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Glony ze strumieni górskich na wyspie Mahé, archipelag Seychelle

Algae from montane streams on the Island of Mahé, in the Seychelles

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Abstract — In the samples of the algae collected on the Island of Mahé 6 species of blue-green algae, 21 species of diatoms, 1 species of green algae, and 1 species of red algae were determined. A probably new species of blue-green alga *Calothrix muscicola* n. sp. ad interim and a new species of red alga *Batrachospermum capensis* sp. n. are described.

In summer 1972 Dr. Julian Rzóška collected a few samples of algae from montane streams of the Island of Mahé which belongs to the Seychelles group in the Indian Ocean, north of Madagascar. He sent me these samples for elaboration, for which I am deeply grateful. The samples were denoted with numbers 2, 3, 3a, 4, 7, 8, and 9. Two samples: 8 and 9 were broken in transport and their content could not be examined, thus only the content of the samples 2, 3, 3a, 4, and 7 from Mahé were left for me to study.

Mahé is the largest of the 80 islands of the Seychelles. It is a granite island with eminences up to 400 m above sea level, a number of streams flowing down them. According to the data obtained from Dr. Rzóška, the islands of the archipelago have been inhabited since the middle of the 18th century, the population now being about 60000. The natural vegetation is already seriously damaged.

The samples were collected at the following sites:

No 2. Du Cap stream. The sample contained 2 not very large thalli of *Batrachospermum*, on which blue-green algae *Homoeothrix juliano* and *Lyngbya kützingii* (Kütz.) Schmidle epiphytically occurred. Among *Batrachospermum* thalli and in the sediment on the bottom of sample fairly numerous species of diatoms occurred.

No 3, 3a. originated from the Le Nial stream and contained mosses: *Crateneurum filicinum* (Hedw.) Roth and *Colliergon cuspidatum* (Hedw.) Kindb., a considerable number of diatom species, and a small fragment of *Batrachospermum*. On the leaves of the mosses were attached the blue-green algae *Calothrix muscicola* sp. n., *Scytonema bohneri* Schmidle, *Lyngbya aerugineo-coerulea* (Kütz.) Schmidle, and *Lyngbya amplivaginata* Van Goor.

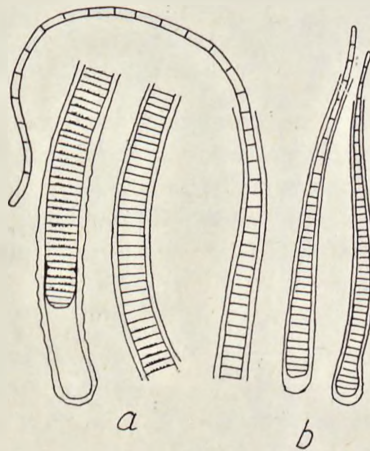
No 4 came from the Val-Riche stream and contained mosses on which *Scytonema bohneri* and the diatoms *Cymbella ventricosa* Kütz., *Eunotia arcus* Ehr. var. *fallax* Hust., *Rhoicosphaenia curvata* (Kütz.) Grun. could occasionally be encountered. Single specimens of *Penium polymorphum* Perty were also found here.

No 7 came from a puddle in the vicinity of Ause-Baileau and contained only barren filaments of *Oedogonium* which were not suitable for identification.

Description of the algae found

Cyanophyceae

Homoeothrix juliana (Born. et Flah.) Kirchner (fig. 1)



Ryc. 1. *Homoeothrix juliana*. a — nici dorosie; b — mlode nici
Fig. 1. *Homoeothrix juliana*. a — mature filaments; b — young filaments

Filaments erect and curved, slightly swollen at the base (the swelling is more distinct with young filaments and only slight with older ones), 5.0—10.0—(11.5) μm wide. Sheathes colourless, slightly swollen and wrinkled at the base, above smooth and adherent, not jagged at the apex and not reaching the apex of the seta. The trichomes were greyish blue-green, with young specimens slightly extended

at the base, this extension not being distinctly visible in older specimens. The breadth of trichomes measured just above the base was (3.6)—5.4—7.2 μm . The cells of the lower part of the trichomes were 1.5—1.8—(2.0) μm long, growing longer and longer towards the apex; in the setae they were 4—5 times as long as their breadth. At transversal walls the cells were undentate; small indentations occurred every few cells only in the lower part of the trichomes. The transversal walls of cells were granulated but frequently the granulation was weak and indistinct.

The species occurred epiphytically, singly or in small groups in the jelly of *Batrachospermum capense* n. sp. in the Du Cap stream on the Island of Mahé.

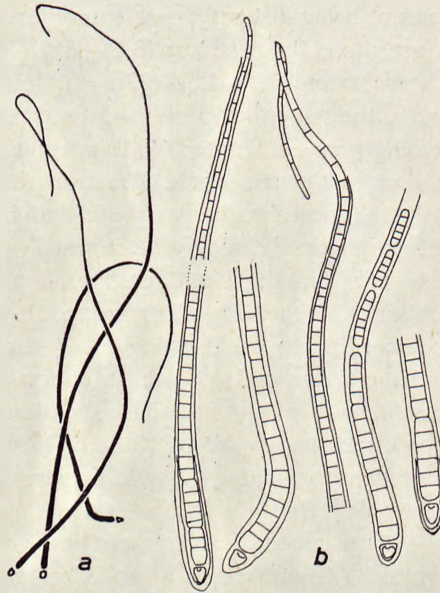
This species surely belongs to the *H. juliana* group, though as compared with typical specimens (e. g. according to the drawings of Frémy (1927) or Komárek (1973) it has a characteristic shape owing to the trichomes uniformly tapering to the apex and ending in setiferous cells. At the base the filaments are not bulbously extended and the trichomes are composed of short cells which are granulated at the transversal walls (degenerating filaments have no granulation).

On *Batrachospermum* thalli relatively short filaments were found: 30—40 μm long, or young ones 10—23 μm long. The shape of these young specimens is most similar to the drawing given by Lemmermann for *H. endophytica*. Older filaments rather correspond to Frémy's or Komárek's drawing for *H. juliana*.

A good description and illustration for the species *H. juliana* was given in the work of Komárek and Kann (1973), though the specimens found on *Batrachospermum* thalli from Island of Mahé are a little similar to *H. endophytica*, which also occurs on *Batrachospermum* thalli but their dimensions do not correspond with this not very certain species which, according to Lemmenmann's description, should be attached to *Batrachospermum* thalli. However, it seems that it was described and drawn on the basis of young, not fully developed specimens, surely belonging to *H. juliana*. Moreover, the specific environment formed by the jelly covering *Batrachospermum* thalli in a certain degree influences the morphology of the filaments of blue-green algae. Hence, the specimens found in *Batrachospermum* thalli may be slightly different from specimens which grow in small groups on stones or on any other substratum. I think that the specimens described from the Mahé should be regarded as an endophytic form of *H. juliana* living inside the jelly of *Batrachospermum* and attached to its branches. It is clear that the remarks concerning *H. endophytica* do not yet justify the crossing off of this species; they only stress that it would be interesting to pay more attention to it.

Calothrix muscicola nova sp. ad interim (fig. 2)

Filaments single or in groups, 130—230—(300) μm long, 8.0—11.0 μm wide at the base, and 5.5—6.3 μm wide in the middle. Sheath colourless, only in the lower part weakly stratified, higher up adherent, disappearing at the apex. Trichomes not swollen or only slightly swollen at the base, 6.0—6.7—(7.2) μm wide, undentate, only in the lower part small dentations sometimes being visible. Trichomes are branched, composed of more or less square cells, gradually ending in setiferous cells, sometimes fairly long. Basic heterocysts single, conical or almost semi-globular,



Ryc. 2. *Calothrix muscicola*. a — grupka nici rosnących na powierzchni listków mchu; b — fragmenty nici dorosłych

Fig. 2. *Calothrix muscicola*. a — group of filaments growing on the surface of moss leaves; b — fragments of mature filaments

not broader than the base of the trichomes, 4.5—6.0 μm wide, 6.0—6.5 μm long. Spores were not found. Hormogonia usually of 5—6 cells, in the sheath a few of them being formed together.

It occurs epiphytically on the leaves of mosses in the Le Nial stream on the Island of Mahé in the Seychelles.

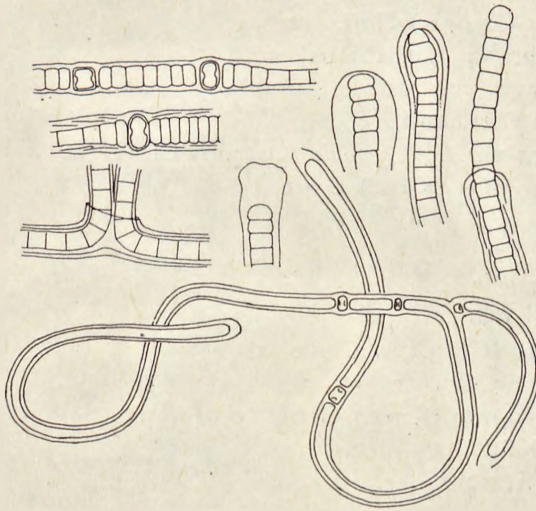
This species is most similar to *Calothrix epiphytica* W. et G. S. West (Geitler 1932, Starmach 1966), which occurs on algae in stagnant waters, of Iceland, Africa, Patagonia, and Antarctica, singly or in groups; has filaments to 350 μm long, 5—7.5 μm broad at the base, the trichomes 3.5—4 μm broad, distinctly swollen at the base.

Thus, *Calothrix muscicola* differs distinctly in size and in the absence of swelling at the base.

Another similar species is *Calothrix stellaris* Born. et Flah. (Geitler 1932, Starmach 1966) which has filaments growing epiphytically on algae and aquatic plants, arranged in groups in the form of a star, 13—21 μm wide at the base. Trichomes bulbously swelled at the base, 6—7 μm wide (just above the swelled base), cells shorter than their width, of course with the exception of setiferous cells. Hence, also in this case the dimensions and the trichome swelling at the base are not consistent. However, definite identification of the species has to be based on the comparison of a greater number of specimens. I found only 8 in the material.

Scytonema bohneri Schmidle (Geitler 1932 p. 753, Desikachary 1959 p. 457, (fig. 3).

This occurs in small clusters on the leaves of mosses in the Le Nial stream in the Island of Mahé. Filaments are curved, 10.8—12.6 μm wide, sometimes at the apex amounting to 19.8 μm in width, scarcely branched, branches single or double. Trichomes 5.4—6.3—8.3—9.9 μm wide, blue green, usually widest at the apex, composed of sometimes cylindrical cells, longer than their width in some places bulgy, more or less square, or, in vigorously growing places, short and peltate. Heterocysts intercalary, elliptic or cylindrical, 8—10 μm wide, 4.5 μm long., spathes colourless, indistinctly stratified.



Ryc. 3. *Scytonema bohneri*, pokrój nici pod małym powiększeniem oraz silniej powiększone fragmenty nici i ich zakończeń

Fig. 3. *Scytonema bohneri*, shape of filaments (slightly enlarged) and more strongly enlarged fragments of filaments and their tips

The species is rarely reported. Schmidle described it from a stream in Cameroun, where it grows on the surface of stones. The features quoted above are in the main consistent with Schmidle's description.

Lyngbya kutzingii (Kütz.) Schmidle

A species with characters consistent with the identification occurred in clusters on *Batrachospermum* thalli.

Lyngbya aerugineo-coerulea (Kütz.) Gom.

The form of filaments typical. It occurs among mosses (sample 3,3a) in small clusters or singly.

Lyngbya amplivaginata Van Goor.

A few groups of filaments, developed and sized true to the identification, occurred among mosses in samples 3 and 3a.

Bacillariophyceae

The following species of diatoms were identified in samples 2, 3, 3a, and 4 (the frequency being evaluated in the scale: ccc = very frequent, cc = frequent, c = fairly frequent, rrr = rarely, rr = very rarely. r = single specimens).

- Achnanthes minutissima* Kütz. cc
A. kryophila Petersen c
Cymbella gracilis (Rabenh.) Cleve c
C. ventricosa Kütz. c
Ceratoneis arcus Kütz. rr
Diatoma hiemale (Lyngb.) Heil, rr
Eunotia arcus Ehr. var. *fallax* Hust. cc
E. fallax A. Cleve cc
E. exigua (Bréb.) Rabenh. c
Frustulia saxonica var. *leptocephala* (Östrup) Cleve cc
Gomphonema parvulum (Kütz.) Grun. c
G. gracile Ehr. cc
G. clevei Fricke r
Navicula gracilis Ehr c
N. cryptocephala Kütz. c
Neidium longiceps (Greg.) A. Cleve r
Nitzschia obtusa W. Sm. r
Rhoicosphaenia curvata (Kütz.) Grun. c
Surirella ovata Kütz. rr
Synedra ulna (Nitzsch) Ehr. rr

Chlorophyceae

- Oedogonium* sp.
Penium polymorphum Perty

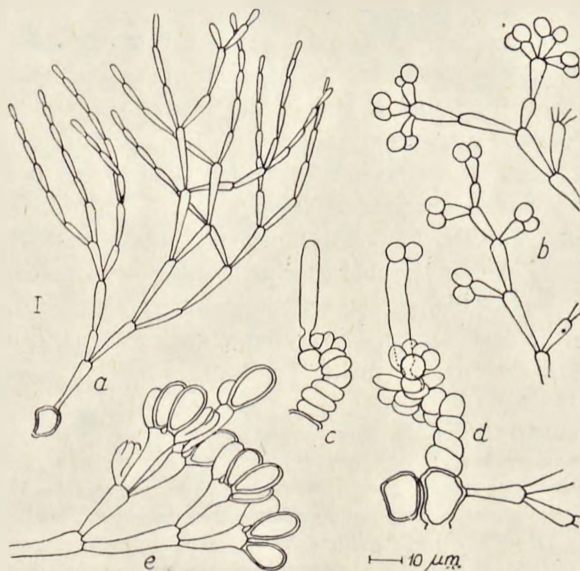
Rhodophyceae

Batrachospermum capensis spec. nova

Thalli 3—5 cm high, medium tremellose, yellow green (colour determined from the material fixed with formalin). Several main filaments of the thallus grow from a fairly wide base composed of tangled and densely matted filaments of rhizoidal type but forming no erect filaments of the *Chantransia* type; they are alternately branched and obtuse at the apices (fig. 5, phot. 1). In the more or less central part of the thallus the central axis is 66.0—72.6 μm wide, at the apex 23 μm wide, in the apical part axial filament without cortical filaments; lower towards the base the number of cortical filaments increases, so that finally a solid cortex occurs, being

yellowish brown in the basal part of the thallus. Internodes grow shorter and shorter towards the apex of the thallus, being 375—450 μm long about its middle part. In the lower part internode cells are slightly broader than in the upper one (fig. 5, photos 2, 3).

Branch whorls are narrow, peltate, distinct at the apices and their ramifications, underneath they apparently merge owing to numerous intermediate branches (fig. 5, photos 2, 3), 400—580 μm wide. Separate whorls are formed by 3—5 branches with numerous ramifications growing out of widened node cells (fig. 5, phot. 3, fig. 4a). Each whorl branch is composed of 7—13 tiers of cells of cylindric-clavate shape (fig. 4a). The ends of branches are straight, basal cells have thin membranes and are 16.2—21.6 μm long and 7.2—8.0 μm wide. Intermediate branches develop from the cells of filaments which surround the internodes to a certain distance from the apex. However, they soon become abundant and as long as the whorl branches but less ramified (fig. 5, phot. 3). No setae occur on branch apices. Whorls and whorl branches disappear near the base of the ramifications (fig. 5, phot. 1).



Rys. 4. *Batrachospermum capensis* n. sp. a — pęd okółkowy wyrastający z komórki węzłowej; b — antheridia; c — młody karpogon; d — dojrzały karpogon z plemnikami na szczycie trychoginu; e — gałązka gonimoblastu z karposporangiami

Fig. 4. *Batrachospermum capensis* n. sp. a — branch whorl filament growing from node cell; b — antheridia; c — young carpegonium; d — mature carpegonium with spermatia at the apex of trichogyne; e — branch of gonimoblast with carposporangia

Monosporangia are absent. This is a monoecious species. Antheridia develop abundantly in some parts of the thallus both on whorl branches and on the intermediate ones (fig. 5, phot. 4, fig. 4b). Antheridia occur at the apices of branches in

one, two, or even three tiers they are globular or slightly oval, 5.4—6.3—(7.0) μm wide.

Carpogones develop from basal cells of whorl branches. Carpogonial branches are composed of 3—8 flattened or barrel-like cells and are most often coiled up. They develop short lateral filaments (bractea), composed of cells of similar size which form a compact bulb at the base of the carpogone (fig. 6, phot. 5, 6 fig. 4c, d). The lower part of the carpogone is 6—7 μm wide, the whole being is 40—63 μm long. The trichogyne is cylindrical, set on a relatively short foot; in mature trichogynes the sides are slightly undulated (fig. 6, phot. 5, 6).

Gonimoblasts develop singly on the whorls; they are large, semiglobular, in the period of maturity being 600—850 μm in diameter (fig. 5, phot. 1, fig. 6, phot. 8). They are fairly loosely composed of ramified filaments, which form carposporangia at the apex. Owing to the relatively loose agglomeration of carposporangial filaments, a compact ball of cells, formed at the base of the carpogone, is visible at the base of gonimoblasts. Carposporangia are pyriform or inversely ovoid, 7.2—9.0 μm wide, 11.7—14.4 μm long. Usually 2—3 of them are formed in tiers at the apices of branches (fig. 4e, fig. 6, phot. 9, 10).

This occurs in the Du Cap stream on the Island of Mahé which belongs to the Seychelles archipelago in the Indian Ocean. A small fragment of the thallus of the same species was also found in the Le Nial stream on the same island.

The description of the species was made on the basis of two small thalli collected by Dr. Julian Rzóška. These specimens are deposited in the Botanical Institute of the Polish Academy of Sciences in Cracow.

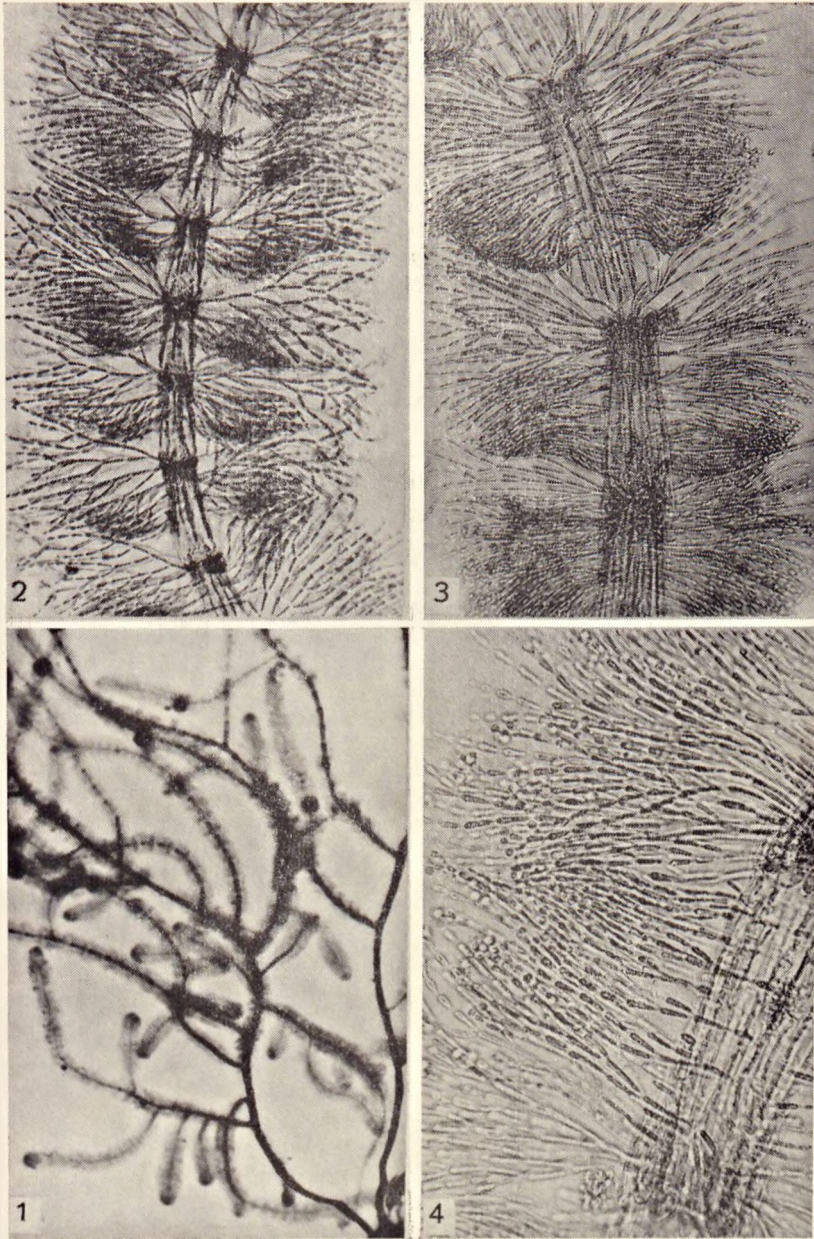
The species belongs to the *Viridia* section and comes near to *Batrachospermum virgatum* Sirodot. It differs in the characteristic shape of the thallus (fig. 5, phot. 1), with the formation of whorls, with the trichogynes set on a relatively short foot and, above all, in the development of very large gonimoblasts, usually wider than the whorls in which they are formed.

Diagnosis: Thallus 3-5(?) cm altus, mediocriter mucosus, flavo-viridis, irregulariter alterne ramosus, ramis fere sub angulo recto egredientibus. Verticillis depressioribus, fere continuis, 400—580 μm latis. Filamentis valde ramosis, verticillorum numero 3—5, elongatis, 7—13 articulis, e cellulis elongato-cylindraceis, vel elongato-claviformibus compositae. Longitudo cellularum basilarium 16, 2—21,6 μm . latitudo 7,2—8,0 μm . Filamentis interverticillaribus multis, aequae longis fere ac fila verticillorum. Pilis nullis. Monosporis nullis. Ramuli carpogoniferi oriuntur e cellulis basilariibus ramulorum verticillorum, 3—7 cellulis depressioribus aut doliiformibus compositi. Carpogoniorum basis 6—7 μm lata, trychoginis cylindraceis ad 70 μm longis, pediculo brevi. Gonimoblastae magnae, globosae aut subglobosae, singulae, ad 850 μm latae. Carposporae piriformes aut oavales, 7,2—9,0 μm latae, 11,7—14,4 μm longae.

Habitat in rivulis Du Cap et Le Nial in insula Mahé, una ex insulis Seychelle Oceani Indici.

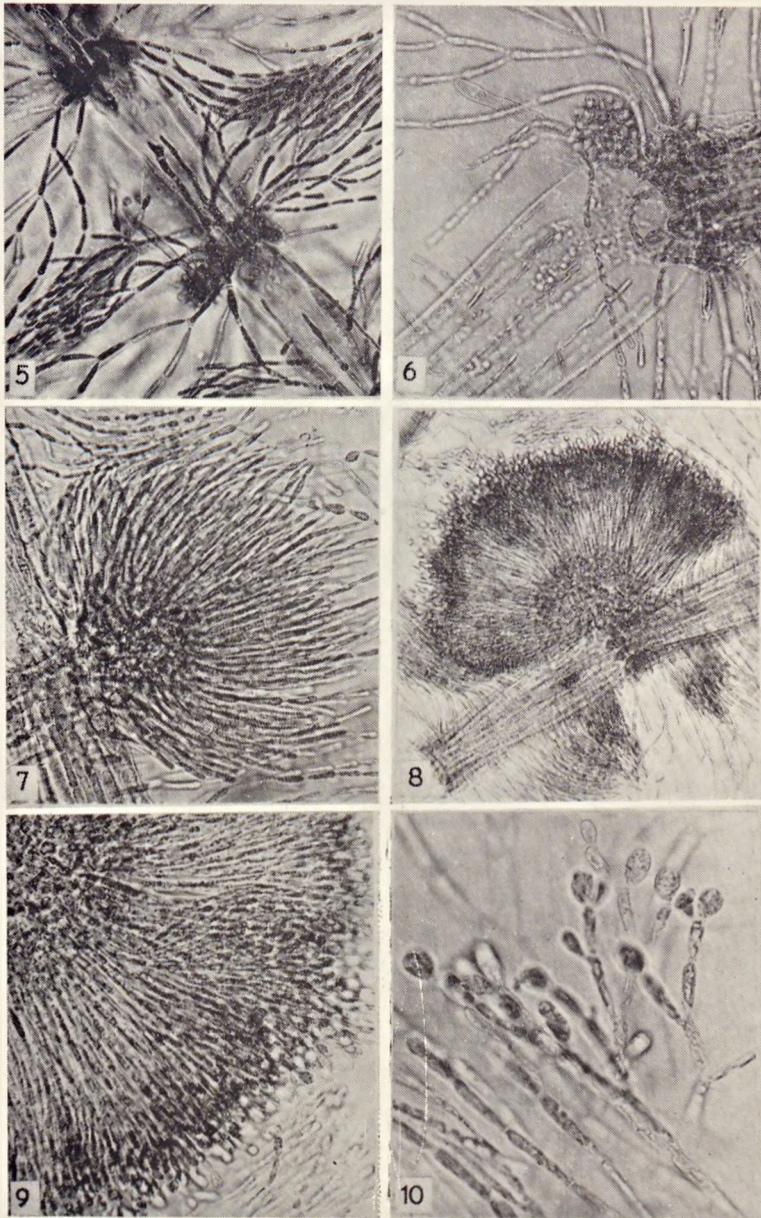
STRESZCZENIE

W 5 próbkach glonów zebranych przez dra Juliana Rzóškę w potokach na wyspie Mahé (archipelag Seychelle) oznaczono 6 gatunków sinic, 21 gatunków okrzemek, 1 gatunek zielenic i 1 gatunek krasnorostów. Opisano jako przypuszczalnie nowy gatunek *Calothrix muscicola*



Rys. 5. *Batrachospermum capensis* n. sp. 1 — plecha pod małym powiększeniem; 2 — szczytowa część gałązki plechy, widoczne są okółki pędów rozgałęzionych i początki okorowania nici centralnej; 3 — starsza część gałązki plechy z pełnym okorowaniem nici centralnej i silnie rozwiniętymi pędami międzyokółkowymi; 4 — anteridia na szczytach gałązek

Fig. 5. *Batrachospermum capensis* n. sp. 1 — thallus slightly enlarged; 2 — apical part of thallus branch, branch whorls, and the beginning of cortical central threads are visible; 3 — older part of the thallus branch with full cortical central threads and strongly developed secondary branches; 4 — antheridia on branch apices



Ryc. 6. *Batrachospermum capensis* n. sp. 5—6 — młode karpogony z długimi trychoginami i brakteami tworzącymi bulwiaste skupienia; 7 — rozwijający się gonimoblast; 8 — dojrzały gonimoblast z karposporangiami na szczycie; 9 — fragment gonimoblastu z karposporangiami; 10 — karposporangia nieco silniej powiększone

Fig. 6. *Batrachospermum capensis* n. sp. 5—6 — young carpogonia with long trichogynes and bractea forming bulbous clusters; 7 — developing gonimoblast; 8 — mature gonimoblast with carposporangia at the apex; 9 — fragment of a gonimoblast with carposporangia; 10 — carposporangia more enlarged

n. sp. ad interim oraz podano szczegółowe opisy i rysunki rzadko spotykanych gatunków: *Homoeothrix nordstedtii* (Born. et Flah). Kirchn. i *Scytonema bohneri* Schmidle. Przedstawiono również opis, rysunki i fotografie nowego gatunku *Batrachospermum capensis* n. sp. Opis tego gatunku wykonano na podstawie dwóch dobrze rozwiniętych okazów zebranych w potoku Du Cap na wyspie Mahé. Drobny fragment plechy tego samego gatunku znalezione również wśród mchów w próbce z potoku Le Nial na wyspie Mahé.

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