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THE GENUS *ENDOGONE* IN DENMARK

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The genus *Endogone* has, like other genera of hypogean fungi, been almost neglected by Danish mycologists. The finds described here are, as far as we know, the first records of *Endogone* from Denmark. There is, on the other hand, no reason to believe that these peculiar *Phycomycetes* are rare here, and an extensive search will no doubt add more species to our flora. Our present knowledge of the genus is mainly due to the careful study by Bucholtz (1911) who demonstrated the zygomycetaceous nature of the species, finding either zygospor- or azygospor-formation in the various forms. Harkness (1899) had previously described a species with sporangia, which Kanouse (1936) removed to a new genus as *Modicella malleola* (Hark.) Kanouse. An extensive study of American species was published by Thaxter (1922). The determination of the species was greatly facilitated through the key published by Zycha (1935), including all well described taxa.

Endogonaceae is the only family among the *Phycomycetes* characterized by a distinct fruit body which, however, is of a rather loose texture, with a scanty peridium and a gleba made up of spores in a loose web of hyphae. The species are found under the leaves or more or less deeply immersed in the soil. Almost all collections recorded here are from rich clay soil, but other species are said to grow among *Sphagnum*.

The species described below have either zygospor- or azygospor- and belong to the genus *Endogone* in its restricted sense. They were found by the senior author on various excursions during 1951—

1952, and were included in the authors' joint studies on some Danish *Phycomycetes*, carried out with help of a grant from „Statens Almindelige Videnskabsfond“.

Endogone macrocarpa TULASNE

Fig. 1.

Fruit body subglobose, lobed, often somewhat flattened, diam. up to 1 cm. but frequently smaller; peridium thin to moderately thick,

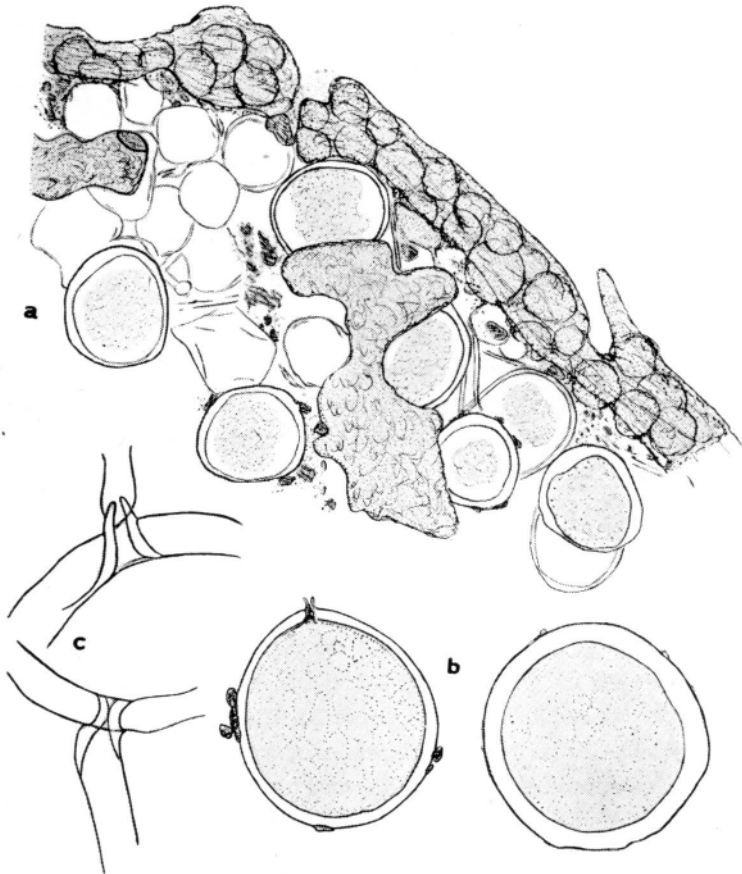


Fig. 1. *Endogone macrocarpa* Tul.

- a) Section of peridium and gleba with azygospores and vesiculae. $\times 125$.
b) Two azygospores. $\times 250$. c) Insertion of spore stipe on spores. $\times 1000$.

dirty whitish to clay colour, somewhat reddish when bruised, gleba clay to brownish olivaceous, not very compact.

Peridium made up of branched hyphae and globose cells with debris. Azygospores globose to short oval, formed as globose swellings on ends of hyphae, yellowish olive to brownish, with slightly paler, granular content, often with some oil globules, $86-178 \times 71-159 \mu$, walls $3-13 \mu$ thick, homogeneous, refractive, incrustated on surface, spore stipe $6-9 \mu$ thick, simple; spores irregularly arranged among hyaline, incrustated hyphae, $6-15 \mu$ thick and often anastomosing; among the spores are distributed compact groups of abortive spores (vesiculae).

Material studied: M 4034, under *Aesculus* and *Fagus*. S. Vallø Dyrehave 16.9.1951. ML 4060, under *Corylus*, under rotten leaves. S. Boserup, 20.10.1951. M 4051a, ML 4051b, under *Tilia*. J. Hald Hovedgaard, 1.10.1951. M 4259, under *Fagus*. J. Rosenvold, 9.9.1952.

***Endogone flavispora* sp. n.**

Fig. 2.

Fruit body firm, almost globose, somewhat lobed, diam. 0.5 cm.; peridium whitish, brown when touched and on drying, gleba darker, yellowish to dark brown, not much incrustated with soil.

Peridium of thick, brown hyphae mixed with vesiculae, vesiculae very few in central part of gleba, where azygospores are irregularly arranged among $6-12 \mu$ broad, branched hyphae with thin walls. Azygospores ovate-oblong, often slightly constricted on the middle, rarely subglobose, $149-202 \times 95-152 \mu$ (individual spores varying from 171×95 to $159 \times 152 \mu$), wall deep yellowish brown, $6-13 \mu$ thick, outer thin layer somewhat lamellate, hardly incrustated, content paler, bright yellowish, granular; stipe $10-13 \mu$ thick, simple.

The species differs from *Endogone macrocarpa* Tul. through shape and colour of spores. *Endogone tuberculosa* Lloyd from New Zealand has spores of similar shape and colour but much smaller; the characters of the outer spore wall recall some types of *Endogone lactiflua* Berk., but the spores are azygotic and differ in shape and colour.

Material studied: M 4054, under *Corylus* on clay. J. Firegaarde Skov, Ry, Oct. 1952. (Type).

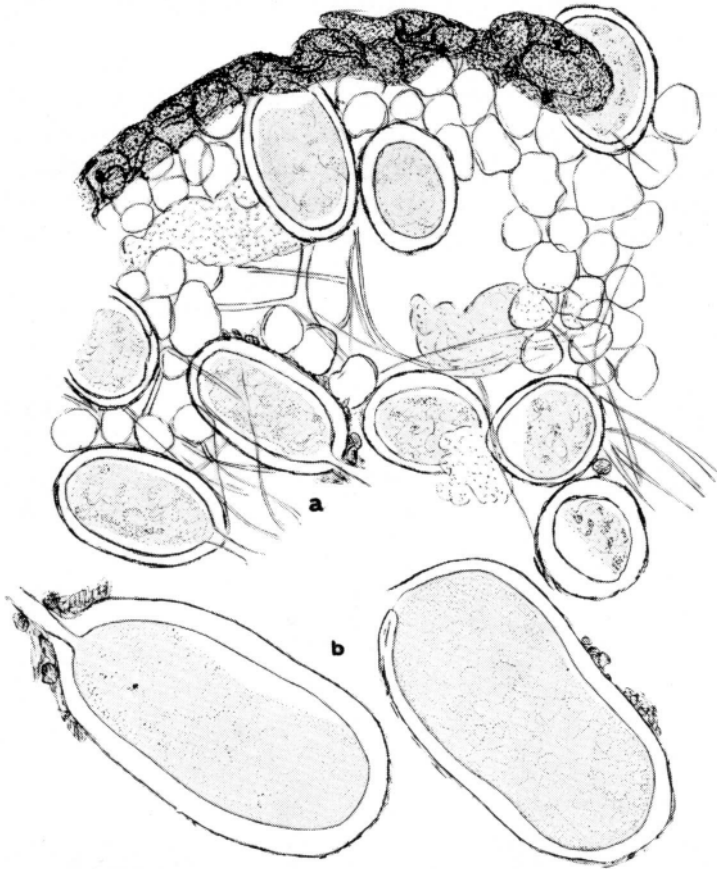


Fig. 2. *Endogone flavispora* sp. n.

- a) Section of peridium and gleba with azygospores and vesiculae. $\times 125$.
b) Two azygospores. $\times 250$.

Diagnosis. Firma, globularis, 0,5 cm lata. Peridium albidum, tactu sordidum. Gleba adustiore colore, inter alutaceum luteum fulvum ravum et fuscum varians. Peridium ex hyphis crassis, fuscis, vesiculis intermixtis compositum. Vesiculae in parte centrali glebae paucae. Azygosporae inter hyphas 6—12 μ latas, ramificatas, parietibus tenuibus irregulariter dispositae, oblongo-ovales, raro subglobulares, magnae 149—202 \times 95—152 μ , parietibus validis, fulvis, contextu citrino, stipitibus 10—13 μ crassis, simplicibus suffultae.

Typus 16.10.1952 ad Ry, Danmark, sub numero 4054 a M. Lange lectus, in Mus. Bot. Haun. depositus.

Endogone lactiflua BERKELEY

Fig. 3.

Fruit body firm, irregularly rounded, diam. 0.4 cm.; peridium white, fibrillose, gleba granulate, greyish brown, moist when sectioned, but with no distinct milky juice, incrustated with debris.

Gleba made up of irregularly arranged spores or in some places spores in regular rows, densely mixed with incrustated substrat-partic-

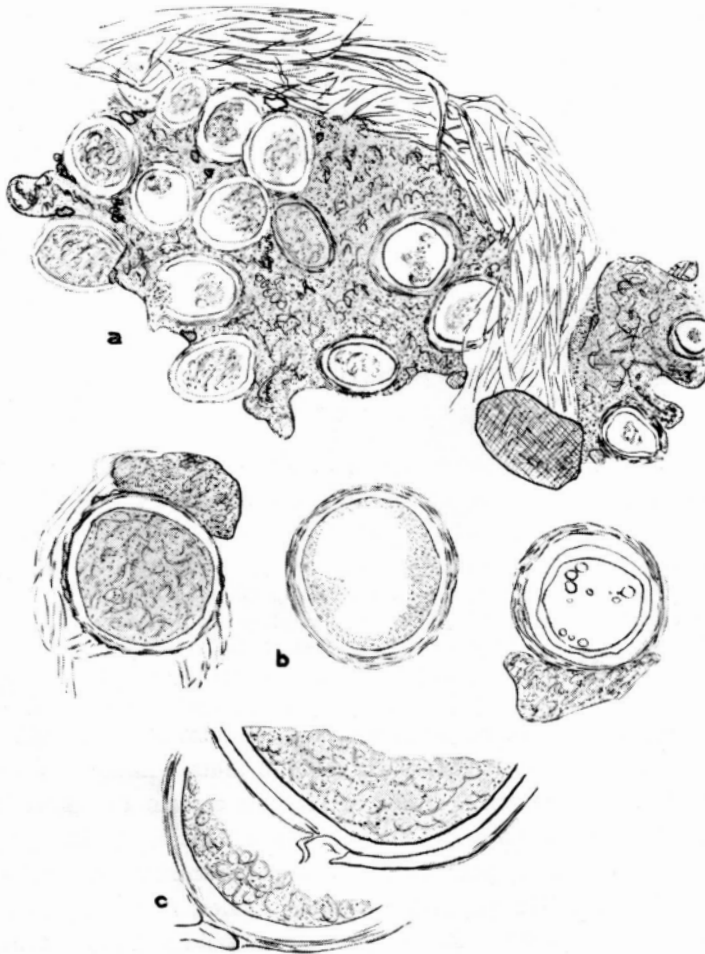


Fig. 3. *Endogone lactiflua* Berk.

- a) Section of peridium and gleba with zygosporangia. $\times 125$. b) Three zygosporangia. $\times 250$. c) Insertion of spore stipe on spores. $\times 500$.

les, amorphous, refractive exudate and hyaline, 4μ broad hyphae; the hyphae continuous with the prominent peridium, made up of several layers of interwoven, hyalin hyphae. Zygospores hyaline to dull yellowish grey, $95-120 \times 76-111 \mu$, wall rather thick, with an often narrow, homogeneous inner layer, and a very variable outer layer made up of lamellae or subcellular tissue, not sharply delimited from the surrounding hyphae, stipe short, more or less distinctly indicating the zygoteous nature of the spores.

Although the "Flammenkrone" structure is not as distinct as in Bucholtz' drawings, we have little doubt to the identity of the species. The zygoteous nature of the spores and also the "Flammenkrone" is according to Thaxter (1922) often hard to see, and our material checks well with some of the specimens described under this name by both these authors.

Material studied: M. 4185, under *Fagus*. S. Rudeskov, 11.8.1952.

Another specimen, M 4055. J. Firegaard Skov, Ry, Oct. 1951, reminds in several respects of *Endogone lactiflua*. It differs, however, in much larger spores ($95-212 \times 82-181 \mu$) and also in other, minor characters. It may belong in a species hitherto undescribed, but the material is hardly sufficient for an accurate description of a new taxon.

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