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Epibolium fonticolum sp. nova i inne glony
w małym źródle

Epibolium fonticolum sp. nova and Other Algae
in a Small Spring

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Near the stream „na Glisnem” in the vicinity of Mszana Dolna there exists a small spring of limnocrenic type. It is located on the highest terrace of the stream below its steep bank overgrown with spruce. In the immediate vicinity there is a small glade, sparsely overgrown with young spruce and juniper. The spring has the appearance of a small bathtub into which water flows from beneath. Its bottom is lined with sand mixed with a considerable amount of detritus and a few stones. The spring occupies a space of 60×50 cm., its average depth being 30 cm. It has no open outflow, the water filtering through stony ground to the stream which lies at a distance of ca. 25 m. and being cut in 3.5 m. in relation to the spring.

The spring has been here for a long time. The author has known it for at least 40 years and has noticed during this time no changes either in its appearance or in the amount of water. Only the environment changed, trees being cut down while others grew in their place. The stream flowing nearby lowered its bed by at least 1 m., but the spring remained unaltered. The author visited it often during his walks and approximately a year ago began to collect in it samples of algae from the surface of sand and slime covering the bottom, as well as from mosses overgrowing its borders and immersed in the water. Algae in the spring, always greatly shaded, grow only on the bottom in the form of dark brown spots and on mosses immersed in the water. In the summer one sometimes encounters frail and very delicate bundles of *Mougeotia* sp., which never develops more intensely and is found merely at a vegetative stage. The only forms observed throughout the year are brown filaments and spots of diatoms visible on slime and mosses.

The water in the spring is always cool, of very even temperature ranging in the course of the year from 6 to 9.5°; pH is neutral or weakly alkaline. The data obtained during the successive collections of samples are assembled in Table I.

Table I

Some properties of the water of the spring

No	Date	Temp. of water	Temp. of air	pH	Alkalinity
1	30.XII.63.	7°	1°	7.3	2.4
2	31.III.64.	6°	8°	7.0	2.0
3	26.V. 64.	8°	16°	7.2	2.0
4	22.VII.64.	8°	25°	7.2	2.2
5	20.IX. 64.	9.5°	21°	7.0	2.2
6	28.XII.64.	6°	- 5°	7.0	2.0

Algae on Mosses

The only form immersed in the water of the spring is *Mnium cinclidioides* (Blytt.) Hüb. and partly also *Drepanocladus* sp. On the leaves and stems of mosses and on the abundantly growing rhizoids the following algae were found: *Diatoma vulgare* Bory and *D. hiemale* var. *mesodon* (Ehrb.) Cleve. Both these species form ribbon-shaped or zigzag filaments covering the mosses in the form of a delicate, hairlike coating.

Blue-green algae: *Clastidium setigerum* Kirchner, *Chamaesiphon curvatus* (Borzi) Nordstedt, and *Ch. incrustans* Grun. occur in clusters or groups on leaves and rhizoids of mosses.

The colour of these algae varies from greyish-bluish-green to reddish-violet, this being related to the stronger or weaker degree of shade. In the shade they assume a red or violet colouring.

A few very small diatoms grow on leaves of mosses, as well as *Cocconeis placentula* var. *euglypta*, which occurs throughout the year, sometimes in large numbers. In summer the epiphytic green alga *Epibolium fonticulum* sp. nova occurs almost continuously; its description is given below.

Both *Cocconeis* and *Epibolium* settle on moss leaves in a very characteristic way. They develop along the vertical walls separating the cells leaving the surface of the latter free. On old leaves, however, they come close together also passing partly on the upper surface of the cell.

Mischococcus confervicola Nägeli occurs in summer, being encountered chiefly on the borders of moss leaves.

In empty cells of old moss leaves *Nostoc punctiforme* Kützing occurs in the form of either distinct strings or filaments tightly rolled up

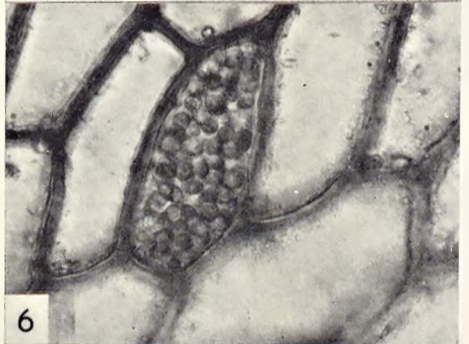
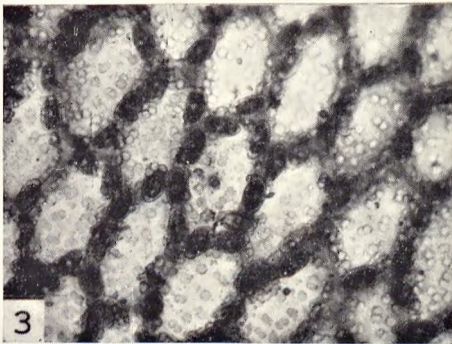
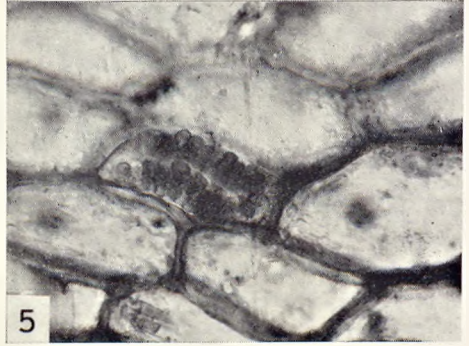
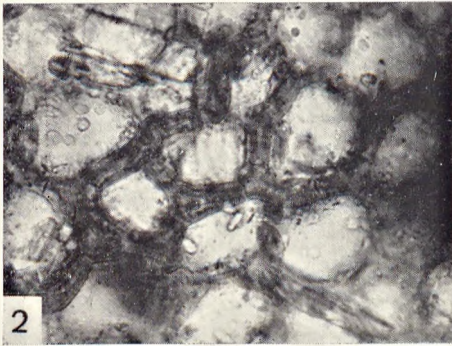
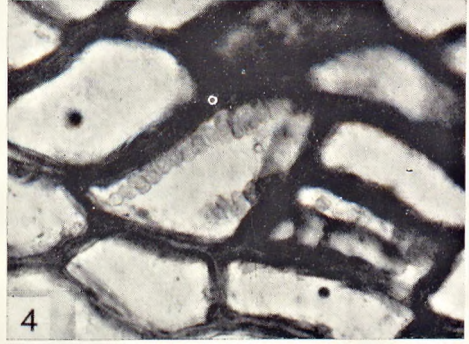


Fig. 1 The investigated spring

Fig. 2 *Epibolium fonticulum* n. sp. on the surface of a leaf of *Mnium cinclidioides*

Fig. 3 *Cocconeis placentula* settling along the moss leaf cell walls transversal to the leaf surface

Fig. 4—6 *Nostoc punctiforme* developing inside empty cells of a *Mnium* leaf

so that the single cells assume angular shapes. The occurrence of *Nostoc punctiforme* was known in lichens but never observed in mosses.

In summer there appeared very delicate, loosely rolled up mats of *Mougeotia* sp., which disappeared towards the autumn.

***Epibolium fonticulum* sp. nova (Fig. 1)**

Thalli epiphytici, primo e singulis filis, praeter parietes erectos repentibus in foliis muscorum subaquaneorum, compositi, deinde paulo plus in latitudinem et altitudinem accrescentes passimque duo aut tria cellu-

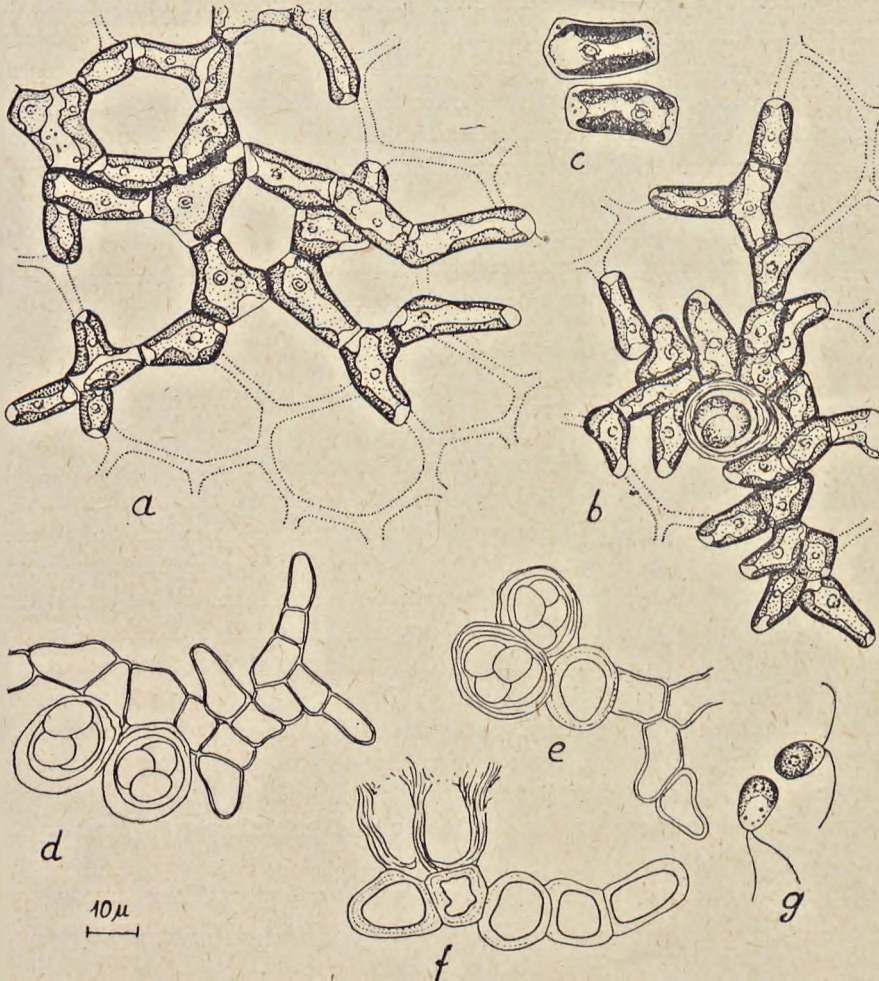


Fig. 7. *Epibolium fonticulum* n. sp.: a — thallus creeping on the surface of a moss leaf; b — thallus forming a zoosporangium; c — separate cells; d—e — zoosporangia; f — emptied zoosporangia; g — zoospores

larum strata efficientes. Cellulae in filorum apicibus et in thallorum marginibus cylindricae, elongatae, in mediis partibus thallorum aetate maiorum breviores, irregulares, nonnullis locis elongatae atque assurgentes. Cellulae in filis repentibus 5—7 (—8) μ latae, ad 20 μ longae; in superficie autem thallorum bistratum 5—7 μ diametri efficientes. Chromatophori adlaterales, canaliformes, in marginibus convoluti, lobati, singulis aut, quod rarius binis, pyrenoidibus praediti. Ante divisionem cellulae conspiciuntur nonnunquam duo chromatophori. Membrana cellularis in filis repentibus tenuis; post crassior et partim gelatinata fit. Propagatio per zoosporas fit, quae in zoosporangis oriuntur, in filorum breviorum e thallis repentibus succrescentium apicibus. Zoosporangia formam habent irregularem, globosam, 10,8—18 μ diametri; maturiora zoosporangia membrana crassiore, lamellosa, partim gelatinosa circumdantur. Zoosporae formam habent oviformem aut ovalem; 5—6 μ latae, 7—7,5 μ longae sunt; singulos possident chromatophores et bina cilia paulo longiora quam corpus. In zoosporangiis 4—8 zoosporae oriuntur. In thallis aetate provectoribus apparent etiam akinetes, formis rotundatis, saepe irregularibus, membrana crassa multistrata.

Habitat in fonte limnocrenaeo, in aqua temperaturae inter 6—9,5° per annum fluctuantis, in foliis muscorum, qui sunt: *Drepanocladus* sp. et *Mnium cinclidioides*. Pagus: Glisne, ad opp. Mszana Dolna, in terra Cracoviensi Polonorum.

Epiphytic thalli, composed at first of single filaments trailing along vertical walls on leaves of mosses immersed in water, such as *Drepanocladus* sp. and *Mnium cinclidioides*, then growing slightly broadwise and upwards, forming 2—3 layers of cells. The cells at the extremities of filaments and on the periphery of thalli are cylindrical, elongated, shortened in the middle part of older thalli, of irregular outlines, sometimes also vertically elongated upwards. The cells in trailing filaments are 5—7 (—8) μ wide and up to 20 μ long; on the surface of a two-layered thallus they have 5—7 μ in section. The parietal, groove-like chloroplast surrounding about 3/4 of the cell is curled at the borders; it is lobular, uneven, with one or sometimes two pyrenoids. Before the division of the cell two chloroplasts are often visible. The cell wall is thin but thickens with time and becomes gelatinous. In the two-layered thalli the cell walls have an indistinct stratification visible only after staining with methylene blue.

The cells of older thalli change readily into akinetes. They then become rounded but often have irregular shapes and are surrounded with a thick, gelatinous and layered membrane.

Zoosporangia form at the apices of short filaments, growing upwards from the trailing thallus. They have an irregularly spherical shape, 10.8—18 μ in diameter and when mature are surrounded by a thick,

layered gelatinous membrane. They usually produce 4 zoospores, more rarely 8. These are of ellipsoid or ovoid shape, 5×7 or $6 \times 7.5 \mu$ in size and have one chloroplast without pigment spot and two flagella somewhat longer than the body. Zoospores were observed only once in summer in material freshly brought from the spring, but they quickly perished. Thus, the observation concerning the presence or lack of pigment spot may be inaccurate. The zoospores are set free after the sporangium wall has become gelatinous and is torn open. Empty sporangia with torn and frayed walls are fairly often encountered among older thalli.

The alga occurs during the summer months on leaves of mosses immersed in water. In winter it was not encountered.

The genus *Epibolium* has two species: *E. dermaticola* Printz (1916) of cells $5-5.5 \mu$ wide and zoosporangia $10-11 \mu$ in diameter, producing 4 zoospores ca. 3μ in size, and *E. polysporum* Düringer (1958) of cells $7.5-10 \mu$ wide and zoosporangia of $30-40 \times 30-35 \mu$, producing ca. 32 zoospores. The latter species was described from various aquatic plants growing in aquaria in the botanical garden in Vienna.

As regards its dimensions, species *E. fonticulum* occupies an intermediate position between the species mentioned above. In shape it rather resembles *E. polysporum* (which, besides, was more accurately described than *E. dermaticola*), but differs from the latter in dimensions, in the size and development of zoosporangia, and in the place of occurrence.

Diatoms on the Bottom of the Spring

On a somewhat slimy sand, mixed with a considerable amount of plant detritus with numerous spruce needles, there appear brown spots of various size formed by developing diatoms. These spots are present throughout the year, occurring with more or less equal intensity in summer and winter.

The specific composition of diatoms growing in the spring is shown in Table II in which the figures denote the frequency of occurrence determined according to the accepted scale.

The dominant species (frequency of occurrence 5—3) were represented by *Synedra parasitica*, *Navicula radiosa*, *Gyrosigma attenuatum*, *G. acuminatum*, *Cymbella cymbiformis*, and *Navicula cryptocephala* var. *veneta*.

The subdominant species were much more numerous. The author classed among them species whose frequency of occurrence ranged from 2—1. They were represented by *Achnanthes affinis*, *Stauroneis Smithii*, *Amphora ovalis* var. *pediculus*, *Cymbella ventricosa*, *C. Reinhardtii*, *Nitzschia fonticola*, *Cymatopleura elliptica*, *Diatoma hiemale* var. *mesodon*, *Gomphonema angustatum*, *G. intricatum*, and *Nitzschia Clausii*.

Table II

Diatoms in the spring "na Glisnem"

Number of sample	1	2	3	4	5	6
<i>Meridion circulare</i> Ag.	+	+	+	1	+	
<i>Diatoma hiemale</i> (Lyngb.) Heib. var. <i>mesodon</i> (Ehrh.) Grun.	+	1	2	2	+	+
<i>Synedra parasitica</i> (W. Smith) Hust.	3	3	2	1	2	3
- <i>ulna</i> (Nitzsch) Ehrh.			+	+	+	+
<i>Cocconeis placentula</i> Ehrh. var. <i>euglypta</i> (Ehrb.) Cleve	+	+	+	+	+	+
<i>Achnanthes affinis</i> Grun.	2	1	1	2	+	2
- <i>lanceolata</i> (Bréb.) Grun.	1	+	+	1	+	+
- <i>nodosa</i> Cleve				+		+
- <i>microcephala</i> (Kütz.) Grun.	+		1	+		+
<i>Diploneis puella</i> (Schum.) Cleve			+			
- <i>Smithii</i> (Erb.) Cl. var. <i>pumila</i> (Grun.) Hust.		+	+			
<i>Amphipleura pellucida</i> Kütz.				+	+	+
<i>Stauroneis Smithii</i> Grun.	1	1	2	3	1	1
<i>Navicula cryptocephala</i> Kütz.	2	1	1	2	2	2
- - var. <i>veneta</i> (Kütz.) Grun.	3	2	3	3	3	2
- - var. <i>intermedia</i> Grun.		+	+	1	+	+
- <i>radiosa</i> Kütz.	4	3	4	4	4	4
- <i>menisculus</i> Schum.			+			+
- <i>minima</i> Grun. var. <i>atomoides</i> (Grun.) Cleve	+		+			+
<i>Pinnularia microstauron</i> (Ehrb.) Cleve	+		+	+		+
- <i>subcapitata</i> Greg.			+			+
- <i>viridis</i> (Nitzsch) Ehrenb.		+	+			+
<i>Gyrosigma attenuatum</i> (Kütz.) Rabenh.	5	5	5	5	4	5
- <i>acuminatum</i> (Kütz.) Rabenh.	4	3	4	5	4	3
<i>Amphora ovalis</i> Kütz.			+			
- - var. <i>pediculus</i> Kütz.	2	1	2	+	1	1
<i>Cymbella aspera</i> (Ehrb.) Cleve	+	+	+	+		+
- <i>cymbiformis</i> (Ag ? Kütz.) V.H.	2	3	2	4	3	1
- <i>lata</i> Grun.				+	+	
- <i>ventricosa</i> Kütz.	1	3	3	2	1	3
- <i>Cesatii</i> (Rabenh.) Grun.			+			
- <i>Reinhardtii</i> Grun.	2	2	1	1	1	3
- <i>microcephala</i> Grun.		+	+			+
- <i>perpusilla</i> Cleve	+	+	+		+	+
- <i>rupicola</i> Grun.			+			+
<i>Comphonema angustatum</i> (Kütz.) Rabenh.	+	1	1	1	1	1
- <i>intricatum</i> Kütz.	+	+	+	1	+	1
- <i>acuminatum</i> Ehrb.	+	+			+	
<i>Denticula tenuis</i> Kütz.			+			
<i>Nitzschia microcephala</i> Grun.			+			+
- <i>fonticola</i> Grun.	2	1	2	+	2	2
- <i>Clausii</i> Hantzsch.		1	1	+	1	+
- <i>frustulum</i> (Kütz.) Grun.		+	+		+	+
<i>Cymatopleura elliptica</i> (Bréb.) Smith.	1	2	2	2	1	3

Note: Numbers of samples as in Table I

The General Characteristics of Algae in the Spring

The composition of algae in the spring "na Glisnem" is characterized by considerable uniformity of vegetation throughout the year. The differences in the specific composition of dominant and subdominant species observed in the particular months are quite insignificant. Among diatoms living on slime at the bottom of the spring the community dominant throughout the year is *Gyrosigma attenuatum* + *G. acuminatum* + *Navicula radiosa*. Among epiphytic algae *Cocconeis placentula* var. *euglypta*, *Chamaesiphon curvatus*, *Ch. incrustans*, and *Clastidium setigerum* occur all the year round. Only the epiphytic green alga *Epibolium fonticulum* and mats of *Mougeotia* sp. were not encountered in winter.

This characteristic composition of species should be attributed to the considerable stability of light, thermal, and chemical conditions in the

water of the spring (see Table I). The temperature of water changes very little throughout the year, not exceeding 10° in summer and not falling below 6° in winter. The pH and alkalinity of water undergo almost no changes throughout the year. The spring is constantly shaded not only by the forest but also by the steep bank on the southern side.

STRESZCZENIE

Zbadano glony występujące w małym źródle nad potokiem Glisne koło Mszany Dolnej. W składzie glonów tego źródła uderza duża jednolitość wegetacji przez cały rok. Różnice w składzie gatunkowym dominantów i subdominantów są nieistotne. Wśród okrzemek żyjących na mule panuje przez cały rok zespół *Gyrosigma attenuatum* + *G. acuminatum* + *Navicula radiosa*. Wśród glonów epifitycznych występuje przez cały rok: *Cocconeis plancentula* var. *euglypta*, *Chamaesiphon curvatus*, *Ch. incrustans*, *Clastidium setigerum*. Od wiosny do jesieni rozwija się jako epifit na listkach mchów *Epibolium fonticulum*, który opisano jako nowy gatunek.

Charakterystyczny i tak stały układ glonów źródła należy przypisać dużej stałości warunków świetlnych, termicznych i chemicznych w wodzie.

Opis nowego gatunku: *Epibolium fonticulum* sp. nova

Plechy epifityczne, złożone z początku z pojedynczych nici płożących się wzdłuż pionowych ścianek komórek listków mchów zanurzonych w wodzie, potem rozrastające się nieco wszędy i w górę, tworzące miejscami 2—3 warstwy komórek. Komórki na końcach nici i na obwodzie plech są cylindryczne, wydłużone, w środkowej części starszych plech są skrócone, w zarysie nieregularne, niekiedy również wydłużone pionowo ku górze. Komórki w niciach płożących się są 5—7 (—8) μ szerokie i do 20 μ długie, na powierzchni natomiast dwuwarstwowej plechy mają 5—7 μ średnicy. Chromatofor jest przyścienny, rynienkowaty, na brzegach zawinięty, płaciasty, z jednym lub z dwoma pirenoidami. Przed podziałem komórki widoczne są niekiedy dwa chromatofory. Błona komórkowa w niciach płożących się jest cienka, z czasem jednak grubieje i częściowo galaretowacieje. Rozmnażanie odbywa się za pomocą zoospor, które tworzą się w zoosporangiach na szczytach krótkich nici wyrastających ku górze z płożącej się plechy. Zoosporangia mają kształt nieregularnie kulisty, średnicę 10,8—18 μ , są też w stanie dojrzałym otoczone grubą, warstwowaną i częściowo zgalaretowaciałą błoną. Zoospory mają kształt jajowaty lub owalny, są 5—6 μ szerokie, 7—7,5 μ długie, posiadają jeden chromatofor bez plamki ocznej oraz dwie wici nieco dłuższe od komórki. W zoosporangiach powstaje 4—8 zoospor. W starszych plechach tworzą się również akinety posiadające zaokrąglone kształty, często nieregularne i grubą, warstwowaną błonę.

Występuje w źródle typu limnokrenowego w wodzie o temperaturze wahającej się w ciągu roku od 6 do 9,5°C, na listkach mchów *Drepanocladus* sp. i *Mnium cinclidioides*. Wieś Glisne koło Mszany Dolnej, województwo krakowskie.

REFERENCES

- Düringer I., 1958. Über die Verteilung epiphytischer Algen auf den Blättern wasserbewohnender Angiospermen sowie systematisch-entwicklungsgeschichtliche Bemerkungen über einige grüne Algen. Österr. Bot. Zeitschr., 105, 1—43.
- Printz H., 1916. Die Chlorophyceen des südlichen Sibiriens und des Urjankailandes. Det. Kgl. Norske Vidensk. Selsk. Skr., 4.
- Printz H., 1964. Die Chaetophorales der Binnengewässer. Haag, Verl. W. Junk.

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