

## The genus *Chlorotetraedron* McENTEE et al. (*Protosiphonales, Chlorophyceae*)

Rod *Chlorotetraedron* McENTEE et al. (*Protosiphonales, Chlorophyceae*)

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KOMÁREK J.<sup>1</sup>) et KOVÁČIK L.<sup>2</sup>) (1985): The genus *Chlorotetraedron* McENTEE et al. (*Protosiphonales, Chlorophyceae*). — *Preslia, Praha, 57 : 289–297*.

The coenocytic structure of cells was proved in the type species of the genus *Chlorotetraedron* McENTEE et al. 1978 (*C. polymorphus*). This unicellular green alga with polynuclear cells, reproducing by naked zoospores and by aplanospores, has to be classified, according to its cell anatomy and life cycle, to the recently defined order *Protosiphonales* ETTL et KOM. 1982 (*Chlorophyceae*). Two other algae, the taxonomic position of which has not been yet correctly classified and the characters of which correspond fully to the diagnostic generic features of *Chlorotetraedron*, belong to this genus: *C. bitridens* (BECK-MANNAG.) comb. nova [*Tetraedron bitridens* BECK-MANNAG. 1926] and *C. incus* (TEIL.) comb. nova [*Tetraedron incus* (TEIL.) G. M. SMITH 1926]. Within the *Protosiphonales*, *Chlorotetraedron* belongs to the group of coenocytic genera with  $\pm$  spherical or polyhedral, solitary, not polarised cells [*Neochloris* STARR 1955 pro parte typico, *Ascochloris* BOLD et McENTEE 1974, *Follicularia* MILL. 1924, *Chlorotetraedron* McENTEE et al. 1978]. This group of genera has to be defined as a special family of the *Protosiphonales*. From the nomenclatural point of view, the name *Neochloridaceae* ETTL et KOM. 1982 must be used for it.

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### INTRODUCTION

*Pseudotetraedron* McENTEE et al. 1977 was described as a monotypical genus from the soils in Australia, with the type species *P. polymorphus*. Since the name „*Pseudotetraedron*“ is the later homonym of the xanthophycan alga *Pseudotetraedron* PASCH. 1912, the names of the Australian alga were changed in *Chlorotetraedron* McENTEE et al. 1978 and *Chlorotetraedron polymorphus* (McENTEE et al.) McENTEE et al. 1978, respectively.

The diacritical features of this alga (derived from the data given in McENTEE & al. 1977 and from our revisions of the typical strain) are as follows: (1) Cells solitary or in groups, polymorphic (i.e. spherical, tetrahedral or saccate); the tetrahedral form “occasionally persistent in adult cells or represented by four minute, vestigial processes”. (2) Chloroplast net-like or spongy, containing usually one central or slightly excentric pyrenoid, sometimes with more pyrenoids. (3) Cells multinucleate (coenocytic). (4) Reproduction by biflagellate, naked zoospores which become spherical and tetrahedral upon quiescence, and by aplanospores. The authors (McENTEE & al. 1977) pointed out the polymorphic shape of cells, particularly the tetrahedral form of young cells, and the spherical or saccate form of the old ones. The

alga is clearly coenocytic (Fig. 3) and belongs without doubts to the order *Protosiphonales*, as defined by Ettl & Komárek (1982).

Also another alga, isolated and studied by STARR (1954), and determined as *Tetraedron bitridens* BECK-MANNAG. 1926 (strain STARR 1952/120), has quite the same diacritical features of *Chlorotetraedron*. The STARR's strain was revised later by KOVÁČIK (1975a), who found that *Tetraedron bitridens* does not correspond to the diagnostic features of the genus *Tetraedron* KÜTZ. 1845 (with the type species *T. regulare*). The diacritical features of *Tetraedron* are mononuclear cells, obligatory reproduction by autospores, and the structure of cell walls in which the outer sporopolenin layer is irregularly warty in all *Tetraedron*-species. The polynuclear cells of *T. bitridens* produce zoospores and aplanospores and their cell walls are smooth (comp. KOVÁČIK 1975a, Plate 34, and KOVÁČIK & KALINA 1975). KOVÁČIK included, therefore, *T. bitridens* to a most similar and zoospore-producing genus *Polyedriopsis* SCHMIDLE, which has also tetrahedral but not coenocytic cells, and bears long setae characteristic of the *Micratiniaceae* on the corners of cells.

It follows without doubts from the comparison of STARR's strain and the strain used by McENTEE & al., from the photo-documentation in papers of McENTEE & al. (1977, p. 164–165, figs. 1–16) and of KOVÁČIK (1975a, Plates 32b-g, 33a-h), and from our comparison of both McENTEE's and STARR's strains, that *Tetraedron bitridens* and *Chlorotetraedron* are generically identical (a conspecificity of both these algae is also possible). Both the algae were isolated from soils and their morphology is almost the same. A difference exists in the form of chloroplast (according to the descriptions, not according to the documentation) and in the size of old cells. We accept *Chlorotetraedron polymorphus* and *Tetraedron bitridens* ad interim as different species of the same genus, the correct name of which must be „*Chlorotetraedron*“ (Pl. XIV).

*Tetraedron incus* (TEIL.) G. M. SMITH is another species in question. This planktic and polymorphic species occurs commonly, but never in great quantity, in eutrophic waters all over the world. However, its reproduction cycle was unknown till 1980 (comp. HINDÁK 1980). Several features excluding this alga clearly from the genus *Tetraedron* have been found recently. KOVÁČIK & KALINA (1975) found smooth cell walls in this alga, which were distinctly different from other *Tetraedron* species. HINDÁK (1980) studied one strain (HINDÁK 1978/34) from western Slovakia and described the reproduction by zoospores. We obtained the same results with the strain HEGEWALD 1977/82. We proved also in this strain the polynuclear state of vegetative cells. According to the described features, *T. incus* also belongs to the genus *Chlorotetraedron* (Pl. XV).

The generic identity of all three mentioned species was proposed already in KOMÁREK & FOTT (1983), but without nomenclatural solution. The cell structure and the life cycle of *Chlorotetraedron* determine clearly its taxonomic position among the *Protosiphonales*. The relation of *Tetraedron bitridens* to another protosiphonalean family, the *Hydrodictyaceae*, was suggested already by STARR (1954). Also HINDÁK (1980), who studied the reproduction process in *Tetraedron incus*, placed it inside the *Hydrodictyaceae*. The type species of the genus *Tetraedron* (*T. regulare*) and several other species (*T. minimum*, *T. caudatum*, *T. triangulare*) are, however, mononuclear and strictly autospore, and belong to the *Chlorellales*. The zoospore and coeno-

cytic species with tetrahedral cells must be transferred to the vicinity of other coenocytic families, as a special genus *Chlorotetraedron*.

In the present paper, the data concerning the genus *Chlorotetraedron* are summarized and a review of this genus is presented.

## METHODS

The following strains were used in our study:

- *Chlorotetraedron polymorphus*, strain DEAN/42, isolated from a soil sample in Australia (obtained from the collection of Göttingen, FRG), type strain;
- *Chlorotetraedron* ("Tetraedron") *bitridens*, strain STARR 1952/120, isolated from a soil sample in the USA (Mass., Woods Hole) (obtained from the collection of Göttingen, FRG).
- *Chlorotetraedron* ("Tetraedron") *incus*, strain HEGEWALD 1977/82 (provided by E. HEGEWALD, Jülich, FRG).

We cultivated all the strains in a biphase soil/water medium and in ZEHNDER's liquid medium for study of the morphological and cytological changes during the life cycle.

The nuclei were stained according to the methods of ZACHLEDER & al. (1974) and CEPÁK & ZACHLEDER (in press). The results are documented in Pl. XVI. All our investigations proved the published data and a narrow relation of all strains investigated, particularly as concern cell structure and life cycles.

## LIFE CYCLE

The reproduction process and the life cycle of *Chlorotetraedron polymorphus* were studied in cultures and described by McENTEE & al. (1977), of *Tetraedron bitridens* by STARR (1954), PICKETT-HEAPS (1972, 1975) and KOVÁČIK (1975a), of *Tetraedron incus* by HINDÁK (1980) and KOVÁČIK (in litt.). In all three strains we revised the nuclear division during the life cycle. The first division of nuclei proceeds in very young cells just after their formation (sometimes starts already inside the mother cell or in the plasmatic vesicle; Pl. XV, arrow) The next divisions continue regularly and synchronously during the whole life cycle (Pl. XV). The maximal number of daughter cells can be higher than 128.

The reproduction process (Fig. 1) is asexual, and can be performed by aplanospores (type **A**) or zoospores (type **B**). Both types of reproduction cells are differentiated endogenously inside the parental cell. The number of daughter components corresponds mainly with the number of nuclei, and both types of reproduction cells are originally uninucleate. Aplanospores arise usually in a number of 4—8—16 (—32—64—128), and during their development they synthesize their new own cell walls. Zoospores arise in a greater number (32—128), and are naked. The aplanospores liberate by the rupture of the mother cell wall. The zoospores release firstly to the plasmatic, gelatinous, external vesicle, which disappears later. In *T. bitridens* motile zoospores often liberate from the vesicle, while in *T. incus* the zooids soon change in immotile young tetrahedral cells, sometimes already inside the mother cell wall (**A'**). This change of motile zoospores and immotile aplanospores corresponds well with the definition of aplanospores by BOLD & WYNNE (1978).

Early after their quiescence, tetrahedral cells develop from the zoospores,

and from the very beginning of the following growth phase the nuclear mitotic division, described and documented in detail by PICKETT-HEAPS (1972, 1975), repeats.

The resting spores (akinetes) were observed in all three species in cultures (C). Their development is similar and proceeds in the stationary phase. The tetrahedral cells become rounded, the cell wall becomes thicker, and carotenoids appear inside the cells. The resting cells are spherical and the corners of tetrahedral cells remain sometimes only as inconspicuous wart-like thickenings on their surface. McENTEE & al. (1977) described an orange colour of resting spores of *C. polymorphus*, their cell walls being up to 10  $\mu\text{m}$  wide, with several pyrenoids. According to the present knowledge, only zoospores develop from the resting cells.

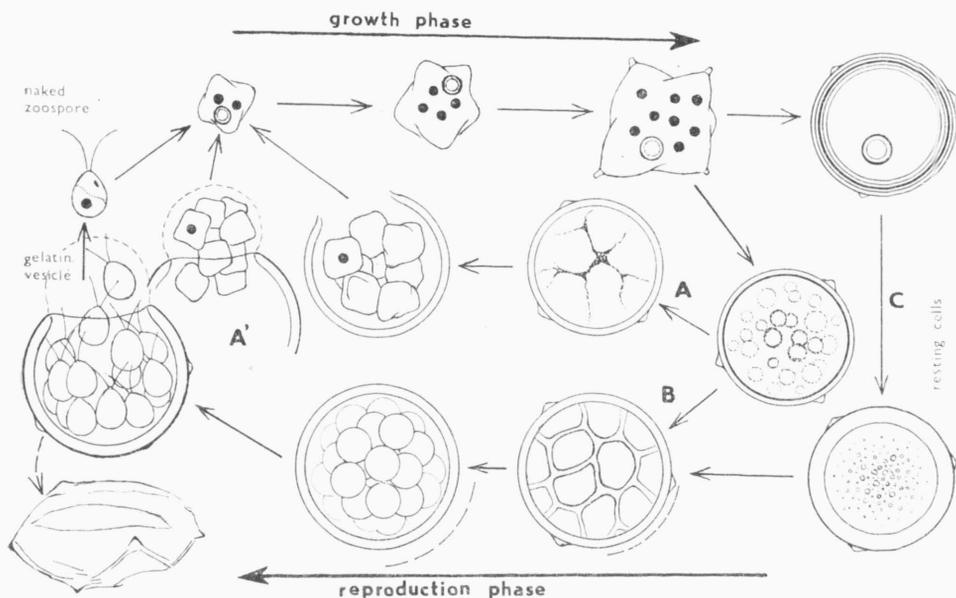


Fig. 1. Life cycle of the genus *Chlorotetraedron*. Explanation see in text. (Orig.)

In *Chlorotetraedron polymorphus* and *Tetraedron bitridens* all described types of reproduction (A, B and C) are known. In *Tetraedron incus*, however, mainly zoospore production (B, A' and C) has been observed till now.

The differentiation of daughter cells and the reproduction cycle of *Chlorotetraedron* are very similar to those of simple *Hydrodictyaceae* (*Euastropsis*, *Pediastrum* — asexual cycle). However, the solitary life form justifies the establishing of a special family.

#### TAXONOMY

According to the diagnostic features, the genus *Chlorotetraedron* belongs to the *Chlorophyceae*, the order *Protosiphonales*, as defined by Ettl & Komárek (1982). However, the families were not defined definitely inside this order. Ettl & Komárek (1982) established four families, from which three are

based on the types with polarised (heteropolar) cells (*Rhopalosolenaceae* Ettl et Kom. 1982, *Characiosiphonaceae* Iyeng. 1936, and *Protosiphonaceae* Blackm. et Tansl. 1902), and the last one, the *Hydrodictyaceae* (S. F. Gray) Dumort. 1880 includes coenobial types. Coccal, microscopic types with  $\pm$  spherical cells (e.g., *Follicularia* Mill. 1923) were included provisionally in the *Protosiphonaceae*.

Since the polarity is an important developmental feature representing the suprageneric category in all algal classes, a special family must be established for these algae (possessing the diacritical characters of the Chlorophyceae and *Protosiphonales*), with the following characters:

- Cells  $\pm$  spherical, irregular or tetrahedral, not polarised, microscopical (up to 100  $\mu\text{m}$  in diameter);
- cells polynuclear, coenocytic;
- reproduction by naked zoospores and facultatively by aplanospores;
- chloroplast with one or more pyrenoids;
- cell wall smooth.

The following genera correspond with this definition: *Follicularia* Mill. 1924, *Neochloris* Starr 1955 (only a part of multinuclear species, but inclusive typo<sup>1</sup>), *Ascochloris* Bold et McEntee 1974, and *Chlorotetraedron* McEntee et al. 1978. As to *Neochloris*, a part of the species was described as mononuclear (comp. p. 108, Table II in Komárek & Fott 1983); if the mononuclearity of this group is proved, it will not correspond with the type and must be classified in a special genus within the simple *Chlorellales*. The polynuclear species of *Neochloris* Starr (based on *N. aquatica* Starr 1955, p. 86–90) can be used as the type for the discussed family of *Protosiphonales*, and the name *Neochloridaceae* Ettl et Kom. 1982 must be applied to it. The other mononuclear genera included in the *Neochloridaceae* in Ettl & Komárek (1982) must be retained in the *Chlorellales* under another family name.

The morphological description of the genus *Chlorotetraedron* McEntee et al. 1978 is as follows: Cells solitary or in irregular groups,  $\pm$  tetrahedral or polyhedral (particularly when young), sometimes with short papillae in the corners, later rounded, spherical (particularly in cultures), sometimes with persistent wart-like papillae or cell wall thickenings. Cell wall smooth, thin, later slightly (or intensely in resting spores) thickened. Chloroplast one, parietal, later net-like or differentiated in many lobes, with one or more pyrenoids (particularly in old cells). Cells polynuclear during the growth phase. Reproduction by biflagellate zoospores or by aplanospores. Resting spores spherical with thickened cell walls and sometimes with internal carotenoids; spores germinate in zoospores. Type species: *C. polymorphus* (McEntee et al.) McEntee et al. 1978. Three cytomorphologically and ecologically distinguishable species.

### Morphology and ecology of *Chlorotetraedron* species (Fig. 2):

1. *Chlorotetraedron polymorphus* (McEntee et al.) McEntee et al. 1978: Cells  $\pm$  solitary, tetrahedral when young, later up to spherical or sack-like, up to 90  $\mu\text{m}$  (? akinetes) in diameter. Chloroplast parietal, later net-like or up to spongiform, with one pyrenoid. In old cells mainly more than 30 nuclei and several large vacuoles are present. Distribution (i) by  $\pm$  spindle-like

<sup>1</sup> The polynuclear (coenocytic) structure of cells of *Neochloris* (in the type species *N. aquatica* Starr) was proved in the type strain (UTEX 138 = NORBY/Bloom. 138) using the method of Zächleder & al. (1974).

zoospores with anterior nucleus, two contractile vacuoles and one pyrenoid, pointed at both poles or only at the anterior one, without visible eyespot; zoospores  $9-10 \times 4.5 \mu\text{m}$ , become tetrahedral soon after quiescence; (ii) by aplanospores. Akinetes spherical with up to  $10 \mu\text{m}$  thick wall, up to  $90 \mu\text{m}$  in diameter. — Distribution: Isolated from soils in Australia (McENTEE & al. 1977, 1978). Till now known only from one culture (type strain DEAN/42).

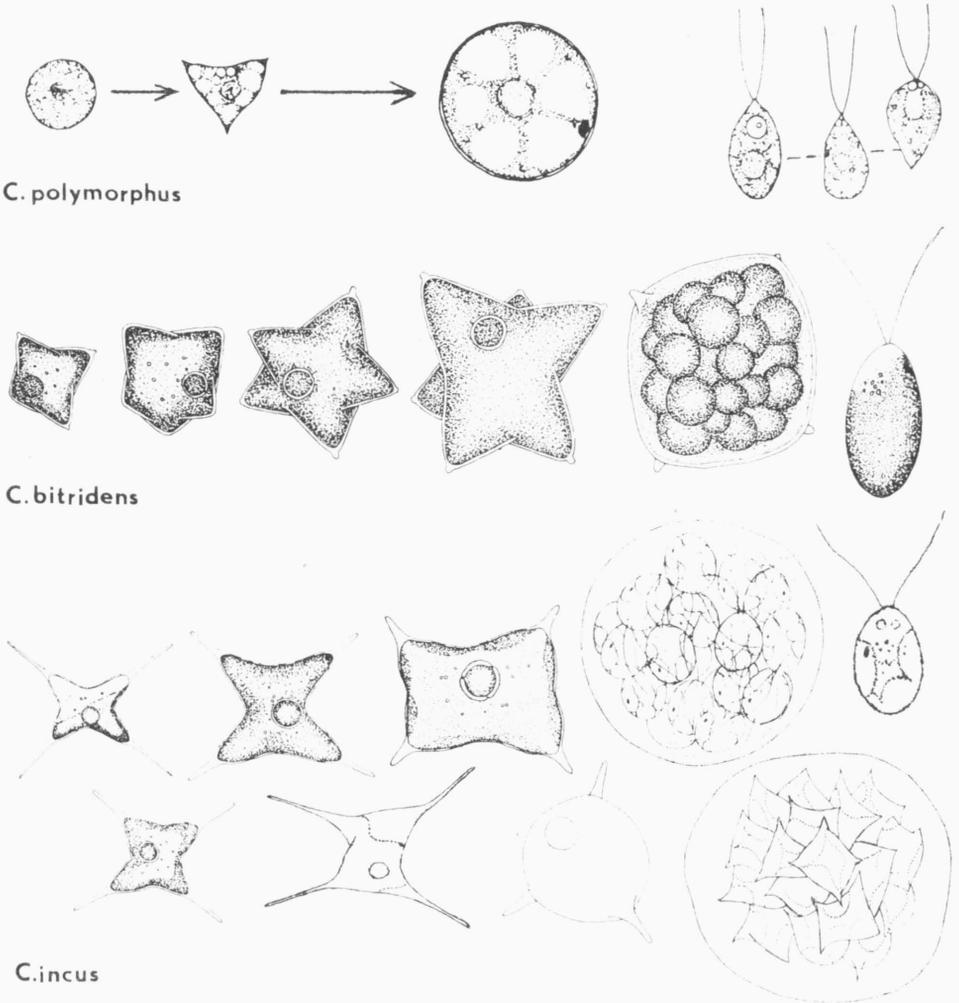


Fig. 2. *Chlorotetraedron polymorphus* (after McENTEE et al. 1977); *Chlorotetraedron bitridens* (after KOVÁČIK 1975a); *Chlorotetraedron incus* (after KOVÁČIK 1975b and HINDÁK 1980).

2. *Chlorotetraedron bitridens* (BECK-MANNAG.) comb. nova [Basionym: *Tetraedron bitridens* BECK-MANNAG. Arch. Protistenk. 55: 182, fig. 11 (iconotype), 1926]; Cells solitary or in irregular groups, tetrahedral or polyhedral, with 4 to 6 lobate corners terminated with short, papilla-like processi,  $4-15 (-25) \mu\text{m}$  in diameter. Chloroplast one, parietal, in old cells of irregular form, composed of disc-like subunits, lobate, with one or more pyrenoids. In old cells pyrenoid disappears and more small disc-like pyrenoids develop in different parts of chloroplast. In old cells mainly 16–32 nuclei. Distribution (i) by ellipsoidal,  $4-32$  zoospores with anterior nucleus and eyespot,  $5.5-13 \times 3.7-7 \mu\text{m}$ ; (ii) by aplanospores, which soon become tetrahedral, but a little

more rounded forms than those of the cells from zoospores. — Distribution: Described from the littoral of a small forest pond (among *Utricularia*) at Moosburg in Austria (BECK-MANNAGETTA 1926), later isolated by STARR (1954) from a soil sample in Woods Hole in the USA-Mass. (strain STARR 1952/120). KOVÁČIK (1975) thinks that *Coelastrum humicola* GISTL from soils in Sumatra (Indonesia) is also identical with this alga. If all the population cited are really taxonomically identical, *C. bitridens* is probably of cosmopolitan distribution, occurring in shallow, not polluted littorals of water bodies and in wet soils.

3. *Chlorotetraedron incus* (TEIL.) comb. nova [Basionym: *Tetraedron regulare* var. *incus* TEIL. Sv. bot. Tidskr. 6 : 277, fig. 12, 1912; *Tetraedron incus* (TEIL.) G. M. SMITH Trans. amer. micr. Soc. 45 : 174, 1926]: Cells solitary, free floating,  $\pm$  tetrahedral or  $\pm$  flat with (3)–4–(5) lobes, terminated by (0.5)–2.5–7  $\mu$ m long, finger-like processus. Cell sides concave, only in old cells convex, old cells (particularly those occurring in cultures) tetrahedral-rounded; cells (3–)12–25 (–33)  $\mu$ m in diameter. Chloroplast parietal, with one pyrenoid, in old cells lobate or slightly irregular in the margin. In vegetative cells mainly 8–16 nuclei, which multiply to 32(–64) during the formation of reproduction cells. Distribution by 8–64 zoospores (aplanospores not known till now), which are  $\pm$  ovoid, sometimes slightly asymmetrical, possessing anterior or median small eyespot, long flagella (mainly longer than the cell itself), two contractile vacuoles; zoospores 3.5–8  $\times$  3–5  $\mu$ m. Chloroplast parietal, seems to be divided in 2–4 parts. Akinetes spherical or oval, with 4  $\mu$ m thick wall, 9–30  $\mu$ m in diameter. — Distribution: Occurs commonly, but never in masses, in stagnant, slightly eutrophic, often shallow waters with water plants. Known from temperate as well as from tropical areas.

### Key for the determination of species:

- 1a Polyhedral cells with very short, wart-like process; soil algae.....2
- 1b Polyhedral (mainly tetrahedral) cells with 2–5  $\mu$ m long processi at the corners; planktic  
..... 3. *C. incus*
- 2a Chloroplast in old cells net-like; resting spores up to 90  $\mu$ m in diameter, with the cell wall  
up to 10  $\mu$ m thick ..... 1. *C. polymorphus*
- 2b Chloroplast in old cells parietal, irregular, but not net-like; resting spores up to 40  $\mu$ m in  
diameter ..... 2. *C. bitridens*

Two further algae, *Coelastrum humicola* GISTL 1935 and *Tetraedroides spetsbergensis* GRIFFITHS 1923 are habitually similar to *Chlorotetraedron*. Both algae were described from soils, and their cell morphology is similar to that of *Chlorotetraedron*. Particularly *Coelastrum humicola* is most probably identical with *Chlorotetraedron bitridens*. However, only reproduction by autospores is described in it. Therefore, this identification cannot be proved without a revision of the type material. *Tetraedroides spetsbergensis* has priority over *Chlorotetraedron*, but its description is unclear and the identification with *Chlorotetraedron* would be rather speculative. GRIFFITHS writes about “thread formation” and “segmentation by constrictions” in this alga.

### ACKNOWLEDGEMENT

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### SOUHRN

Rod *Tetraedron* KÜTZ. 1845 (*Chlorellaceae*, *Chlorellales*) je kokální, mononukleární jednobuněčná zelená řasa s typickou sporopoleninovou, na povrchu skulpturovanou buněčnou stěnou (KOVÁČIK & KALINA 1975). Typem tohoto rodu je *T. regulare* (SRVN. KOMÁREK & FOTT 1983). Do rodu *Tetraedron* byly dříve řazeny jakékoliv další druhy řas s tetraedrickými buňkami, u mnohých však byly později zjištěny vlastnosti, odlišné zásadně od typového druhu (jiné složení pigmentů, zoosporní rozmnožování, ap.). Tyto druhy byly postupně revidovány a přerazovány do odpovídajících taxonomických skupin, převážně do různých rodů třídy Xanthophyceae. Druhy, které sice patří (podobně jako typický *Tetraedron*) mezi zelené řasy (pigmenty, asimilační produkty),

ale mají polynukleární, coenocytické buňky, hladkou buněčnou stěnu pravděpodobně celulosního typu a rozmnožují se 2-bíčíkatými bezblannými zoosporami a aplanosporami, patří do řádu Protosiphonales, definovaného ETTLEM & KOMÁRKEM (1982). Tyto druhy, řazené dříve do r. *Tetraedron*, odpovídají diagnose r. *Chlorotetraedron* McENTEE et al. 1978 (s typovým druhem *Ch. polymorphus*, izolovaným z půd Austrálie), který byl dosud pokládán za monotypický.

Na základě studia izolovaných kmenů (včetně typového kmene *Ch. polymorphus*) byla provedena revize dalších zoosporinních druhů, které odpovídají svými znaky diagnose r. *Chlorotetraedron*. U všech kmenů byla prokázána coenocytická stavba vegetativních buněk, jejich obdobná struktura, obdobný průběh reprodukčního procesu, a tedy i jejich rodová totožnost. Rod *Chlorotetraedron* nyní obsahuje tři druhy, jejichž přehled a popisy jsou obsahem závěrečné části článku: *Ch. polymorphus* (McENTEE et al.) McENTEE et al. 1978, *Ch. bitridens* (BECK-MANNAG.) comb. nova, a *Ch. incus* (TEIL.) comb. nova.

V řádu *Protosiphonales* nebyla dosud ustanovena čeleď pro solitární, jednobuněčné, coenocytické rody s  $\pm$  sférickými nebo polyedrickými, nepolarizovanými buňkami (*Neochloris* STARR 1955 pro parte typico, *Ascochloris* BOLD et McENTEE 1974, *Follicularia* MILL. 1924 a *Chlorotetraedron* McENTEE et al. 1978). Podle nomenklatorických zásad je pro tuto čeleď oprávněné jméno *Neochloridaceae* ETTL et KOM. 1982, musí být ovšem opravena a nově definována její náplň v souladu s novými poznatky o typovém rodu. Polynukleární charakter vegetativních buněk u všech druhů r. *Chlorotetraedron* a u typového druhu (a typového kmene) r. *Neochloris* (*N. aquatica* STARR) byla prokázána barvicími metodami podle ZACHLEDERA & al. (1974) a ČEPÁKA & ZACHLEDERA (in press).

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See also Plates XIV—XVI in the Appendix

K. H. Rechinger [red.]

### G. Hegi, *Illustrierte Flora von Mitteleuropa*, ed. 2, III/2, Lieferung 8, 9, 10

Verlag Paul Parey, Berlin—Hamburg. Lieferung 8, 1978, 80 str. [1013—1092], 72 obr. [467 až 538], 1 tab. [106], cena 28,— DM. Lieferung 9, 1979, 80 str. [1093—1172], 67 obr. [539—605], 2 tab. [107—108], cena 28,— DM. Lieferung 10, 1979, 93 + 8 str., [1173—1265 + I—VIII], 37 obr. [606—642], 1 tab. [109], cena 37,— DM. (Uvedené sešity jsou v knihovně ČSBS; údaje o cenách jsou z r. 1979.)

Po pauze od r. 1971 se v poměrně krátké době od ledna 1978 do září 1979 objevily 3 zbývající sešity 2. části 3. svazku znovu vydávané Hegiho *Illustrierte Flora von Mitteleuropa*, čímž bylo vydávání tohoto svazku původně plánované do 9 sešitů po 15 letech uzavřeno. Zatímco některé svazky vycházejí pouze v dotisech s doplňky, v tomto případě jde o zcela nové zpracování celého svazku (čeledi *Phytolaccaceae*, *Amaranthaceae*, *Chenopodiaceae*, *Illecebraceae*, *Caryophyllaceae* a *Portulaccaceae*). Vzhledem k tomu, že jde o dílo mající bezprostřední vztah k našemu území, je potěšitelné, že alespoň sešity 8—10 se prostřednictvím knihovny ČSBS stávají dostupnými i pro širší botanickou veřejnost. Tyto sešity zahrnují dokončení čeledi *Caryophyllaceae*, čeledi *Portulaccaceae* a společný text k celému svazku (seš. 8 část rodu *Dianthus*, *Cucubalus* a část rodu *Silene*, seš. 9 druhou část rodu *Silene* a část rodu *Lychnis*, seš. 10 zbývající část rodu *Lychnis* a rod *Agrostemma*, dále čeledi *Portulaccaceae* a doplňky, opravy, rejstřík atd. k celému svazku III/2). Autory zpracování jsou východoněmečtí autoři — jednak prof. Meusel se spolupracovníky (H. Meusel a K. Mühlberg — *Dianthus*, H. Meusel a K. Werner — zbývající rody čeledi *Caryophyllaceae*), jednak dr. H. Jage (*Portulaccaceae*).

Zpracování problematiky je velmi podrobné, mnohdy překračující běžný způsob zpracování i v tomto kompendiu. U většiny taxonů lze dokonce říci, že podrobnější moderní zpracování ve florách ani publikováno nebylo. Autoři se snažili o pokud možno vyčerpávající přehled údajů o zpracovávaných taxonech z nejrůznějších hledisek (u rodu je to např. nejen jejich morfologická charakteristika, ale i jejich vymezení, vnitřní členění, počet druhů, rozbor jednotlivých morfologických znaků — často dokonce ve vztahu k ontogenezi jednotlivých orgánů, ekologické charakteristiky nejrůznějšího typu, údaje o pěstování či zavlékání cizích zástupců, o škůdcích apod., obdobně jsou zpracovávány i jednotlivé druhy). Dále se snažili využít jak všech svých vlastních poznatků, tak i existující literatury. Ta je na rozdíl od prvního vydání poměrně bohatě citována u čeledí, rodů i jednotlivých druhů, navíc jsou citovány i originální prameny u správných jmen základních taxonů, někdy i u synonym. U druhů jsou důsledně uváděny počty chromosomů (avšak bez citace původního pramene) a formule pro areálovou diagnosu a květenný element. Mnohem bohatší ve srovnání s prvním vydáním jsou i obrázky, fotografie a kartogramy doplňující text. V případě kartogramů jde většinou o Jágerem nově upřesněné kartogramy obrysově (r. 1965 publikované Meuselem, Jágerem a Weimertem), řidčeji jsou to kartogramy jiné, např. síťové. Velká podrobnost a různorodost údajů je na jedné straně jistě přínosem, na druhé straně však nutí k zamyšlení, do jaké míry budou údaje etenaří využity (např. fotografie jihoafrických křovitých zástupců čel. *Portulaccaceae* si sice etenař jistě se zájmem prohlédne, záměrně je však v tomto díle o středoevropské květeně bude sotva hledat; obdobně otázky vyvolává i množství — velice kvalitních — schémat vzrůstových forem či stavby květenství u různých taxonů čel. *Caryophyllaceae*).