

A wider and more natural concept of the genus *Gyromitra* Fr.

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In the course of my studies on the genus *Gyromitra* I have found it unavoidable to expand the concept of that genus so as to include three genera usually considered separate, essentially because of differences in spore characters. Modern authors have treated *Pseudorhizina* Jačevskij (*Helvellella* Imai), *Neogyromitra* Imai (*Maublancomyces* Herter) and the old genus *Discina* (Fr.) Fr. as independent genera beside *Gyromitra* Fr. ECKBLAD (1968) too, maintains these genera except for *Neogyromitra* which he groups with *Discina*. On the other hand he writes that «smooth versus ornamented spores is a character of differentiating value on specific level only». BENEDIX (1962) has even established for *Neogyromitra* and *Discina* a family of their own.

When delimiting the genus *Helvella* [L.] St.-Amans, Nannfeldt and Dissing (see DISSING, 1966) have emphasized the uniform anatomy of the excipulum together with the characters of the spores as the uniting characteristics of that genus. The form of the ascocarp is, on the contrary, most variable in the genus, from sessile to ones with a very distinct lacunose stipe and a mitrate fertile cap. I have found their ideas to be valid and adaptable also in the delimitation of *Gyromitra*. According to my studies, in *Gyromitra*, *Pseudorhizina*, *Neogyromitra* and *Discina* the anatomy of the excipulum (as observed by ECKBLAD, 1968, too) and the paraphyses are much alike, and to a high degree the spores, too.

Pseudorhizina Jačevskij. This monotypic genus has been established for *Helvella sphaerospora* Peck because of the spherical spores of the latter. Subsequent authors (e.g. ECKBLAD, op. c.) have not observed any other «significant» difference between it and the *Gyromitra* species. Though ECKBLAD in his revision of the genera of operculate *Discomycetes* writes that «in no case is it obvious that a genus should be separated on spore form alone» he still acknowledges the genus.

I have studied the lectotype of *Gyromitra gabretae* Kavina, which belongs to *P. sphaerospora* and found the excipulum to be composed of *textura intricata* as described by ECKBLAD (op.c.). The spores are small and completely spherical and a perispore cannot be distinguished. The spore wall is about 0.5 μm thick as in species of *Gyromitra*. Many spores seem to be completely devoid of oil drops but probably most of them, however, contain one (some contain two or more) very small eccentric drop. The various species of *Gyromitra* s.lato have a characteristic number and size of oil drops in most of their spores but the drops can be lacking in a number of even mature spores. The fact that I have not observed any perispore in *P. sphaerospora* does not necessarily exclude the possibility of its existence. It may well be so thin and tightly appressed to the spore wall that other means than passive studying under the microscope are needed to detect it.

I have studied some specimens of *Gyromitra californica* (Phill.) Raitv. from Cali-

for­nia and Idaho. This species is a true *Gyromitra* as verified by RAITVIIR (1965) and ECKBLAD (op.c.) and it seems to be nearly-related to *P. sphaerospora* both macroscopically and microscopically. The spores of *G. californica* are small, ellipsoid, without an observable perispore and most of them contain two very small drops, one at each end, but often not symmetrically located. Viewed from above, it is obvious that the spores of *P. sphaerospora* represent through those of *G. californica* one end of the variation of the *Gyromitra* spore and that the species belongs to that genus, where its correct name is *Gyromitra sphaerospora* (Peck) Saccardo.

Neogyromitra Imai. This genus has been established and used for stipitate species with «apiculate and sculpturate» spores. At least two valid species have been recorded in the genus, *N. gigas* (Krombh.) Imai and *N. caroliniana* ([Bosc] Fr.) Imai.

According to the studies of LE GAL (1947) and my own, the appendages of the spores of *N. gigas* are but inflations of the perispore filled with some substance. The substance, periplasma, which is located between the spore wall and the perispore stains deep blue in Cotton Blue. MAAS GEESTERANUS (1965) has found that the spores are principally similar in *N. caroliniana*. The deep-staining inflations of the perispore are, however, not restricted to these two stipitate species as it has been supposed when maintaining this genus. Probably RAITVIIR (op.c.) was the first to find in *G. infula* and *G. ambi-*

gua (s.n. *G. infula* v. *apiculatispora* Raitv.; see HARMAJA 1969) the inflated perispore although he thought it was «the thickened episporic membrane». He did not, however, consider this discovery very significant and he merely suggested that *Gyromitra* and *Neogyromitra* should be placed in the same tribus, but not united into one genus. Independently of him I have observed a perispore more or less inflated at the spore ends surround the spores of the same two species and of the type species of *Gyromitra*, *G. esculenta*, too. The periplasma stained always deep blue in Cotton Blue as in *N. gigas*. In *G. ambigua* the inflations are rather wide and in some spores they are much like those of *N. gigas*. There is thus no principal difference between the spores of *Gyromitra* and *Neogyromitra*, to the contrary of what has been emphasized in the literature (see Fig. 1). There is, however, a reticulum, composed of an unknown substance, on the perispore of mature spores of *Neogyromitra* (and *Discina*; see LE GAL, op.c.). According to ECKBLAD (op.c.) the excipulum in *N.* («*Discina*») *gigas* (also verified by me) and *N. caroliniana* is throughout composed of *textura intricata* which is the type of excipulum of *Gyromitra* s.str., too. *N. gigas* and *N. caroliniana* thus differ from the three *Gyromitra* species named above in that their mature perispore has a reticulum. This is an infrageneric difference only and the two species must be called *Gyromitra gigas* (Krombh.) Cooke and *Gyromitra caroliniana* ([Bosc] Fries) Fries.

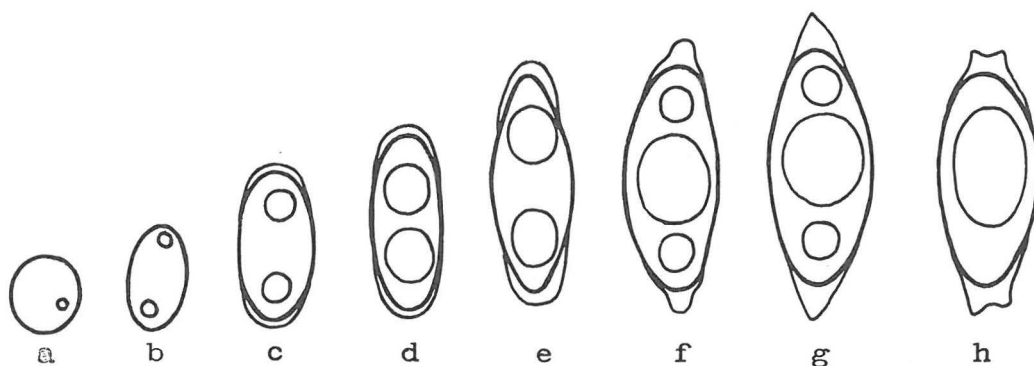


Fig. 1. Spores of some species of *Gyromitra*, drawn x 1 000 in heated Cotton Blue (the reticulum has not been drawn in f, g and h): a) *G. sphaerospora* (lectotype of *G. gabretae*), b) *G. californica* (Idaho, leg. A. W. Slipp), c) *G. esculenta* (Finland, Laitila, leg. K. Alho, I. Kaase & U. Laine), d) *G. infula* (Finland, Lohja, leg. H. Harmaja), e) *G. ambigua* (holotype), f) *G. gigas* (Finland, Järvenpää, leg. Y. Palmu), g) *G. perlata* (Finland, Lohja, leg. H. Harmaja), h) *G. leucoxantha* (type).

Discina (Fries) Fries. There are at least two valid species in this genus, *D. perlata* (Fr.) Fr. and *D. leucoxantha* Bres. From the first-named I have studied several specimens collected by myself and others; from *D. leucoxantha* the type and another specimen collected by Bresadola. The excipulum of both species is composed of *textura intricata* as observed by ECKBLAD (op.c.) in the case of *D. perlata*. Their spores have a pronounced perispore which is reticulate at maturity and in each species it is inflated in a characteristic way at the spore apices because of the blue-staining periplasma. These characters of the spores of both species have earlier been studied and described thoroughly by Le GAL (op.c.). Accordingly, microscopically *Discina* species differ only very slightly from «*Neogyromitra*». The fruit-bodies of *Discina* have a more or less distinct, mostly lacunose stipe (In *D. perlata* I have seen the stipe as long as 2 cm). With age the hymenium usually gets folded and convex. Sometimes there is indeed not much separating *Discina* from «*Neogyromitra*». The two genera have, however, nearly uniformly been treated as separate genera because of the distinct stipe and gyrose hymenium of *Neogyromitra*, the *Discina* species being indistinctly to shortly stipitate and having a discoid smooth hymenium at least when young. ECKBLAD (op.c.) is the sole author to consider these differences unsatisfactory at the generic level and he united *Neogyromitra* to *Discina*. It is to be noted, however, that in his article as early as 1930, CORNER considered *Discina perlata* as a very nearly-related derivative of *Gyromitra gigas*. This case resembles much the situation in the genus *Helvella* which includes both sessile and distinctly stipitate species with almost uniform anatomy and spores. Accordingly, I agree with ECKBLAD and consider *Neogyromitra* and *Discina* congeneric. In the preceding paragraph I have, however, united *Neogyromitra* with *Gyromitra*, from which it follows that the *Discina* species must be included in *Gyromitra*, too. Two new combinations become necessary: *Gyromitra perlata* (Fr.) Harmaja, n. comb. (basonym *Peziza perlata* Fries, Syst. Myc. II, p. 43, 1822) and *Gyromitra leucoxantha* (Bres.) Harmaja, n. comb. (basonym *Discina leucoxantha* Bresadola, Rev. Myc. 4, p. 212, 1882). Fortunately the name *Gyromitra* is older than the name *Discina*.

The emended genus *Gyromitra* Fr. thus contains distinctly to very shortly stipitate terricolous or lignicolous, vernal to autumnal species without dull colours (black, grey) and mostly growing in the neighbourhood of conifers. The excipulum is \pm uniform throughout and composed of interwoven, \pm filamentous hyphae (*textura intricata*). The spores are ellipsoid or oblong or \pm fusiform, rarely spherical, 1-, 2- or 3-guttulate, some to many of them may, however, have no or many guttules. The spores have a smooth wall ca. 0,5—0,8 μ m thick and are mostly (if not always) surrounded by a perispore. The perispore, when present, is more or less inflated (often in a characteristic manner) at the spore apices and the space between it and the spore wall is filled with periplasma deep blue in Cotton Blue. The periplasma is accordingly most prominent at the spore apices. In some species the mature spores have in addition a reticulum farthest off.

It is very probable that *G. infula* (and *G. tasmanica* ?; not studied by me) represents a rather primitive type in the genus. Assuming that the genus is monophyletic, *G. sphaerospora* would thus represent one end of the variation in *Gyromitra*, viz. towards simpler and smaller spores with smaller to no oil drops but towards a well developed fruit body (as also BENEDIX, 1962, has suggested) whereas the *Discina* group would be at another end with the reverse evolution: the development of large thick-walled spores with a complex perispore and large and/or several oil drops, but the degeneration of the fruit body. A less plausible possibility is that the whole genus has evolved from *Rhizina*-like ancestors via the *Discina* group. I do not consider it probable that the *Discina* group is the most primitive one from which the stipitate *Gyromitras* would have evolved to one direction and *Rhizina* to another, opposite one.

The natural family *Rhizinaceae* Bon. sensu ECKBLAD (op.c.) contains beside the emended *Gyromitra* only one additional genus, *Rhizina* [Fr.] Fr. *R. undulata* (studied by me) has spores very similar to those of *G. perlata*, but it deserves a genus of its own because of the total lack of stipe, the «diffuse» yellow margin of the ascocarp, the rhizomorphs, and the deviating anatomy with setae and almost globose cells in the outer excipulum.

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