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ON THE SCALES OF SOME SYNURA SPECIES

II

BY

JOHS. BOYE PETERSEN AND J. BENTH HANSEN

København 1958
i kommission hos Ejnar Munksgaard

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Synopsis.

The scales of some Synura-species viz. *S. sphagnicola* Korsh., *S. Conradii* Kuff., *S. lapponica* Skuja and two new forms of *S. Petersenii* Korsh. (f. *Kufferathii* and f. *macracantha*) are examined by electron microscopy. It is established that *S. Conradii* is identical with *S. echinulata* Korsh. Finally some general remarks on the genus Synura.

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After the publication of our first paper on Synura scales examined by electron microscopy (Boye Petersen & J. Benth Hansen 1956), there appeared a paper on the same subject by Fott & Ludvík (1957), dealing with the scales of the same species we had discussed, as well as with those of *S. sphagnicola* Korsh. Our descriptions of the scales are in perfect agreement, apart from a few details, but concerning *S. sphagnicola* we have something to add, namely figures of the basal scales, which Fott & Ludvík only mention in passing. We have, besides, received material from Dr. H. Kufferath and from Professor Skuja, for which we are very grateful.

1. *Synura sphagnicola* (Korsh.) Korsh.

The species was established by Korshikov (1927) under the name of *Skadovskiella*. Owing especially to its peculiar scales and the position of the chromatophores in the cell, he considered it right to refer this species to a new genus. In the known Synura species the chromatophores are parietal, but in *S. sphagnicola* he found them placed centrally in the cell, separated from the outer side by two leucosin vesicles. The scales, which he saw for the first time in a Synura on this occasion, he interpreted as an oval ring provided with a handle, like a tennis racket. Korshikov does not give the dimensions of the scales. Later he changed his view of the species (1929), referring it to the genus Synura, because he realised that he was here concerned with real scales (not rings), and that the position of the chromatophores was hardly any good generic character always to be found in this species.

This species was found in Lille Skidendam in Teglstrup Hegn (leg. Berit Asmund), and in Bøllemose near Skodsborg (leg. J. Kristiansen). Both these localities are pronounced Sphagnum bogs with acid water. In Bøllemose ph 3.7 has been

measured (Boye Petersen 1943, p. 34), and in Lille Skidendam ph 3.9. The specimens found here agreed exactly with Korshikov's description of *Skadovskiella*, even the chromatophores did not seem closely appressed to the outer surface of the cell, as is usual in the Synura species. Nygaard (1949, p. 138) gives some localities for the species, but the determinations have not been verified by electron microscopy. While the other Synura species often occur in such large amounts that they give the water a brownish colour, we have only seen comparatively few specimens of *S. sphagnicola*.

After drying on cover slips the scales showed quite clearly the appearance described by Korshikov, so we must consider the determination as certain as it can be without the original material for comparison, material which we tried in vain to procure (Korshikov † 1943).

Specimens were dried on formvar film and after shadow-casting with palladium electron micrographs were taken. The scales then proved to resemble those of *S. spinosa* in many respects, but they were totally different from the latter by the fact that, though the surface of the scale was uniform, with small round holes like the lower part of the surface of the spinosa scale, the reticularly joined ribs on the upper surface of that scale were entirely absent. The basal scales proved to be ovoid and of the same type as in *S. spinosa*. Under the light microscope it is not very easy to distinguish the scales of these two species from each other. Korshikov (1927) draws the scales in such a way that the thorn of the scale must be presumed to be on the same plane as its plate. In *S. sphagnicola* this is no more the case than in the rest of the Synura species, and the thorn is also attached a short distance from the front edge of the scale.

Description of the scales of
Synura sphagnicola (Korsh.) Korsh. Korshikov 1929, p. 287.

Syn.: *Skadovskiella sphagnicola* Korshikov 1927, p. 450.
Pl. I, figs. a—c.

Apical scales oval, length 2.7—3.3 μ, breadth 1.9—2.5 μ, below with an upturned edge 0.3 μ broad, reaching about $^2/_3$ up the

scale. Here it seems to turn so as to form an edge at right angles to the surface of the scale. The whole of the surface is uniform with round holes about 0.06 μ in diameter, evenly distributed, about 8 in 1 μ. The spine is attached a little way inside the edge, ending in 2—3 short points, length 2.2—2.7 μ, breadth 0.2—0.3 μ. Basal scales ovoid, pointed at top (length 3.3 μ, breadth 2.1 μ), all the way round with a inflexed edge (breadth 0.3 μ) which at the top covers a space of about $^1/_3$ down the scale from the tip. The surface uniform with round holes about 0.06 μ in diameter, about 7 in 1 μ, without spine. In material from Abisko (sent by Professor Skuja) there were also scales with an oblong, nearly rectangular outline (Pl. I c), length 3 μ, breadth 1 μ. We have not been able to see with certainty where these scales were placed on the cell, for we have only had loose scales for examination. It is possible that they have been situated among the normal scales provided with spines. The same material also contained the usual basal scales.

Fott & Ludvík (1957) also mention the scales of *S. sphagnicola* and in the main their description agrees with our observations. In addition to the ordinary scales with spines we have also depicted basal scales without spines.

The small holes in the surface of the scale are described as hexagonal by Fott & Ludvík. In our figures they are quite circular, and this, we think, is the case too in the figures of the two authors. Probably we have here an optical delusion. Fott & Ludvík mention *Syncrypta volvox* Ehrb. as a synonym of *S. sphagnicola* (l. c.). As to this it must be urged that though Syncrypta is most certainly identical with Synura, it would seem that several, perhaps all, Synura species may enter into a Syncrypta stage. Thus we have had occasion to see such stages in *S. Petersenii* (see also Conrad 1920, p. 177).

2. On the Validity of the Name *Synura Conradii* in Conrad 1946, p. 5.

Pl. II.

Owing to the great kindness of Dr. Kufferath and the Musée royale d'histoire naturelle de Belgique, Conrad's original preparations containing this species have been sent to us, as well

as CONRAD's and KUFFERATH's drawings and notes dealing with the genus Synura. The material for the preparations is derived from Mare des Clabots by Rouge Cloître near Brussels and was collected by W. CONRAD in February 1943. In most of the preparations there were numerous Synura scales, for the most part evenly distributed, while whole cells were rare. This, as described by CONRAD (1946, p. 3), is due to the way in which the samples were collected and examined. Precisely for the purpose of making the scales clearly visible it was especially the sediment in the plankton samples which was investigated, the cells there being separated, and the scales more or less detached from them. By means of the light microscope we have found perfect agreement between the drawings and the finds on the slides. We then soaked some of the preparations in xylene and removed the cover slip, after which part of the material which had dried on the slide or cover slip was removed with collodion and transferred to formvar film for use in electron microscopy. We were able to do so without removing all the material, so that the essential part of it could be left and the preparation restored to its original appearance. In this way the following preparations were examined: Nos. I, VII, XIII, and No. XIV. The preparations were mounted as follows:

No. I. Gentian violet, Canada balsam. No. VII. Gentian violet, euparal. No. XIII. Cresyl blue, without cover slip. No. XIV. Safranin, without cover slip.

The scales of the Synura species stain only faintly with the ordinary stains, presumably because they consist chiefly of silicic acid. When immersed in a medium with about the same refractive index as silicic acid, they will be very difficult to see clearly. In the preparations without cover slips the scales were distinct, and were sharply defined with the high dry system, whereas with oil immersion the scales will again be in a medium with about the same refractive index as the silicic acid, and the picture loses clearness of contrast. It is understandable, therefore, that CONRAD and KUFFERATH were not able to determine the species with certainty. The best method, which has previously been adopted by KORSHIKOV, is to dry the material on a cover slip and then fasten this on to a slide with a little canada balsam at the corners and with the material turned downwards. Such a pre-

paration can be examined with an oil immersion objective, and distinct pictures of the scales can be obtained. Further, the method has the advantage that the material can be preserved unchanged for an indefinite time.

In the e. m. examination we obtained the best results from the preparations without cover slips. In the preparations mounted in euparal or canada balsam some obscurity still remained in the shape of a fine veil, even though they were carefully treated with all the usual dissolving agents.

According to KUFFERATH's notes the preparations should contain the following species: *Synura Conradii* (in abundance), *S. uvella*, *S. Petersenii*, and *S. spinosa*. The three latter species we have, indeed, found. Of *S. Petersenii* a deviating form was seen, to which we shall revert presently. *S. spinosa* was found as f. *spinosa*.

It turned out, however, that by far the commonest scales in the preparations were from *S. echinulata* (Pl. II), which is not mentioned at all, and since none of the other scales present could be mistaken for *S. Conradii*, we must conclude that *Synura Conradii* Kuff. is identical with *S. echinulata* Korsh.

3. *Synura lapponica* Skuja.
Pls. III, IV.

SKUJA (1956, p. 275, Pl. 57, figs. 10—14; Pl. 58, figs. 1—2) has described a new species, *Synura lapponica*. Of this species, which in all other respects resembles the rest of the Synura species, he depicts the scales, which differ in appearance from those of all others. They are scutiform without any apical thorn, oval in shape, and have a small boss in the middle. Professor SKUJA has kindly placed at our disposal material of this species, taken from a small pond at Abisko and dried on slides. The sample contained a number of specimens with cysts. On these specimens it was impossible for us to find the scales, but scattered throughout the preparation we found single scales or small groups of such, which were transferred to formvar and photographed. These scales corresponded closely in shape and size to SKUJA's description, but it was difficult to point out with certainty any particular scale as apical or basal. Their shape differed some-

what, some were elliptical and large, presumably apical scales; others were smaller, almost circular, presumably basal scales.

A scale may be described as follows:

Shape elliptical, length 7.5 μ—8.9 μ, breadth 3.4—4.8 μ, with an upturned edge (ca. 0.2 μ broad) all the way round. The surface smooth with small holes (ca. 0.03 μ in diam.), about 16 in 1 μ. In the middle there is an annular elevation within which the surface continues with holes. The smallest scales have the same structure, length 4.9 μ, breadth 4.1 μ.

In principle these scales differ very much from those of the species previously known. Consequently this species cannot be referred to any of the previously mentioned sections of the genus (Boye Petersen & J. B. Hansen 1956, p. 6), and probably it may even be best to interpret *S. lapponica* as belonging to a separate genus. That, however, we will not do for the present, since there might, amongst other things, be a possibility that it is identical with genera already described (*Synuropsis*?) in which no scale-covering is known, though it may nevertheless be present.

4. *Synura Petersenii* Korsh. formae.

Of *Synura Petersenii* we have seen a large material and it turns out that the scales are of somewhat variable structure. As the type we must establish the form whose scales were originally described by Korshikov (1929), I. Manton (1955), and Boye Petersen & Hansen (1956). It must be named *Synura Petersenii* Korsh. f. *Petersenii* nomen novum.

In the material from Kufferath there were scales differing from the type (1) in that the middle cavity was short and (2) in that the ribs were connected by transverse folds so that a network of ribs was formed at the lower end of the scale. This form might be called *S. Petersenii* f. *Kufferathii* n. f. In the material from Abisko sent by Professor Skuja there were scales remarkable for (1) a very large and strong spine and (2) a very stout network of connected ribs. The dimensions of the scales were: length 4.3 μ, breadth 2.2 μ; spine: length 1.5 μ, breadth 0.5 μ, that is to say, of the same size as in the type but with a stronger spine than the latter. This form may be called *S. Petersenii* f. *macracantha* n. f. It is possible that *Synura intermedia*

(Bioret) Kufferath, of which we have in vain tried to obtain authentic material (Conrad 1946, p. 5, fig. 23) is a form of Petersenii with a still stronger spine.

5. General Remarks on the Genus Synura.

In the present paper we have established some new forms of *S. Petersenii*, and we have previously described five forms of *S. spinosa* (Boye Petersen & J. B. Hansen 1956, p. 20—21). These forms show characteristic differences and under the electron microscope they may easily be distinguished from one another. At present, however, our knowledge of the range of variation of the various species is very imperfect. It might be supposed, for instance, that within the same species the appearance of the scales might vary with the seasons. We have considered it sufficient, therefore, to call these varieties forms, but it is possible that they actually represent well separated species.

Successively, the scales of a number of species of the genus Synura have been examined, partly by light microscopy, partly by electron microscopy. The scales are so small and their structure is so fine that but little satisfactory pictures of it can be obtained by light microscopy. In most cases, however, if the best optical instruments that can be had are employed, it will be possible to distinguish the species from one another under the light microscope, particularly if a distinct impression of their structure has first been gained from e. m. pictures. All species of the genus which have been established without taking into account the structure of the scales must be considered doubtful and are therefore entered in the list below as species inquirendae. In the same list some species have also been entered which are referred to affiliated genera, though it may be conjectured that they actually belong to the genus Synura, where the scale-covering hitherto has not been observed. Unfortunately it has proved impossible to procure authentic material of most of these species, despite the fact that merely a sample containing the species dried on a slide would be sufficient to determine the position of the species.

Before concluding this paper we must refer the reader to Harris & Bradley (1956, I and II), who have given very fine pictures of Synura scales produced by the so-called carbon

replica process. These pictures emphasise certain details which are less distinct in ours. On the other hand, other details are not seen in them.

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Diagnoses formarum novarum.

S. Petersenii f. *Kufferathii* n. f. a forma Petersenii differt cavitate centrali curta, costis marginalibus in parte inferiore reticulatim connectis.

S. Petersenii f. *macracantha* n. f. a forma Petersenii differt spina maxima costis marginalibus usque ad apicem reticulatim connectis.

Species et varietates delendæ.

Synura caroliniana Whitford 1943, p. 158 = *S. Petersenii* Korsh.
– *Conradii* Kufferath in Conrad 1946, p. 5 = *S. echinulata* Korsh.
– *uvella* var. *punctata* Awerinzev 1899, p. 264 = *S. sphagnicola* Korsh. (fide Fott and Ludvík 1957).
– *uvella* f. *turfacea* Steinecke 1916, p. 32 = *S. sphagnicola* Korsh. (fide Fott and Ludvík).

Species inquirendæ.

Synura Adamsii G. M. Smith 1924.
– – f. *malabarica* Philipose 1953, p. 239.
– *australiensis* Playfair 1915, p. 315.
– *Bioretii* Huber-Pestalozzi 1941, p. 141.
– *granulosa* Playfair 1915, p. 314.
– *intermedia* (Bioret) Kufferath in Conrad 1946, p. 5.
– *Lohammeri* Skuja 1956, p. 274.
– *reticulata* Lemmermann 1903, p. 119.
– *splendida* Korshikov 1942, p. 27.
– *uvella* var. *lævis* Kisselew 1931, p. 243.
– – – *punctata* Kisselew 1931, p. 243.
– – – *longipes* Virieux 1916.
– *verrucosa* Pascher 1913, p. 51.
Chlorodesmus hispidus Philipps 1884.
Pseudosynura urogleniformis Kisselew 1931, p. 243.
Synuropsis danubiensis Schiller 1929, p. 443.
– *globosa* Schiller 1929, p. 445.
Actinoglena Klebsiana Zacharias 1897, p. 5 = *Synura Klebsiana* Lemmermann 1899, p. 110.

Bibliography.

Awerinzew, S. 1899. Zur Kenntnis der Protozoën-fauna in der Umgebung von Bologoje. Trav. d. l. Soc. Imp. des Naturalistes de St-Pétersbourg Vol. XXX, Livr. 1, No. 6 p. 238—251, 262—264.

Bioret, G. 1933. Les écailles de Synura uvella Stein. Travaux du Laboratoire de Botanique de l'Université Catholique d'Angers. (Recueil de travaux cryptogamiques dédiés à Louis Mangin. P. 1—8.

Conrad, W. 1920. Contributions à l'étude des Chrysomonadines I. Bull. Acad. Royale de Belgique, Cl. des Sciences. p. 167—189.

— 1946. Notes protistologiques XXXI, Matériaux pour la morphologie des Synura Ehrenberg. Bull. du Musée roy. d'Hist. nat. de Belgique **22**: nr. 11, p. 1—12.

Ehrenberg, C. G. 1838. Die Infusionsthiere als volkommene Organismen. Leipzig.

Fott & Ludvík. 1957. Die submikroskopische Struktur der Kieselschuppen bei Synura. Preslia **29**: 5—16.

Harris and Bradley 1956. I. Potentialities of the carbon replica technique in the examination of the scales of Synura and Mallomonas under the Electron-microscope. Research Correspondence **9**:

— 1956. II. Electron microscopy of Synura scales. Discovery **17**: no. 8.

Huber-Pestalozzi, G. 1941. Das Phytoplankton des Süsswassers 2' Teil, 1' Hälfte. In Thienemann: Die Binnengewässer Bd. XVI.

Kisselew, J. A. 1931. Zur Morphologie einiger neuer und seltener Vertreter des pflanzlichen Microplanktons. Arch. f. Protistenkunde **73**: 235—250.

Klebs, G. 1893. Flagellatenstudien II. Zeitschr. f. wiss. Zool. **55**: 353—445.

Korshikov, A. 1927. Skadovskiella sphagnicola, a new colonial Chrysomonad. Arch. f. Protistenk. **58**: 450—455.

— 1929. Studies on the Chrysomonads I. Arch. f. Protistenk. **67**: 253—280.

— 1942. On some new or little known Flagellates. Arch. f. Protistenk. **95**: 22—44.

Lemmermann, E. 1899. Phytoplankton sächsischer Teiche. Plöner Forschungsbericht Teil 7: 96—135.

— 1903—04. Das Plankton schwedischer Gewässer. Ark. f. Bot. 2: no. 2.

Manton, I. 1955. Observations with the electron-microscope on Synura caroliniana Whitford. Proceed. of the Leeds philosophical society (Scientific section) VI, part V, p. 306—316.

NYGAARD, G. 1949. Hydrobiological Studies on some Danish Ponds and Lakes, Part II. Biol. Skr. Dan. Vid. Selsk. **7**: No. 1.

PASCHER, A. 1910. Der Grossteich bei Hirschberg in Nord-Böhmen. I. Chrysomonaden. Monogr. und Abhandl. zur Internat. Revue der gesammten Hydrobiologie und Hydrographie.

— 1913. Die Süsswasserflora Deutschlands etc. Heft II, Flagellatæ II.

PETERSEN, JOHS. BOYE 1918. Om Synura Uvella Stein og nogle andre Chrysomonadiner. Vid. Medd. fra dansk Naturhist. Forening 69: 345—357.

— 1943. Some Halobion Spectra (Diatoms). Biol. Medd. Dan. Vid. Selsk. **17**: No. 9, 1—95.

— and J. BENTH HANSEN 1954. Electron microscope Observations on Codonosiga Botrytis (Ehr.) James-Clark. Bot. Tidsskr **51**: 281—291.

— — 1956. On the Scales of some Synura Species. Biol. Medd. Dan. Vid. Selsk. **23**: No. 2.

PHILIPOSE, M. T. 1953. Contributions to our knowledge of Indian algae. 1. Chrysophyceæ. Proceed. of the Indian Academy of Science **37**: 232—248.

PHILIPPS, F. W. 1884. On Chlorodesmus hispida a new flagellate animalcule. Transact. Hertfordsh. Nat Hist. Soc. and Field Club II. (not seen).

PLAYFAIR, G. J. 1915. Freshwater-Algae of the Lismore district. Proceed. Linn. Soc. N.-S.-Wales. **40**: 310—362.

SCHERFFEL, A. 1904. Notizen zur Kenntnis der Chrysomonadineæ. Ber. d. d. bot. Ges. **22**: 439—444.

SCHILLER, J. 1929. Neue Chryso- und Cryptomonaden aus Altwässern der Donau bei Wien. Arch. f. Protistenk. **66**: 436—458.

SKUJA, H. 1956. Taxonomische und biologische Studien über das Phytoplankton Schwedischer Binnengewässer. Nova acta regiæ Soc. scientiarum Upsaliensis Ser. IV, Vol. **16**: No. 3.

SMITH, G. M. 1924. Ecology of the Plankton algae etc. Roosevelt Wild Life Bull. II (not seen).

STEIN, F. 1878. Der Organismus der Infusionstiere III, 1' hälfte. Leipzig.

STEINECKE, F. 1916. Die Algen des Zehlaubruches in systematischer und biologischer Hinsicht. Schr. d. physik.-ökonom. Ges. zu Königsberg. **56**: 1—138.

WHITFORD, L. A. 1943. The fresh-water algae of North-Carolina. Journ. of the Elisha Mitchell Scientific Soc. **59**: 131.

VIRIEUX, J. 1916. Recherches sur le plancton des lacs du Jura central. Ann. Biol. Lacustre **8**: 5—192.

ZACHARIAS, O. 1897. Neue Beiträge zur Kenntnis des Süsswasserplanktons. Plöner Forschungsber. Teil 5: 1—9.

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Plates.

PLATE I.

Synura sphagnicola, a. apical scale seen from the inner side. Shaded with palladium, negative print. ×15.000. Ll. Skidendam 9/8 1956. b. Apical and basal scale seen from the outer side. Shaded with palladium, negative print. ×15.000. Ll. Skidendam 9/8 1956. c. Positive print. ×15.000. Abisko.

PLATE II.

Synura echinulata (= *S. Conradii* Kuff.). From Conrad's slide nr. VII. Positive print. ×15.000.

PLATE III.

Synura lapponica, a. scale shaded with palladium, negative print. ×15.000. b. Central part of a scale, positive print. ×32.000.

PLATE IV.

Three different scales of *Synura lapponica*, shaded with palladium, negative print. ×15.000.

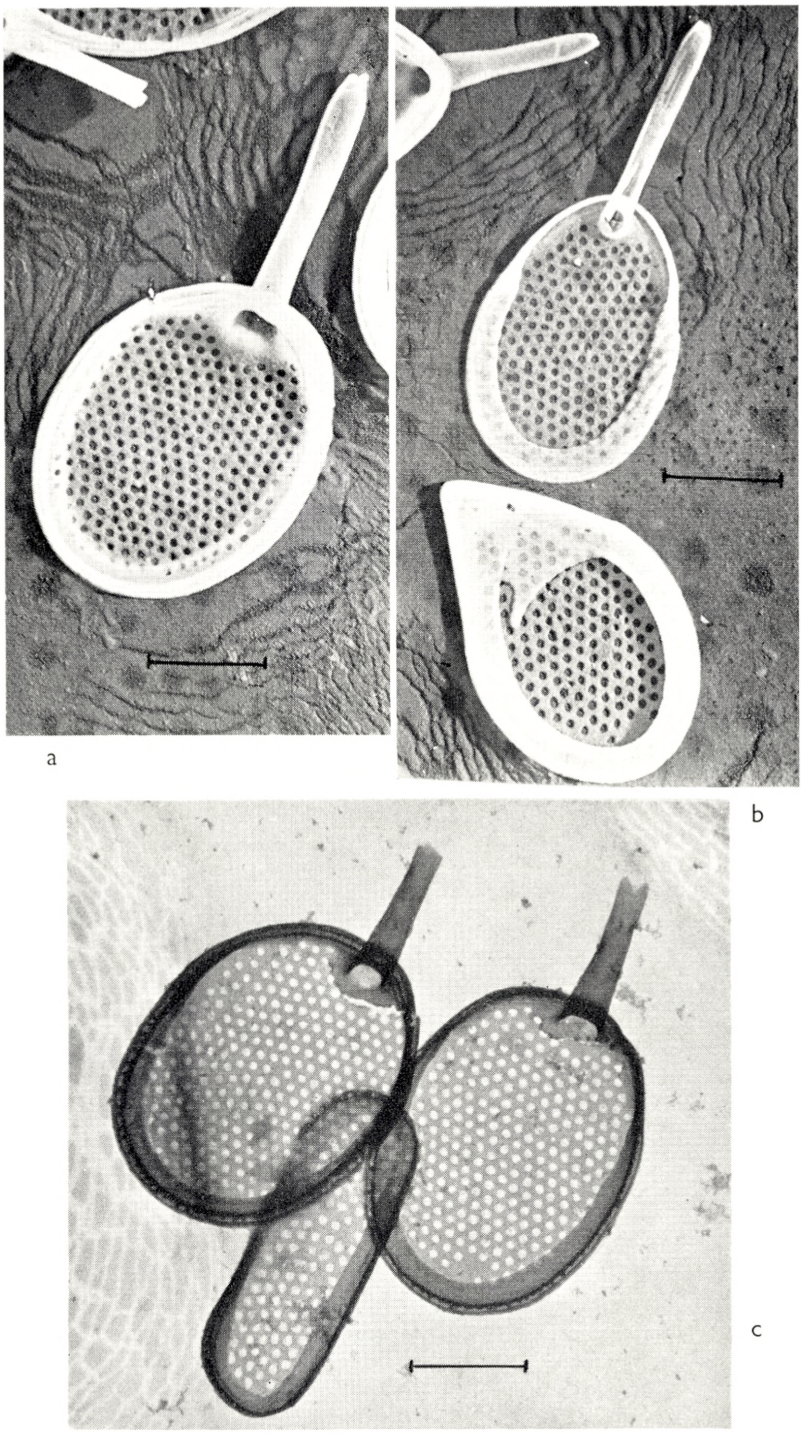
PLATE V.

Synura Petersenii f. *Kufferathii*. From Conrad's slide nr. XIII. Shaded with palladium, negative print. ×20.000.

PLATE VI.

Synura Petersenii f. *macracantha*. Shaded with palladium, negative print. ×20.000. Abisko.

The unit of measurement represents 1 μ.



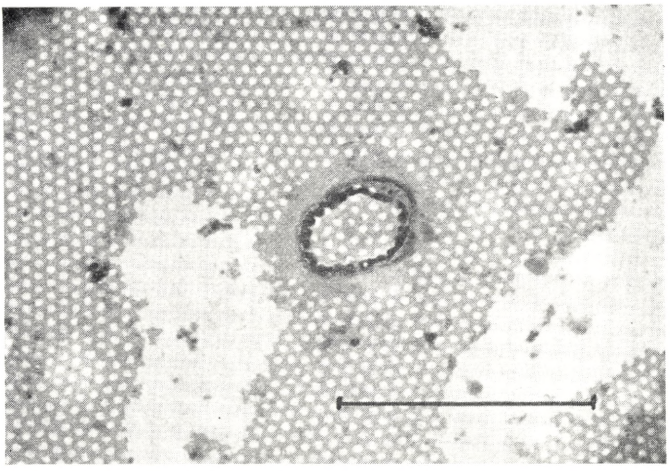
a

b

c

PLATE II.

a



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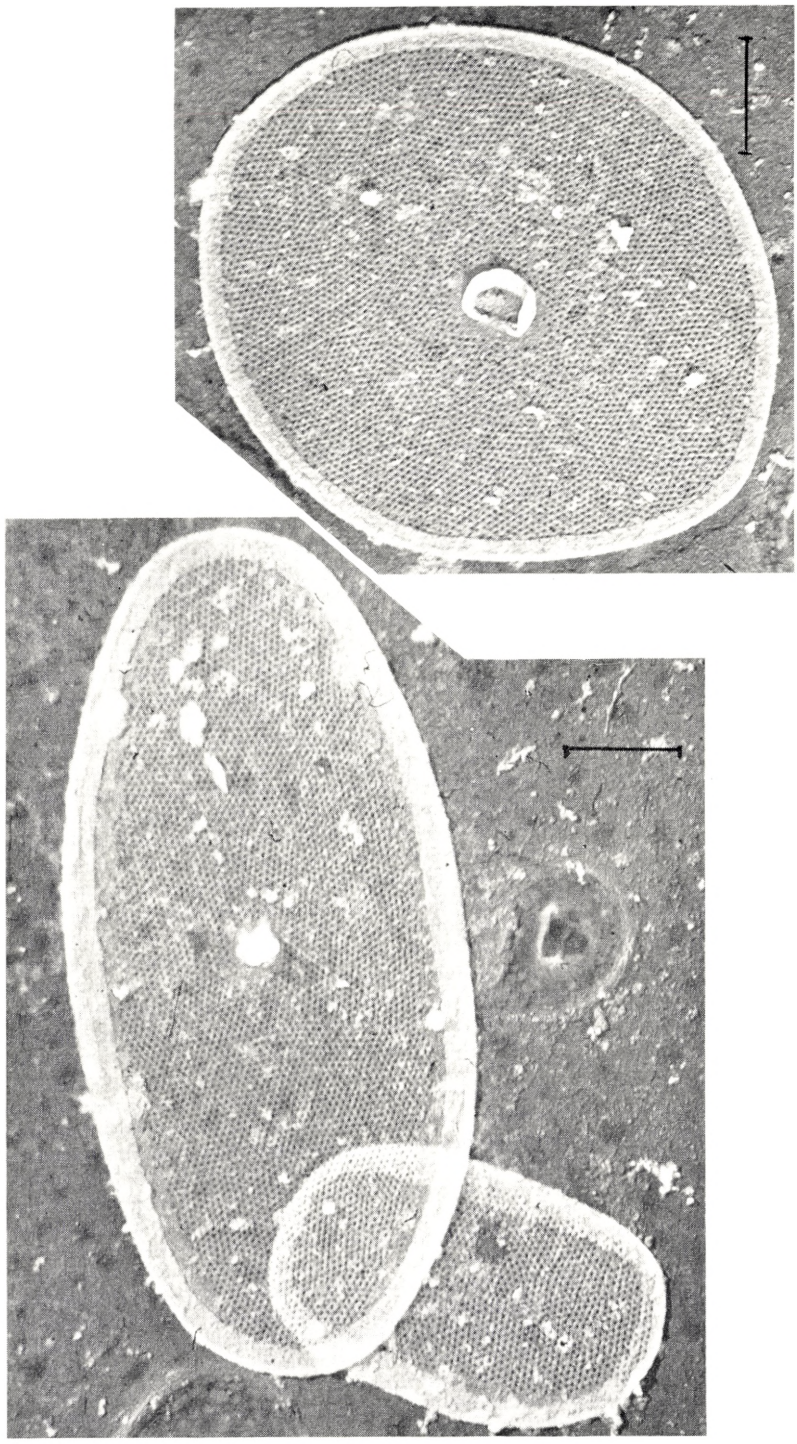


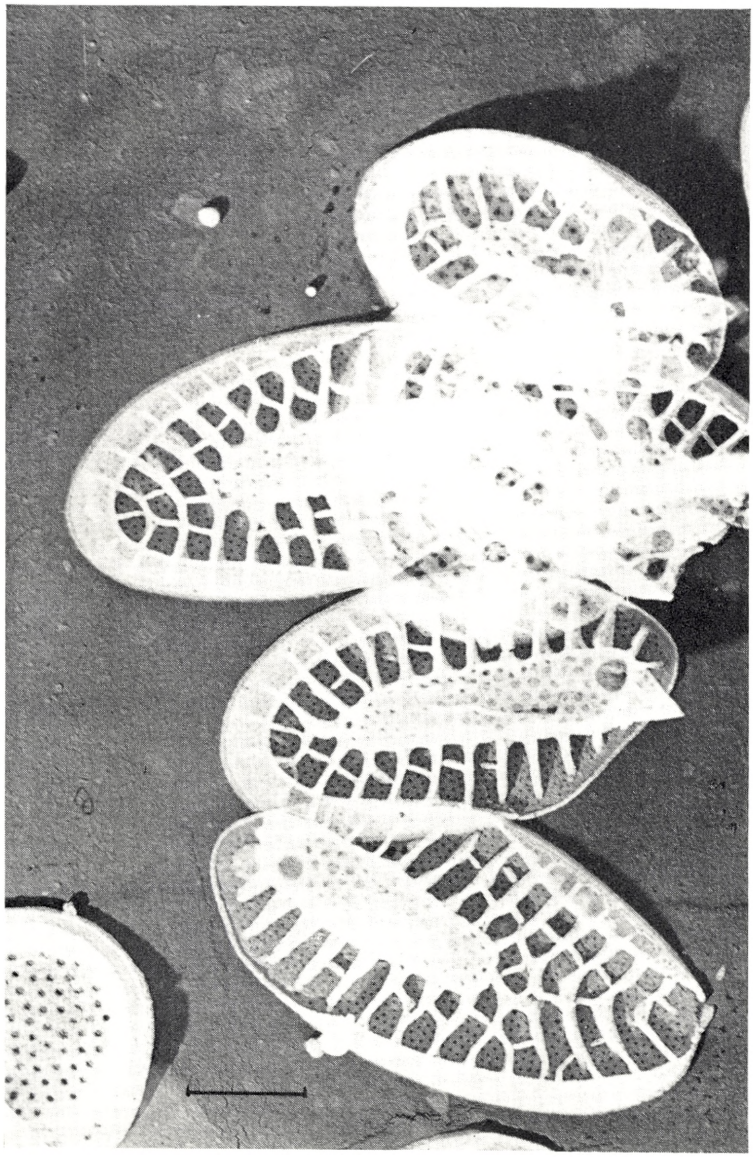
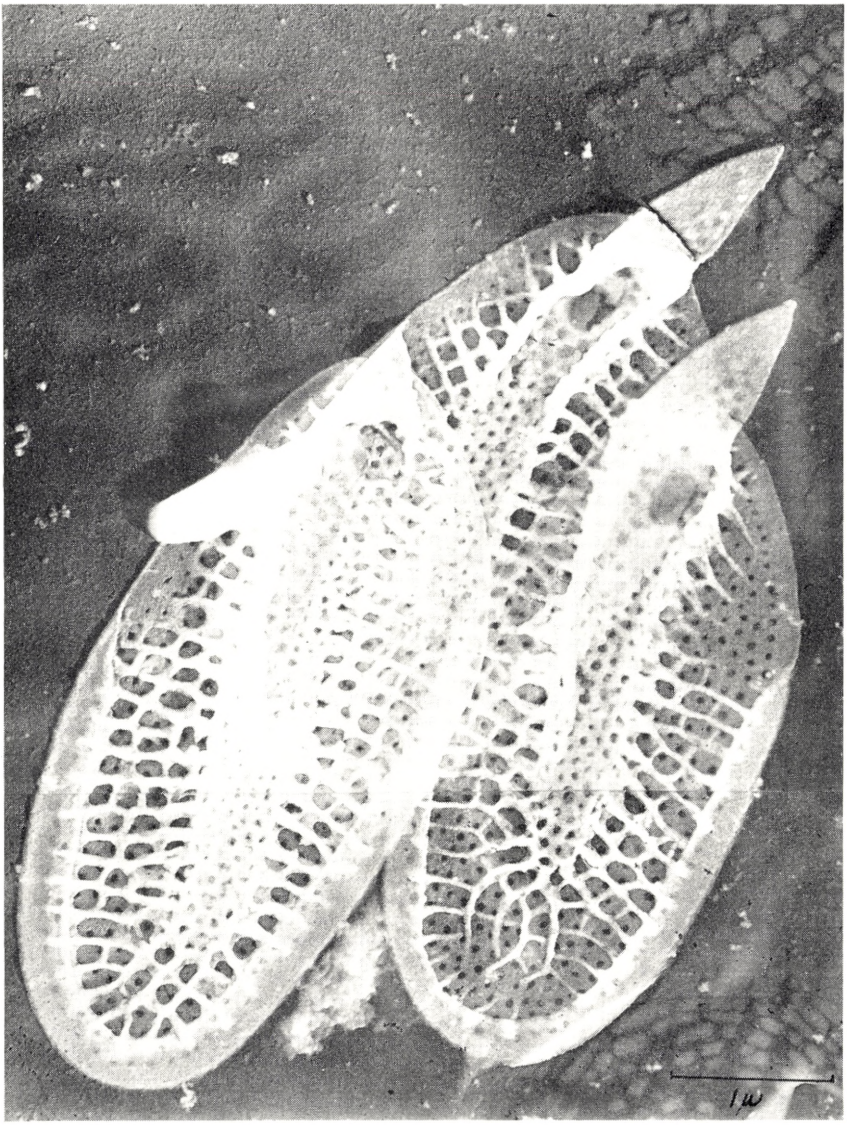


PLATE VI.



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