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Some Interesting Algal Flagellates

Abstract

22 species or forms of flagellates, observed in nature in Czechoslovakia and Poland, are pictured and described in the present paper. They belong to four classes: *Chrysophyceae* (2), *Chlorophyceae* (1), *Cryptophyceae* (9), and *Dinophyceae* (10). They were nearly all identified with the existing taxa; some names are suggested as synonyms, some new nomenclature combinations are put forward. One new species, *Chilomonas bacillaris* sp. n., has been established.

DESCRIPTIONS

CHRYSOPHYCEAE[1]

Pedinella elastica (SKUJA) comb. nova

Basionym: *Pseudopedinella elastica* SKUJA, Symb. bot. upsal. 9/3: 252, tab. XXIX: 20–24, 1948.

Plate 2: 1 a–b

This flagellate was sporadic among the rich phytoplankton of Mikołajskie Lake in Mazury, Poland, June 1963. *Cyanophyta* (*Aphanizomenon flos-aquae*

[1] The higher taxa and the cytological terminology in all groups after FOTT, 1959.

RALFS, *Oscillatoria limnetica* LEMM., *O. agardhii* GOM., *Anabaena* sp. div.) dominated in the phytoplankton community, but *Chlorophyta* (mainly *Phacotus lenticularis* (EHRENB.) STEIN), *Bacillariophyta* (mainly *Fragilaria crotonensis* KITTON) and various autotrophic flagellates were also rather abundant. Mikołajskie Lake contained 9 mg chlorides per litre in the year 1950 (OLSZEWSKI and PASCHALSKI, 1959) and it cannot be therefore considered as a saline lake.

Pedinella elastica (SKUJA) c.n. was actively motile; this was due to the intensive undulation of the single long anterior flagellum. The posterior trailing pseudopodium showed no contractions. On the broad apex of the cell, slightly visible very delicate protoplasmic pseudopodia were observed. In lateral view the cell was more or less hexagonal, the width of the cell being greater than the length. Also in apical view the cell was of a rounded hexagonal shape, isodiametric, with six yellow chromatophores placed in the angles. The dimensions, as well as other details of the cell morphology, could not be ascertained in the poor material.

The comparison of all descriptions from the literature with the present find indicates that it is of no use to consider *Pedinella* VYSOCKI (1887) and *Pseudopedinella* N. CARTER (1937) as two different genera. CARTER (p. 36) differentiated the new genus by five characteristic features, the first, second and fifth of which may be probably considered as valid for species only (details of shape, disposition of chromatophores, somewhat smaller dimensions). The third diacritic feature, namely the complete absence of tentacles in *Pseudopedinella*, is controverted by the observations of SKUJA, BOURRELLY, as well as by that presented here. SKUJA (1948, p. 250) writes about *Pseudopedinella:* „Von der umgebenden Körpervorwölbung können sich mitunter einzelne ganz kurze, einfache Pseudopodien entwickeln." BOURRELLY (1957) even attributes to the new species *Pseudopedinella ambigua* a crown of tentacles. His statement (p. 270): "Cette espèce par la couronne de pseudopodes rappelle les tentacules apicaux de *Pedinella*, mais ils ne sont pas permanents et n'ont pas l'aspect massif des tentacules observés par CONRAD", is in contradiction with the original description of the tentacles of *Pedinella* given by VYSOCKI (1887, p. 8, translated): "...very thin, hardly visible processes of an indefinite number." CARTER's fourth characteristic feature of *Pseudopedinella*, namely the sessile or free mode of living, could be considered as the most important. VYSOCKI (l.c.) and CONRAD (1926), however, wrote about the motile stages of *Pedinella hexacostata* as well as about the pseudopodial character of its stalk. With respect to the presence of the trailing pseudopodia in all *Pseudopedinella* species, the prevalence of one or other mode of living may be considered as a specific feature, or as the response to environmental factors only.

Consequently several new combinations are proposed, but some of the species ought to be synonymized after more detailed study:

Pedinella hexacostata VYSOCKI, Trudy Obšč. Ispyt. Prir. charkov. Univ. 21: 8, Tab. I: 16—17, II: 15, 1887; typus of the genus. *Pedinella pyriformis* (N. CARTER) comb. nova, basionym: *Pseudopedinella pyriforme* N. CARTER, Arch. Protistenk. 90: 34, Tab. 6: 23—31, 1937. *Pedinella elastica* (SKUJA) comb. nova, basionym: *Pseudopedinella elastica* SKUJA, Symb. bot. upsal. 9/3: 252, tab. XXIX: 20—24, 1948. *Pedinella erkensis* (SKUJA) comb. nova, basionym: *Pseudopedinella erkensis* SKUJA, Symb. bot. upsal. 9/3: 253, tab. XXIX: 25—28, 1948. *Pedinella disciformis* (SCHILLER) comb. nova, basionym: *Pseudopedinella disciformis* SCHILLER, Österr. bot.

Zeitschr. 99: 101, Fig. 1, 1952. *Pedinella rhizopodiaca* (SCHILLER) comb. nova, basionym: *Pseudopedinella rhizopodiaca* SCHILLER, Österr. bot. Zeitschr. 99: 105, Fig. 2, 1952. *Pedinella ambigua* (BOURR.) comb. nova, basionym: *Pseudopedinella ambigua* BOURRELLY, Thèses Fac. Sci. Univ. Paris, Sér. A, 2704/3576: 269, Tab. VIII: 28, 1957. *Pedinella gallica* (BOURR.) comb. nova, basionym: *Pseudopedinella gallica* BOURRELLY, Thèses Fac. Sci. Univ. Paris, Sér. A, 2704/3576: 269, Tab. VIII: 27, 1957.

Phaeaster vesiculiferus (SKUJA) BOURR.

Synonyms: *Monochrysis vesiculifera* SKUJA, Symb. bot. upsal. 9/3: 245, 1948. *Phaeaster vesiculifera* (SKUJA) BOURRELLY, Thèses Fac. Sci. Univ. Paris, Sér. A, 2704/3576: 276, 1957 — orthographic variant.

Plate 2: 2—7

The flagellates were found in both cases in peat-bogs, in the hollows left after the exploitation of peat and filled with dark-brown water of pH 3.5—5. Localities: Trpnouzy near České Velenice, southern Bohemia, August 1958; "Malá jizerská louka", the Jizera Mountains, northern Bohemia, September 1964.

The cells were rounded, bluntly triangular, piriform, or kidney-shaped, always strongly flattened. The orientation of the cell was not wholly clear. A single flagellum was inserted in the flat, somewhat concave area, nearer to the narrow cell pole. Two contractile vacuoles and a stigma were also placed below the flattened apex. According to the motion, however, the narrow cell pole may also be considered as an apex. But flagellum, vacuoles and stigma accumulated in one place, i.e. in the flat concave area, indicate the strange position of the apex. Consequently the monad is compressed along an apical axis. The slightly convex, flat antapical area and the posterior narrow part of the cell were filled by a single brown-yellowish chromatophore. Several spherical grains of reserve material, perhaps chrysosa, were dispersed in the cytoplasm; two small, strongly light-breaking corpuscles, however, without any vesicles, were frequently present (Plate 2: 4, 5, 7). The oval nucleus (?) was situated in the shallow cavity of the chromatophore (Plate 2: 6—7).

The cells were from the apical view ± isodiametric, 4.2—9 (averagely about 5) μm in diameter, 2—3 μm thick (= long !).

Only open water with flagellates (zoospores) was sampled, so that no resting stages (vegetative cells) and no multiplication were observed. There was no trace of any division of the motile monads, which supports the classification of *Phaeaster* among *Chrysocapsales*. Two genera of similar, strongly flattened chrysomonads have been described: *Sphaleromantis* PASCHER (1913) and *Monochrysis* SKUJA (1948). MARVAN (1957) considers one genus, i.e. *Sphaleromantis*, as sufficient. This genus, however, is well defined by the lateral flattening, apical or only slightly subapical insertion of the flagellum and by the closely apical position of the stigma and the contractile vacuoles. BOURRELLY (1957) combined the second genus *Monochrysis* SKUJA with the chrysocapsal genus *Phaeaster* SCHERFFEL (1927), emend. BOURR. My specimens were not

wholly identical with any of SKUJA's species of *Monochrysis* (1948, 1956). They were mostly related to *M. vesiculifera* SKUJA, being only a little smaller and not having the typical vesicles; however, two small light-breaking corpuscles, resembling SKUJA's "Kristalloid", were detected.

CHLOROPHYCEAE

Platymonas bichlora H. ETTL et O. ETTL

Plate 2: 8—9

The flagellate was observed in the plankton of the polluted River Vltava in Praha, March 1961, and the water-supply reservoir on the forest brook Klíčava, central Bohemia, December 1961.

The cells were evidently dorso-ventral, widely elliptical with a notch on the apex from ventral view, and with convex dorsum and flat ventrum, rounded apex and pointed antapex from lateral view. Four flagella of about the cell length were inserted in the apical notch. Two lateral yellow-green chromatophores filled up both halves of the cell with the axial slot left free. Numerous ± spherical trichocysts of variable size, were accumulated, probably marking the position of the gullet. The other trichocysts were dispersed over the entire periphery of the protoplast. Two large contractile vacuoles were disposed laterally near the expected entry of the gullet. A large oval pale-red stigma was situaled on the left side of the ventrum about halfway along the cell's length. Sometimes irregular starch grains were observed in the inner part of the chromatophore (Plate 2: 9).

The cells were 14—15.5 μm long and 10.5—12.5 μm wide.

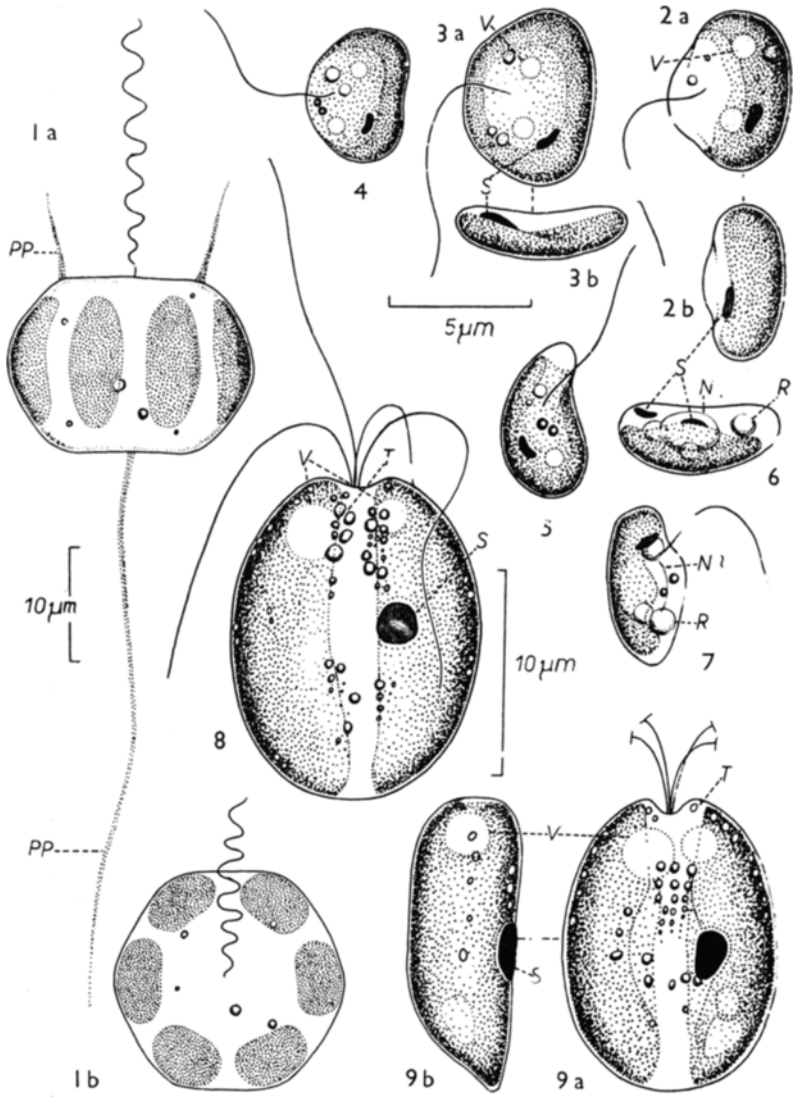
The present record fully agrees with the original description. The name *Platymonas bichlora* was invalidly published by H. and O. ETTL, 1959; the diagnosis of the species was reported later (H. and O. ETTL, 1960).

CRYPTOPHYCEAE

Chilomonas oblonga PASCHER f. **minor** (CZOSN.) comb. nova

Basionym: *Chilomonas minor* CZOSNOWSKI, Poznań. Towar. Przyc. Nauk 11: 24, tab. V: 12—13, 1948.

Plate 3: 1—3



1: *Pedinella elastica* (SKUJA) c. n.; 1a — lateral view, 1b — apical view. 2—7: *Phaeaster vesiculiferus* (SKUJA) BOURR. (2: specimen from Trpnouzy; 3—7: specimens from the Jizera Mountains); 2a, 3a, 4 — apical views, 2b, 3b, 6 — lateral views, 5, 7 — oblique views. 8—9: *Platymonas bichlora* H. ETTL et O. ETTL (8: specimen from Klíčava; 9: specimen from the Vltava); 8, 9a — ventral views, 9b — lateral view. (Original)

The flagellate was observed among sapropel in peat pools and bogs with pH values of about 4 ("Pod blatky" near Nové Hrady in southern Bohemia, June 1957, and "Malá jizerská louka" in the Jizera Mountains in northern Bohemia, September 1964).

The cell morphology corresponded wholly to the picture by ÚLEHLA (1911, as *C. paramaecium* f. *obtusa*) giving an apical rostrum and a cut-off or ± rounded antapex. In my specimens this shape was stable without any mark of the sigmoid curvation typical for *C. paramaecium* EHRENB. This agrees with the views of PASCHER (1913) and SKVORTZOW (1925) in contrast to BĚLAŘ (1910) and HUBER—PESTALOZZI (1950). The latter authors consider these two species as identical.

The cells were laterally somewhat flattened, being 20.5—22 μm long, 6—7 μm wide and 7.5—8.5 μm thick. The infracellular morphology also agreed well with ÚLEHLA's picture (1911: p. 286, Fig. 1A—B), namely the gullet with small spherical trichocysts, the single anterior contractile vacuole, and many starch grains, which vere accumulated in the protoplast's periphery. In some individuals from the Jizera Mountains (Plate 3: 3), however, two oval light-breaking corpuscles (Maupas corpuscles) of elongated shape were observed. They are not presented in the cytological works by ÚLEHLA (l.c.) and ALEXEIEFF (1911, as *C. paramaecium*), but they may be observed sometimes in *C. paramaecium* EHRENB.

PASCHER (1913) gives a wide range of cell length, i.e. 20—50 μm. My specimens, though, being within this range of size, are only a little beyond the lower limit. CZOSNOWSKI (1948) described this minute form as a new species *C. minor* CZOSN.; the morphological differences from *C. oblonga* PASCHER are insufficient to warrant the existence of two species. I propose to divide the species into two forms. The iconotypus of the species is ÚLEHLA's picture, reprinted by PASCHER (1913, p. 97, Fig, 153), which shows a cell length of 35 μm. Consequently the larger form is the typical one, i.e. *C. oblonga* PASCHER f. *oblonga;* the smaller form is *C. oblonga* PASCHER f. *minor* (CZOSN.) comb. nova.

Chilomonas bacillaris spec. nova

Plate 3: 4—6

The flagellates were found among filaments of *Mougeotia* sp. in a small forest brook, which connects several fish ponds at Jevany near Praha, May 1958.

The cells had narrow-cylindrical shape, so that the dorsal and ventral outlines were parallel. They were not flattened, the cross section was circular (Plate 3: 4 b). The apex was distinctly rostrate, the antapex regularly rounded, sometimes somewhat narrowed (Plate 3: 5—6). The gullet was short (about 1/3 of cell length) and wide, inlaid with numerous spherical trichocysts. The single contractile vacuole was placed immediately under the apical rostrum.

Two flagella, somewhat shorter than the cell's length, were inserted in the entry of the gullet. Many starch grains of irregular shape were accumulated in the periphery of the protoplast. Maupas corpuscles were not observed.

The cells were 16—19 μm long and 5—6 μm wide and thick.

The new species is related to *C. oblonga* PASCHER, but it differs in the stable cylindrical form of the cell and in the smaller dimensions.

The Latin diagnosis: Cellulae anguste cylindricae, lineis dorsali, ventrali, lateralibusque parallelicis, non compressae, sectione transversa circulari. Apex cellulae cuneatus in rostrum rectum, antapex rotundatus, interdum paulo angustatus. Faux brevis (ad tertiam partem cellulae), lata, trichocystidis parvis sphaeroideis obtecta. Flagella bina, longitudine distincta, breviora quam cellula, sub rostro apicali inserta. Chromatophora absentia, cytoplasma incoloratum. Granula amylacea, forma irregulari, sub superficie cellulae dispersa. Corpuscula ovalia (Maupas) nec nucleus observabantur. Vacuolum pulsans sub rostro apicali.

Dimensiones: longitudo 16—19 μm, latitudo et crassitudo 5—6 μm.

Habitatio: inter filamenta *Mougeotiae* sp. in rivo parvo silvestri prope Jevany prope Pragam, Bohemia.

Iconotypus: figura nostra: 4a—b, 5.

Chilomonas insignis (SKUJA) comb. nova

Basionym: *Chilomonas acuta* SCHILLER var. *insignis* SKUJA, Nova Acta Reg. Soc. Sci. Upsal., Ser. 4, 16/3: 349—350, tab. LX: 41—45, 1956.

Plate 3: 7—8

The flagellate was very abundant among the sapropel of a little forest pool near the village of Hamr on the Nežárka, near Veselí on the Lužnice, southern Bohemia, August 1958.

The cells were notched below the curved apical rostrum where the entry of gullet and the insertion of flagella were placed. The antapex was curved towards the dorsum, elongated and sharply pointed. The whole cell was slightly laterally flattened. The gullet hardly reaching the middle of the cell was inlaid with numerous spherical trichocysts. Two oval Maupas corpuscles were situated on the dorsal side behind the gullet. Only somewhat above them, relatively low, was the single contractile vacuole. Numerous starch grains were piled up under the cell surface.

The cells were 16—19 μm long, 6—7 μm thick.

Chilomonas insignis (SKUJA) c.n. differs from *C. paramaecium* EHRENB. in being of smaller dimensions, but mainly by the sharply pointed cauda. The latter feature was characteristic for all specimens observed and did not disappear until the cells died under a cover glass. Thus there ixists between these two species the same difference as between *Cryptomonas marssonii* SKUJA, on the one hand, and *C. reflexa* SKUJA and *C. curvata* EHRENB., on the other hand.

My specimens were morphologically identical with those of SKUJA (1956);

the latter, however, were much more variable in cell size, the smallest being similar to the material from Bohemia. SKUJA described them as a new variety of the species *Chilomonas acuta* SCHILLER (1929). There is, however, a severe divergence between SCHILLER's type and the flagellates observed by SKUJA and myself. Apart from the lack of an apical notch, probably due to SCHILLER's schematic drawing, the curvature of an antapex towards the ventral side is an important feature in the taxonomy of *Cryptophyceae*. It is possible that SCHILLER's conception of cell orientation was erroneous, but there is no proof of it. SKUJA (1956, p. 349—350) wrote: "...es steht auch nichts im Wege, sie als eine selbstständige Art (*Ch. insignis*) aufzufassen." This, however, cannot be considered as a valid publication of a name.

Cryptochrysis pochmannii HUBER—PEST.

Plate 3: 9—11

The flagellate was very abundant in a peat pool "Pod blatky" near České Velenice, southern Bohemia, June 1957.

The cells were oval, dorsoventrally somewhat flattened. The apical rostrum was slightly curved towards the ventrum, the antapex was straight and rounded. Two flagella (about 15 μm long) were inserted subapically in the ventrolateral furrow, reaching down over half the cell's length, being surrounded by two irregular rows of small trichocysts. They were visible under an oil immersion objective only and could be slightly stained with the methylene-blue which was at hand (Plate 3: 11). Two lateral yellow chromatophores, many starch grains and two dorsally located Maupas corpuscles could be observed, but no true pyrenoid was found, even after the application of iodine. A single contractile vacuole was found near the insertion of the flagella. No gullet was noted.

The cells were 21.5—25.5 μm long, 11.5—12.5 μm wide and 9—10.2 μm thick.

I have observed the gullet even in the smallest species of *Cryptomonas* or *Rhodomonas*, but in the present flagellate no trace of any cavity was visible. PRINGSHEIM (1944) was "inclined to agree with scepticism concerning the existence of cryptomonads without a gullet." Since that time, however, for example CZOSNOWSKI (1948) not only recognized *Cryptochrysis commutata* PASCHER, but also described new species of *Cryptochrysis* and *Cryptella*.

The cell morphology of my specimens agrees closely with *Cryptochrysis commutata* PASCHER, but they had two oval Maupas corpuscles instead of a pyrenoid with starch sheaths. The only species with Maupas corpuscles described is *C. pochmannii* HUBER—PEST. The diagnosis (HUBER—PESTALOZZI, 1950) is based on a schematic picture and a laconic note by POCHMANN (1943). The wedge form of the iconotype is so strange that it can be considered as a lethal stage (see Plate 3: 11). The relation between Maupas corpuscles and the

true pyrenoid has not been wholly clarified (see *Chroomonas* sp. in POCHMANN, 1943), but the former have not yet been observed in *C. commutata* PASCHER.

Rhodomonas pusilla (BACHMANN) comb. nova

Basionym: *Cryptomonas pusilla* BACHMANN, Verh. naturforsch. Ges. Basel 35: 165, Fig. 5, 1923.

Synonyms: *Cryptomonas curvata* GUSEVA, Bull. Soc. Nat. Moscou, Ser. biol. 45: 221–222, 1936. (Non *Cryptomonas curvata* EHRENBERG). *Rhodomonas minuta* SKUJA var. *minuta* et var. *nannoplanctica* SKUJA, Symb. bot. upsal. 9,3: 346–347, 1948.

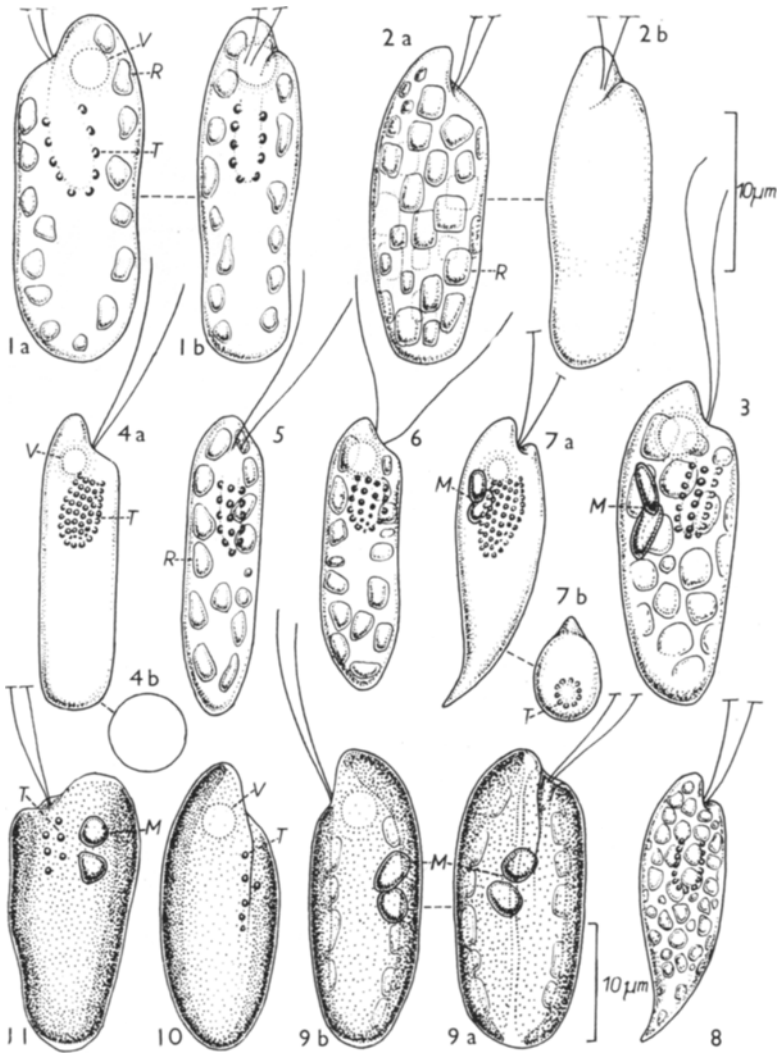
Plate 4: 1–6

The flagellate has been observed many times in the plankton of dam-reservoirs in Bohemia, of the Great Mazurian Lakes in Poland, and of Lago Maggiore in Italy. It usually occurred together with *Cryptomonas marssonii* SKUJA, *C. reflexa* SKUJA, sometimes with *C. curvata* EHRENB., being present throughout the whole season. Its vegetation in Slapy Reservoir on the River Vltava displayed a maximum of the order of 10^3–10^4 cells per millilitre at the surface during April–June. Its share in the phytoplankton biomass was, however, not pronounced, as the average volume of one cell was only 70 μm^3 (in comparison with 1 200 μm^3 of *C. marssonii*, 3 600 μm^3 of *C. reflexa*, and 11 000 μm^3 of *C. curvata*).

The cells were wedge-shaped, with a wide truncate apex and an elongated, usually sharply pointed antapex, curved apparently towards the ventrum. Two flagella were inserted somewhat subapically in the entry of the gullet which reached more or less half the cell's length and was inlaid with minute trichocysts. The single parietal chromatophore of a brown, yellowish brown or reddish brown colour was placed dorsally. No pyrenoid could be observed in my specimens in vivo, but it was always distinct after preservation of the material by Lugol's solution (Plate 4: 4, 5). The nucleus with nucleolus in the antapical cell part and small spherical starch grains on the interior wall of the chromatophore were also more clearly visible in preserved cells. 1–2 light-breaking grains of irregular shape, well visible in vivo, were very often placed in the caudal part. A relatively large contractile vacuole was in the apical rostrum.

The dimensions of the cells from Slapy Reservoir were (averages of about 25 specimens are given in the brackets): length 7.1–(9.4)–11.2 μm, thickness 4.0–(5.2)–6.2 μm; from Klíčava Reservoir: length 8.2–(9.8)–12.2 μm, thickness 4.2–(5.2)–7.2 μm

The organism was described by BACHMANN (1932) from Vierwaldstättersee as *Cryptomonas pusilla*. He observed no pyrenoid, but only the antapical grain. This is understandable if the flagellate was investigated only in vivo. GUSEVA (1936) drew and described the flagellate very faithfully, but under the homonym *Cryptomonas curvata*. She gives both the pyrenoid and the basal grains. SKUJA (1948) studied, drew and described this flagellate in detail and classified it as a new species of the genus *Rhodomonas* KARSTEN, *R. minuta* SKUJA. This



1—3: *Chilomonas oblonga* f. *minor* (CZOSN.) c. n. (1: specimen from Nové Hrady; 2—3: specimens from the Jizera Mountains); 1a, 2a, 3 — lateral views, 1b, 2b — ventral views. 4—6: *Chilomonas bacillaris* sp. n.; 4a, 6 — lateral views, 4b — cross section, 5 — ventral view. 7—8: *Chilomonas insignis* (SKUJA) c. n.; 7a, 8 — lateral views, 7b — apical view. 9—11: *Cryptochrysis pochmannii* HUBER—PEST., 9a — ventral view, 9b — lateral view, 10 — oblique view, 11 — the cell stained with methylene-blue. (Original)

seems to be correct, since *R. minuta* has all the typical features of the genus: one dorsal parietal chromatophore, the true sheathed pyrenoid, basal light-breaking grains, and in some specimens at least, a reddish colour. Under SKUJA's name the species was recognized by KRISTIANSEN (1959) and LUND (1962). The latter author writes: "It seems open to doubt whether *R. minuta* can be separated into two varieties..." (p. 135), i.e. *R. minuta* SKUJA var. *minuta* and var. *nannoplanctica* SKUJA. I agree with this scepticism, extending it also to the independent existence of the species *Cryptomonas pusilla* BACHM. (SKUJA 1956, WILLÉN 1960). All the taxa named above may be found in the variable Slapy population (Plate 4: 1—6). Since BACHMANN's species has the priority, however, the relevance of the species to the genus *Rhodomonas* proves to be correct, I propose the new combination *Rhodomonas pusilla* (BACHM.) c.n.

Cryptomonas obovata SKUJA

(Non *C. obovata* CZOSNOWSKI, Poznań. Towar. Przyj. Nauk 11: 24, 1948 = *C. czosnowskii* KISELEV, Opred. presnov. Vodor. SSSR 6: 69—70, 1954.)

Plate 4: 7—9

The flagellate was found in various biotopes: a peaty pool with brown water ("Zhůřská slať" near Horská Kvilda, Šumava Mountains, southern Bohemia, July 1955), a stagnant water with suspended ferric hydroxide below the fish-pond dam (Jevany near Praha, May 1958), a brook, amidst the clumps of *Rhizoclonium* sp. (Bělá pod Bezdězem, northern Bohemia, March 1959).

The widely rounded apex with a deep ventro-lateral entry of the gullet and the insertion of the flagella is characteristic of this species. The cells were widest closely below the subapical notch, the dorsum as well as the ventrum were convex, the antapex was somewhat narrowed, but bluntly rounded. The cells were only slightly flattened, either laterally (Plate 4: 8), or dorso-ventrally (Plate 4: 7). The two brown chromatophores were situated laterally, two Maupas corpuscles of irregular shape, one of them usually smaller or sometimes missing, were disposed dorsally. The nucleus with the nucleolus was observed in the posterior part, the single contractile vacuole near the entry of the gullet; this was either long and narrow (Plate 4: 7) or bag-shaped (Plate 4: 8), inlaid with numerous trichocysts.

The cells from southern and central Bohemia were 19—22 μm long, 11—13 μm wide, 9—10 μm thick; those from northern Bohemia were 27 μm long, 12 μm wide and 15 μm thick.

My records agree well both with SKUJA's original description (1948) and his new record (1956). SKUJA has also drawn slightly laterally flattened cells in the first publication, dorsoventrally flattened in the second. The range of dimensions of the Swedish specimens is wider.

Cryptomonas lobata KORŠIKOV

Plate 4: 10

The flagellate was observed in sapropel in the shallow littoral of a fish-pond, amidst *Equisetum fluviatile* (pond "Punčocha" near Nové Strašecí, central Bohemia, May 1958).

It was of regularly ellipsoidal shape, with an obliquely cut, however, rounded apex. The flagella were inserted somewhat subapically only; the gullet, inlaid with minute trichocysts, was narrow and exceeded half the cell. The single contractile vacuole was wholly apical. Very strange was the morphology of the single ochraceous chromatophore: it was an irregularly lobed plate with three deep notches of which the anterior one was deepest. No pyrenoid, no Maupas corpuscles, nor any structure of the periplast were visible in vivo.

The cells were 18 μm long, 9 μm thick.

The present record agrees well with the original description (KORŠIKOV, ex KISELEV, 1954) except for the pyrenoid and structured periplast. Apart from the importance of these features, which may be latent in vivo, the entire habitus of the cell and particularly of the chromatophore is identical with the typus. To the best of my knowledge the species has been recognized for the first time.

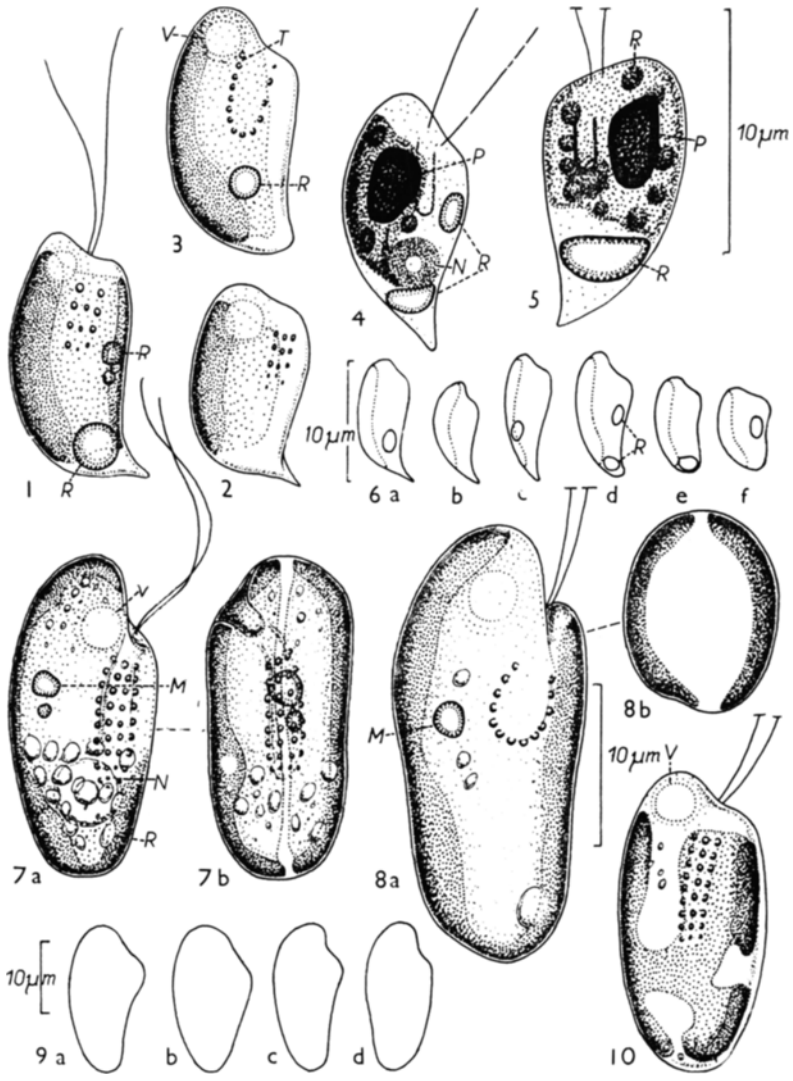
Cryptomonas pyrenoidifera GEITLER f. **procera** (SCHILLER) comb. nova

Basionym: *Cryptomonas procera* SCHILLER, Wissenschaft. Arbeit. Burgenland 18: 33, tab. XI: 48, 1957.

Plate 5: 1—2

The flagellate was observed among sapropel with suspended ferric hydroxide in a drain with stagnant water of a fish-pond system near Jevany near Praha, May 1958.

The cells were markedly slender, somewhat ventrally curved (ventrum concave, dorsum convex), not flattened (circular cross section, Plate 4: 1 c), with rostrate apex and bluntly pointed antapex. The gullet, rather more than half the cell, inlaid with numerous spherical trichocysts, ran out subapically into a funnel-shaped depression where two subaequal flagella were also inserted. The large contractile vacuole was situated dorsally from this depression. Two brown-yellow chromatophores with lobed margins were placed laterally, with a wide free slot on the ventral side. Two large oval pyrenoids with starch sheaths, placed laterally half-way along the cell, were attached inside to the chromatophores (amphosomes). In some cells a single light-breaking corpuscle, perhaps Maupas corpuscle, of an irregularly oval shape, was situated dorsally behind the pyrenoids and the gullet (Plate 5: 2).



1 – 6: *Rhodomonas pusilla* (BACHM.) c. n. (all specimens are from Slapy Reservoir on the River Vltava); 1, 2, 3 – lateral views, 4, 5 – cells preserved with KJ + J, 6 – lateral views, variability of shape and size. 7 – 9: *Cryptomonas obovata* SKUJA (7, 9c, d: specimens from Jevany; 8: specimen from Bělá; 9a, b: specimens from Šumava Mountains); 7a, 8a – lateral views, 7b – ventral view, 8b – cross section, 9 – lateral veiws, shape variability. 10: *Cryptomonas lobata* KORŠ., lateral view. (Original)

The cells were 15.5—21 μm long, 5—7 μm thick and wide.

The morphology of my specimens fully agreed with the original description by GEITLER (1922) as well as with the observations of SKUJA (1948). They had, however, a greater ratio of length to width than any form hitherto observed. SCHILLER (1957) described this form as a new species *Cryptomonas procera* SCHILLER. When the ratios of the cell length to width of all records are compared (see table 1), it is hardly possible to base the establishment of the new species on this difference only. SCHILLER, however, was able to distinguish both forms, while my specimens were even more slender. Thus the form *C. pyrenoidifera* GEITL. f. *procera* (SCHILLER) c.n., with the ratio of length to width > 2.5, is proposed.

Table 1

Ratios of length to width of the cells of *Cryptomonas pyrenoidifera* GEITL., according to several authors

Form	Author	Year	Length: Width Ratio
C. pyrenoidifera	GEITLER	1922	2.2—2.3
f. *pyrenoidifera*	BOURRELLY	1947	2.0
	SKUJA	1948	1.5—1.9
	SCHILLER	1957	1.6—2.1
C. pyrenoidifera	SCHILLER	1957	2.5—2.6
f. *procera*	JAVORNICKÝ	1966	3.0—3.1

Cryptomonas cylindrica EHRENB.

Plate 5: 3—7

This flagellate was very common in small plus minus periodical standing waters with low pH values (3.5—4), among *Sphagnum*, *Polytrichum*, *Utricularia* and *Carex* (Hrdlořezy on the Lužnice near České Velenice and Husinec in southern Bohemia, Jizerka in Jizera Mountains and "Břehyňský" pond near Doksy in northern Bohemia).

The cells were of more or less cylindrical shape, widest commonly in the anterior part, sometimes a little curved with a convex dorsum and flat or slightly concave ventrum. The apex was obliquely cut, the entry of the gullet and the insertion of the flagella being only a little subapical. The antapex was rounded; the cells were not flattened, so that the cross section was circular (Plate 5: 3b), or only slightly flattened laterally. The yellow-brown chromatophores were either lateral, with wide slots (Plate 5: 3,6), or of an indeterminate position, with spiral slots (Plate 5: 4—5). The gullet was commonly wide and reached nearly half way along the cell; it was inlaid with either sparse but large, or numerous but minute trichocysts. The large contractile vacuole was disposed dorsally from the entry of the gullet and two oval Maupas corpuscles were situated behind the lower part of the gullet. The spherical nucleus with nucleolus was posteriorly situated.

The cells were 18.5—24 μm long, 8—9 μm thick.

This species is not mentioned by modern authors in spite of its common occurrence. My specimens, especially those pictured in Plate 5: 3, 7b, d, agree well with EHRENBERG's (1838, p. 42, tab. II, XIX) original description and pictures with the exception of the green colouring and the length of 1/36 mm (= 28 μm) which he gives. The colour of the cryptomonades is variable and also the small difference in size cannot be considered as substantial. The ratio of enlargement of EHRENBERG's pictures, however, shows the cell length ranging from 23 to 28 μm. The original name was abandoned and the species was partially identified with other species (*C. erosa* EHRENB. in SKUJA, 1939, Fig. 14?). Some of the newly described species belong to *C. cylindrica* EHRENB., e.g. *C. cylindracea* SKUJA (1956). Closely related species are *C. wołoszyńskae* CZOSNOWSKI (1948; compare our specimen in Plate 5: 7a) and *C. metalimnica* CHRISTEN (1959); however, they do not have Maupas corpuscles.

DINOPHYCEAE

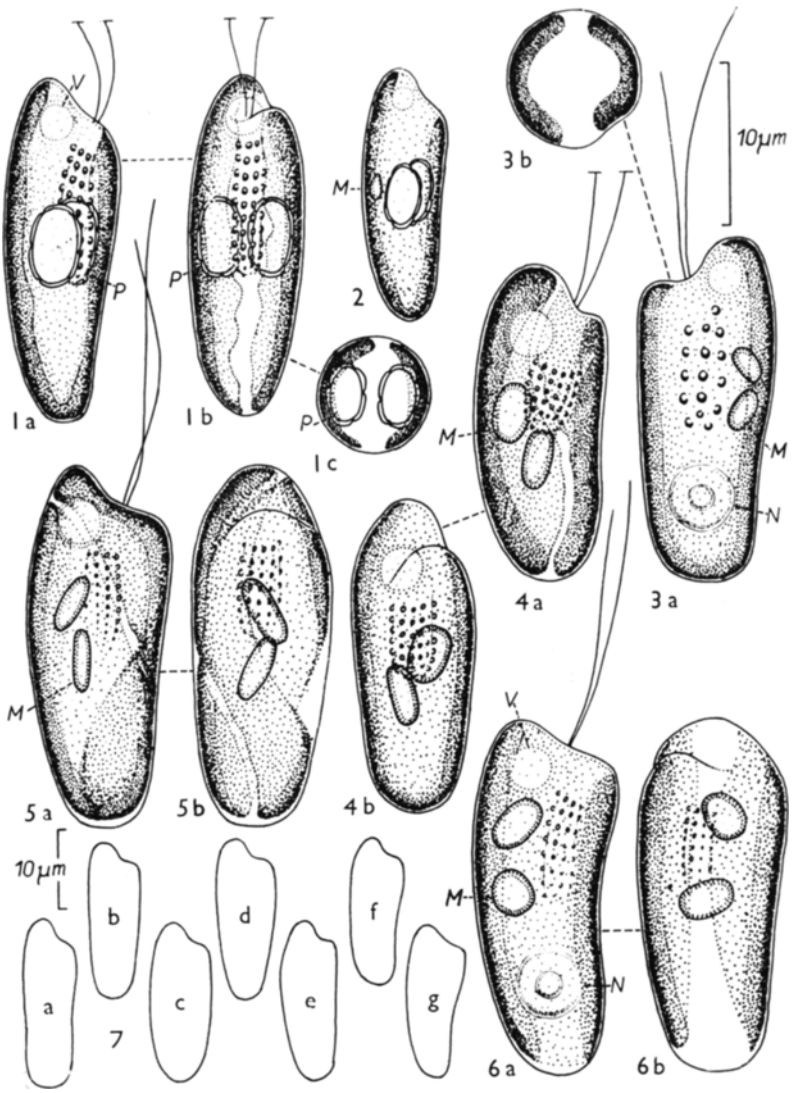
Amphidinium larvale LINDEMANN

Synonyms: *Amphidinium hyalinum* ENTZ, Arb. I. Abt. ungar. biol. Forschungsinst., 1930: 207. *A. Tatrae* et *A. Tatrae* f. *achromaticum* WOŁOSZYŃSKA, Arch. Hydrobiol. Ryb. 10: 190, 1936. *A. luteum* SKUJA, Acta Horti bot. Univ. latv. 11/12: 148—149, 1939. *A. gyrinum* HARRIS, Proc. lin. Soc. London 152, 1: 18—19, 1940; false *A. gyrum* et *A. gyrus* in FOTT et ETTL, Preslia 31: 216, 240, 1959. *A. lohammari* SKUJA, Nova Acta reg. Soc. Sci. upsal., Ser. 4, 16/3: 354, 1956. *A. Skujae* CHRISTEN, Hydrobiologia 10: 69, 1958.

Plate 6: 1—4

The flagellate was very common, though, not abundant in the polluted River Vltava, its reservoirs and tributaries. It was frequent after several days' incubation of samples in the dark (JAVORNICKÝ and PROKEŠOVÁ, 1963: 340). It was, furthermore, observed in the fish-pond "Pilný" near Telč, Moravia. The species occurred in these localities during June—November.

The epicone was considerably smaller and a little narrower than the hypocone, rounded or flattened. The hypocone was widely rounded with a shallow notch on the antapex; the sulcus was, however, hardly visible, being wide and shallow without touching the epicone. The girdle was deep and distinct. After five days, a teratological form appeared in the sample (Plate 5: 4f). Both flagella were free, the longitudinal one being 1.5 to double the cell length. The large, oval nucleus with pearl-like structure was seldom visible in the hypocone (Plate 6: 1a). The reserve materials were of various forms: very small or relatively large grains of irregular or exactly spherical shape, sometimes a large red or orange oil globule (Plate 6: 1a, 4d—e). No stigma was present. Chromatophores were absent in the majority of cells; in one case



1–2: *Cryptomonas pyrenoidifera* f. *procera* (SCHILLER) c. n.; 1a, 2 — lateral views extremes of size, 1b — ventral view, 1c — cross section. 3—7: *Cryptomonas cylindrica* EHRENB. (3, 7c, d: specimens from Husinec; 4, 7e, f: specimens from Třebon; 5, 7g: specimens from Břehyně; 6, 7a, b: specimens from the Jizera Mountains); 3a, 4a, 5a, 6a — lateral views, 4b, 5b, 6b — ventral views, 3b — cross section, 7 — lateral views, shape variability. (Original)

only three were observed, parietal, bright yellow (Plate 6: 3a—b). They were very distinct and sharply limited, being unmistakably distinguishable from ingested algae which were also observed; the other specimens of this population were colourless, but morphologically identical (Plate 6: 4a—b,e).

The cells were dorsoventrally somewhat flattened; the dimensions of the specimens observed are collected in the table 2.

Table 2

The dimensions (in μm) of the specimens of *Amphidinium larvale* LINDEM. observed from various localities in Czechoslovakia

Length			Width		Thickness
Cell	Epicone	Hypocone	Epicone	Hypocone	
9.2	—	—	7.0	8.0	—
10.5	—	—	—	7.5	—
12.0	4.0	8.0	8.0	10.0	—
12.2	4.5	7.7	9.8	11.0	10.3
13.0	—	—	—	11.0	—

All the populations observed were very variable, but no separable species could be determined. Three species of small *Amphidinia*, all about 10 μm, either with or without chromatophores, were described: *A. elenkinii* SKVORTZOW, *A. tatrae* WOŁOSZ., and *A. skujae* CHRIST. Of these *A. elenkinii* differs in the antapically narrowed sulcus, particularly in "Chromatophoren kugelig, sehr klein, braun..." (SKVORTZOW, 1927). This species was recently recognized in Czechoslovakia (J. POPOVSKÝ, personal communication). In my opinion it is related to *A. lacustre* STEIN. As to the plastidom of the other two species their authors wrote: WOŁOSZYŃSKA (1936, p. 190—191): "Die Zellen aus der Litoralzone der Seen haben mehrere dunkelgelbe Chromatophoren, dagegen die aus tieferen Regionen sind hellgelb. In den Zellen aus ±40 m Tiefe... fehlen Chromatophoren vollständig." CHRISTEN (1958, p. 70): "...gelbgrünen Chromatophoren von *A. Skujae* können hie und da auch fehlen oder stark reduziert sein." CHRISTEN also describes a stigma, but a small one, morphologically undefined and often hardly visible. Various carotenoid corpuscles are very common in these flagellates.

In addition, four species of colourless *Amphidinia* were described, which cannot be differentiated from one another and can be fully identified with the colourless morphae of *A. tatrae* and *A. skujae;* they are *A. larvale* LINDEM., *A. hyalinum* ENTZ, *A. gyrinum* HARRIS, and *A. lohammarii* SKUJA. The stigma is given only for *A. hyalinum*, but a little doubtfully: "Dieser... Organismus hat... oft auch einen roten Augenfleck." (ENTZ, 1930, p. 207). On the other hand, *A. luteum* SKUJA is identical with the coloured morpha of *Amphidinium* in my material (Plate 6: 3 a—b).

It is clear that all the taxa named before represent a single, even if very variable species. Either the autotrophic, or the heterotrophic morpha may dominate according to the environmental conditions. Perhaps some infraspecific taxa could be distinguished. The name *A. larvale* LINDEMANN (1928) has the priority in case *A. elenkinii* SKVORTZ. does not belong to this group.

Gymnodinium triceratium SKUJA

Synonyms: *Gyrodinium asymmetricum* WOŁOSZYŃSKA, Arch. Hydrobiol. Ryb. 10: 192, 1936. *Gymnodinium impar* HARRIS, Proc. lin. Soc. London 152, 1: 9, 1940.

Plate 6: 5—6

The flagellate was observed very rarely among the clumps of *Mougeotia* in a small forest brook near Jevany near Praha, May 1958.

The epicone of my specimens was hemispherical, somewhat wider than the hypocone; the latter ran out into a pointed antapex. The two latera of the hypocone formed two rounded protuberances, without any point. The girdle was regularly circular; the sulcus, visible only in the hypocone, passed obliquely on the right side of the antapex. The cells were only slightly dorsoventrally flattened. 2—3 irregularly lobed chromatophores of bright yellow colour were placed mainly in the epicone; the spherical nucleus, without any structure visible in vivo, was more a less inframedian. Several spherical grains of reserve materials were dispersed in the colourless cytoplasma. Neither stigma nor red oil globules were present. Both flagella were free; the longitudinal one was 1.5 times the cell length.

The cells were 12—14 μm long, 10—11 μm wide.

The specimens observed agree closely with the description given by SKUJA (1939) except for two conical processes on the hypocone's latera. A very similar, in my opinion identical, flagellate was described by WOŁOSZYŃSKA (1936) as *Gyrodinium asymmetricum*. She gives four processes of the hypocone, 2 conical and 2 papillate ones. The morphology of this flagellate does not agree with the definition of the genus *Gyrodinium* KOFOID et SWEZY (1921) and the species must be ascribed to the genus *Gymnodinium*. Thus the description of the flagellate in question is the oldest, but a new combination is impossible, since the name *Gymnodinium asymmetricum* MASSART must be respected, even if it is synonymous with *Katodinium asymmetricum* (MASSART) LOEBLICH (MASSART 1920, SCHILLER 1933, FOTT 1957, LOEBLICH 1965). There is no doubt that also *Gymnodinium impar* HARRIS belongs to this variable species. HARRIS (1940) describes the epicone as "subaequalis" to the hypocone, which shows only two processes. So we have a distinct succesion of variability: hypocone with four processes (WOŁOSZYŃSKA 1936), three processes (SKUJA 1939, THOMPSON 1947), two processes (HARRIS 1940), irregularly conical antapex (in the present paper). *Gymnodinium triceratium* SKUJA is, according to all the records, a winter or spring species, which lives in small forest or dystrophic waters.

Gymnodinium lantzschii UTERM. var. **rhinophoron** JAVORN.

Plate 6: 7

This colourless flagellate was found in the clarifier of the sewage treatment plant at Sedlec near Praha, August 1959. In purified sewage water with pH = 7.4 there developed a rich community of colourless flagellates, *Ciliata*, *Bdelloidea* and green algae (*Chlamydomonas* sp., *Stigeoclonium lubricum* (DILLW.) KÜTZ.). Bacteria cultivated on agar plates reached nearly one million per millilitre.

Only one solitary specimen of *G. lantzschii* var. *rhinophoron* was observed. Its epicone was a little higher and wider than the hypocone, both being slightly oblique. The epicone was bluntly conical, the hypocone widely rounded with a posterior shallow notch. The girdle was wide and deep, slightly spiral, disconnected in the middle of the ventrum by a vertical "keel" adhering to the right margin of the sulcus. This keel resembled a nose from lateral view. Inside the cell there were numerous granules of reserve materials, the food-vacuole with ingested algae and the nucleus without any visible structure.

The cell was 16 μm long, 14 μm wide, dorsoventrally a little flattened.

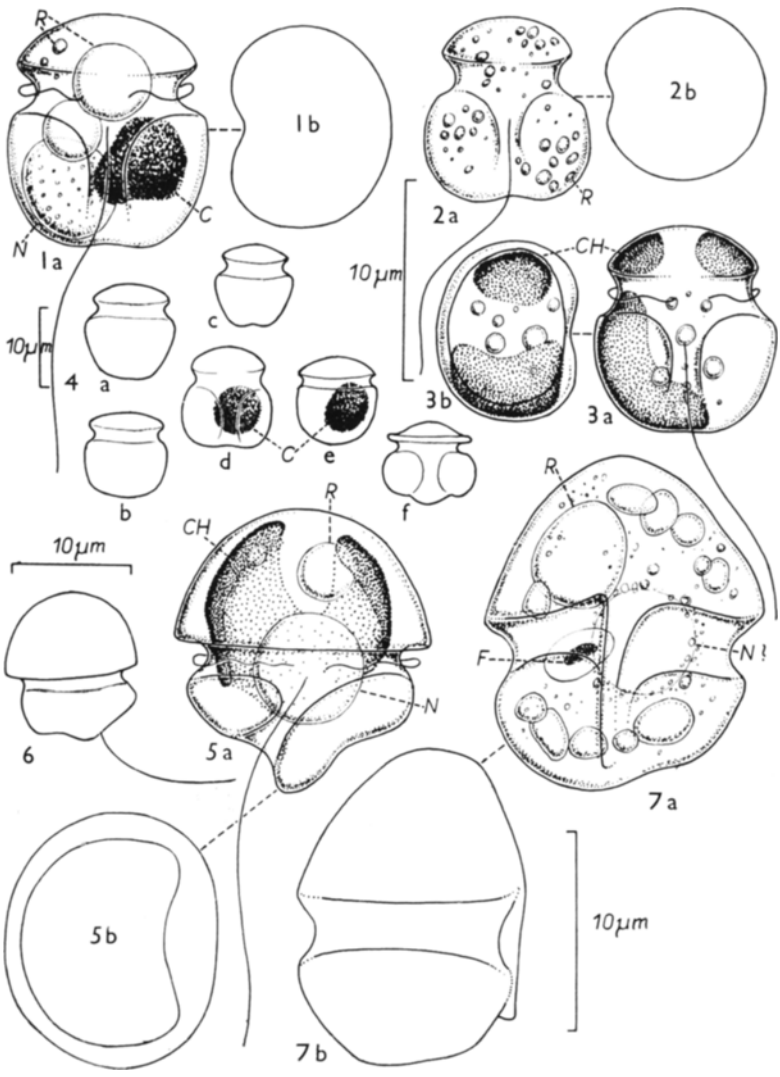
The new record agrees in details with the diagnosis (JAVORNICKÝ, 1957) and completes the ecology of the variety described from an aquarium.

Gymnodinium wawrikae SCHILLER

Plate 7: 1—4

The flagellate was found in swamp-pools among the growths of *Typha*, *Juncus* and *Ceratophyllum*, with pH 7.0 (Hostivice near Prague, August 1958), or 6.0 (Třebíč, south-western Moravia, June 1963), in the plankton of the fishpond (village Doupě near Telč, not far from Třebíč, September 1959), in an experimental nylon tank in the reservoir Sedlice on the River Želivka (south-eastern Bohemia, August 1958).

The cells were ± spherical, dorsoventrally a little flattened. The epicone was nearly conical with the apex either rounded or bluntly pointed; it was slightly higher and wider than the broadly rounded hypocone. The girdle was relatively wide and slightly spiral; the margin of the epicone projected into the girdle as a short tip on the ventral side. The wide sulcus was situated on the hypocone, forming an antapical notch in some specimens only (Plate 7: 1a). Both flagella were free, the longitudinal one was a little longer than the cell. Many yellow chromatophores in the form of irregular disks, relatively large, sometimes smaller, were disposed on the periphery of the protoplast (Plate 7: compare 1 and 3 with 2 and 4); sometimes they were accumulated near the cell poles so that the equatorial area became hyaline (Plate 7: 1a). The red stigma of irregular shape was situated behind the sulcus in the hypocone.



1—4: *Amphidinium larvale* LINDEM. (all specimens are form the River Vltava and its reservoirs); 1a, 2a, 3a — ventral views, 1b, 2b — cross sections of hypocones, 3b — apical view, 4 — variability of size and shape (a, b, c, e — dorsal views, d, f — ventral views; e = teratological form!). 5—6: *Gymnodinium triceratium* SKUJA; 5a — ventral view, 5b — antapical view, 6 — dorsal view (less magnified). 7: *Gymnodinium lantzschii* var. *rhinophoron* JAVORN.; 7a — ventral view, 7b — lateral view. (Original)

The large spherical nucleus with a pearl-like structure was in the centre of the cell or somewhat posterior. The plasm was hyaline, sometimes with dispersed carotenoid corpuscles and granules of reserve materials. Under the microscope the cells lost their shape after some time without leaving any membrane.

The dimensions of the specimens from various localities are given the table 3, in μm.

Table 3

The dimensions (in μm) of the specimens of *Gymnodinium wawrikae* SCHILLER observed from various localities in Czechoslovakia

	Length			Width		Thickness
Locality	Cell	Epicone	Hypocone	Epicone	Hypocone	
Hostivice	25.5	13.5	12.0	24.0	22.5	19.5
Třebíč	22.0	11.0	11.0	19.5	18.0	14.0
Telč	18.0	—	—	15.6	—	14.2
Sedlice	16.0	—	—	15.0	—	—

This species, though common, is neither described nor drawn in earlier literature, as far as I know; but it agrees well with the species described and schematically drawn by SCHILLER (1955) as *Gymnodinium wawrikae* sp.n.; he, however, reports the epicone somewhat smaller than the hypocone, but this may be a variable feature.

Woloszynskia coronata (WOŁOSZ.) THOMPSON var. **glabra** WOŁOSZ.

Plate 7: 5—6

The flagellate was found in the plankton of the reservoir on the River Blanice near Husinec, southern Bohemia, August 1958 (water-bloom of *Cyanophyta*, pH 10).

The cells were broadly elliptic, dorsoventrally scarcely flattened, with a hemispherical epicone, a little higher and wider than the apically slightly flattened hypocone. The margin of the epicone projected as a short tip into the deep, somewhat spiral girdle. The sulcus was formed only in the hypocone, reaching the antapex. The membrane was very thin and elastic, with a very fine hexagonal structure, not visible until stained with methylene-blue. One empty membrane with an incomplete epivalva was observed so that no fillet on the apex was found; the hypovalva was complete, without any punctation visible on the antapical plate (Plate 7: 5 b). The longitudinal flagellum was a bit longer than the cell; the transverse flagellum was not visible. A large tetragonal groove-shaped stigma was seen in the hypocone, behind the sulcus. Numerous yellow-brown wedge-shaped chromatophores were situated radially, with thickened poles below the protoplast surface (Plate 7: 6c). The

oval nucleus with a pearl-like structure was in the left lower part of the epicone. Small carotenoid corpuscles were dispersed in the cytoplasm.

The epicone of a single specimen was 12.7 μm high and 19.5 μm wide, the hypocone 9.8 μm high and 16.8 μm wide; i.e. the whole cell was 22.5 μm long and 19.5 μm wide.

The present record agrees well with *W. coronata* var. *glabra* as given by WOŁOSZYŃSKA (1917, as *Gymnodinium*) and THOMPSON (1950). The little ventral tip on the lower margin of the epicone was neither described, nor drawn in living cells by these authors. The scheme of the membrane structure drawn by WOŁOSZYŃSKA (1917, Tab. 11: 13), however, indicates it clearly. In my opinion *Gymnodinium nygaardii* CHRISTEN (1958a) also belongs to this species. The problems of the presence or absence of the apical fillet (not given by THOMPSON, 1950!) and of the taxonomical significance of the punctation of the antapical plate, could not be solved from my poor material.

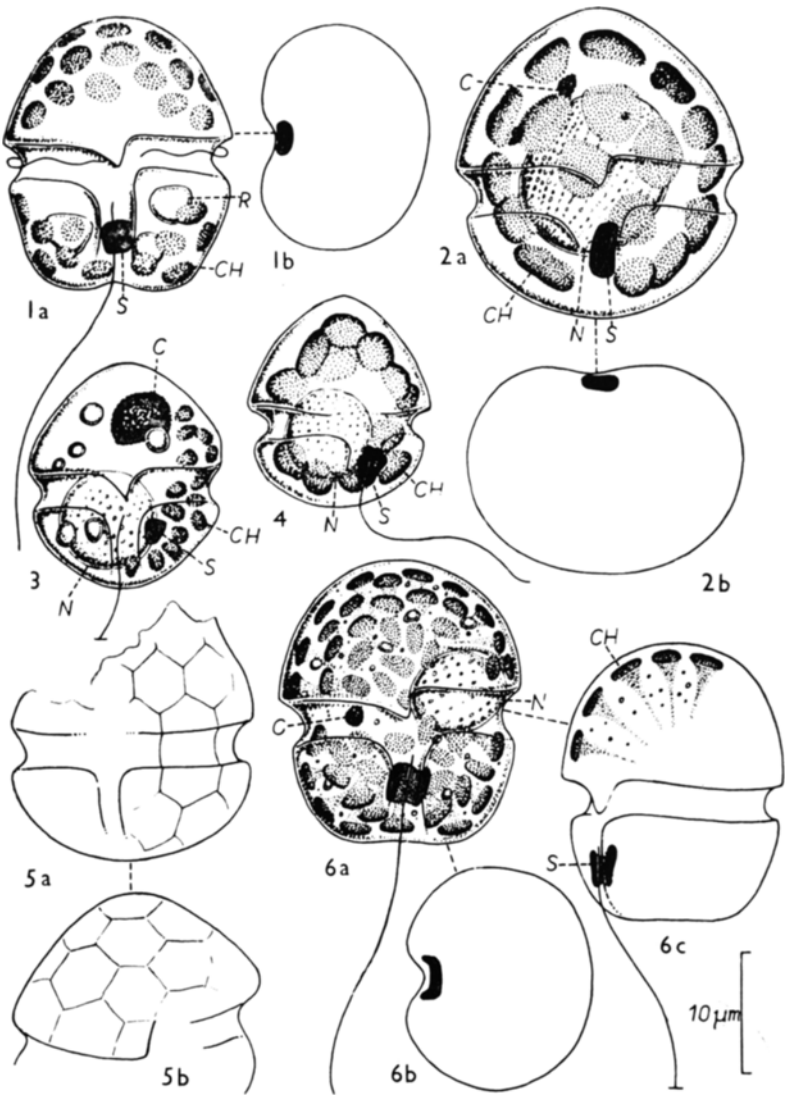
Woloszynskia neglecta (SCHILLING) THOMPSON

Plate 8: 1—2

The flagellate was observed in the same locality near Nové Strašecí, central Bohemia, as *Cryptomonas lobata* KORŠ., May 1958.

The cells were broadly elliptic, dorsoventrally flattened, with both cones widely rounded; the epicone was higher than the hypocone and its margin was somewhat broadened. The girdle was deep, but narrow; the sulcus was visible only on the hypocone without reaching the antapex. Only the longitudinal flagellum approximately of the length of the cell was observed. The membrane was firm (plasmolysis!) with a very fine hexagonal structure, visible only in the empty membrane. This was, unfortunately, found only in the hypovalva (Plate 8: 2a—b). The marginal fillets of the sulcus were apparent, however, no antapical spine was present (compare WOŁOSZYŃSKA, 1917 with THOMPSON, 1947). The oval red stigma, placed behind the crossing of the sulci, was not present in all specimens observed. Besides this there were several pale-red carotenoid corpuscles, dispersed within the cytoplasm. Reserve materials were in the form of minute granules among the chromatophores, which were yellow-brown elongated stripes, radially disposed, with the distal ends flattened, forming discoid plates (Plate 8: 1d). This type of chromatophore can be erroneously considered as parietal discoid as it is given in some descriptions (HUBER—PESTALOZZI, 1950). THOMPSON (1947) gives the chromatophores as "discoid-ovoid,... parietal or radial at the periphery". The elongated oval nucleus, situated assymmetrically in the epicone (Plate 8: 1 a), is characteristic for the species (NYGAARD, 1945, tab. III: 8).

The cells were 33—36 μm long (epicone/hypocone = 18/15 or 21/15 μm), 30 μm wide and 20 μm thick.



1—4: *Gymnodinium wawrikae* SCHILLER (1: specimen from Třebíč; 2: specimen from Hostivice; 3: specimen from Telč; 4: specimen from Sedlice Reservoir); 1a, 2a, 3 — ventral views, 1b, 2b — cross sections of hypocones, 4 — ventro-lateral view. 5—6: *Woloszynskia coronata* var. *glabra* WOŁOSZ.; 5a — empty membrane, ventral view, 5b — antapical view, 6a — living cell, ventral view, 6b — cross section of hypocone, 6c — ventro-lateral view. (Equally magnified, original)

Woloszynskia mira (UTERM.) KISELEV

Basionym: *Gymnodinium mirum* UTERMÖHL, Schrift. Süßwasser- Meeresk. Büsum 1: 6, 1923.

Synonyms: *Gymnodinium carinatum* SCHILLING var. *hiemalis* WOŁOSZYŃSKA, Bull. Acad. Sci. Cracovie, Ser. B, 1917: 118—119. *Glenodinium helicozoster* HARRIS, Proc. lin. Soc. London 152, 1: 23, 1940.

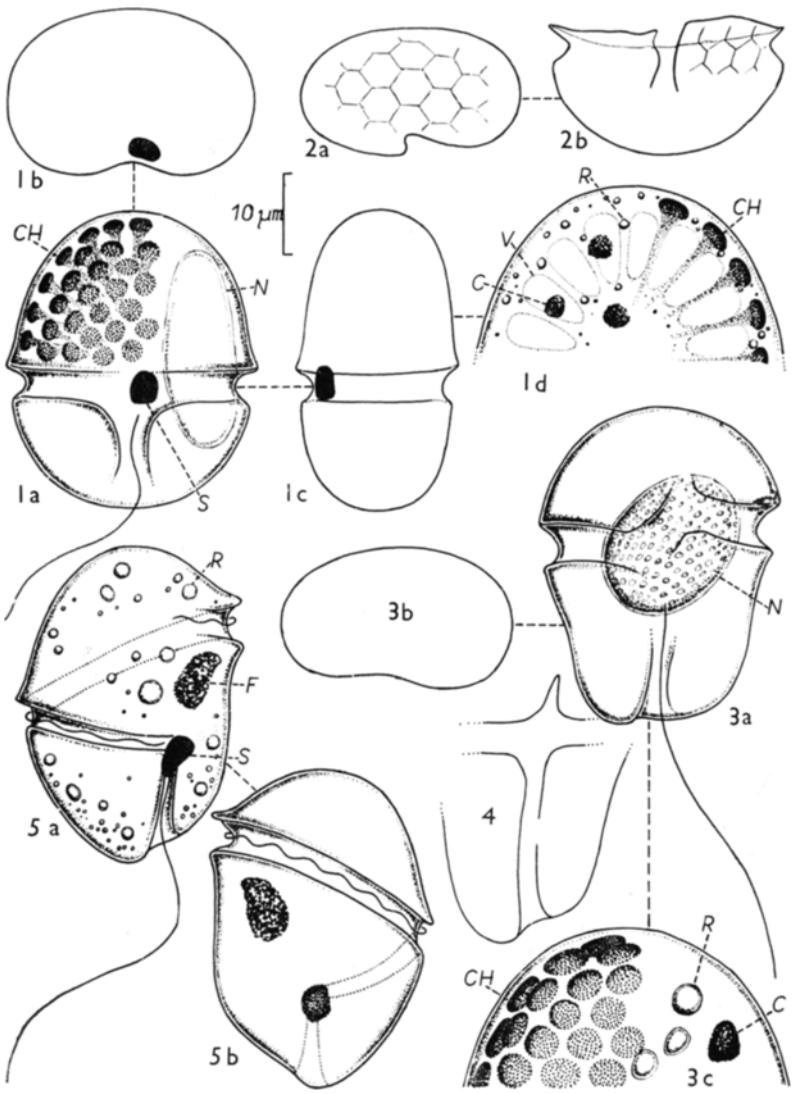
Plate 8: 3—4

The flagellate was abundant in the plankton of a small forest pool near Ďáblice in the vicinity of Praha, April 1957.

The cells were generally ovoid, slightly assymmetrical. The epicone was hemispherical, less high than the conical hypocone with obliquely cut antapex. The deep and wide girdle formed a spiral descending to the left; the sulcus formed a sharp oblique sinus in the margin of the epicone and on the hypocone reached the antapex broadening slightly. The right half of the hypocone was longer and thicker than the left, forming an assymetrical projection visible from the ventral and the lateral view. Dorsoventrally the cells were flattened. Both flagella were free, the longitudinal one being a little longer than the cell. No structured membrane could be observed; in the course of observation the cells became spherical without plasmolysis. Numerous yellow-brown discoid chromatophores were disposed under the protoplast surface. Small granules of starch and red carotenoid corpuscles were dispersed in the plasm (Plate 8: 3c). The large oval nucleus with clear pearl-like structure was placed centrally. The stigma was absent.

The cells were 30 μm long (epicone 13, hypocone 17 μm), 24 μm wide (hypocone 22 μm) and 17 μm thick.

The present record agrees well with the type of UTERMÖHL (1923) being only a little smaller, as well as with the record by NYGAARD (1945); the latter author gives the range of dimensions comprising my specimens (27—45 μm long, 22—23 μm wide; p. 32, tab. III: 10). UTERMÖHL reports the membrane without drawing it "sehr zart, aus Platten zusammengesetzt". KISELEV (1954) transferred the species to the genus *Woloszynskia* THOMPSON on the basis of the original diagnosis by UTERMÖHL. It is, however, evident that *Gymnodinium carinatum* SCHILLING var. *hiemalis* WOŁOSZ. is much more similar to *G. mirum* UTERM. than to *G. veris* LINDEMANN (1925; = *Woloszynskia veris* (LINDEM.) THOMPSON, 1950, false *W. vera*). We may thus consider the pictures by WOŁOSZYŃSKA (1917, tab. 11: 1—2, tab. 12: 12) as the membrane structure of *W. mira* (UTERM.) KISEL. The relation of this species to *W. veris* (LINDEM.) THOMP. is not yet clear; their epicones are different, but this feature may be variable. *Glenodinium helicozoster* HARRIS (1940) also belongs evidently to *W. mira*. It is smaller, thus broadening the size range of the species.



1–2: *Woloszynskia neglecta* (SCHILLING) THOMP.; 1a – ventral view (only a part of th chromatophores is pictured!), 1b – cross section of hypocone, 1c – lateral view, 1d – detai of protoplast structure in epicone, 2a – empty hypovalva, antapical view, 2b empt hypovalva, ventral view. 3–4: *Woloszynskia mira* (UTERM.) KISEL.; 3a – ventral viev (chromatophores are not pictured!), 3b – cross section of hypocone, 3c – detail of protoplas structure in epicone, 4 – detail of the course of furrows. 5: *Gyrodinium hyalinum* (SCHILLING KOF. et SWEZY; 5a – ventro-lateral view, 5b – dorsal view. (Original)

Katodinium vorticella (STEIN) FOTT in CHRISTEN[2]

Plate 9: 1—3

The flagellate was collected in the swamp-pool "Chobot" near Hostivice in the vicinity of Praha (pH = 7.0), in experimental nylon tanks exposed in Sedlice Reservoir on the River Želivka, south-eastern Bohemia (in both localities accompaniing *Gymnodinium wawrikae* SCHILLER!), and in village-ponds near Třeboň; all collections made in August 1958.

The conspicuous variability of the cell shape was already given by the author of the species (STEIN, 1883, tab. III: 1—3). Also THOMPSON (1950, Figs. 94—99) drew the whole spectrum of the various morphae. Nevertheless, it might be useful to present drawings of the specimens from Czechoslovakia, which show in one respect a greater variability than do those from North America. The shape of their epicones varied from widely rounded through a more on less blunt cone to the shape of an acute miter. The last morpha (Plate 9: 3b, c) is very similar to *Katodinium piscinale* FOTT (1957), but without any cavity on the hypocone and the sulcus prolongated on the epicone. The form of the sulci in my specimens was constant: the spiral displacement of the ends of the girdle was relatively small compared with THOMPSON's material. The tetragonal stigma was observed in all cases; this supports the existence of *K. astigmatum* CHRISTEN (1959). There is, of course, the question of taxonomical weight of this feature.

As to the size variability, my specimens were exactly the same as those of THOMPSON: length 21—33 μm, width 18—30 μm. The ratios of the epicone/ /hypocone heights were 1.25, 1.67, 1.75, 2.30, 2.50.

Katodinium tetragonops (HARRIS) FOTT in CHRISTEN

Plate 9: 4—8

The flagellate inhabited a periodical pool of a rich green colour owing to *Chlorella* sp. in an unfinished concrete building at Husinec in southern Bohemia, August 1964.

The cells were obovoid, dorsoventrally flattened. The girdle was spiral with ends displaced about 1/3 the cell length, the sharp notch of the sulcus projected into the epicone. The lateral notch of the gridle was deeper on the left side. This course of the sulci contributed to the assymmetric shape ot the

[2] FOTT (1957) proposed the new generic name *Katodinium* instead of the synonymous name *Massartia* CONRAD. His new combinations, however, were invalidly published, since he did not quote basionyms according to Article 32 of the International Code (LANJOUW et al., 1956). In my opinion, it was sufficiently completed by CHRISTEN (1961), even though he only called the basionyms synonyms. It is understandable that these names are "epithet-bringing synonyms" (LANJOUW et al., 1061, Article 33) and so the formal correction published by LOEBLICH (1965) is in this respect useless.

whole flagellate, resembling the genera *Gyrodinium* KOF. et SWEZY or *Bernardinium* CHODAT. The height of the hypocone was about one third of the cell length. Both flagella were free; the bright red tetragonal stigma was placed in the hypocone behind the sulcus. No chromatophores were observed, but only small spherical light-breaking granules and yellow-green remains of ingested algae, dispersed within the cytoplasm. (Plate 9: 4, 7). The flagellate multiplied by division in a motile stage.

The cells were 15.5—20 μm long, 11.5—16.5 μm wide and 7.5 μm thick.

The population observed had a stable cell shape which was very similar to three of the specimens described by HARRIS (1940: p. 14, Figs. 4: G, H, I). My specimens were larger on the average, but this only points to a greater variability of size. THOMPSON (1950) recognized this species in the U.S.A.; it had a tetragonal cell shape resembling the fourth specimen of HARRIS (Figs. 4: J, K, L), which seemed in accordance with the specific name "tetragonops"; however, this was inspired by the shape of the stigma, not by the shape of the cell. Respecting the shape homogeneity both of THOMPSON's and my populations, it seems that HARRIS's type material was not homegeneous, being collected in several localities. My material corresponds to the majority of HARRIS's specimens, pictured by him in the first row (Figs. 4: G, H, I) and described in the diagnosis: "Cellula vel ovalis vel rotunda..." (p. 15). They have to be considered as the typus of the species. The single specimen in HARRIS's Figs. 4: J, K, L, as well as the specimens of THOMPSON (1950: p. 289, Figs. 100—102), do not differ in any important feature from the species *Katodinium ptyrticum* (HARRIS) FOTT in CHRISTEN and ought to be identified with it. The relationship of these two species was already pointed out by CHRISTEN (1961).

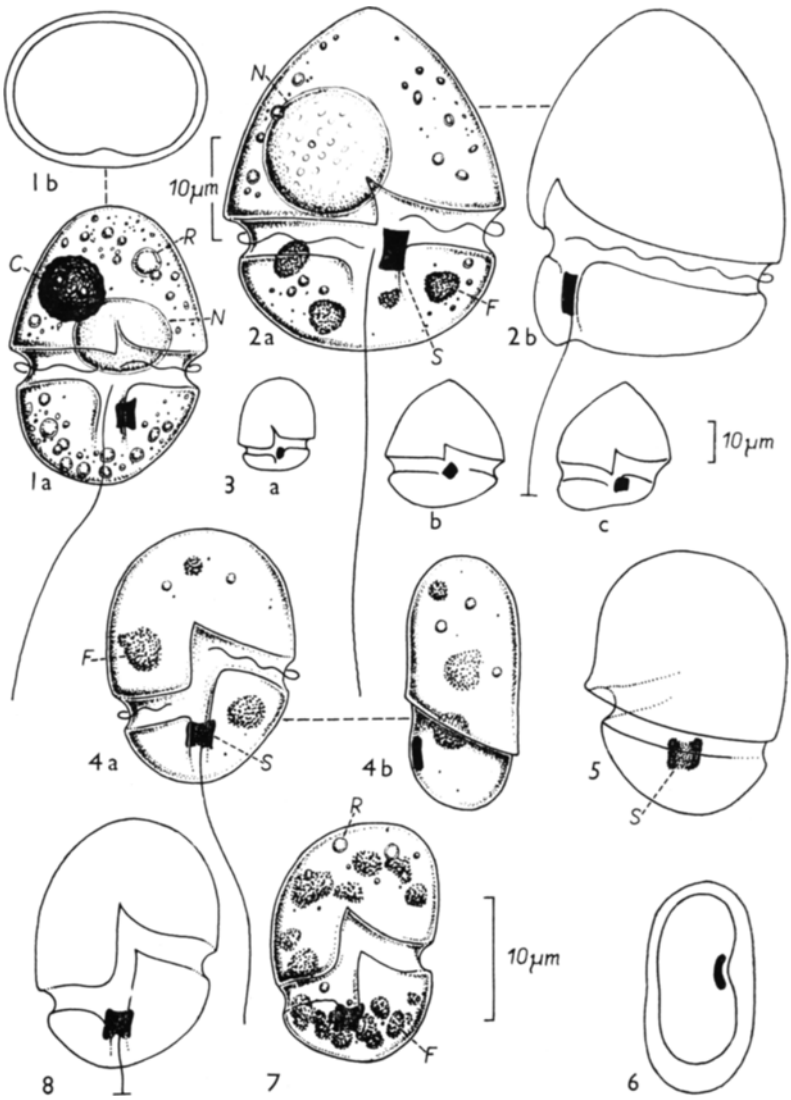
Both species, as well as other species of *Katodinium*, described by HARRIS, could also belong to the genus *Gyrodinium* KOF. et SWEZY with respect to the spiral course of the girdle. It will be necessary to clear up which feature is dicisive for the distinction between these two genera: either the size ratio of the cell-halves or the morphology of the sulci.

Gyrodinium hyalinum (SCHILLING) KOF. et SWEZY

Plate 8: 5

This flagellate was observed in the plankton of Vrané Reservoir on the Vltava River near Praha, Semptember 1964, in a rich community of green algae, diatoms and *Euglenophyta*.

The cells were irregularly obovoid, with an apparently smaller, flatly rounded epicone and large pointed hypocone in the shape of an irregular miter. The narrow but deep girdle with turned-up margins followed a downward left handed spiral with the ends displaced more than one half of the cell length. The sulcus was visible only below the girdle, reaching the shallow notch on the antapex. Behind the joining of the sulci there was the oval



1—3: *Katodinium vorticella* (STEIN) FOTT (1: specimen from Hostivice; 2, 3a: specimens from Sedlice Reservoir; 3b, c: specimens from Třeboň); 1a, 2a — ventral views, 1b — antapical view, 2b — ventro-lateral view, 3 — ventral views, variability of size and shape. 4—7: *Katodinium tetragonops* (HARRIS) FOTT; 4a, 7, 8 — ventral views, 4b — left lateral view, 5 — dorsal veiw, 6 — antapical view. (Original)

bright-red stigma. Both flagella were free, the longitudinal one being 1.5 times the cell length. No chromatophores were present, but only remains of ingested algae and small light-breaking spherical corpuscles in the hyaline colourless cytoplasm. The cells had no firm membrane, losing their shape and becoming spherical after long observation under the microscope. They were 31 μm long and 23 μm wide.

The record agrees closely with the original description and other records (SCHILLING, 1891, NYGAARD, 1945). My specimens were only somewhat larger.

SUMMARY

Chrysophyceae. The species *Pseudopedinella elastica* SKUJA was collected in Poland. No distinct differences exist between the two genera: *Pedinella* VYSOCKI and *Pseudopedinella* N. CARTER. It is proposed to admit only one genus, i. e. *Pedinella* VYSOCKI, and new combinations are therefore performed. The zoospores of *Phaeaster vesiculiferus* (SKUJA) BOURR. were studied from two peat-bogs in Bohemia.

Chlorophyceae. The species *Platymonas bichlora* H. ETTL et O. ETTL, described from Czechoslovakia, was recognized in two new localities.

Cryptophyceae. In the genus *Chilomonas* EHRENB. two new combinations are proposed: *C. oblonga* PASCHER f. *minor* (CZOSN.) c. n. and *C. insignis* (SKUJA) c. n. The new species *C. bacillaris* sp. n. is described. It is related to *C. oblonga* PASCHER, but it differs by the cylindrical form of the cell and by smaller dimensions (even than *C. oblonga* f. *minor*). The species *Cryptochrysis pochmannii* HUBER—PEST. was recognized; as the diacritic features the lack of true pyrenoid and the presence of Maupas corpuscles were considered. For very common small flagellate, known under several names, the name *Rhodomonas pusilla* (BACHMANN) c. n. is proposed. Two interesting species of the genus *Cryptomonas* EHRENB., *C. obovata* SKUJA and *C. lobata* KORŠ. are recorded. It is proposed to consider the species *C. procera* SCHILLER only as a form of *C. pyrenoidifera* GEITLER. The common but very variable *Cryptomonas* is identified with the forgotten description of *C. cylindrica* EHRENB.

Dinophyceae. Six species of the genus *Amphidinium* CLAP. et LACHM. are considered as the synonyms of *A. larvale* LINDEM. This variable species occurs commonly in colourless, but rarely also in coloured form. *Gymnodinium triceratium* SKUJA was studied from one locality in Bohemia and two species are synonymized with it accordingly. *G. lantzschii* UTERM. var. *rhinophoron* JAVORN., described from an aquarium, was recognized from the sewage treatment plant. Another common variable dinoflagellate is identified with the species *G. wawrikae* SCHILLER. Three taxa of the genus *Woloszynskia* THOMPSON were also studied: *W. coronata* (WOŁOSZ.) THOMP. var. *glabra* WOŁOSZ., *W. neglecta* (SCHILLING) THOMP. and *W. mira* (UTERM.) KISELEV. Morphological variability of commonly known colourless dinoflagellates, *Katodinium vorticella*

(STEIN) FOTT and *Gyrodinium hyalinum* (SCHILLING) KOF. et SWEZY, is discussed. The species *Katodinium tetragonops* (HARRIS) FOTT is determined according to HARRIS' type figures, not according to THOMPSON's record which is identified with *K. ptyrticum* (HARRIS) FOTT.

ZUSAMMENFASSUNG

Chrysophyceae. Die Art *Pseudopedinella elastica* SKUJA wurde in Polen gefunden. Da zwischen den Gattungen *Pedinella* VYSOCKI und *Pseudopedinella* N. CARTER keiner deutlicher Unterschied besteht, wird vorgeschlagen nur eine einzige Gattung, u.zw. *Pedinella* VYSOCKI, anzuerkennen; die diesbezüglichen nomenklatorischen Kombinationen wurden durchgeführt. Die Zoosporen von *Phaeaster vesiculiferus* (SKUJA)BOURR. wurden in zwei Torfmooren in Böhmen studiert.

Chlorophyceae. Die aus der Tschechoslowakei beschriebene Art *Platymonas bichlora* H. ETTL et O. ETTL, wurde auf zwei böhmischen Lokalitäten neuerdings gefunden.

Cryptophyceae. Bei der Gattung *Chilomonas* EHRENB. wurden zwei neue Kombinationen vorgeschlagen: *C. oblonga* PASCHER f. *minor* (CZOSN.) c.n. und *C. insignis* (SKUJA) c.n. Es wird eine neue Art *C. bacillaris* sp. n. beschrieben; sie ist mit der Art *C. oblonga* PASCHER verwandt, unterscheidet sich jedoch von derselben durch die zylindrische Form der Zelle und durch noch kleinere Dimensionen als die der *C. oblonga* f. *minor*. Weiters wurde die Art *Cryptochrysis pochmannii* HUBER-PEST. determiniert; als diakritische Merkmale für diese Art wurde die Nichtanwesenheit des rechten Schalenpyrenoids und dagegen die Anwesenheit des Maupaskörpers angesehen. Für den gewöhnlichen, unter einige Namen bekannten kleinen Flagellaten, wird die nomenklatorische Kombination *Rhodomonas pusilla* (BACHMANN) c.n. vorgeschlagen. Zwei neue beachtenswerte Funde von Arten der Gattung *Cryptomonas* EHRENB. werden angeführt, u.zw. *C. obovata* SKUJA und *C. lobata* KORŠ. Weiter wird vorgeschlagen die Art *C. procera* SCHILLER nur als eine Form der Art *C. pyrenoidifera* GEITLER zu betrachten. Die gewöhnliche, sehr variable *Cryptomonas*-Art wurde, nach der bereits vergessenen Beschreibung, mit der Art *C. cylindrica* EHRENB. identifiziert.

Dinophyceae. Sechs Artennamen der Gattung *Amphidinium* CLAP. et LACHM. werden als Synonyma der Art *A. larvale* LINDEM. angesehen. Diese variable Art kommt gewöhnlich als farblose, selten auch als autotrophe Form vor. *Gymnodinium triceratium* SKUJA wurde auf einer Lokalität in Böhmen studiert. Die aus einem Aquarium beschriebene Art *G. lantzschii* UTERM. var. *rhinophoron* JAVORN., wurde in einer Kläranlage neuerdings gefunden. Ein andere verbreiteter Dinoflagellat wird mit der unvollkommen beschriebenen Art G. *wawrikae* SCHILLER identifiziert. Weiters wurden drei Verterter der Gattung *Woloszynskia* THOMPSON studiert, u.zw. *W. coronata* (WOŁOSZ.) THOMP. var. *glabra* WOŁOSZ., *W. neglecta* (SCHILLING) THOMP. und *W. mira* (UTERM.) KISELEV. Die morphologische Variabilität der beiden allgemein bekannten

Arten *Katodinium vorticella* (STEIN) FOTT und *Gyrodinium hyalinum* (SCHILLING) KOF. et SWEZY wird angeführt. Die Art *Katodinium tetragonops* (HARRIS) FOTT wurde nach einem Teil der HARRIS'schen Typusfigur genauer bestimmt

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Symbols used in the plates:

C = carotenoid corpuscle, CH = chromatophore, F = ingested food, M = Maupas corpuscle (oval c.), N = nucleus, P = pyrenoid, PP = pseudopodium, R = reserve material, S = stigma, T = trichocyst, V = vacuole.