OBSERVATIONS ON THE BOLBITIACEAE 10: THE ENIGMA OF THE PERISPORE

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ABSTRACT. The perispore of *Conocybe oculispora* is reassessed in the light of developmental studies; an emended description of the species is given.

Parallelism is a well known phenomenon in unrelated genera or even families in the Agaricales, e.g. rough basidiospores are characteristic of *Galerina* but uncommon in *Conocybe*, and nodulose spores although they typify one whole group in *Inocybe* are rare but not absent in *Conocybe*. The occurrence of a perispore in a species of *Conocybe* would represent such a parallelism but it is essential to evaluate the nature of the structure carefully before reaching any conclusions.

The presence of a perispore is typical of many members of the genus *Galerina*, one section of *Coprinus* (sect. *Narcoticus*), etc. However, only one species with a perispore has been described in the Bolbitiaceae, i.e. *Conocybe oculispora* Locquin (1955). Professor Locquin has been kind enough to allow me to study the type material of his suggested unique species. Although one can observe the structures figured in the original paper, my interpretation of the facts is rather different, and are the subject of this contribution.

In several dark-spored agarics some areas of the gills produce pale coloured basidiospores under certain environmental conditions. *C. oculispora* is an extreme case of this phenomenon for any mount of the hymenium shows not only typical unmistakedly bolbitiaceous basidiospores but many others, often in pairs or in tetrads, which are paler and/or misshapen. Basidia have been located with such abnormal spores surmounting the sterigmata just as figured by Locquin. From an undetermined cause, some of the basidiospores during their development collapse about the germ-pore in fact it appears that a true germ-pore rarely forms in these pale-coloured basidiospores, or that because of some failure in development the spore-wall collapses at this apical spot. The result of such a collapse is that the spore appears to be terminated by a convex protuberance as shown in the lowest right hand figures in Locquin's illustration: this projection may be prominent or obscure. Ultimately such spores become detached from the basidia and float amongst the normal spores becoming loosely attached to them (fig. $1f_2$; plate 6c). The suggestion is therefore made that it is these pale collapsed spores attached to the pigmented spore which Locquin interpreted as the perispore (fig. $1f_1$). His lowest left hand figure illustrates normal spores and the centre figure is of a 'grouped' spore, i.e. a tetrad of pale spores attached to a normally formed spore. Indeed the outline of the four spores were accurately illustrated by Locquin (fig. $1f_2$).

It can be quite easily demonstrated in several agarics using segments of pileus with gills attached and mounted in damp chambers that the developing

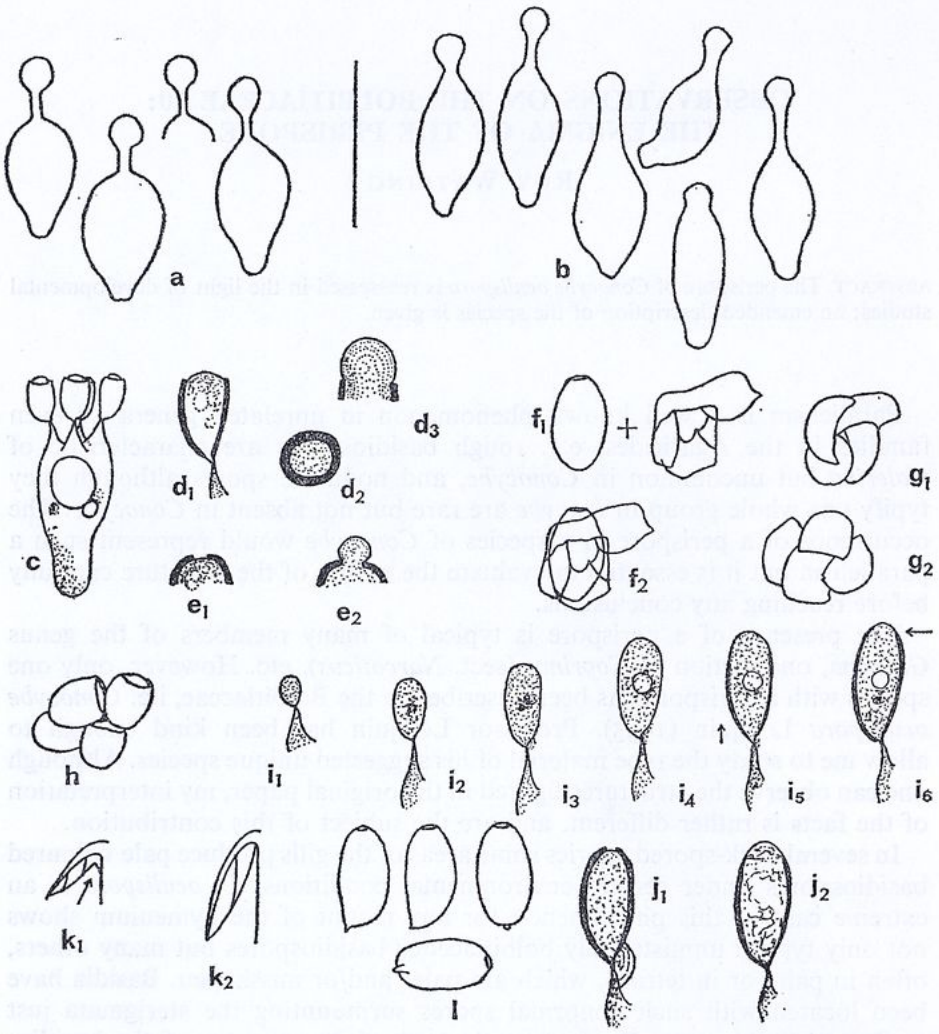

FIG. 1. *Conocybe oculispora* Locquin: a, cheilocystidia; b, caulocystidia; c, basidium with 4 'abnormal' basidiospores; d_1 single abnormal spore in optical section, d_2, same end-on, d_3, germ-pore area of same after treatment with conc. H_2SO_4; e_1, germ-pore area of single normal spore, e_2, same after treatment with conc. H_2SO_4; f_1, interpretation of Locquin's perispore-covered basidiospores, f_2, Locquin's illustration, g_1 and g_2 examples of collapsed, clustered spores similar to f_1; h, collapsed tetrad; i_{1-6}, development of basidiospore resulting in normal spore (j_1) and abnormal spore (j_2); k_1, gill-attachment after Locquin 1955, compared with that in *C. tenera* (k_2); l, basidiospores.

basidia can be induced to collapse by sudden changes in water tensions etc. (Watling, 1964). This loss of turgor is associated with a premature rejection or collapse of the basidiospores onto the hymenium indicating that external and internal water regimes are critical and must be carefully adjusted by the agaric for successful spore-dispersal. Observations suggest that closeness of gills, and/or the power of facial cystidia to act as baffles to gaseous movement, are mechanisms to assist this end (Watling, 1964). Observations also show

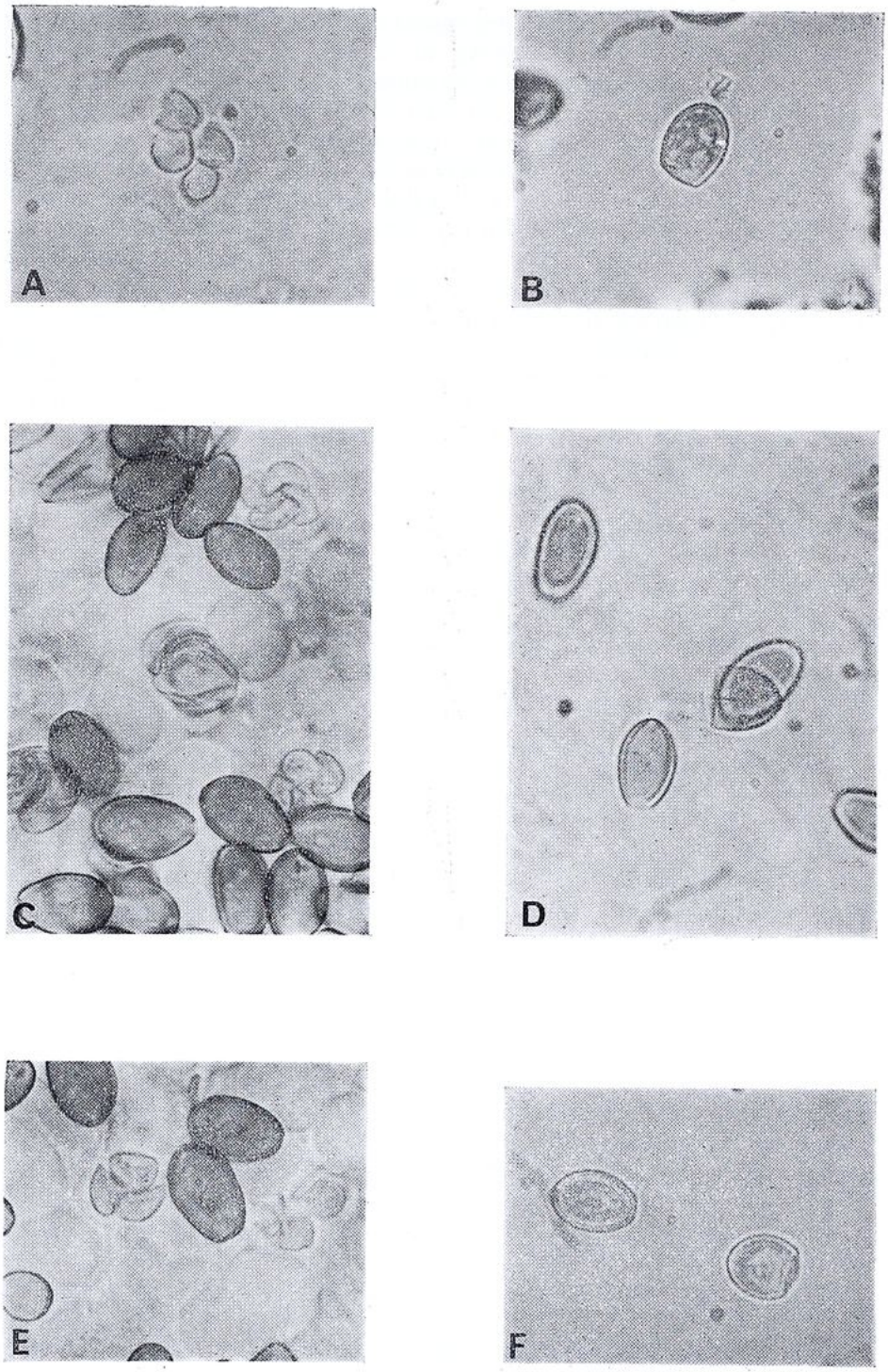

PLATE 6. *Conocybe oculispora* Locquin: A, C & E, tetrads of collapsed 'abnormal' basidiospores—in C & E note normal thick-walled pigmented basidiospores; B, D & F, 'abnormal' basidiospores showing ill-formed germ-pore end

that in any case a very high percentage (as high as 80%) of all abnormal basidiospores produced collapse on the gill-face. This is therefore not only a warning to mycologists who measure spores only from the hymenium and not from a spore-print, but surely indicates a way by which a fungus eliminates abnormal spores. In herbarium material many an agaricologist is familiar with the frequent observation of abnormal tetrads on the hymenium; 'typical' spores can only be sampled in a spore-print, and if herbarium material must be used then a much larger number of spores should be taken and a statistical analysis carried out (see Watling, 1964).

One would expect therefore to see abnormal tetrads in any mount of a gill when a cover-slip was not tapped too vigorously during its preparation (fig. 1h & plate 6 A, C & E). The figure and photographs supporting this paper depict how the spore in *C. oculispora* has formed. The convex termination of the abnormal spores is the exposed endospore (fig. 1c); apparently no typical germ-pore is present (plate 6 B, D & F). The outer surface of the endospore can be readily demonstrated in normal spores if the latter are treated with concentrated sulphuric acid; under these conditions the endospore-wall balloons out (fig. $1e_1$, e_2). Corner (1948) has shown in *Collybia apalosaria* B. & Br. [= *Oudemansiella canarii* (Jungh) Höhnel fide Singer] that the endospore thickens firstly at the (sterigma) apiculus end of the spore, the hardening and thickening progressing slowly up the spore as it continues to expand. In fact he found a slight fall off in overall dimension when the spores actually reached maturity. It is suggested that the spores in *C. oculispora* also proceed through this process of maturation of the wall (fig. $1i_1$–i_6, j_1), but in the abnormal spores this is hindered and ends long before the spore has reached its mature size (fig. $1j_2$). Nevertheless the wall which has formed becomes pigmented in the normal fashion. The convex protuberance of the partly formed 'mature' spore might be erroneously interpreted therefore as the endospore pushing through an extra large 'germ-pore' (fig. $1d_1$–d_3); in these spores no special annular thickening about the opening is observed. It is not known how many of these abnormal spores were in the original spore-print; indeed there is no indication in the notes accompanying the material that a spore-print was taken, nor are there spore-prints in the boxes with the specimens. One would speculate that few if any of the abnormal spores would have been present in a spore-print anyway! Amongst the several thousand collections of Bolbitiaceae which have been examined a parallel developmental pattern has never been seen.

The observations described above indicate that there is no true perispore in *C. oculispora*; thus there is no known case of this structure in the Bolbitiaceae. It was first thought that Locquin's fungus may have given some lead as to the suggested relationship between *Setchelliogaster* Pouzar (Česká Mykol. 12:33, 1958) and *Conocybe*; *Setchelliogaster tenuipes* (Setchell) Pouzar possesses an ornamental perispore. However, any possible connections because of the above information are destroyed, and in fact probably a much better relationship will be found between *Setchelliogaster* and *Descolea* (*Cortinariaceae*). Except for the abnormal development of some of the basidiospores, *C. oculispora* fits into the existing framework outlined by Watling (1966). Although I cannot agree with Locquin's interpretation of the 'peculiar' spores the name for the fungus still stands as a member of *Conocybe* subgenus *Conocybe* section *Conocybe*.

Conocybe oculispora Locquin in Bull. Mens. Soc. Linn. Lyon 24, 7:184 (1955). *Pileus* 10–15 mm, globose then hemispherical, conico-campanulate or campanulate with straight edge, striate but mat when dry, yellow ochraceous fawn to clear fawn-brown, paler towards the margin. *Stipe* 40–50 × 1–1·2 mm, separable, cylindrical, narrowed towards the summit slightly swollen towards base, clear yellow, ochraceous rose becoming reddish brown from the base then brown, entirely covered in white pruina arranged regularly in longitudinal bands. *Gills* adnate to adnate-uncinate (fig. $1k_1$,), quite serrate, quite narrow (1–3l–2λ)–Locquin's terminology–ochraceous then ochraceous brown; edge slightly brighter and crenulate powdered.

Cheilocystidia lecythiform, hyaline or slightly yellowish in water and aqueous alkaline solutions, 23–26 μm long, body 10–12·5 μm and head up to 5 μm (fig. 1a); *pleurocystidia* absent. *Caulocystidia* varying from lecythiform to not truly lecythiform (simply fusiform to subcapitate), 22–27 × 8–10 μm, with heads variable 3–5 μm (fig. 1b). *Basidia* 4-spored, clavate, hyaline in water and alkaline mounts. *Basidiospores* 9·5–10·5 × 5–5·5 μm, elliptic in both face- and side-views, with small distinct apiculus and germ-pore, smooth, thick-walled, ochraceous yellow in water, ochraceous rust-colour or golden-yellow in alkaline solutions.

The structure of the hymeniderm is of pyriform cells up to 20 μm broad; subhymenium, pileus trama etc., is that of a typical member of the genus *Conocybe*. The coprophilous habit, gill-attachment and small spores apparently characterise this species in sect. *Conocybe*.

References

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