. Oto wykaz tych taksonów: *Mesotaenium endlicherianum* Näg. var. *endlicherianum* f. *exiguum* (Hansg.) stat. nov., *Actinotaenium cucurbita* (Bréb. ex Ralfs) Teil. var. *cucurbita* f. *inflatum* (Gutw.) comb. nov. et stat. nov., *Actinotaenium cucurbitinum* (Biss.) Teil. var. *minutum* (Presc.) Teil. comb. nov. et stat. nov., *Actinotaenium wollei* (W. et G. S. West) Teil. ex Růž. et Pouz. var. *wollei* f. *longior* (Grönbl.) comb. nov., *Staurodesmus extensus* (Anderss.) Teil. var. *retusus* (Hirano) comb. nov., *Staurodesmus ralfsii* (W. West) comb. nov., *Cosmoastrum hystrix* (Ralfs) Pal.-Mordv. var. *pannonicum* (Lütke.) comb. nov., *Cosmoastrum lapponicum* (Schmidle) Pal.-Mordv. comb. nov., *Cosmoastrum muriciforme* (Schmidle) comb. nov., *Cosmoastrum orbiculare* (Ralfs ex Ralfs) Pal.-Mordv. comb. nov., *Cosmoastrum teliferum* (Ralfs) Pal.-Mordv. var. *pecten* (Perty) comb. nov., *Cosmoastrum turgescens* (De Not.) Pal.-Mordv. var. *sparsigranulatum* (Scott et Grönbl.) comb. nov., *Cosmoastrum wellipiticum* (Wille) comb. nov. et nom. nov.

Na podstawie poczynionych obserwacji, jak i danych zawartych w literaturze, krytycznie ustosunkowano się do wydzielenia niektórych gatunków, jak również taksonów wewnątrzgatunkowych. Zaproponowano dokonania pewnych korekt w diagnozach, uznania za synonimy, utrzymania dotychczas przypisywanej rangi.

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