

***Fottea cylindrica* gen. et sp. nov., a New Member of the Ulotrichacean Algae**

***Fottea cylindrica* gen. et sp. nov., nový rod ulotrichálných rias**

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Abstract — *Fottea cylindrica* HINDÁK, a new genus and species is described obtained from soil (snow detritus) of the Malá Studená dolina valley in the High Tatra (Czechoslovakia). This unicellular alga belongs to the group of the simplest members of the order *Ulotrichales* (*Chlorophyceae*).

In the system of green algae (*Chlorophyceae*) the members of the order *Ulotrichales* may be characterized by the absence of contractile vacuoles, stigma and flagella in the vegetative state and by asexual reproduction through the dividing of cells into two parts. The mother wall is subjected to division and thus becomes either permanently or transiently a part of the cell wall of the daughter cells. The assumption that the order *Ulotrichales* also covers unicellular green algae with vegetative division of cells, though not forming filaments, may be assumed to be correct (VISCHER 1933, HINDÁK 1962a, 1962b, PRINTZ 1964, FOTT 1967 etc.).

Having the above in mind, the idea arises of the possibility of a developmental sequence in the order *Ulotrichales*, beginning with unicellular algae, and continuing with the typical filamentous unbranched algae and ending in the multicellular filamentous type with a specific sexual process. Two groups of genera in the simple ulotrichacean algae are not able to form filaments. This classification depends on the fact whether the subsequent division of the cells takes place in the same direction as the previous ones or whether it takes place transverse to the axis of the previous divisions. The members of the first group e.g. *Elakatothrix* WILLE, *Koliella* HIND., *Stichococcus* NAG. may be directly phylogenetically related to the unbranched filamentous algae (e.g. *Gloetila* KÜTZ., *Chlorokormidium* FOTT, *Ulothrix* KÜTZ.) while the second group, represented e.g. by *Chlorosphaera* KLEBS, *Chlorosarcina* GERN., *Planophila* GERN., *Phacomyxa* SKUJA, *Pleurococcus* MENEGH. shows a relation to some algae with a branched thallus (e.g. *Protoderma* KÜTZ., *Leptosira* BORZI, *Pseudendoclonium* VISCH., *Coleochaete* BRÉB., etc.). The assumption that some of the branched and foliose algae may have developed from the unbranched ones (the morphologic relation between the genera *Ulothrix* KÜTZ. — *Schizomeris* KÜTZ. — *Prasiola* AG.) is also of interest.

Tab. 1. Review of significant features of some genera resembling *Fottea*

Feature	Genus						
	<i>Phacomyza</i>	<i>Elakatothrix</i>	<i>Fottea</i>	<i>Geminella</i>	<i>Stichococcus</i>	<i>Gloeotila</i>	<i>Koliella</i>
Cells	in colony	solitary or in colony	in colony seldom solitary	uniseriate pseudofilamentous colony	solitary or short filament	short or long filament	solitary
Form of cells	asymmetrical, globose, semi-globose to ovoid	fusiform	cylindrical	cylindrical to ellipsoidal	cylindrical to sphaerical	cylindrical	fusiform
Shape of chloroplasts	discoid	discoid to plate-shaped	parietal-through-like	discoid to oblong or band-shaped	discoid, plate-shaped to through-like	plate-shaped to through-like	discoid, band-shaped to trough-like
Number of chloroplasts	numerous	1	1	1	1	1	1
Pyrenoid	—	+	—	+	—	—	— (+)
Mucilage	+	+	+	+	—	— (+)	—

The new genus *Fottea*¹⁾ belongs to the first group of the simplest members of the order *Ulotrichales*. *Fottea* HINDÁK gen. nov.

Coloniae liberae, gelatinosae, formae variae

Cellulae cylindricae, in coloniis mucosis irregulariter dispositae, raro solitariae, nunquam in filamentis; chromatophorum singulum, parietale; nucleus singulus.

Multiplicatio: asexualis cellularum divisione transversa in partes duas; propagatio sexualis, zoosporis et status persistens non observata.

Typus generis: *Fottea cylindrica* sp. nov.

The genus *Fottea* can be considered to be a genus which is closely related to *Elakatothrix*, *Stichococcus* and *Gloeotila*. However, according to the present status of the systematics of the above genera, as well as according to their original descriptions, the new genus *Fottea* cannot be included in either of them.

Formation of gelatinous colonies in which the cell distribution is solitary and haphazard is one of the most significant features of the genus *Fottea*. The cells are cylindrical and do not form filaments. The reproduction of the cells by division with a transverse septum is of the same type as e.g. *Stichococcus* or *Gloeotila*, the only difference being that the cells soon separate after division. On the latter feature, the genus *Fottea* resembles the genus *Elakatothrix* p. p., in which, however,

¹⁾ It is my pleasure and honour to name this new genus after Prof. Dr. BOHUSLAV FORT DrSc., the nestor of Czechoslovak algologists and my teacher, a sexagenarian this year.

the dividing septum, which is originally transverse, becomes oblique (which fact is due to the spindle form of the cells). The genus *Fottea* may be said to resemble the genera *Geminella* and *Radiofilum* in the manner and course of the asexual reproduction.

Table 1 shows a review of the main features of this new genus and some related genera.

The table indicates that in the form of the colonies and the manner of cell distribution throughout the colony, *Elakatothrix* (especially *E. subacuta* KORŠ.) and partly also *Phacomyxa* SKUJA are the nearest genera to *Fottea*. *Phacomyxa*, however, contains more chloroplasts and the subsequent division of cells does not take place in the same axis (chlorophaecoccean algae). *Fottea*, *Stichococcus* sensu auct. p. p., *Gloeotila* and partly also *Geminella* are characteristic because of their cylindrical cells. *Geminella* is, on the other hand, distinctly different from all the mentioned genera due to the presence of pyrenoids. In contrast to *Fottea*, the genera *Stichococcus* and *Gloeotila* p. p. do not form mucilage, and generally form filaments, though short and fragile. Certain species of *Stichococcus* do not form filaments at all (*S. chlorelloides* GRINTZ. et PÉT., *S. atomus* SKUJA). The genus *Hormidiopsis* HEERING belongs to the group of genera characterized by mucilage. *H. crenulata* HEERING forms uniseriate and sometimes biseriate filaments, in which the cells are in contact. Further, formation of aplanospores has been observed in this species. The second species *H. ellipsoideum* PRESCOTT (1944, 1951) is probably not a member of the genus *Hormidiopsis*, because the cells do not form the typical filaments (the cells are situated in continuous series in the mucilage and are not in contact), a pyrenoid is also present. It is my opinion that this species should belong either to the genus *Geminella* TURP. or it is a quite different genus, characterized by its transversally elliptic cells. The genus *Koliella* HIND. is characterized by its solitary cells, but they are fusiform and without mucilage. The members of the genus *Mesotaenium* NÄG. (*Conjugatophyceae*) are different from *Fottea* in the first place due to their sexual reproduction, the form of the chloroplast, and the presence of the pyrenoid.

The following review of genera in form of a generic key points to the main differential features of the suborder *Ulotrichineae*.

Key to the genera of the suborder *Ulotrichineae*

- 1a Cells without pyrenoid
 - 2a Cells in the colony, seldom solitary
 - 3a Cells with mucilage
 - 4a Cells fusiform: *Elakatothrix* WILLE
 - 4b Cells cylindrical: *Fottea* gen. nov.
 - 3b Cells without mucilage
 - 5a Cells fusiform: *Koliella* HINDÁK
 - 5b Cells spherical or ovoid to ellipsoidal: *Stichococcus* NÄG. p. p.
 - 2b Filaments short or long
 - 6a Filaments uniseriate; aplanospores unknown
 - 7a Filaments very short, cells frequently solitary; zoospores unknown; without mucilage
 - 8a All cells cylindrical: *Stichococcus* NÄG. p. p.
 - 8b Cells cylindrical with exception of terminal $\pm$ rostrate cells: *Raphidonema* LAGERH.
 - 7b Filaments short or long; zoospores known or unknown; with or without mucilage
 - 9a Filaments without or with mucilage; zoospores known; cells cylindrical, without Fe-rings at the ends: *Gloeotila* KÜTZ.

- 9b Filaments with mucilage; zoospores unknown; cells with Fe-ring at the ends: *Catena* CHOD.
- 6b Filaments seriate or sometimes biseriate; aplanospores known: *Hormidiopsis* HEERING p. p.
- 1b Cells without pyrenoid
- 10a Filaments (or "pseudofilaments") without mucilage
- 11a Zoospores unknown; filaments with a few cells only placed in a row; aplanospores known: *Heterothrichopsis* IYENG. et KANTH.
- 11b Zoospores known
- 12a Zoospores biflagellate
- 13a Filaments not attached
- 14a Filaments mostly long; aplanospores unknown: *Chlorhormidium* FOTT
- 14b Filaments short, cells frequently solitary; aplanospores known: *Gloeotilopsis* IYENG et PHIL.
- 13b Filaments with a long hyaline thread-like stalk with a knob-like disc by which it is attached to the substratum *Hormidiella* IYENG. et KANTH.
- 12b Zoospores quadriflagellate: *Ulothrix* KÜTZ. incl. *Uronema* LAGERH.
- 10a Filaments (or "pseudofilaments") with mucilage
- 15a Cell wall not composed of two halves
- 16a Cells transversally elliptic, in continuous series, often in groups of four, each group inclosed by a sheath; filaments short: *Hormidiopsis* HEERING p. p. (*H. ellipsoideum* PRESCOTT)
- 16b Cells cylindrical to ellipsoidal, frequently in linear pairs, forming filaments of indefinite length: *Geminella* TURP.
- 15b Cell wall composed of two halves: *Radiofilum* SCHMIDLE incl. *Interfilum* CHOD. et TOR.

Genus with one species:

Fottea cylindrica HINDÁK sp. nov.

Coloniae liberae, 2—4—11 et ultracellulares, gelatinosae, formae ovalis usque irregularis.

Cellulae longe cylindricae, rectae vel raro paulo curvatae, apicibus late rotundatis, in tegumento mucoso homogeneo crasso irregulariter dispositae, raro solitariae, nunquam in filamentis. Chromatophorum singulum, parietale, alveiforme, fere totum cellulae peripheriam occupans, sine pyrenoide. Nucleus singulus, sphaericus, in cellulis adultis centralis. In protoplasto guttas olei.

Dimensiones: cellulae 21—32 μ m longae, 8—9 μ m latae; tegumentum gelatinosum cellulae solitariae 8—12 μ m crassum.

Multiplicatio: cellularum divisione transversa in partes duas.

Habitatio: in edaphono vallis Malá Studená dclina (circa 2100 m supra mare, collectio 11. X. 1962) in montibus Tatrensibus, Slovacia.

Typus: figura nostra 1.

General characters same as those of the genus.

The cells in the laboratory cultures (test-tube with the natural material consisting of snow-water with detritus) appeared solitary, mostly in colonies of 4—11—16 and more, haphazardly distributed in the common, distinctly contoured mucilage without structure. The form of the colony varied with the number of the cells, being generally irregular in shape, sometimes oval and round.

The cells in the colony were always solitary and did not form short filaments and chains, and were not in contact. They were three to three-and-half times longer than broad, symmetrical, cylindrical, usually straight or slightly bent, with broad rounded ends. There was only one chloroplast which was green to dark-green, parietal, trough-like, relatively massive and without

a pyrenoid. It went as far as the ends of the cells and occupied almost the whole cell cavity. The margins were often very close and in some cells were in contact. One round nucleus could be observed in the centre of the cell. The plasma of the cells, mainly of old ones, contained fat granules of different sizes.

The asexual reproduction took place in the way of transverse division into two daughter cells, which soon separated and never joined to form filaments.

The young growing cells were generally 21–24 μm long, the developed cells before the division or in the course of the division 29–32 μm long. The width of the cells varied only to a very slight degree and amounted to 8–9 μm . The gelatinous sheath was well contoured without structure and relatively broad, 8–12 μm in thickness, measured from the cell wall. Our efforts to obtain a unialgal culture of this species failed.

Gloeotila curta SKUJA (1956) seems to be a morphologically related species, on account of the cylindrical type of cells and that of the chloroplast. *G. curta* forms not very long, mostly 20-cell filaments, which have either no or a very fine sheath of mucilage. *G. curta* differs from *Fottea cylindrica* by the fact that the former is able to form filaments, the cells are smaller ($4-13 \times 2-2,8 \mu\text{m}$) and the sheath is mostly 1,8 μm broad. This species is closely related to *Fottea*.

Súhrn

V článku bol opísaný nový rod a nový druh ulotrichálnych rias *Fottea cylindrica*, pozorovaný v kultúre pôdnych rias (snehový detrit) z Malej Studenej doliny vo Vysokých Tatrách. V systéme zelených rias patrí táto jednobunková riasa do skupiny najjednoduchších predstaviteľov radu *Ulotrichales* (*Chlorophyceae*).

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See also plate XV. in the appendix.

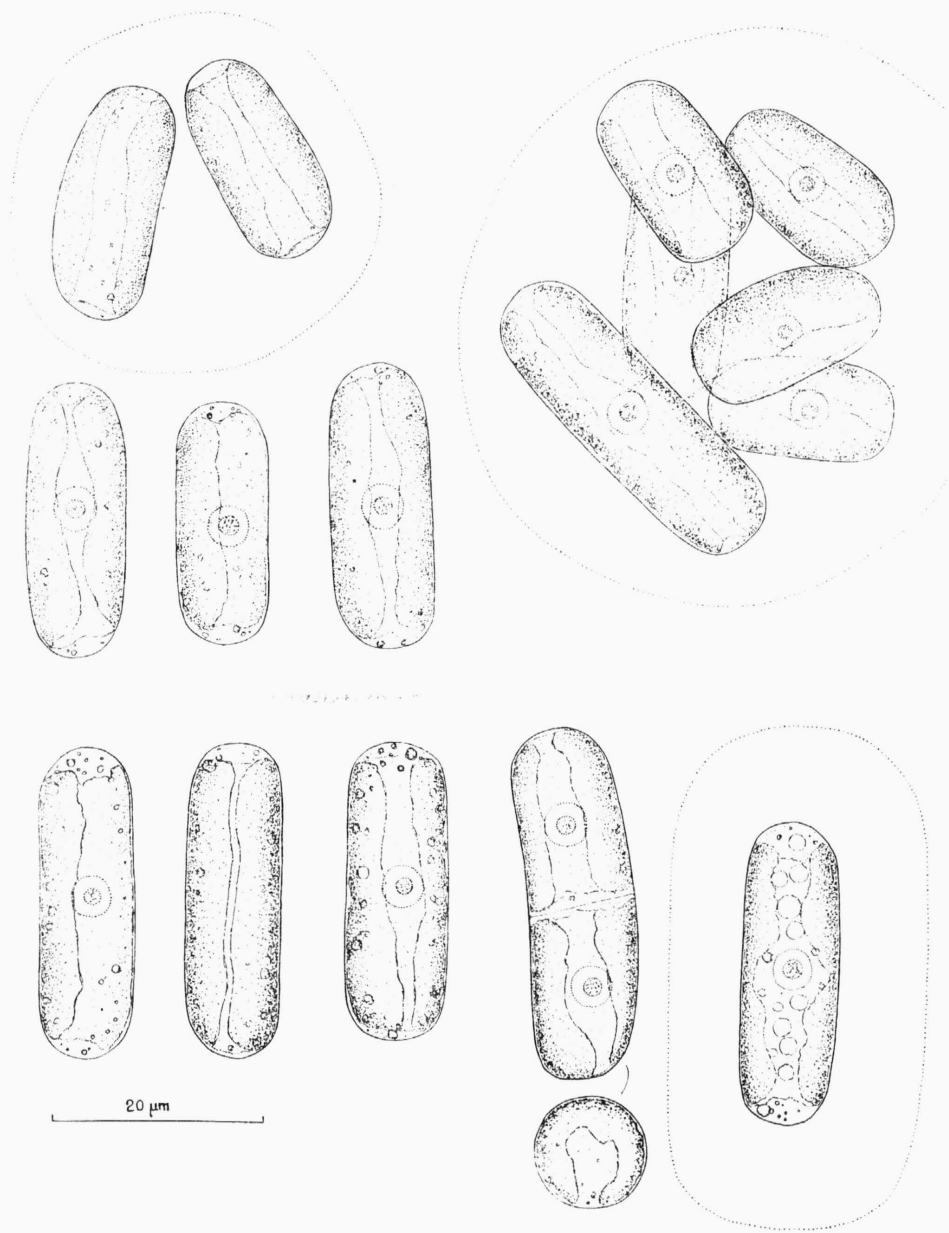


Fig. 1. *Fottea cylindrica* gen. et sp. nov.; orig.

F. H i n d á k: *Fottea cylindrica* gen. et. sp. nov., a New Member of the Ulotrichacean Algae