Preslia, Praha, 54 : 1—18, 1982

Systematic position of some genera of green algae characterized by the formation of mucilaginous or pseudofilamentous colonies

Systematické postavenie niektorých rodov zelených rias význačných tvorbou slizovitých a pseudovláknitých kolónií

František Hindák

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Some genera of colonial green algae have been studied which though characterized by mutually detached cells in the mucilage as in the order *Chlorococcales*, would nevertheless reproduce by cell division into two parts as simple ulotrichacean algae. Since the mode of asexual reproduction by autospores and by cell division into two parts is considered as a feature differentiating the orders *Chlorococcales* and *Ulotrichales*, the genera *Hormotila* Borzi, *Dispora* Printz, *Chaetopedia* Skuja = *Crucigloea* Soeder, *Disporopsis* Koršikov = *Planochloris* Komárek, *Phacomyxa* Skuja and *Parallela* Flint were taken as representatives of the order *Ulotrichales*. The generic limits of *Hormotila* Borzi, *Hormidiopsis* Heering, *Paralella* Flint, *Radiofilum* Schmidle and *Geminella* Turpin are discussed. One new genus (*Possonia* Hindák) with a new species (*P. sestonica* Hindák) is described and four new combinations [*Heleococcus ramosissimus* (Koršikov) Hindák, *Geminella flavescens* (G. S. West) Hindák, *G. scalariforme* (G. S. West) Hindák, *G. ellipsoidea* (Prescott) Hindák] are proposed.

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In this paper some genera of green algae have been studied characterized by mucilaginous colonies in which the cells are detached from each other as in some representatives of chlorococcal algae. Their cells, however, do not form characteristic autospores but divide into two portions in a manner similar to simple ulotrichal algae. Algologists have mostly stressed the formation of mucilaginous colonies or pseudofilamentous configurations and previously assigned these algae to the order *Chlorococcales* (e.g. Skuja 1948, 1956, Koršikov 1953, Bourrelly 1966) or to the order *Tetrasporales*, respectively (Lemmermann 1915, Skuja 1927, 1948, 1964, G. M. Smith 1950) or to a group of uncertain systematic position (Pascher 1915, Koršikov 1953). Attention has been drawn to this problem several times already in our preceding papers (Hindák 1962a, 1978), and especially in papers of a monographic character, e.g. in connection with the genera *Elakatothrix* Wille and *Fusola* Snow (Hindák 1962b), *Koliella* Hind. and *Raphidonema* Lagerh. (Hindák 1963), *Hortobagyiella* Hajdu (Hindák 1976), *Catena* Chod. (Hindák 1977), *Fottea* Hind. (Hindák 1968, 1981) and elsewhere.

The non-uniformly conceived definition of autospores and of the cell division into two parts is responsible for this non-uniform way of viewing the systematic position of some genera. Where 4 or more autospores emerge from the maternal protoplast, there in no doubt about the inclusion into the

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order *Chlorococcales*. In autospore formation the mother cell wall does not partake in building the cell wall of the daughter cells as is the case with *Ulotrichales*, but dies off. After the release of autospores, the empty mother cell wall may be seen entire or divided into parts in colonial mucilage; contingently it is modified into connecting links, stalks etc. Only in isolated cases is the process of mother cell wall gelatination so quick that the already dead mother cell wall may be seen only in the process of autosporulation.

If, however, only two daughter cells are formed from the maternal protoplast, autospore formation and cell division into two parts are to be differentiated. In our view, in the process of cell division into two parts the mother cell wall remains part of the daughter cells permanently or at least for some time, this being not the case in autospore formation. A good example is the family *Microsporaceae* in which the cell wall is composed of two parts. When the mother cell divides, each daughter cell receives one half of the mother cell wall. Eventually each daughter cell regenerates the entire cell wall, as may be seen in the genus *Cylindrocapsa* (see FOTT 1971), or in the family *Microsporaceae*, respectively. The development of the filament from the cell may be conceived in terms of PASCHER (1930) and as interpreted by FOTT (1967, 1971). In their view, cell division into two parts (vegetative division = Zellteilung) is two autospores that are aligned with the longer cell axis, remaining in the mother cell wall and then discharging the cell wall of their own. Repeated cell division thus brings about a filament, a colony, a pseudofilament or a pseudoparaenchymatic thallus.

As more recent electron microscopic research (PICKETT-HEAPS 1975) has shown, the order *Ulotrichales* is a heterogenous group of algae where several groups may be differentiated according to mitosis and cytokinesis, in terms of van den HOEK (1978) at least four groups. Primitive ulotrichacean algae forming colonies, pseudofilaments, aggregates or pseudoparenchymatic thallus, are obviously a heterogenous group as well. Subsequent investigations into cell ultrastructure, into the mitosis and cytokinesis of this group of green algae, will certainly provide more information on the relationship of these primitive *Ulotrichales* with chlorococcal algae, thus also making the taxonomic inclusion of the closely related genera more accurate.

If adhering to the previously mentioned way of looking upon vegetative cell division into two parts, characteristic of the order *Ulotrichales* sensu FOTT (1967, 1971), HINDÁK (1962b, 1978), HINDÁK et al. (1965, 1975, 1978), within the system of green algae, then the position of some genera mostly assigned to the order *Chlorococcales* or *Tetrasporales* has to be reassessed. The formation of particular group of uncertain position for these genera between the orders *Chlorococcales* and *Ulotrichales* is not believed to be a suitable solution, since in addition the situation is similar in other groups of green algae (*Volvocales-Tetrasporales, Tetrasporales-Chlorococcales*). Because of the mode of cell division is essentially in alignment with vegetative division, the inclusion of the genera treated in this paper at the commencement of the system of the order *Ulotrichales* is more justified than their preservation within the order *Chlorococcales*.

The genus *Hormotila* BORZI 1883

The type species *Hormotila mucigena* BORZI was found only in some states of Europe and Northern America (LEMMERMANN 1915, SKUJA 1927, 1964,

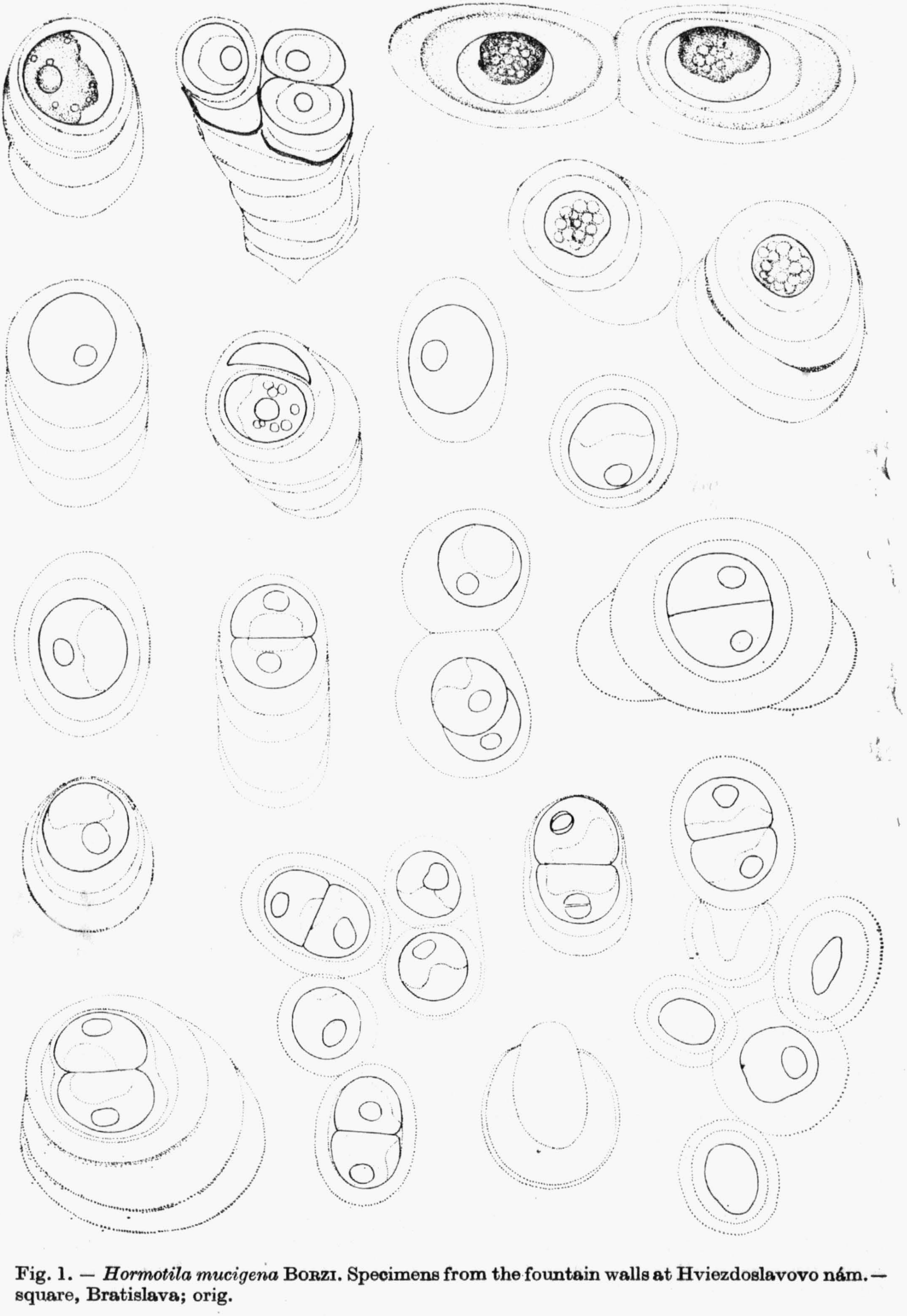

Fig. 1. — *Hormotila mucigena* Borzi. Specimens from the fountain walls at Hviezdoslavovo nám. — square, Bratislava; orig.

G. M. SMITH 1950). BORZI had presented a detailed diagnosis of this alga, having thoroughly studied and depicted the mode of cell reproduction by division into two parts and by biflagellate zoospores. Subsequent authors took over BORZI's data without more essential supplementations. LEMMERMANN (1915) included the genus *Hormotila* into the order *Tetrasporales*, as did G. M. SMITH (1950) and SKUJA (1927 — under the name *Gloeocystis naegeliana* ARTARI, 1964). KORŠIKOV (1953) included the genus *Hormotila* in the order *Chlorococcales* (*Protococcales*), as did BOURRELLY (1966). KORŠIKOV described a further species *H. ramosissima* KORŠ. with the formation of 2—4 autospores.

Hormotila mucigena BORZI 1883 Fig. 1

The author of this paper had the occasion of observing *H. mucigena* on fountain walls in front of the statue of P.O. Hviezdoslav at Hviezdoslav Square in Bratislava (Fig. 1). Colonies as abundantly ramified, as drawn by BORZI, were not found. Cells mostly occurred solitary, in pairs or formed only small groups as observed by SKUJA (1928). The cells were asymmetrical, oval to spherical, 5—6 × 5—7 μm, attached to the end of wide and clearly layered hyaline stalks which were in turn attached to the substrate by their base. The mucilaginous stalks were very tough, long up to 20 μm but usually shorter, broadest at the base or ± equally thick as at the apex, wide up to 22 μm. Cell content was granular, filled with spherical assimilates that often made the chloroplast unclear, in older cells the protoplast was yellow-green to orange-brown. The chloroplast was parietal, cup-shaped, with one basal bipartite pyrenoid. The cells divided crosswise into two parts which subsequently separated, forming a stalk of their own, thus producing a dichotomic ramification of stalks. Flat tetrads following cell division did not occur, only cells in pairs remained together for a certain time. Sporadically three cells were observed on one stalk whence one was indipendent and the other two connected (Fig. 1, left above). Their grouping might imply that the daughter cell division (2nd generation) is not in the direction of the division of the original mother cell (1st generation) but perpendicular to this plane, as it similarly occurs in some representatives of the family *Chlorosarcinaceae*. Remnants of the mother cell walls, formation of zoospores or akinetes were not found, neither in the natural nor in the laboratory cultivated material.

BORZI observed cell reproduction by crosswise division into two parts and by zoospores. Cell division was in 1—3 directions, implying that this alga belongs to the family *Chlorosarcinaceae*. Zoospore formation was preceded by cell enlargement and the thickwalled zoosporangia were up to 30 μm large. Zoospores (8—64) got released from the cell through a lateral opening, they were ovular, 3—5 × 1—2.5 μm, of a variable shape (hence without cell wall) and with two flagella approximately equally long as the zoospore. The zoospores subsequently changed into vegetative cells or into a *Palmella*-like state. The formation of zoospores was also confirmed by SKUJA (1964) he did not enclose drawings, however. According to SKUJA, 16 or more zoospores with two flagella formed in the zoosporangia with a slightly bent elliptic shape, at the apex they were tapered, 7—8 × 3—4 μm, very variable, with a lateral chloroplast, without pyrenoid and with a small spotted eyespot.

Fig. 2. — 1, *Heleococcus ramosissimus* (KORŠ.) HIND. (from KORŠIKOV 1953 as *Hormotila ramosissima* KORŠ.). 2, *H. mucicola* KORŠ. (from KORŠIKOV 1953, type species). 3, *Phacomyxa sphagnicola* SKUJA (from SKUJA 1956). 4, *Chaetopedia crassiseta* SKUJA var. *crassiseta* = *Crucigloea crassiseta* (SKUJA) SOEDER var. *crassiseta* (from SKUJA 1948).

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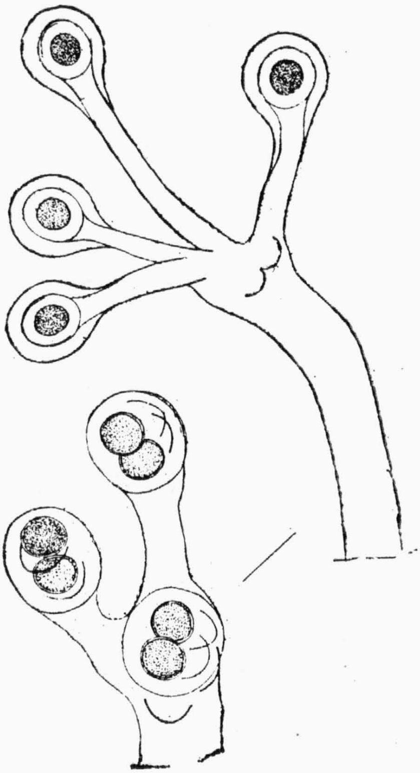

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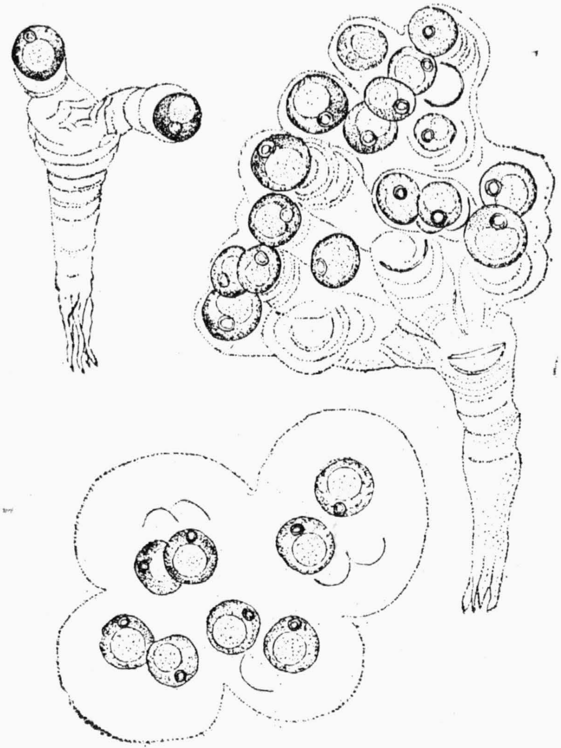

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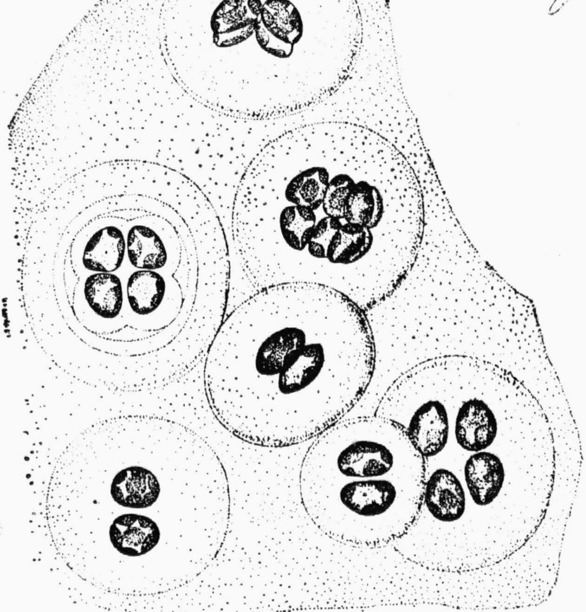

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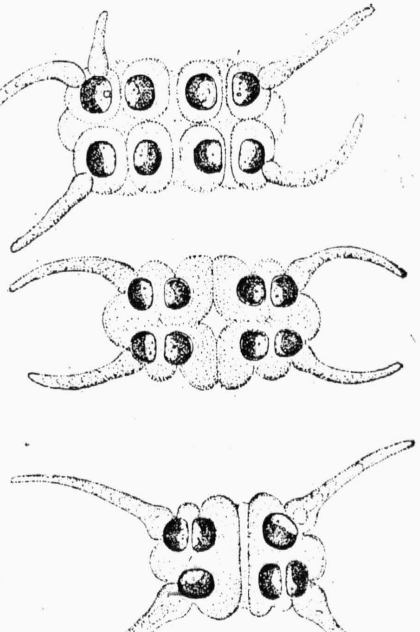

BORZI made a particular point of drawing the zoosporangia, not together with vegetative cells. Since SKUJA did not depict the formation of zoospores, either, doubts might arise that vegetative cells and zoosporangia would pertain to two different algal species. The author examined this particular alga in three seasons but always found vegetative cells only. Thereby, of course, doubt cannot actually be cast upon the observations of BORZI and SKUJA, but there is an obvious need for their data to be verified.

Three species have hitherto been included in the genus *Hormotila*: alongside the type species, *H. mucigena* BORZI, KORŠIKOV (1953) established the species *H. ramosissima* KORŠ. and BOURRELLY (1966), reclasified the species *Heleococcus mucicola* KORŠIKOV 1953 as a member of the genus *Hormotila* as *H. mucicola* (KORŠ.) BOURR. Adhering to the original diagnosis for the genus *Hormotila*, neither *H. ramosissima* nor *H. mucicola* belong to this genus. In practise, both species resemble the species *H. mucigena*, forming mucilaginous stalks attached to the base, zoospore formation also being known with them, but the cells do not divide into two parts but forms 2—4 autospores. Cell wall remnants in these two species remain conspicuous for a certain time in the colonial mucilage. We believe that in terms of the different mode of reproduction it is justified to retain the genera *Hormotila* BORZI and *Heleococcus* KORŠ. and to include into the genus *Heleococcus*, beside the type species *H. mucicola* KORŠ. [syn.: *Hormotila mucicola* (KORŠ.) BOURRELLY 1966] (Fig. 2: 2), also the species *Heleococcus ramosissimus* (KORŠIKOV) HINDÁK comb. nova (bas.: *Hormotila ramosissima* KORŠ. Vizn. Prisnovodn. Vodor. Ukr. RSR 5 : 208, 1953) (Fig. 2: 1). Because of the typical formation of autospores, the genus *Heleococcus* KORŠ. pertains to the order *Chlorococcales*, whereas the genus *Hormotila* BORZI, due to vegetative cell division in 1—3 planes, to the order *Ulotrichales*, family *Chlorosarcinaceae*. Since the genus *Hormotila* is being reclassified into the order *Ulotrichales*, the name of the family *Hormotilaceae* sensu KORŠIKOV (1953) and BOURRELLY (1966) should be relinquished and the family designation *Heleochloridaceae* sensu FOTT (1971) used instead for this group of chlorococcal algae.

In our view, not only the genus *Hormotila* but also the simillar genera *Chaetopedia* SKUJA 1948 = *Crucigloea* SOEDER 1978 and *Phacomyxa* SKUJA 1956 belong, among other, to the family *Chlorosarcinaceae*. In the monotypic genus *Chaetopedia* SKUJA two varieties had differentiated: *Ch. crassiseta* SKUJA 1948 var. *crassiseta* (Fig. 2: 4) and var. *puella* SKUJA 1964. As distinguished from *Hormotila mucigena* living attached to a solid substrate, SKUJA's algae occur freely in the plankton of lakes and *Phacomyxa sphagnophila* (Fig. 2: 3), respectively, freely in the littoral of Sphagnum-lakes (Sweden) forming flat tabular colonies. Just as in the genus *Hormotila*, there are no contractile vacuoles or an eyespot in the protoplast with the genera *Chaetopedia* and *Phacomyxa* either. Hence it is not justified to include the genera *Chaetopedia* and *Phacomyxa* into the order *Tetrasporales*, as SKUJA did.

On the contrary, it is the genus *Hormotilopsis* TRAINOR et BOLD 1953 with the species *H. gelatinosa* TRAINOR et BOLD that belongs to the order *Tetrasporales*. Habitually, it bears close resemblance to the species *Hormotila mucigena*, but in the apical part of the cells there are two contractile vacuoles. BOURRELLY (1966) classified the genus *Hormotilopsis* into the family *Hormotilaceae*, *Chlorococcales*, beside the genus *Hormotila*, but the genus *Hormotilopsis* had been included already earlier by FOTT et KALINA (1965), and then later by FOTT (1972), in a monographic study, into the order *Tetrasporales*, justifiably into that order *Tetrasporales*, with *Gloeophyllum fimbriatum* KORŠIKOV 1953 = *Phyllogloea fimbriata* (KORŠIKOV). SILVA 1959 having been designated as the synonym. SKUJA (1964) apart from the species *Hormotila mucigena*, observed a similar alga with characteristic features in which the mucilaginous stalks were approximately of equal thickness (9—22 μm) but the cells were very much larger (11—35× ×6—20 μm). In the older cells the originally parietal chloroplast divided into several parts, acquiring an asteroid shape. In the captions (Taf. XVI, Fig. 24—28) SKUJA made use of the designation *Hormotilopsis* sp. It is obvious, however, that this alga will not belong to the genus *Hormotilopsis* because of the absence of contractile vacuoles; probably it refers to the variety or a form of the species *Hormotila mucigena*. NAKADO (1977) found *Hormotilopsis gelatinosa* in soil samples in Japan and included it into the family *Palmellaceae*, *Tetrasporales*.

The genera *Hormidiopsis* HEERING 1914, *Parallela* FLINT 1974, *Radiofilum* SCHMIDLE 1897 . . .

According to BOURRELLY (1966) the genus *Hormidiopsis* with the type species *H. crenulata* (KÜTZ.) HEERING bears resemblance to the genera *Hormidium* KLEBS or *Ulothrix* KÜTZ. with cells without pyrenoid, at the other hand, by the capacity of forming, at places, also biseriate filaments, to the representatives of the family *Prasiolaceae*. As a rule, the filaments have no mucilaginous sheath but in the process of filament disintegration mucous stages arise, as in the case with some other filamentous green algae, e.g. with *Microspora quadrata* HAZEN (see SKUJA 1956, Taf. XXIV, Fig. 17—22). The cells in the filament are in contact and have a thick cell wall, this being partly due to their exposed way of life on the bark of trees. Zoospore formation is unknown, cells reproduce by crosswise division into two parts, and sometimes 8 or more spherical aplanospores are formed, capable of germinating immediately.

PRESCOTT (1944) described another species of the genus *Hormidiopsis* : *H. ellipsoideum*. By the cells being in one row and mutually detached in a mucous sheath, this species, however, bears resemblance to the representatives of the genus *Geminella* TURP. or to *Radiofilum* SCHMIDLE. In the species *H. ellipsoideum*, the significant features of the genus *Hormidiopsis*, such as filament formation with touching cells, thick cell walls, mucilage absence in vegetative filaments, absence of pyrenoid etc. are missing.

As already mentioned, several genera characterized by flat or pseudofilamentous colonies have hitherto been included among chlorococcal algae, whereby it is obvious that there is no typical formation of autospores in them. These are e.g. the genera *Dispora* PRINTZ 1914, *Chaetopedia* SKUJA 1948 = *Crucigloea* SOEDER 1978, *Disporopsis* KORŠIKOV = *Planochloris* KOMÁREK 1979, *Phacomyxa* SKUJA 1956, *Parallela* FLINT 1974 and others. The common feature of these species is the formation of tetrads after two consecutive cell divisions contingently of biseriate filamentous bodies (*Parallela*). According to KORŠIKOV (1953) the genus *Disporopsis* (Fig. 3: 3) differs

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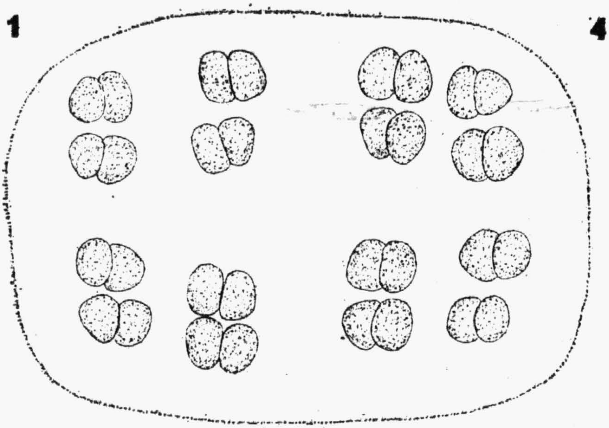

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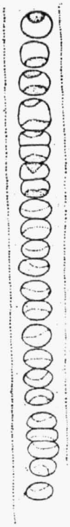

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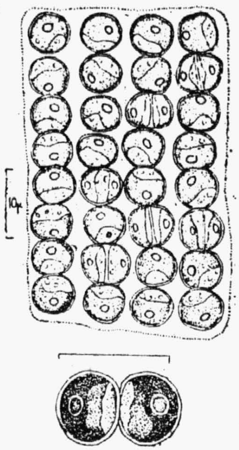

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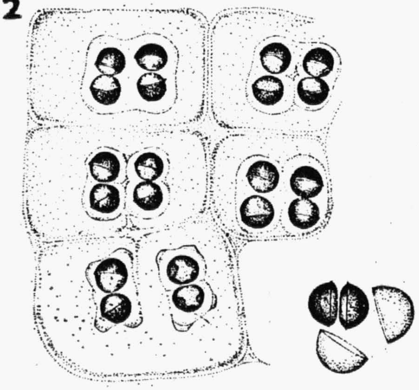

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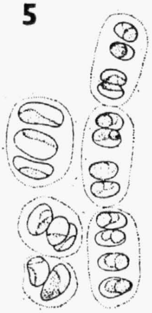

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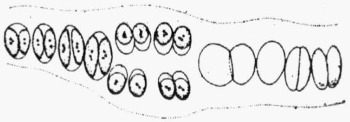

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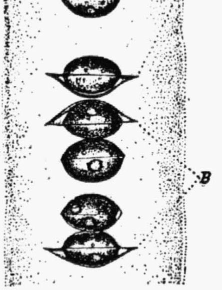

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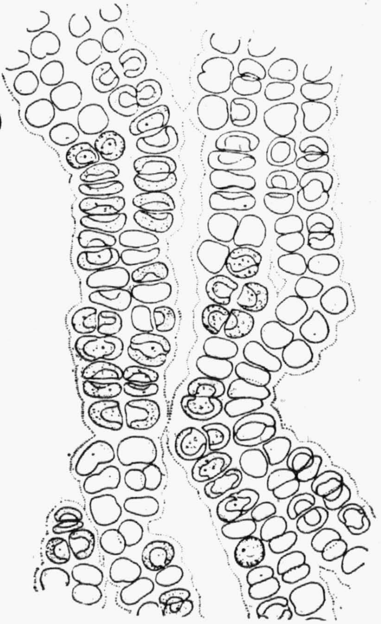

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from the genus *Dispora* (Fig. 3: 1, 2) only by the capacity of forming zoospores, this being a feature employed in the present taxonomy of the order *Chlorococcales* (e.g. the genera *Chlorococcum-Chlorella*). KORŠIKOV (Fig. 3: 1) and PRINTZ observed a compact cell wall with the type species *Dispora crucigenioides*. SKUJA (1956) (Fig. 3: 2), in contrast, found a bipartite cell wall of a similar appearance as in the genus *Radiofilum*, nominally with the species *R. conjunctivum* SCHMIDLE (Fig. 4: 6—9). Since the genus *Radiofilum* has traditionally been included into the order *Ulotrichales* (HEERING 1914, PRINTZ 1964, RAMANATHAN 1964, STARMACH 1972, MOŠKOVA 1979), then the genus *Dispora* sensu SKUJA also belongs to this order, as already put forward in our determination keys and manuals (HINDÁK et al. 1965, 1975, 1978). The possibility may not be excluded, however, that *D. crucigenioides* sensu PRINTZ and KORŠIKOV on one hand and sensu SKUJA on the other hand are two different algal species. Our observations of this species (Seeon, Bavaria) are in agreement with data supplied by PRINTZ and KORŠIKOV, no bipartite cell wall has been ascertained (Fig. 4: 1, 2).

FLINT (1974) found in New Zealand a macroscopic, ribbon-like, palmelloid, freshwater alga which he named *Parallela novae-zelandiae* and included among the *Chlorococcales* (Fig. 3: 10). Each ribbon was composed of one layer of cells which were arranged in parallel rows and up to eight cells wide. Cell division was in two planes with a certain time interval between the first and the second division. Tetrads of cells arose this way, consecutively positioned. FLINT took cell division for autospore formation but neither his drawing nor the photographs make remnants of mother cell walls or the formation of more than two daughter cells visible. In our view, cell division in *Parallela* is of the same type as in the genera *Dispora*, *Disporopsis* = *Planochloris* or in some species traditionally included into the family *Chlorosarcinaceae*. The formation of zoospores and cell division into two parts in the genus (and similarly in the genus *Disporopsis*) are in favour of their classification into the order *Ulotrichales*, family *Chlorosarcinaceae*, of which both features are referred to, and the formation of tetrads are characteristic. Inclusion in the family *Prasiolaceae* is also considered for the genus *Parallela*.

LEITE, R. M. T. BICUDO et C. E. M. BICUDO (1979) announced the record of *Parallela* in Brazil. The preceding discovery of the alga *Radiofilum irregulare* (C. E. M. BICUDO et R. M. T. BICUDO 1969) was also denoted by them as a species of *P. novae-zelandiae*. As it may be inferred from the attached figures (Fig. 3: 9), the alga from Brazil differs from that of New Zealand not only habitually but also by the manner of cell division. In both

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Fig. 3. — 1, 2. *Dispora crucigenioides* PRINTZ (1, from KORŠIKOV 1953, 2, from SKUJA 1956). 3, *Disporopsis pyrenoidifera* KORŠ. (from KORŠIKOV 1953). 4, *Geminella flavescens* (G. S. WEST) HIND. (from PRESCOTT 1951 as *Radiofilum flavescens* G. S. WEST). 5, *G. ellipsoidea* (PRESCOTT) HIND. (from PRESCOTT 1951 as *Hormidiopsis ellipsoideum* PRESCOTT). 6, *G. scalariformis* (G. S. WEST) HIND. (after G. S. WEST from PRINTZ 1864 as *Radiofilum scalariforme* (G. S. WEST) PRINTZ, iconotype). 7, *G. flavescens* (G. S. WEST) HIND. (after G. S. WEST from PRINTZ as *Radiofilum flavescens* G. S. WEST, iconotype). 8, *Radiofilum mesomorfum* SKUJA (from SKUJA 1964). 9, *Geminella* cf. *flavescens* (G. S. WEST) HIND.? (from LEITE, R. M. T. BICUDO et C. E. M. BICUDO 1979 as *Parallela novae-zelandiae*). 10, *Parallela novae-zelandiae* FLINT (from FLINT 1974, iconotype).

findings from Brazil, the alga formed a microscopic thallus, cells were arranged in parallel rows. Cell division was in two planes also, but cell division often prevailed only in one direction as in the genus *Radiofilum*. In our opinion, the findings made by the Brazilian authors are neither *P. novae-zelandiae*, nor are they *R. irregulare*, since no bipartite cell wall was observed. The species in question is most probably *R.* cf. *flavescens*.

At this stage mention should be made in more detail of the genus *Radiofilum* SCHMIDLE. According to the type species *R. conjunctivum* SCHMIDLE the significant features of the genus involve the cell wall structure made up of two ± equal parts which become mutually detached following the division of the protoplast, each of the daughter cells obtaining one half. The composition of the cell wall of the two parts justifies the inclusion of the genus *Radiofilum* into the family *Microsporaceae* (HINDÁK et al. 1965, 1975, 1978, HINDÁK 1978) beside the genus *Microspora* in which the cell wall is also composed of two parts. Next to species with a bipartite cell wall, species with a compact cell wall used to be classified within the genus *Radiofilum*. The first group of the species encompasses, beside the type species *R. conjunctivum* SCHMIDLE (Fig. 4: 6—9) the species *R. irregulare* (WILLE) BRUNTHALER, *R. mesomorphum* SKUJA (Fig. 3: 8), *R. paradoxum* (CHODAT et TOPALI) PRINTZ and *R. humberi* BOURRELLY. In the second group of species where bipartite cell walls have not been observed, there are *R. flavescens* G. S. WEST and *R. scalariforme* (G. S. WEST) PRINTZ.

In our opinion, the latter two species do not belong to the genus *Radiofilum* and should be reclassified with another genus. Mostly in question is the genus *Geminella* TURP., of which a compact cell wall and a consecutive placing of the cells in a row inside a mucous sheath is characteristic, whereby cells do not touch or do so only in the process of intensive division. By the latter feature the genus *Geminella* differs for example from the genera *Gloeotila* KÜTZ. and *Ulothrix* KÜTZ., in which the cells are touching inside the filament and become detached only when akinetes or aplanospores are formed. In the genus *Geminella* the formation of a biseriate filament is not as frequent as in the genus *Radiofilum*, but the bipartite cell wall is an unusual feature, characteristic of only a few genera within the order *Ulotrichales*, hence it is to be considered as an important character in taxonomic classification. It is therefore suggested that the two species of the genus *Radiofilum* just discussed and similarly the species *Hormidiopsis ellipsoideum* should be transferred to the genus *Geminella*. All three species are characterized by crosswise oval cells by which they differ from the majority of species of the genus *Geminella*.

Geminella flavescens (G. S. WEST) HINDÁK, comb. nova Fig. 3: 4

Bas.: *Radiofilum flavescens* G. S. WEST J. Bot. 37 : 57, 1899.

In the literature reference is made to the cosmopolitan occurrence of this species in the plankton of stagnant waters.

Fig. 4. — 1, 2, *Dispora crucigenioides* PRINTZ. Specimens from Eisloch, Seeon, W. Germany; orig. 3—5, *Geminella scalariformis* (G. S. WEST) HIND. Specimens from Cuba, Zapata; orig. KOMÁREK. 6—9, *Radiofilum conjunctivum* SCHMIDLE (6, specimens from the Ereč lake near the river Danube, stained with methylene violet; orig. JURIŠ, 7—9, specimens from the lake at Gabčíkovo near the river Danube; orig.). — Scale: 10 μm.

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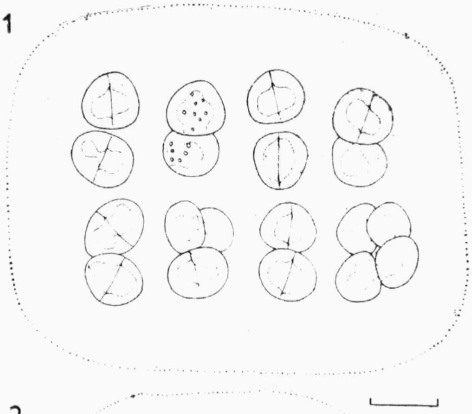

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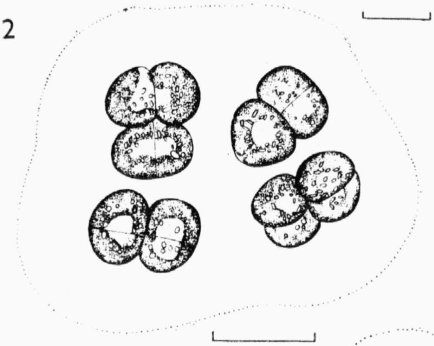

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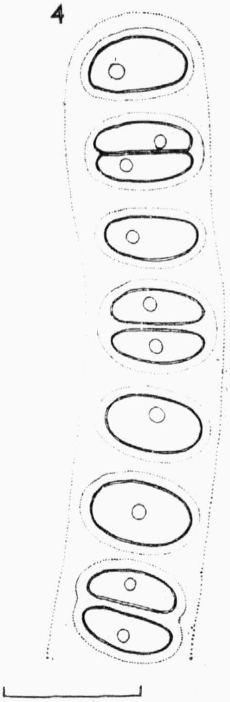

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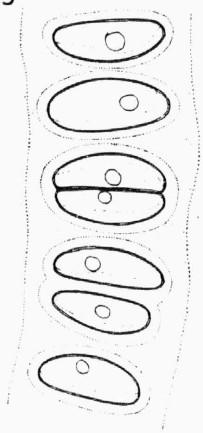

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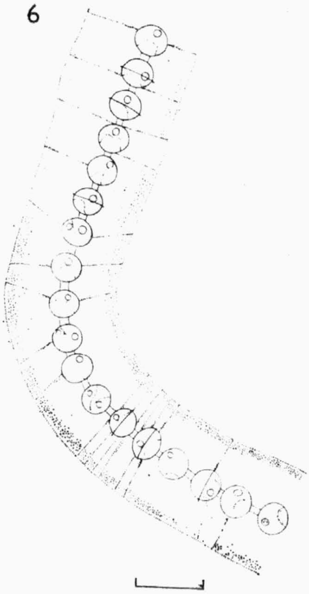

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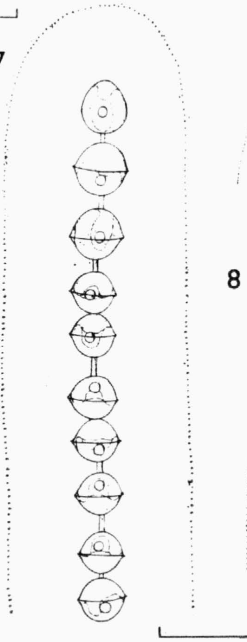

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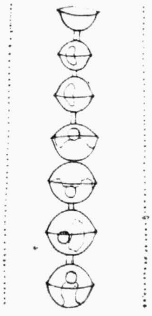

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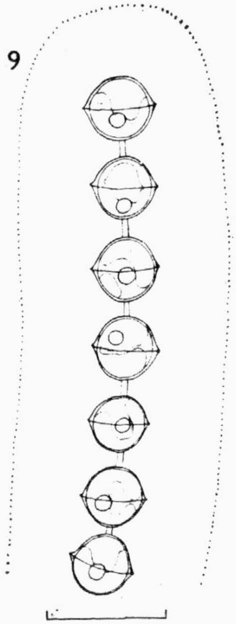

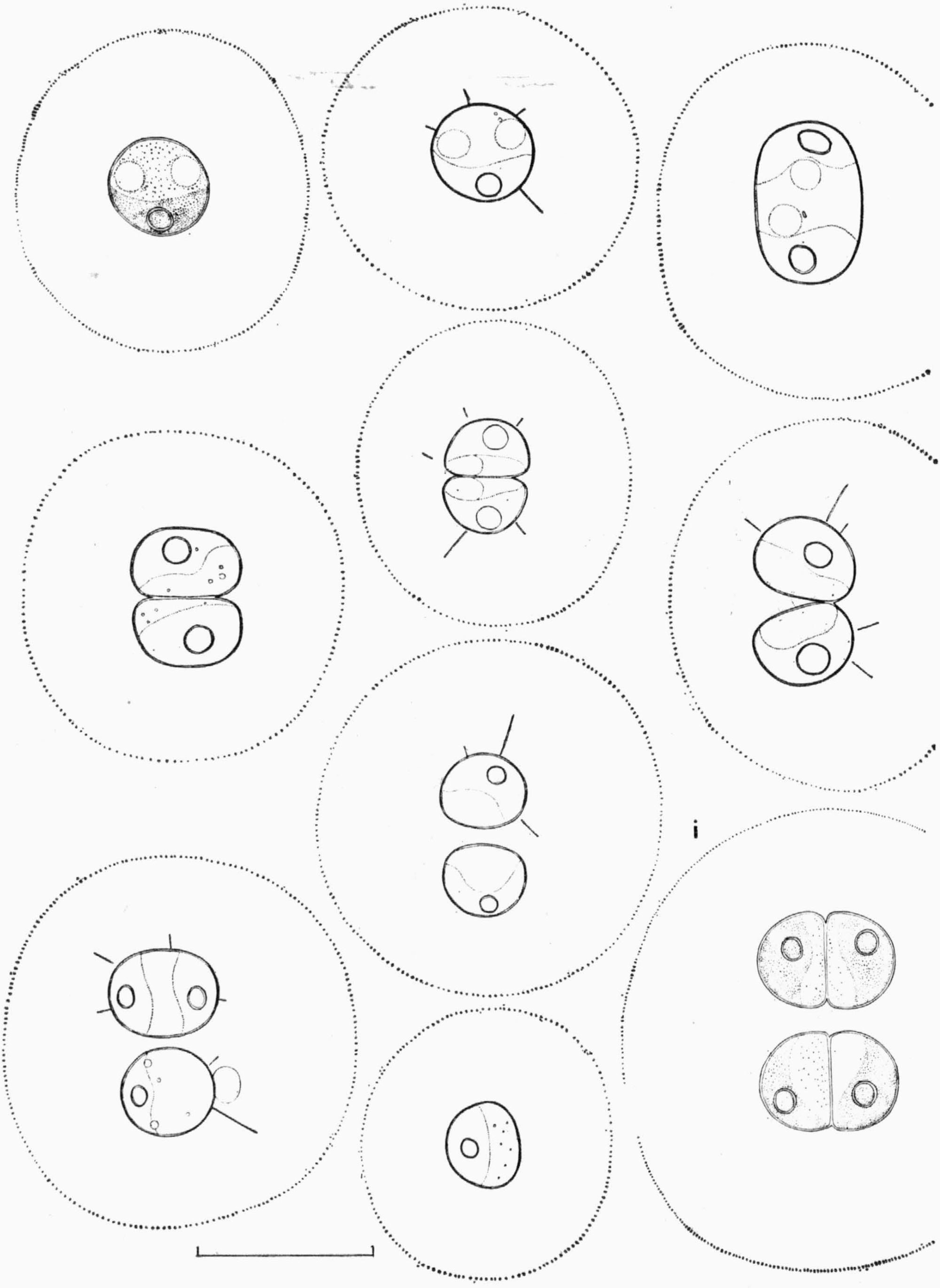

Fig. 5. — *Possonia sestonica* Hind. Specimens from the gravel pit lake Štrkovec, Bratislava, i iconotype; orig. — Scale: 10 µm.

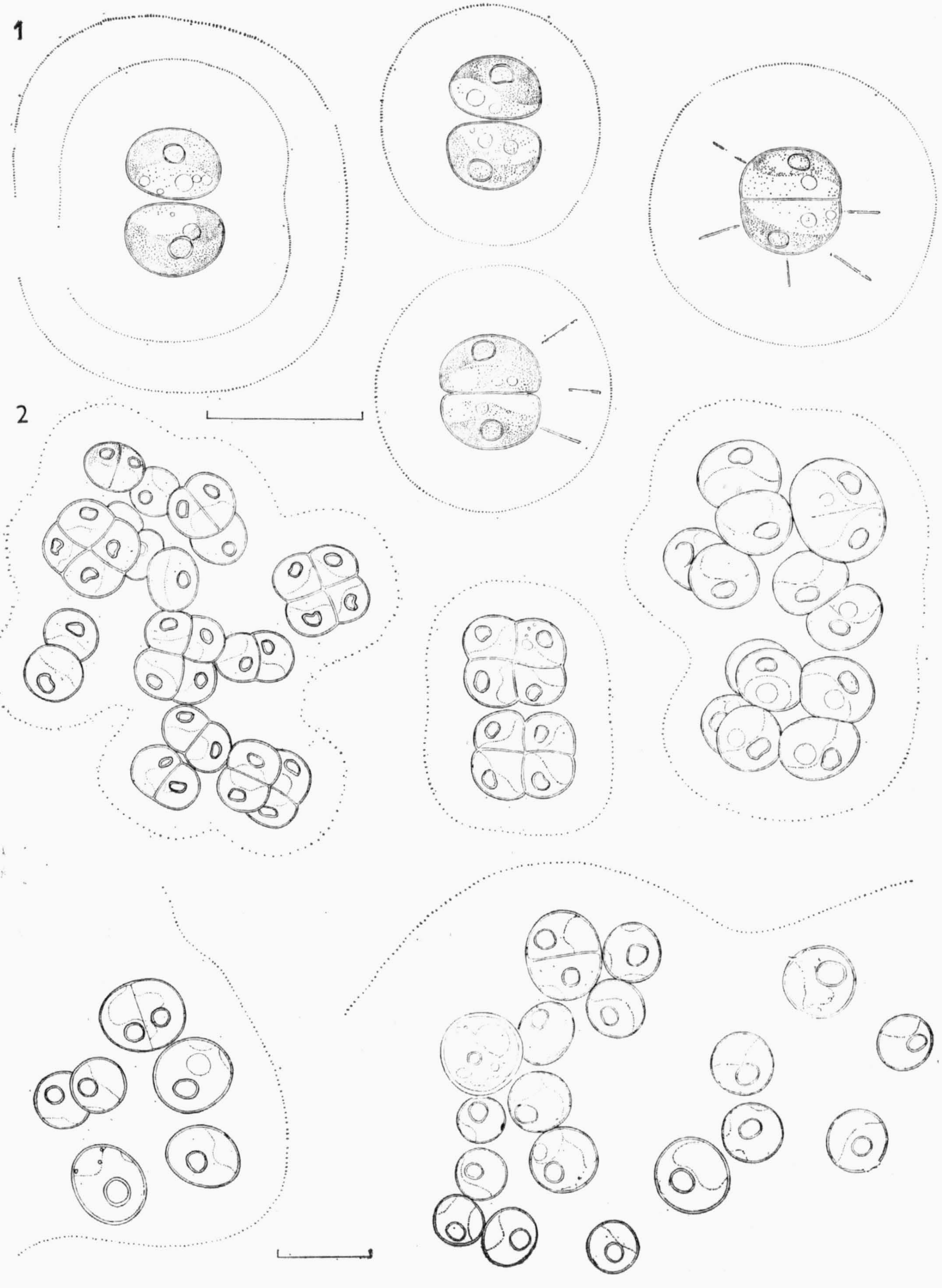

Fig. 6. — 1, 2, *Possonia sestonica* HIND. (1, specimens from the sand pit lake at Lozorno near Bratislava, 2, studied strain HINDÁK 1969/120 isolated from the gravel pit lake Štrkovec in Bratislava; orig.). — Scale: 10 μm.

Geminella scalariformis (G. S. West) Hindák, comb. nova Fig. 3: 6, 4:3–5

Bas.: *Hormospora scalariformis* G. S. West J. Bot. 42 : 281, 1904. — Syn.: *Radiofilum scalariforme* (G. S. West) Printz Hydrobiologia 24 : 67, 1964.

G. S. West described this species from the island of Barbados in the Caribbean area (Fig. 3: 6) and it has not been found since. Dr. J. Komárek, Třeboň, found this alga in 1979 on Cuba (the Zapata Peninsula) which is similarly located in this part of the western hemisphere. From the drawings obtained (Figs. 4: 3–5) the following features may be laid down. The cells were transversely oval, embedded in a mucilaginous sheath uniseriately in consecution. The mature cells were ± oval or ± semi-oval after division, 7.2–8.4 × 2.4–3.6 μm. The mucilaginous envelop was conspicuous, with irregular margins, 2–2.5 μm wide around cells. Around the individual cells their own thin mucous layer was found to be conspicuous. The cell wall was compact, smooth on the surface. The chloroplast was parietal, troughy, with one pyrenoid. Cell division occurred in the longitudinal direction of the cell, thus perpendicularly to the longitudinal axis of the pseudofilament. The daughter cells became detached from each other after division and gradually assumed an elliptic shape. The Cuban material did not differ from that of Barbados in which G. S. West observed cells 7–8.5 × 2.3–2.6 μm and a mucilaginous envelope 13.5–17 μm wide.

Geminella ellipsoidea (Prescott) Hindák, comb. nova Fig. 3: 5

Bas.: *Hormidiopsis ellipsoideum* Prescott Farlowia 1 : 349, 1944.

It is presumed that this species has not been correctly included in the genus *Hormidiopsis*, mainly on two grounds. Not only are the cells embedded solitarily in the mucilaginous sheath but there is also a pyrenoid present. The characteristic feature of the species are transversely elliptic cells which are arranged in linear series in froups of 2–4, enclosed by a wide mucilaginous sheath. This species was found in a Sphagnum-bog-lake, Wisconsin, USA (Prescott 1951).

The genus ***Possonia*** Hindák, gen. novum

Thallus microscopicus libere natans unicellularis usque pluricellularis, cellulis in familias unistratosas tabulatas. Membrana cellularis achroa, hyalina, cum tegumento gelatinoso sine structura. Propagatio bipartione succedanea in duas directiones.

Typus generis: *P. sestonica* Hindák, sp. nova.

Ethymologia: Possonium — antiquum nomen urbis Bratislava. Slovacia.

The genus contains only one species:

Possonia ***sestonica*** Hindák, sp. nova Fig. 5, 6

Coloniae libere natantes, 2–4-cellulares, planae, sphaericae usque ovales vel cellulae solitariae. Tegumentum gelatinosum homogeneum, sine structura, circa cellulas ad 3–10 μm. Coloniae 2–4-cellulares 28–35 × 15–24 μm. Cellulae sphaericae, sphaerice ovales usque ovales, 5–9 × 5,4–8 μm, post divisionem binae conjunctae. Membrana tenuis, hyalina. Chromatophorum singulum, parietale, poculiforme usque alveiforme, cum pyrenoide. Propagatio divisione transversali in cellulas duas, aequales; cellulae filiales post divisionem separantur. In culturis propagatio bipartione succedanea cellularum in duas directiones.

Habitatio: In plancto lacus glareosorum Štrkovec in Bratislava et Lozorno apud Bratislava, Slovacia occidentalis; cultura nostra Hindák 1969/120.

Iconotypus: Figura nostra 5: i.

Cells singular, in pairs of 3—4 in the colony adjacently in one plane, enveloped by a wide hyaline unlayered or sporadically two-layered mucilage. Mature cells spherical, 5—7.5 μm, before division shortly cylindrical, 5—9 × 5.4—8 μm, pairs of connected cells up to 15 μm long, mucilage around cells 3—10 μm, size of 2—4-celled colonies with mucilage 28—35 × 15—24 μm; rod-like bacteria are frequent in the mucilage. Cell wall smooth and hyaline. Chloroplast parietal, cup-shaped, with one large pyrenoid, sometimes an eyespot-like short dash-shaped body occuring. Frequently in the protoplast are relatively large 1—2 non-contractile vacuoles and large oil drops. Cell reproduction is by division into two parts, after division the daughter cells are joined together for a time, then they become detached; in free habitat no tetrads are formed with touching cells but at most only two solitary adjacent pairs of cells in one plane. In the laboratory cultures flat tetrads of connected cells are often formed, not, however, package-like clusters of the Chlorosarcina type.

Occurrence: In the plankton of the gravel pit lake Štrkovec in Bratislava (1968—1969) and in the sand-bank lake at Lozorno near Bratislava (1974); studied strain Hindák 1969/120, isolated from the gravel pit lake Štrkovec in Bratislava.

In the plankton of the gravel pit lake Štrkovec in Bratislava and of the sand-bank lake at Lozorno near Bratislava, spherical to oval cells were found in the mucilage, singular or after division in pairs; only sporadically were 3 or 4 cells adjacently placed in the colony or ± in one plane. The mature cells had a spherical shape; prior to division they elongated slightly and subsequently divided into two parts. The daughter cells had a semi-spherical to loaf-like shape, they stayed joined together for some time, later they detached and finally separated with the already formed mucilaginous envelope. In the process of growth the cells became spherical, slightly elongated and divided again. In the free habitat 3—4-celled colonies were found very rarely in both localities. The cells were in one plane, in the 4-celled colony two pairs of young daughter cells were adjacent. The mucilage was hyaline, unlayered and rarely bi-layered.

According to the grouping of cells in the 4-celled colony it was possible to make inferences regarding the affiliation to the family *Chlorosarcinaceae*. Bourrelly (1966) included in this family algae forming regular or irregular packages, tetrads but not forming filaments or filamentous clusters of cells. Reproduction is not by autospores but the cells divide in two or three planes; in some genera zoospores are produced and in the genus *Chlorosarcinopsis* sexual reproduction by isogamy is known. Ten genera are incorporated in the family, they differ by the shape of the colonies, of the chloroplast, by the presence or absence of pyrenoid, mucilage etc. The alga studied by us could not be included in the genus *Chlorosarcina* since no package-like colonies were formed but flat colonies, with at most two pairs of cells in one plane. This favoured the inclusion in the genus *Planophila* in which, however, no species has so far been known with cells enveloped in mucilage.

As in other groups of algae, there are no diagnostic characters available for the members of family. To exemplify this, let us present the genus *Chlorosarcina* Gern. into which Lemmermann (1915) had included species with or without mucilage, with or without pyrenoid and reproducing by zoospores. According to Bourrelly (1966) and Starmach (1972) species without pyrenoid pertain to this species. The formation of tabular or spherical colonies is considered a generic feature in this algal group, as for example with the blue-green algae (*Merismopedioideae-Gomphosphaerioideae*) or with the chlorococcal algae (*Hofmania-Coronastrum, Tetrastrum-Pseudotetrastrum*). The formation of flat colonies is also characteristic of some genera that have been discussed in this paper, e.g. *Dispora*, *Disporopsis* = *Planochloris*, *Chaetopedia* = *Crucigloea*, *Phacomyxa*.

For this reason we suggest the establishment of a new genus *Possonia*. The most closely related genus is *Planophila* GERN. which differs by the production of zoospores and by the absence of mucilage. In terms of the original diagnosis and figures in GERNECK's species *P. laetevirens* and *P. asymmetrica* (see also LEMMERMANN 1915); these species do not have mucilage, nor has a further species established by REISIGL (1964). The author of the species *P. bipyrenoidosa* mentions, in contrast to GERNECK, reproduction by 2—4 autospores and refers (p. 437) to VISCHER (1933) that in the family *Chlorosphaeraceae* „. . . in Wirklichkeit handelt es sich auch hier um eine Autosporenteilung, nur dass eben die Muttermembran nicht abgeworfen, sondern verdehnt wird.“

In the species *Possonia sestonica*, cell division in the free habitat was always only in one plane, then the cells separated and the subsequent cell division was in a direction perpendicular to the preceding division. In the laboratory culture strain Hindák 1969/120, isolated from the plankton of the lake Štrkovec most tetrads of cells arose thus (Fig. 6: 2). Package formation did not occur even on L—C agar nutrient medium. On the agar heaped clusters of cells arose having the shape of packages but after the separation of individual colonies (e.g. by pressure upon the cover slip of the preparation) at most flat tetrads of cells occurred. The formation of such tetrads in the culture could be presumed according to the formation of 4-celled colonies in a free habitat but this presumption had to be verified in a laboratory culture since the large majority of the specimens occurring in a free habitat were unicells. The stage of the unicells and the pairs of cells in the mucilage were reminiscent of some representatives of the genus *Fottea* HIND. 1968, nominally of *F. montana* HIND. (HINDÁK 1981). However, in the genus *Fottea* cell division is always in one direction, therefore short filamentous clusters of cells are sporadically, formed, not tetrads.

In *P. sestonica* reproduction was observed only by cell division into two parts, formation of zoospores was not observed in laboratory culture, either. In many cells, however, a red dash-like body was found on the chloroplast resembling an eyespot. Contractile vacuoles were not ascertained.

SÚHRN

Študovali sa niektoré rody kolóniových zelených rias, ktoré sa síce vyznačujú od seba oddialenými bunkami v slize podobne ako je to v rade *Chlorococcales*, ale rozmnožujú sa delením buniek na dve časti ako jednoduché ulotrichálne riasy. Pretože spôsob nepohlavného rozmnožovania autospórami a delením na dve časti (tzv. vegetatívne delenie) pokladáme za znak odlišujúci rady *Chlorococcales* a *Ulotrichales*, zaraďujeme rody *Hormotila* BORZI, *Dispora* PRINTZ, *Chaetopedia* SKUJA = *Crucigloea* SDEDER, *Disporopsis* KORŠ. = *Planochloris* KOM., *Phacomyxa* SKUJA a *Parallela* FLINT do radu *Ulotrichales*. Diskutovali sa diagnostické znaky rodov *Hormotila* BORZI, *Hormidiopsis* HEERING, *Parallela* FLINT, *Radiofilum* SCHMIDLE a *Geminella* TURPIN. Opísal sa nový rod *Possonia* HIND. s jedným druhom *P. sestonica* HIND. a navrhli sa 4 nové kombinácie: *Heleococcus ramosissimus* (KORŠ.) HIND., *Geminella flavescens* (G. S. WEST) HIND., *G. scalariforme* (G. S. WEST) HIND. a *G. ellipsoidea* (PRESCOTT) HIND.

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