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GYOERFYELLA KOL 1928, A GENUS OF THE HYPHOMYCETES

L. MARVANOVÁ, P. MARVAN, and J. RŮŽIČKA

Czechoslovak collection of microorganisms, J. E. Purkyně University, Brno
Laboratory of Experimental Algology, Microbiological Institute, Czechoslovak Academy of Sciences, Třeboň

(With Plate 5 and 34 Text-figure)

After a detailed analysis of the accessible data, the authors came to the conviction that *Gyoerffyella tatrica* Kol 1928, published as a green alga, is, in fact, the conidia of a fungus belonging to the Hyphomycetes. This led to certain taxonomical and nomenclatural decisions; the scope of the genus *Gyoerffyella* Kol is proposed as follows: *G. rotula* (Höhn.) Marvanová (syn., *Titaea rotula* Höhn. and *G. tatrica* Kol), *G. craginiformis* (R. H. Peters.) Marvanová (syn., *Ingoldia craginiformis* R. H. Peters.), *G. tricapillata* (Ingold) Marvanová (syn., *I. tricapillata* Ingold), *G. entomobryoides* (Boerema & Arx) Marvanová (syn., *I. entomobryoides* Boerema & Arx), and *Gyoerffyella* sp. from the High Tatra Mountains (ČSSR) which remains unnamed as only the conidia were found.

Introduction

In 1957, we found in the High Tatra Mountains (ČSSR) conspicuous structures consisting of spirally twisted arms (Figs. 22–27), the taxonomic position of which was not evident at first sight. In the course of further study, it was discovered that similar structures were already described in the literature, partly as conidia of fungi under the names *Titaea rotula* Höhn. and *Ingoldia craginiformis* R. H. Peters. and partly as a filamentous green alga, *Gyoerffyella tatrica* Kol. The similarity in shape of all these organisms is striking and it appeared very doubtful that it could only be an example of morphological convergence, especially as Nilsson (*1964*: 98) had pointed out, that the last two species were probably synonymous. Therefore, before making a definite decision regarding the correct systematic position of our collection, we considered it necessary to clarify the relationships between the three species.

Some data for this study were obtained during the stay of L. Marvanová at the Centraalbureau voor Schimmelcultures, Baarn, The Netherlands, who expresses her grateful thanks to Dr. J. A. von Arx, the Director of this institute. The authors are further indebted to the Farlow Herbarium, Cambridge, Mass., U.S.A., for the kind loan of the original specimen from the herbarium of F. X. R. von Höhnel.

Historical review

TITAEA ROTULA HÖHNEL 1904

In 1903, von Höhnel found rather peculiar conidia on the decayed lower leaves of *Myosotis alpestris* in the Ötztal Alps (Tyrol, Austria). According to his published description (von Höhnel, *1904*: 57) the conidia consisted of four curved, one- or two-celled members ("Glieder"), which were each rounded at one end (called the inner central), where they were 2–3 μ wide, whilst the other external end tapered to a thread-like projection ("Zilie, cauda filiformis"). The "Glieder" lay in the same plane and were attached to each other by their broader ends ("wie die Speichen eines Rades"), while their free, tapering ends were all curved in the same sense.

The author gave no figure of his species and, so far as we are aware, it has not been illustrated (cf. Ingold, *1942*: 371). This collection from the *locus classicus* is preserved under collection No. H 1113a of the von Höhnel herbarium, in the Farlow Herbarium. Whilst von Höhnel (*1904*) gave the collection date as "mense Augusto anni 1903", and the exsiccatum has "7. 1903" on the label, we consider that this exsiccatum must be regarded as the type of the species in spite of these two dates.

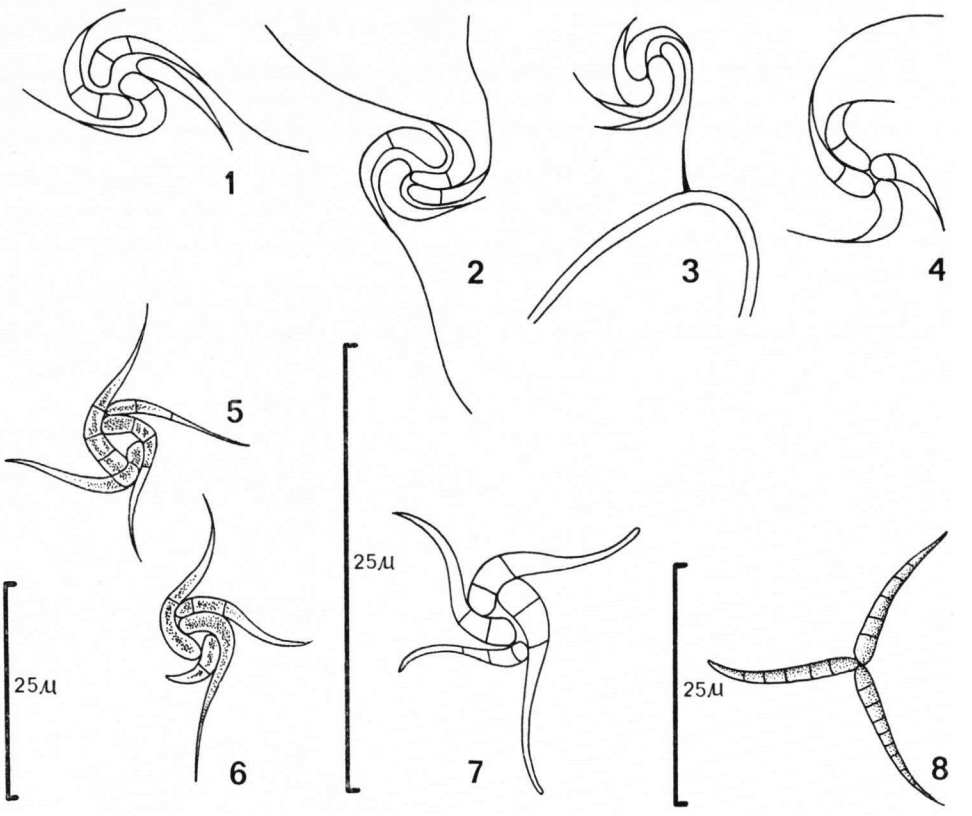
The collection comprises about forty single leaves of *Myosotis alpestris* and three whole leaf rosettes but, in spite of a very thorough microscopical examination, we could find no sign of the conidia described by von Höhnel. However, valuable information is given on the label, namely the description in short hand and four pencil drawings of conidia, probably in the author's hand. These appear to be the only illustrations of this species and a photograph of the label is, therefore, reproduced (Plate 5 fig. 1).

The data on the label differ slightly from the published description; and run: "3 μ breit, 30 μ lang. Fäden 20–25 μ lang; Sporen 2-zellig, hyal., 2–3 μ dick, 8—10 μ lang, halbkreisförmig gekrümmt, alle liegen in einer Ebene! Oft das 'Ganze' (?) nur 25 μ breit". Three of the figured conidia have the characteristic construction, and correspond to the later published illustrations of *Gyoerffyella tatrica* and *Ingoldia craginiformis* (see below), but the fourth is a little anomalous (Fig. 4).

Certain mycological compendia which mention *T. rotula* refer, however, only to the original record of von Höhnel (Lindau, *1904*; Migula, *1934*), and it does not appear to have been reported again under this name.

GYOERFFYELLA TATRICA KOL 1928

In 1927, E. Kol observed an organism on snow in the High Tatra Mountains (ČSSR), which she published as *Györffyella tatrica* Kol (*1928*: 618, pl. 17 figs. 23, 24, our Figs. 5, 6). She considered it to be a green alga in the order Chaetophorales. According to her description, this organism forms colonies, consisting of four radiating, slightly curved, sigmoid filaments. The filaments are rounded at their bases (according to the description, even "kopfförmig aufgeschwollen", but this does not correspond to the illustration), and tapering to a fine point on the opposite, free end ("borstenförmig zugespitzt"). The author mentioned that every cell contains



FIGS. 1–8. — 1–4. *Gyoerffyella rotula*, conidia, copied from unpublished drawings on the label of No. H 1113a in von Höhnel's herbarium. — 5, 6. Copied from Kol, *1928*: pl. 17 figs. 23, 24. — 7. Copied from Kol, *1957*: fig. 48. — 8. "*Györffyella tatrica* Kol" copied from Kol, *1966*: pl. 1 fig. 11.

"ein reingrünes, scheibenförmiges Chromatophor ohne Pyrenoid" and considered her species to be a cryosestonic organism. Further data, mostly concerning ecology, are available in the later accounts of Kol (*1949*: 246; *1957*: 206 fig. 48, our Fig. 7; in both cases under the name "*G. tatrae*").

Another, more recent record of *G. tatrica*, again from snow, was reported by Kol (*1966*: 164 pl. 1 fig. 11, our Fig. 8) from the Polish part of the High Tatras. In this case, it was evidently confused with another organism as neither the description nor the illustration correspond to her own data from 1928 (compare Figs. 5, 6, and 8!). Therefore our further considerations exclude this later collection which the author again placed in the green algae, this time in the Ulotrichales; we think it was probably the conidium of an undescribed fungus. Similar but quadriradiate spores were figured from snow by Tubaki (*1960*: fig. 3).

INGOLDIA CRAGINIFORMIS R. H. PETERS. 1962

In 1952, Ingold & Ellis (*1952*: 158 fig. 1d, our Fig. 9) published an illustration of a septate, branched conidium, reminiscent of the figures of *Titaea rotula* and *Gyoerffyella tatrica*, which they had found in scum in a tidal ditch near a wood close to Norwich (England). As neither mycelium nor conidiophores were observed, they refrained from describing it as new. Six years later, Nilsson (*1958*: 310 fig. 12a, our Fig. 11) published his record of the same conidia from a small pond in the botanical garden at Uppsala (Sweden) also without a name. Subsequently, Petersen (*1962*: 147 fig. 11A-E, our Figs. 15–17), who found the same fungus in a small river in South Carolina (U.S.A.) and isolated it in pure culture, described it as *Ingoldia craginiformis* R. H. Peters., which he made the type species of his new genus, *Ingoldia*. He identified the English records of Ingold as this species but made no reference to Nilsson (*1958*). He published the first description of this organism, and gave a detailed explanation of the structure of its conidia as well as data concerning their variability.

The conidia of this species have since been collected on several occasions (Nilsson, *1964*: 98 fig. 17e, our Fig. 10; Ingold, *1965*: 455; Ingold, *1966*: 50 fig. 6) and the fungus is now known from Sweden, England, Scotland, Ireland, France, and North America.

Comparison of the three species

INTERGENERIC DIFFERENCES

The fundamental problem concerns the relationship of *Titaea rotula*, *Gyoerffyella tatrica*, and *Ingoldia craginiformis*. From a rough comparison of their figures, it is evident that they are closely related (cf. Figs. 18–20):

(a) In all three spore types or 'colonies', the same general plan of construction exists. All consist of four 1–5-celled, heteropolar arms, curved in the same sense, with their broader ends approaching each other in the centre and the free, tapered sigmoid ends radiating outwards at angles of approximately 90°.

von Höhnel (*1904*: 58) considered this structure a conglomerate of secondarily grown together or adhering spores; Kol (*1928*: 618) a colony of equivalent filaments; and Petersen (*1962*: 147), in agreement with Ingold and Nilsson, a branched conidium consisting of a main axis and three laterals of the first and second orders. This last interpretation was proved by the study of living material in culture and is attested by descriptions, illustrations, and photographs. Its correctness is indisputable.

After a more detailed analysis of the drawings of Kol and von Höhnel, we found that their specimens are in general accordance with the branched conidium described by Petersen, Ingold, and Nilsson. Namely, it is possible to distinguish in their figures an arm corresponding to the main axis (see Figs. 18–20, arms labelled with the letter "a"), which is recognizable by the other two arms ("b" and "c"), which correspond to the branches of the first order, being attached side by side to its con-

cave part. The position of the fourth arm ("d") is also exactly in agreement with that of the branch of the second order.

The misunderstanding of the construction by the earlier authors (Kol, von Höhnel) is pardonable. The branches are connected by a narrow isthmus which gives the impression that the arms are separated or secondarily attached, especially when microscopically examining fixed or dried material.

(b) The explanation of the development of the structure as a branched conidium is quite natural and logical, which, however, it is not possible to say about the other two. von Höhnel (*1904*: 58) suspected that the four single clavate, curved, conidia arose successively from one point on the mycelium and afterwards they either became attached or grew together at their wider apical ends, which consequently became central, and in this way, they remained connected even after they had separated from the mycelium. The thin hair-like extensions ought then to represent stalks on which the spores grew out from the mycelium. A similar manner of conidial attachement by the thin tip of one arm was described for *Titaea callispora* Saccardo (see Ferraris, *1913*). However, Hansford (*1946*), who studied living material, showed that the conidia of this species are, in fact, joined to the conidiophore by one of the blunt-ended, central cells. The earlier author (Ferraris, *1913*: 846 fig. 241: 1, 2) figured conidia accidentally attached to another substrate and something of this kind might probably have been observed by von Höhnel in *Titaea rotula* (Fig. 3). After all, their subsequent fusion or the attachment of separate conidia could hardly result in such a regular arrangement and be in such exact agreement with the construction of the *I. craginiformis* conidium. It must rather be considered that the conidia of *T. rotula* are attached to the conidiophore by the basal cell of the main axis, as was described for the conidia of *I. craginiformis*.

Kol explains her material as a colony of separated algal individuals. She did not mention the number of filaments, but always figured four (cf. Kol, *1928*: pl. 17 figs. 23, 24; *1957*: fig. 48). Her conception presumes a mode of reproduction which is not known in the filamentous green algae. Either we might consider these structures to be true colonies with an increasing number of filaments (in which case it is difficult to imagine the origin of these new filaments, how the whole colony divides and, after completing division, resumes the characteristic arrangement of four filaments) or that the number of filaments are constant from the beginning, i.e. they might originate simultaneously, something like daughter-coenobia formation in chlorococcal algae, but this way of reproduction is highly improbable in the filamentous algae.

(c) The presence of chromatophores in the cells of *G. tatrica* mentioned in the diagnossis (Kol, *1928*: 618) is very problematical and it must undoubtedly be an error. In the original figures, there is no possibility to see any distinctly and morphologically limited chromatophore. Moreover, the author later published (Kol, *1957*: Fig. 48) a coloured illustration of her supposed alga. There the cell contents are grey-blue-greenish, much more different in colour from the green algae than from either the blue green algae or the cryosestonic fungi, both of which are shown by the author on the same plate. We emphasize again that, with regard to the very small

dimensions of the cells (only 2–3 μ), it is very difficult to distinguish their contents, particularly when the material has been fixed, which is usually the case with cryosestonic specimens.

After a careful consideration of the facts mentioned above, we have reached the conclusion that the three organisms discussed are members of the same genus and belong to the Hyphomycetes. We therefore put forward the following views:

(i) It is clear that the main alleged differences between the three species are based on errors.

(ii) The morphological agreement, especially in the construction of the conidium, is so very conspicuous and characteristic that the classification of these species in two phylogenetically distant groups (Chlorophyceae and Hyphomycetes), where they would represent two quite different states of ontogenetic development (the thallus of an alga and the conidium of a fungus), is highly improbable.

Interspecific differences

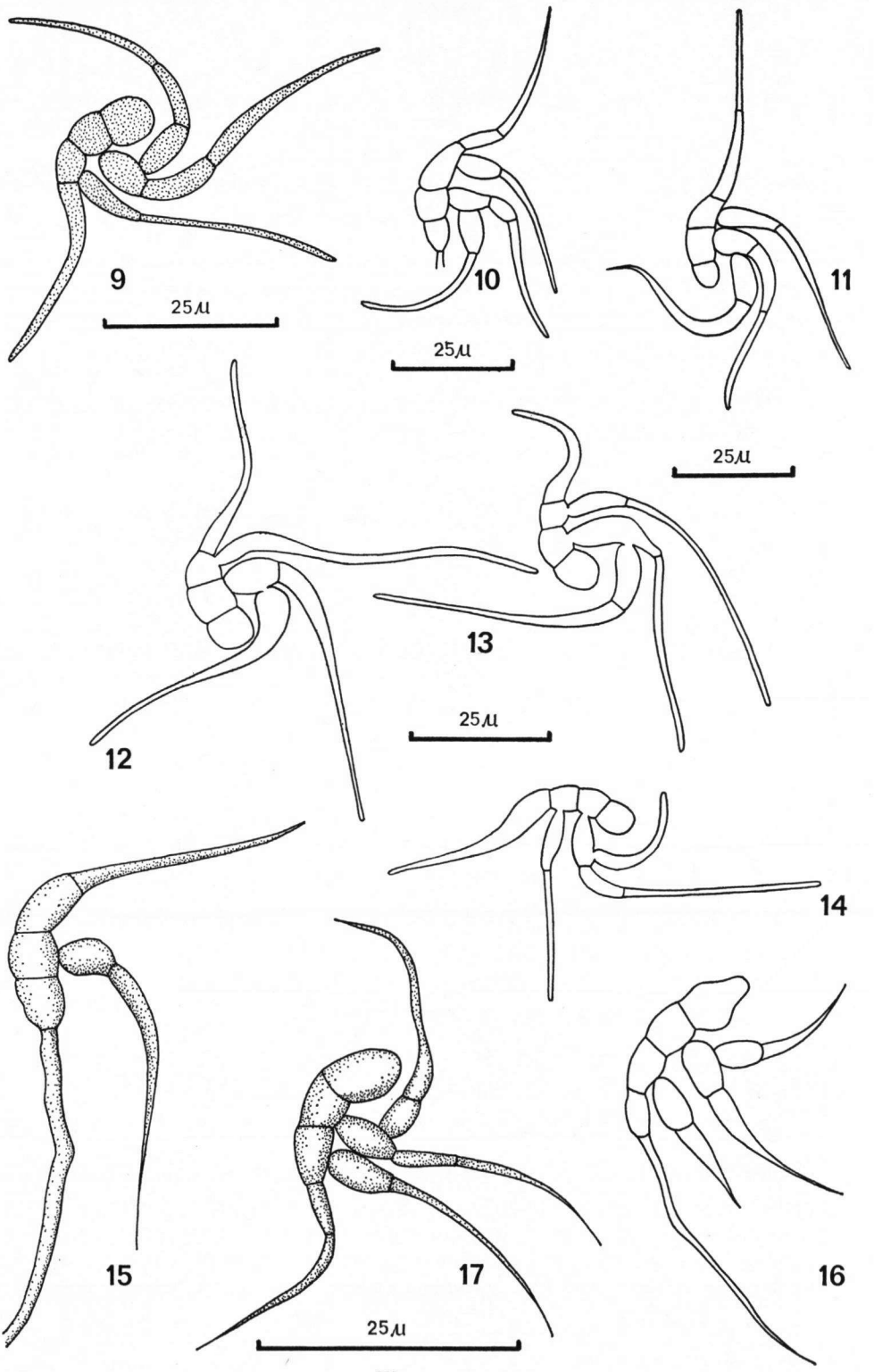
The additional question as to whether the three organisms can be regarded as one species remains to be investigated but some difficulties arise when comparing them. First of all, the descriptions and illustrations of both *T. rotula* and *G. tatrica* are inaccurate and we are not acquainted with their range of variability. Only in *Ingoldia craginiformis*, for which a greater number of observations has been made, is the variability better understood. On the basis of our present knowledge, we consider that there are two different species with the first one represented by *I. craginiformis* whilst the second includes both *T. rotula* and *G. tatrica*. The basis for our opinion is as follows:

(a) The dimensions of the conidia of these two species differ conspicuously, especially in the width (compare Figs. 18, 19 with Fig. 20!). *Ingoldia craginiformis* has the main axis at the widest part more than twice the width found in either *T. rotula* or *G. tatrica* and, whilst the differences in length seem to be less distinct, this is probably attributable to the inaccuracy of the drawings and the difficulties in measuring the sigmoid arms, which may not always lie in the same plane. Nevertheless, according to the authors' data (*T. rotula*: arms 20–40 × 2–3 μ, ratio *c.* 12; *G. tatrica:* arms 20–30 × 2–3 μ, ratio *c.* 10; and *I. craginiformis*: main axes 35–50 × 5–8 μ, ratio *c.* 6.5), the arm length/width ratio would appear to be sufficiently distinct for the separation of two species.

(b) Further differences lie in the compactness of the conidial disc and in the degree of curvature of the arms around the centre. In *I. craginiformis* the branches are more loosely

Explanation of Figures 9–17

Figs. 9–17. — *Gyoerffyella craginiformis*, conidia. — 9. Copied from Ingold & Ellis, *1952*: fig. 1d. — 10. Copied from Nilsson, *1964*: fig. 17e. — 11. Copied from Nilsson, *1958*: fig. 12a. — 12–14. Copied from Ingold, *1964*: fig. 3. — 15–17. Copied from Peterson, *1962*: fig. 11B-D.



Figs. 9–17

arranged, their curvature is variable and a continual sequence exists from one-sided, crest-like to spiral, star-shaped forms with strongly curved ends (Figs. 9, 11). The conidia of the other two species are relatively more compact, judging, at least, from the illustrations. The arms in *T. rotula* seem to be more curved than in *G. tatrica*; its diagnosis mentions only a bow-shaped curvature, but the drawing on the label shows at least one sigmoid structure.

(c) The constriction of the cells at the septa is another feature for differentiation. In all figures of *I. craginiformis*, both the main axis and the branches possess distinctly constricted cells (Figs. 9–17) but, with *G. tatrica* (Figs. 5–7), the constriction is very inconspicuous and rare, whilst it is completely absent in *T. rotula* (Figs. 1–4). However, the only published photograph of *I. craginiformis* (Ingold, *1966*: fig. 6) shows also only inconspicuous constrictions.

The other features seem to be of less taxonomic value:

(d) The number of cells (and, *eo ipso*, the number of septa) differ in the arms, perhaps more according to the data in the literature than in reality. *Ingoldia craginiformis* has 3–5 cells in the main axis, 1–3 in the branches of the first order and 1–3 in the branch of the second order (Figs. 9–17). In the figures of *G. tatrica*, 3–4 cells are found in the main axis, 2–4 in the branches of the first order and 2–3 in the branch of the second order (Figs. 5–7). In *T. rotula*, only one septum for each arm is mentioned in the diagnosis but the drawings on the label show 1–3 cells (Figs. 1–4). This discrepancy in the latter species can be explained by the indistinctness of the septa, which fact is also mentioned by Kol (*1928*: 618). Therefore, it is possible that von Höhnel omitted some septa, having been influenced by his classification of the species in the genus *Titaea*, where two-celled arms are regular, even in the type species, *T. callispora*.

(e) A further problematical feature is the termination of the arms. According to the drawing on the label, the terminal hair-like extensions seem to be thinnest and longest in *T. rotula*. *Gyoerffyella tatrica* has its extensions shorter and thicker (Figs. 5–7). In *I. craginiformis*, both shapes are present (compare Figs. 12 and 16), but the more elongated extensions prevail.

(f) Ecological requirements seem to differ, too, according to the published data. *Ingoldia craginiformis* is probably a representative of the aquatic Hyphomycetes and nearly all its records come from aquatic biotopes. On the contrary, *T. rotula* and *G. tatrica* are reported only from extra-aquatic conditions (see Chapter "Ecology" for a more detailed survey).

From the above comparison of all three species, we conclude:

(i) The organisms published as *T. rotula* and *G. tatrica* are morphologically very similar and, at the present time, we are not able to find any reliable features to separate them. We suppose that they ought to be classified in the same species. If we omit the evidently erroneous data in the diagnoses, only small differences in the spore morphology may be seen in the illustrations: the conidia are more compact in *T. rotula*, which is due to their more curved arms, the number of cells in the arms is lower and the radial extensions are longer. These facts can be explained by the

different characters of the illustrations (von Höhnel's rough drawing on the label and Kol's published figure); whilst, moreover, the authors may have been influenced by having placed their organisms in different groups, i.e. a fungus in the genus *Titaea* and a green alga.

(ii) The organism named *I. craginiformis* differs prominently in some morphological features (especially the dimensions of the conidia and the width/length ratio of the arms), and perhaps also in its ecological requirements. In our present level of knowledge, we consider it advisable to keep it as an independent species. However, we are not very far from the idea that those differences which we now regard as important might become insignificant when the full variability of *T. rotula* and *G. tatrica* is understood.

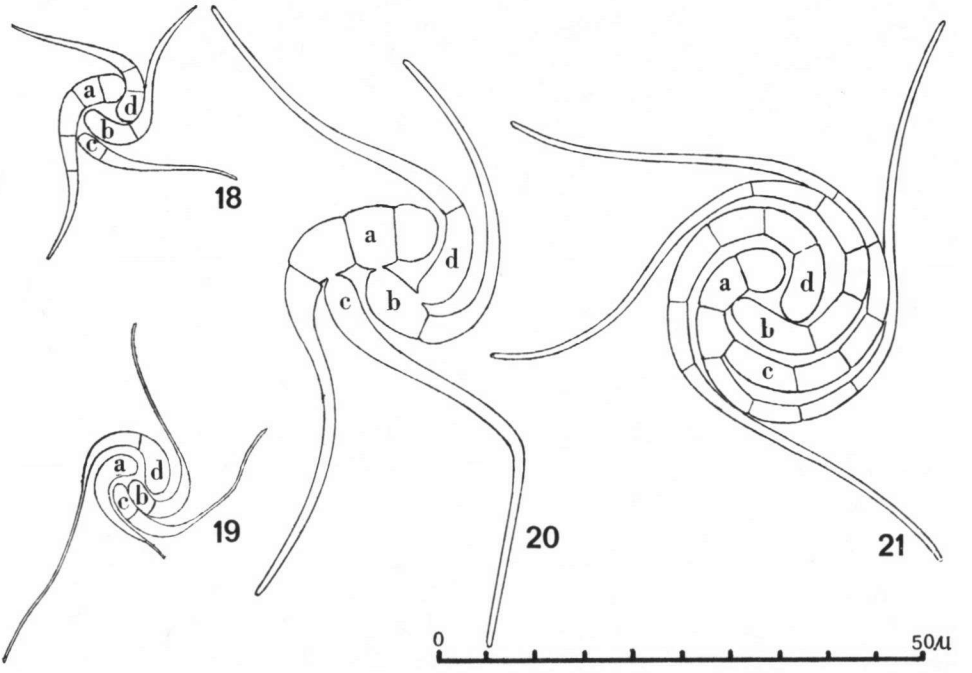
Gyoerffyella spec.

As mentioned above, we have found in the High Tatras structures whose general construction agrees well with the conidia of the three species under discussion but which differ in some characters. We are convinced that they are the conidia of an undescribed species of the genus *Gyoerffyella*. Unfortunately, as we have not succeeded in observing the conidiophores and the mycelium, we do not feel inclined to erect a new species on the basis of conidia alone and we restrict our communication to the illustration and description of all known facts.

DESCRIPTION.—Conidia hyaline, consisting of the main axis, with two branches of the first order arising from the second and third cells of the main axis on its concave side, and one branch of the second order originating from the first cell of the near the basis located branch of the first order. This is in full agreement with the general construction for the conidia of *T. rotula*, *G. tatrica*, and *I. craginiformis*. The main axis and branches are usually 6–8-celled (the septation is more or less indistinct, so that, especially in the thin parts of the arms, it is often very difficult to ascertain precisely the true number of cells); they are 3–5 μ broad at their wider ends, spirally arranged around the centre with the angles of curvature being up to 360°, which gives the conidium the appearance of being a compact disc. The main axis and branches converge gradually towards the free ends, where they taper to thin, hair-like extensions, sigmoid-recurved (only exceptionally straight) and radiating from the centre, with one of the arms often lying in a different plane. We assume that these conidia are attached to the conidiophore by the basal cell of the main axis, as is found with the fully studied species of the genus. The main axis and the branches are approximately 40–75 μ long, with the diameter of the disc being 15–25 μ (measured without extensions).

LOCALITY.—High Tatra Mountains (ČSSR, Slovakia) only one record (Růžička 8.8.1957) in a moss sample, collected under a waterfall on the peaty bank of a mountain torrent originating from the lake "Batizovské pleso", approximately 1800 m above sea level.

The main difference between the new species and *G. craginiformis* is in the higher degree of curvature of the arms around the centre in the former, so that the conidium reminds one somewhat of a catherine-wheel firework. This shape seems to be constant in all the conidia so far observed. Further, the arms have a higher number of cells, are narrower and longer, and are only indistinctly constricted at the septa.



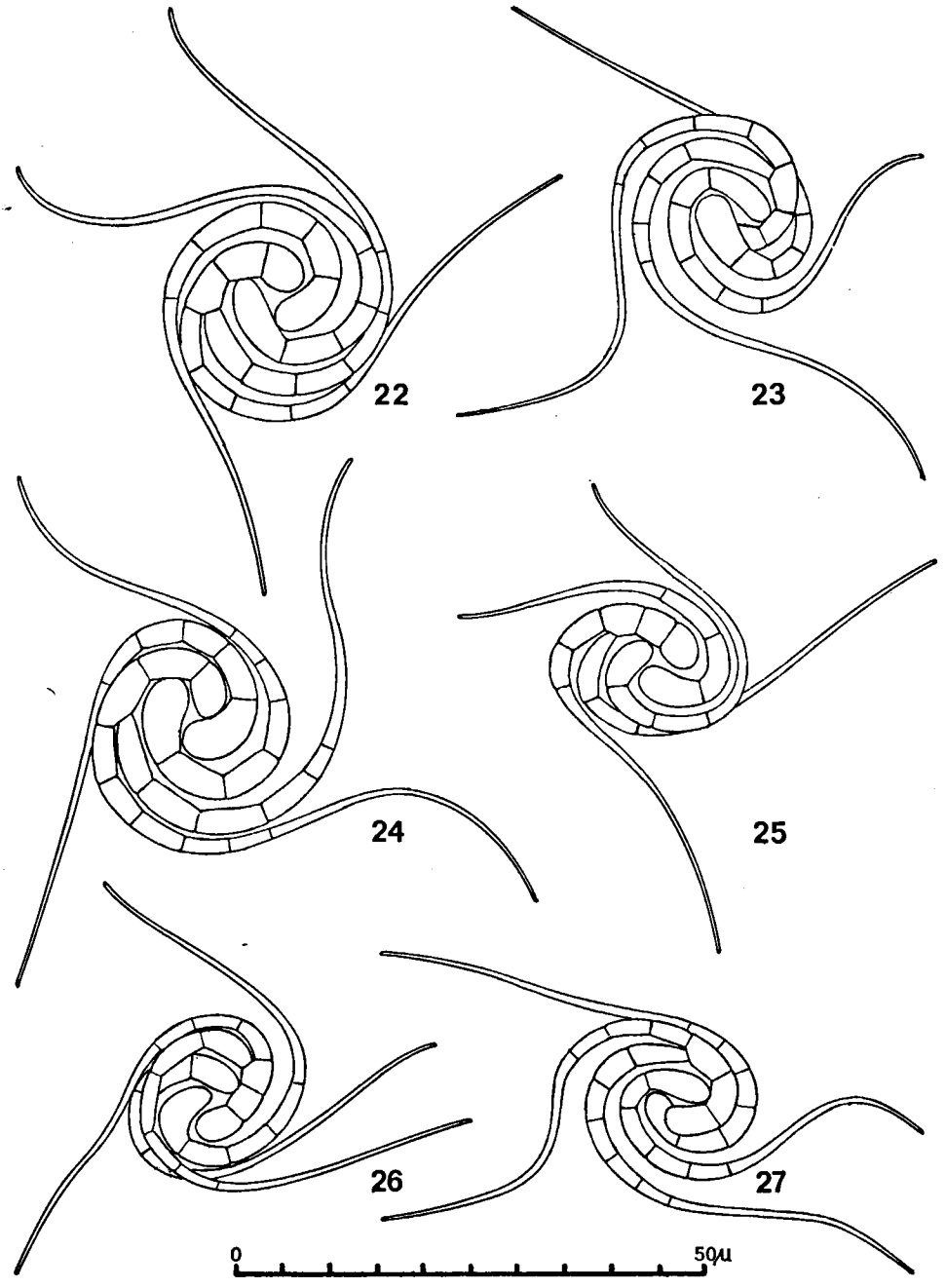
FIGS. 18–21. — Construction of the conidia for the three species under discussion. — 18, 19. *Gyoerffyella rotula*. 18 according to Kol, *1928*: pl. 17 fig. 23; 19 according to von Höhnel's drawing, somewhat enlarged. — 20. *Gyoerffyella craginiformis*, according to Ingold, *1966*: fig. 3. — 21. *Gyoerffyella* spec. — a, main axis; b, c, branches of the first order, adjacently attached to the concave side of the main axis; d, branch of the second order, arising from branch b.

From *T. rotula* and *G. tatrica*, it differs, apart from the above characters, in the size of the conidia, which are twice as large in the new species. However, some similarity to these two species may be seen in the indistinctness of the septal constrictions.

It is of interest to mention, that in all the conidia studied, we have observed (see Figs. 22–27) that the point of attachment of the near-apex-situated lateral (labelled with "c" in Fig. 21) is a broad septum (see Plate 5 fig. 4) instead of the narrow isthmus found where the branches are attached in other species of *Gyoerffyella*. In agreement with this, the third cell of the main axis, which bears branch "c", has a corresponding pentagonal shape. However, we are not, at the present time, sure of the taxonomic value of this feature. It is neither mentioned nor figured in any other species of the genus and its ultimate evaluation cannot be made until developing conidia have also been studied.

Taxonomy and nomenclature

Since the genera *Gyoerffyella* Kol 1928 and *Ingoldia* R. H. Peters. 1962 are regarded as identical, as has been established above, their names must be treated as taxonomic synonyms. *Gyoerffyella* Kol has priority. It is irrelevant that its description was based



FIGS. 22–27. *Gyoerffyella* spec., conidia.

on an incomplete organism (conidia only), partly confused (organelles are described, which do not occur in cells, i.e. chromatophores) and that the genus was originally classified in the green algae. In addition, the validity of the genus is in no way affected by the original spelling of *Györffyella*, which is only an orthographic variant and must be corrected to *Gyoerffyella* (pronounced in English as 'dyerfyella') in accordance with Art. 73 of the Code (Lanjouw & *al.*, *1961*).

In our opinion, it is necessary to transfer to the genus *Gyoerffyella* all the species which have been placed in the genus *Ingoldia*. This also includes *I. tricapillata* and *I. entomobryoides*, both of which fit very well in this genus according to their spore morphology (see Figs. 28–34).

From the genus *Titaea* we remove only one species, *T. rotula*, which departs from the generic conception in the spiral arrangement of the curved arms. However, the name *Titaea* remains available for the type species, *T. callispora*, and the other related species. All these species differ from *Gyoerffyella* in having a straight main axis without projections, and slightly curved branches on both sides.

The diagnosis published by Kol (*1928*: 618) is a "descriptio generico-specifica", which is permissible in monotypic genera (Art. 42 of the Code). It was indirectly corrected and completed by Petersen (*1962*: 147) in his description of the genus *Ingoldia* and it was supplemented by Boerema & von Arx (*1964*: 298) as regards the conidiophore. The correct name of the genus is, therefore, the name *Gyoerffyella*.

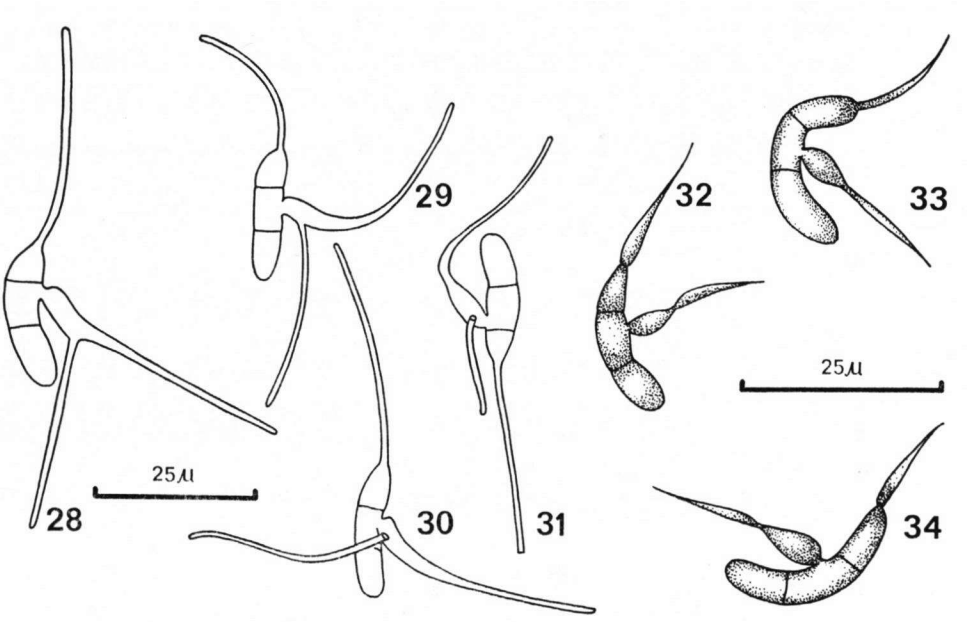
As the two organisms, *Gyoerffyella tatrica* and *Titaea rotula* are considered to be conspecific, their names are, therefore, taxonomic synonyms, with the older name having priority, which is *Titaea rotula*. The only specimen which has been located is No. H 1113a in the von Höhnel collection, preserved in the Farlow Herbarium, Cambridge, Mass., and should be retained as the type because, although we were unable to find the fungus, it is always possible that another student could be more successful. The other species only require transferring from *Ingoldia* to *Gyoerffyella*.

According to our present knowledge, *Gyoerffyella* seems to consist two groups of species. The first one comprises *G. rotula*, *G. craginiformis* and *G.* spec., and is characterized by four-armed conidia with more or less conspicuously curved arms, which form a relatively compact disc. The arms taper gradually to their long terminal extensions. In the second group, where both *G. tricapillata* and *G. entomobryoides* are to be placed, the conidia consist of only three arms (the near-apex-situated branch of the first order is lacking) which are only slightly bent, so that they never form any disc and their terminal extensions taper abruptly from the apical cells.

KEY TO THE SPECIES OF GYOERFFYELLA

1. Main axis of conidium bearing two branches of the first order, all arms tapering rather gradually to a thin, long, terminal extension.
   2. Main axis and branches of more than 5 cells (usually 6–8), strongly spirally curved around the centre (angles of curvature up to 360°) . . . . . *Gyoerffyella* spec.
   2. Main axis of merely 5 cells; branches not more than 3-celled, less curved around the centre (angle not exceeding 180°).
      3. Main axis 5–8 μ in its widest part; arm length/width ratio *c.* 6 . . *G. craginiformis*

3. Main axis only 2–3 μ in its widest part; arm length/width ratio *c.* 11 . . *G. rotula*
1. Main axis bearing only one branch of the first order; all arms tapering abruptly to thin terminal extensions.
4. Branch of the second order present. Aquatic species. . . . . *G. tricapillata*
4. Branch of the second order lacking. Terrestrial species . . . . . *G. entomobryoides*



FIGS. 28—34. — 28—31. *Gyoerffyella tricapillata*, conidia, (from Ingold, *1964*: fig. 2). — 32—34. *Gyoerffyella entomobryoides*, conidia (from Boerema & von Arx, *1964*: fig. 1).

GYOERFFYELLA Kol

Gyoerffyella Kol, *1928*: 618 [ut "*Györffyella*"] (diagnosis). — Typus: *Gyoerffyella tatrica* Kol 1928: 618.

Ingoldia Petersen, *1962*: 147; Boerema & von Arx, *1964*: 298 char. emend. — Typus: *Ingoldia craginiformis* R. H. Peters.

1. **Gyoerffyella rotula** (Höhn.) Marvanová, *comb. nov.*

Titaea rotula von Höhnel, *1904*: 57 (diagnosis, sine icone); Lindau, *1904*: 545; Migula, *1934*: 201. — Typus: Exsiccatum No. H 1113a (herbarium von Höhnel, Farlow Herbarium, Cambridge, Mass., U.S.A.).

Gyoerffyella tatrica Kol, *1928*: 618, 622 *pl. 17 figs. 23–24* ut "*Györffyella Tatrica*" et "*G. Tatrae*"; Kol, *1929*: 416 [ut "*Györffyella Tátrae*" et "*G. Tátrica*"]; Kol, *1957*: 206 *fig. 48* [ut "*Györffyella tatrae*"].

Non: "*Györffyella tatrica* Kol", Kol, *1966*: 164 *pl. 1 fig. 11.*

2. **Gyoerffyella craginiformis** (R. H. Peters.) Marvanová, *comb. nov.*

Ingoldia craginiformis Petersen, *1962*: 147 *fig. 11A-E* (diagnosis, typus); Ingold, *1964*: 106 *fig. 3*; Nilsson, *1964*: 98 *fig. 17e*; Ingold, *1955*: 455; *1966*: 50 *fig. 6.*

Hyphomycetes spec. *Ingold & Ellis, 1952*: 158, 159 *fig. 1d*; Nilsson, *1958*: 311 *fig. 12a*; Ingold, *1959*: 126 *fig. 14 p.p.*

3. **Gyoerffyella tricapillata** (Ingold) Marvanová, *comb. nov.*

Ingoldia tricapillata Ingold, *1964*: 103 *fig. 1–2, pl. 3 figs. 1–6* (diagnosis, typus).

4. **Gyoerffyella entomobryoides** (Boerema & Arx) Marvanová, *comb. nov.*

Ingoldia entomobryoides Boerema & von Arx, *1964*: 298 *figs. 1–2* (diagnosis, typus).

5. GYOERFFYELLA spec.

Sine nomen.

Ecology

The genus *Gyoerffyella* includes both aquatic and terrestrial species, although the ecological requirements have not yet been fully recognized in all species. *Gyoerffyella tricapillata* was reported as a true aquatic Hyphomycete which produced and distributed conidia under water. *Gyoerffyella craginiformis* was collected on submerged leaves, but its conidia also occurred in scum whilst Nilsson (*1964*: 63, 98) found them among garden leaf litter and considered this fungus to be rather of a semi-aquatic character. *Gyoerffyella tricapillata* was recorded from low altitudes. *Gyoerffyella craginiformis* is reported from both low (Nilsson, *1962*; *1964*) and high altitudes (Ingold, *1965*; *1966*). *Gyoerffyella entomobryoides* has never been found in water and occurred on decayed twigs of *Rosa* spec. The locality was at a low altitude.

The ecology of *G. rotula* has not yet been recognized with certainty. Kol reported her species from snow fields at altitudes of 1340 and 2180 m above sea level; further details, mainly concerning the quality of the snow, were added in her later publication (Kol, *1949*). von Höhnel found his fungus near the village Tumpen, in the Ötztal, a valley in the Tyrolean Alps. Tumpen lies 946 m above sea level, but the specimen could have been collected in its neighbourhood, where the mountains reach more than 2000 m. This species seems to be of a montane character.

von Höhnel observed his conidia on the decayed leaves of *Myosotis alpestris*, whereas Kol found them directly on snow. This need not necessarily lead to the conclusion that the ecological requirements of both species must differ. Conidia of a saprophyte or minute parts of plant tissue bearing fungus can easily be transported to snow by wind or water, whilst a cryosestonic organism could accidentally appear to be attached to the leaves of some alpine plant, growing near a field of remaining snow. We must, however, not omit the third possibility, which is that conidia of an aquatic Hyphomycete could easily be transported from water by dispersing spray

from waterfalls or blown by wind from the desiccated leaves (on which they developed) to either *Myosotis* or snow. Tubaki (*1960*) also lists some conidia of aquatic Hyphomycetes from snow. As to von Höhnel's statement about the connection of conidia with mycelium, this has already been shown to be an error. In any case, *G. rotula* must be a very rare species, or cryoseston is not its natural habitat as it was not found during the ten-year systematic investigation of the cryosestonic microorganisms of the High Tatras (F. Hindák, Brno, ČSSR, personal communication) nor has it been refound in the original locality.

Similar comments as regards ecology could also be made about the unnamed species of *Gyoerffyella*. It was found only once, as free conidia, and its natural substrate is unknown.

Summary

1. The cryosestonic organism, *Gyoerffyella tatrica* Kol *1928*, described as a green alga, shows very close morphological conformity with the conidia of fungi published under the names *Titaea rotula* von Höhnel *1904* and *Ingoldia craginiformis* Petersen *1962*, so that the classification of these species in two unrelated groups is untenable. On the basis of a detailed analysis, we consider that they belong to the same genus of Hyphomycetes, the correct name of which is *Gyoerffyella* Kol *1928*.

2. The data which we had at our disposal have not produced any reliable feature which would enable us to keep *Titaea rotula* and *Gyoerffyella tatrica* as two independent species. We therefore consider both names to be taxonomic synonyms, with the correct name for this species being *Gyoerffyella rotula* (Höhn.) Marvanová.

3. *Ingoldia craginiformis* R. H. Peters. differs a little from the above two species, both morphologically and ecologically. We could not justify its identity with *G. rotula*, but do not exclude this possibility in the future. Its specific epithet has been recombined with *Gyoerffyella* as *G. craginiformis* (R. H. Peters.) Marvanová.

4. Two species of *Ingoldia* have been transferred to *Gyoerffyella* as *G. tricapillata* (Ingold) Marvanová and *G. entomobryoides* (Boerema & Arx) Marvanová.

5. *Gyoerffyella* spec., found in the High Tatras is closely related to *G. rotula* and *G. craginiformis*. We refrain from naming it, as we have seen neither the conidiophores nor the mycelium. Our description and illustrations therefore deal only with the conidia.

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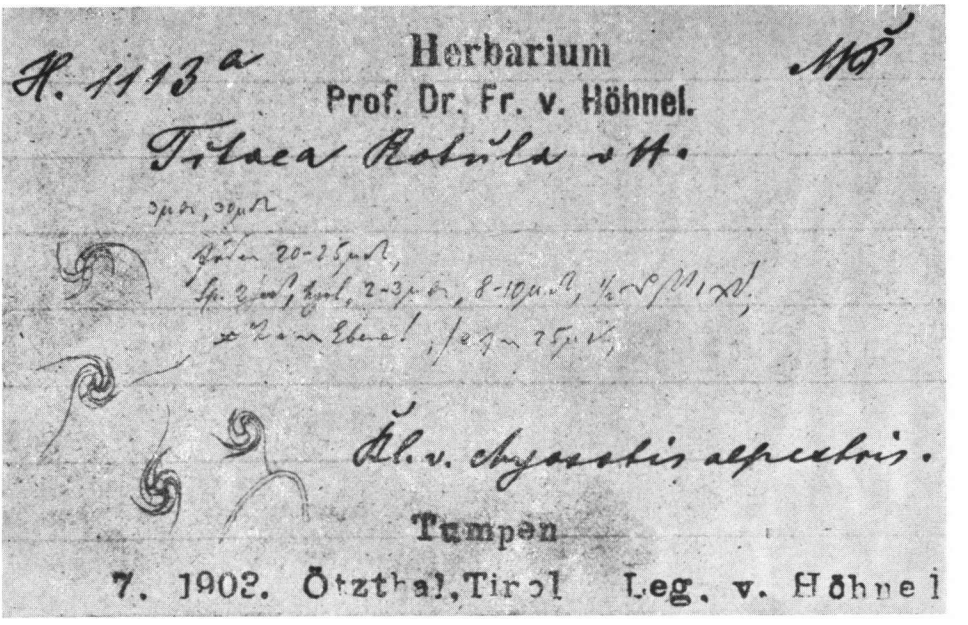
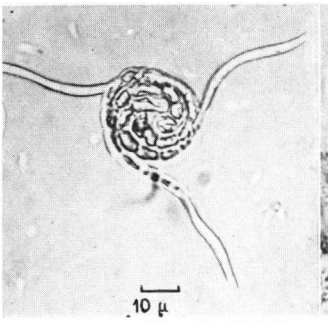
EXPLANATION OF PLATE 5

FIGS. 1–4. — 1. Label of No. H. 1113a of von Höhnel's collection (Farlow Herbarium). — 2–4. *Gyoerffyella* spec., conidia, in 4, detail of disc. The branch of the first order situated near apex is attached to the third cell of the main axis by a broad septum.


Herbarium
Prof. Dr. Fr. v. Höhnel.
Tumpen
7. 1902. Ötzthal, Tirol Leg. v. Höhnel

1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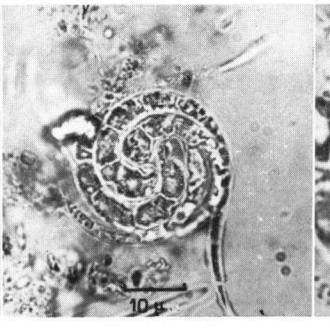
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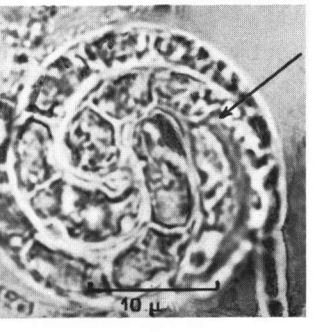
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