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ULTRASTRUCTURE OF THE ASCUS AND THE ASCOSPORE WALL IN SCUTELLINIA (PEZIZALES, ASCOMYCOTINA)

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The development of wall layers in the ascus top and of ornamentation of ascospores is studied with the electron microscope in *Scutellinia pseudotrechispora*, *S. umbrorum*, *S. patagonica*, *S. trechispora*, and *S. scutellata*. In all species studied the ascus top shows a roughly delimited operculum and ascostome, a subapical ring, and special plasmatic structures just beneath the operculum. Details of these structures, as found with different methods of fixation and contrasting, are summarized. The structure and dehiscence mechanism of the ascus as described here for *Scutellinia* are considered to be characteristic of the family Pyronemataceae. The developmental pattern of the ascospore wall in *S.* pseudotrechispora is different from that found in the other species. The secondary wall in this species develops a complex structure not known from other representatives of the Pyronemataceae.

Recently, much attention has been paid to the taxonomy of the genus *Scutellinia* (Cooke) Lamb., a well characterized genus of the Pezizales with a great number of species. Most species possess ascospores with a characteristic pattern of ornamentation.

As shown by Svrček (1971), Kullman (1982), and Schumacher (1990) there is a wide variation in the ascospore ornamentation within the genus *Scutellinia*.

Earlier work on the ultrastructure of the ascospore wall in *Scutellinia scutellata* (L.: Fr.) Lamb. and *S. armatospora* Denison [= *S. trechispora* (B.& Br.) Lamb.] was carried out by Merkus (1974), while the ascan substructure was studied in *S. armatospora* by van Brummelen (1978) and in *S. scutellata* by Samuelson (1978).

Despite these investigations, several problems of the fine structure of asci and ascospore ornamentation remained unsolved. Especially some components of the apical ascoplasm, such as a tract, a funnel, and an apical globule, observed by Chadefaud (1942) with light microscopy in *Ciliaria* [*Scutellinia*] *hirta* (Schum.) Boud. and in some species of related genera, could not be traced in ultrastructural studies of *Scutellinia* and other representatives of the '*Otidea-Aleuria* complex' by Samuelson (1978).

In the present study five species of *Scutellinia* have been investigated with different conventional and advanced methods of fixation and contrasting for the development of their asci and ascopore ornamentation.

Unlike representatives of the families Pezizaceae, Ascobolaceae, and Sarcoscyphaceae, most of the differentiation of the ascus top in species of *Scutellinia* can only be observed in mature asci shortly before spore discharge.

Chemical fixation of mature asci poses two problems. The asci can easily collapse because of minor changes in the osmotic value of their contents and the primary wall of

mature ascospores becomes resistant to fixation, embedding, and thin-sectioning. Often the material is distorted and the structures difficult to interpret. In contrast material fixed by ultra-rapid freezing followed by freeze substitution proved to be much more suitable in this respect even though the dimensions of asci and ascospores are just at the limit of the possibilities of this technique. The shape and arrangement of cytological elements are found to be perfectly conserved. However, the good preservation of structure usually decreases rapidly in zones more distant from the surfaces that have been in direct contact with the freezing medium.

Different wall layers and even different wall regions of the ascus top show a different capacity to take up water. As this imbibition changes when turgor falls or disappears, the relative thickness of wall layers or regions may change considerably.

MATERIALS AND METHODS

The material used in the present study was collected in the Netherlands and in Sweden. The following list gives more details of the specimens and their localities.

Scutellinia pseudotrechispora (Schröt.) Le Gal — *van Brummelen 7861*, on the ground, Hägnen, Femsjö, Småland, Sweden, 4.VIII.1989 (L); *S. umbrorum* (Fr.) Lamb. — *Huyser*, on the ground, 'De Schouw' between Helmond and Someren, Noord-Brabant, the Netherlands, 31.V.1989 (L); *S. patagonica* (Rehm) Gamundi — *Huyser*, on the ground, 'De Schouw' between Helmond and Someren, Noord-Brabant, the Netherlands, 2.VI.1989 (L); *S. trechispora* (B. & Br.) Lamb. — *Piepenbroek*, on damp soil, Duursche Waarden between Olst and Wijhe, Overijssel, the Netherlands, 19.VIII.1973 (L); *S. scutellata* (L.: Fr.) Lamb. — *van Brummelen 4070*, on burnt wood, Nederhorst den Berg, Noord-Holland, the Netherlands, 12.V.1973 (L).

The apothecia were collected along with the substratum on which they were growing. At the laboratory they were removed from the substratum and subsequently fixed for electron microscopy, using different methods. Material of all species was fixed using chemical fixation procedures with glutaraldehyde and potassium-permanganate (van Brummelen, 1986). In addition, part of the material of *S. patagonica* and *S. umbrorum* was fixed by using the ultra-rapid freeze fixation method followed by freeze substitution.

For rapid freeze fixation of the asci very small parts of the hymenium, containing a few asci only, were spread out as thinly as possible, quickly brought into the narrow space of a doubled 100 mesh copper grid, and then rapidly shot with the help of an injector into liquid propane at -180°C. The frozen material was quickly placed in liquid nitrogen for transfer to precooled small metal cylinders each containing 2 ml of a solution of about 1% OsO_4 in anhydrous acetone.

Freeze substitution was carried out in a Reichert KF80 freeze substitution apparatus at -80°C for about 72 hours. After this, the containers were allowed to warm up slowly to about 10°C for two hours. After several rinses in dry acetone the material was infiltrated with increasing concentrations of Epon over a period of 24 hours.

Longitudinal median ultrathin sections of asci were cut with a diamond-knife on a LKB Ultratome III. Sections were usually stained with Reynold's lead citrate and uranyl acetate, while others were stained with this and barium permanganate.

Selected sections of material fixed in glutaraldehyde or by rapid freezing were placed on gold grids and treated with the Thiéry technique for polysaccharides (Thiéry, 1967). The ultrathin sections were viewed with a Philips EM 300 electron microscope.

Legends to Figures 1–10 (on pages 4–13)

Abbreviations used in figures: AG, apical globule; AS, ascostome; AW, ascus wall; CM, condensed material; E, epiplasm; EN, endospore; EP, epispore; ER, endoplasmatic reticulum; FU, funnel; IL, inner layer; IM, investing membrane; IS, inner stratum; M, mitochondrion; N, nucleus; O, operculum; OL, outer layer; OS, outer stratum; P, periascus; PM, plasma membrane or plasmalemma; PW, primary spore wall; S, ascospore; SP, sporoplasm; SR, subapical ring; SW, secondary spore wall; T, tract or funiculus; TS, tubular structure; V, vacuole; WZ, weakness zone. – The scale markers in all figures equal approximately 0.5 µm. Unless stated otherwise, the illustrated material was fixed in 1% $KMnO_4$, post-fixed in 1% OsO_4 and contrasted with uranyl acetate and lead citrate.

Fig. 1. *Scutellinia pseudotrechispora*, electron micrographs of young and ripening asci. a, c. Young asci, showing early development of subapical ring. b, d. Details of lateral ascan wall with subapical ring. e. Idem, showing ripening wall, fixed in 1% glutaraldehyde and stained with uranyl acetate and lead citrate.

Fig. 2. *Scutellinia pseudotrechispora*, development of ascus top. a–c. Median sections showing details of apical ascoplasm. d. Detail of ascus wall of almost mature ascus, fixed in 1% glutaraldehyde and contrasted with Thiéry technique.

Fig. 3. *Scutellinia umbrorum*, development of ascus top. a, c, d. Median sections showing apical ascoplasm, fixed by ultra-rapid freezing and freeze substitution and contrasted with Thiéry technique. b. Idem, but contrasted with uranyl acetate and lead citrate.

Figs. 4a–e. *Scutellinia patagonica*, development of ascus top, fixed by ultra-rapid freezing and freeze substitution and contrasted with Thiéry technique. a. Top of emptied ascus. b. Operculum of the same ascus. c–e. Details of ripening ascus. — Fig. 4f. *Scutellinia umbrorum*, detail of apical ascoplasm, fixed by ultra-rapid freezing and freeze substitution and contrasted with uranyl acetate and lead citrate.

Figs. 5a–c. *Scutellinia trechispora*, development of ascus top. a. Detail of emptied ascus near ascostome. c. Idem, lower part of lateral wall. b. Detail of mature ascus wall with zone of fracturing. — Figs. 5d–f. *Scutellinia pseudotrechispora*, ascospore development. d. Early differentiation of secondary wall, fixed in 1% glutaraldehyde and contrasted with Thiéry technique. e, f. Idem, fixed in 1% $KMnO_4$ and 1% OsO_4 and contrasted with uranyl acetate and lead citrate.

Fig. 6. *Scutellinia pseudotrechispora*, ascospore development. a–c. Advanced differentiation of secondary wall. d. Idem, fixed in 1% glutaraldehyde and contrasted with Thiéry technique.

Fig. 7. *Scutellinia umbrorum*, ascospore development, fixed by ultra-rapid freezing and freeze substitution and contrasted with uranyl acetate and lead citrate. a, b. Ripening ascospores. c, d. Details of secondary wall.

Figs. 8a–d. *Scutellinia patagonica*, ascospore development, fixed by ultra-rapid freezing and freeze substitution and contrasted with uranyl acetate and lead citrate. a, b. Differentiation of the primary wall. c, d. Details of mature secondary wall. — Fig. 8e. *Scutellinia trechispora*, detail of nuclear segregation in very young ascus.

Fig. 9. *Scutellinia trechispora*, ascospore development, fixed in 1% $KMnO_4$ and 1% OsO_4 and contrasted with uranyl acetate, lead citrate, and barium permanganate. a. Primary wall and very early secondary wall. b. Condensation of secondary wall material. c, d. Development of secondary wall. e. Detail of advanced state of spore development.

Fig. 10. *Scutellinia scutellata*, ascospore development (a, c, d, f, fixed in 1% glutaraldehyde and 1% OsO_4; b, e, fixed in 1% $KMnO_4$ and 1% OsO_4). a. Primary wall and early secondary wall. b–d. Condensation of secondary wall material. e. Development of secondary wall. f. Detail of advanced state of ascospore development.

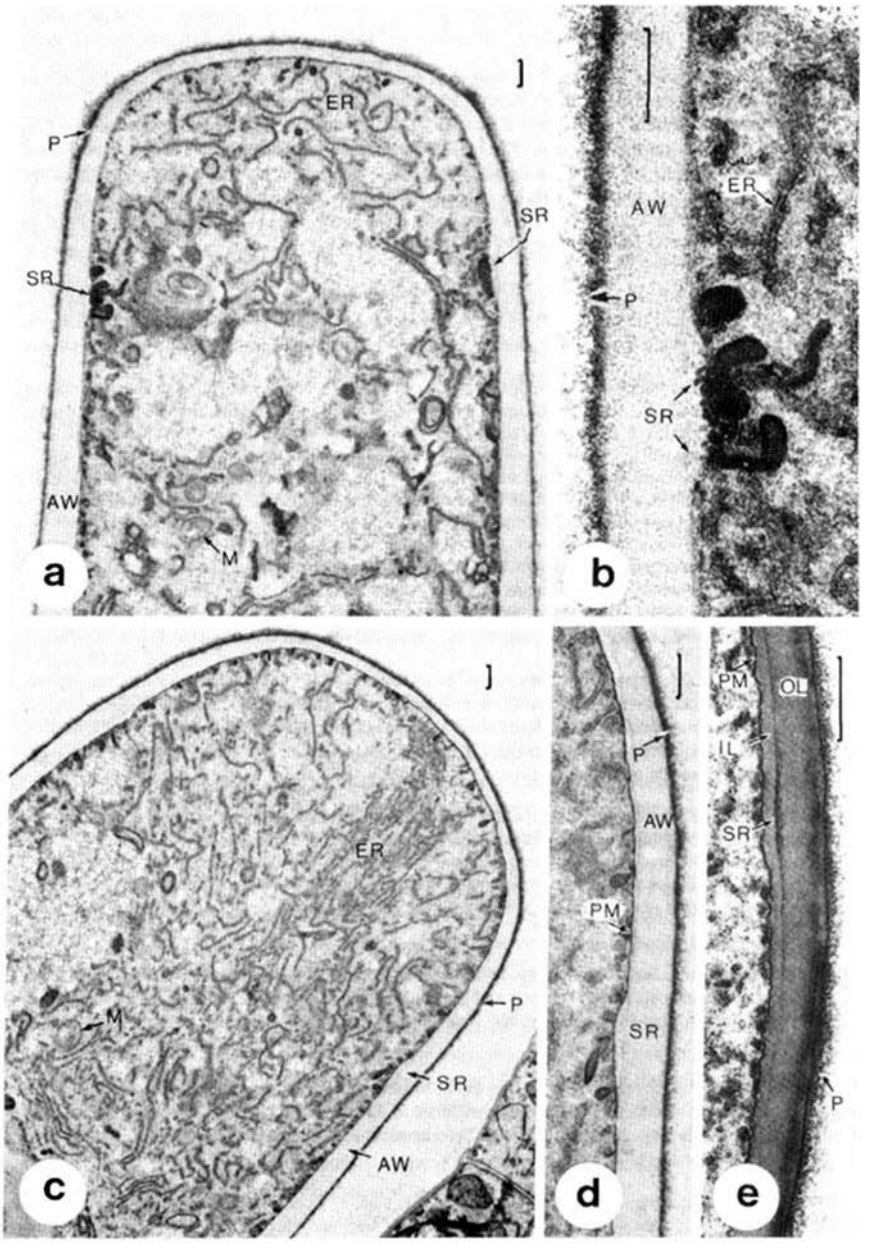
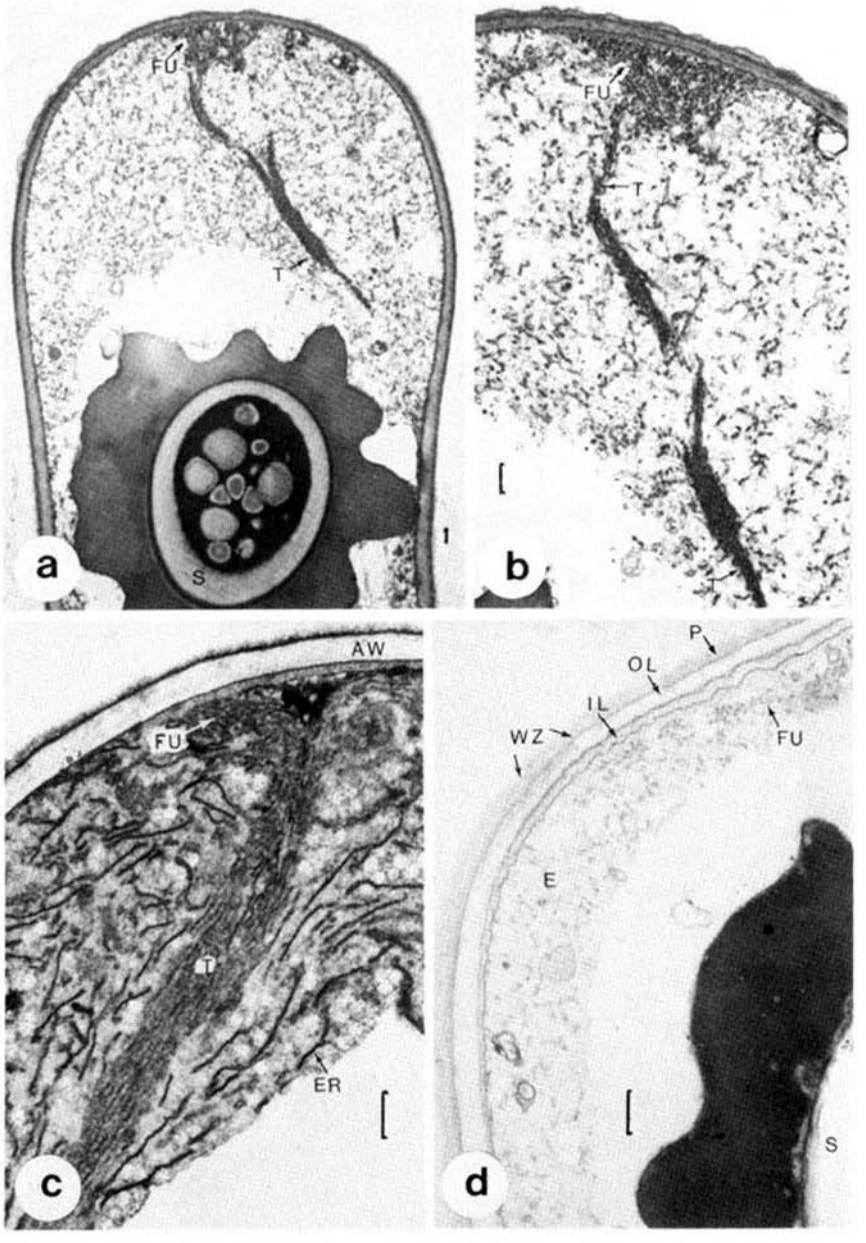


Fig. 1 (legend on page 131)



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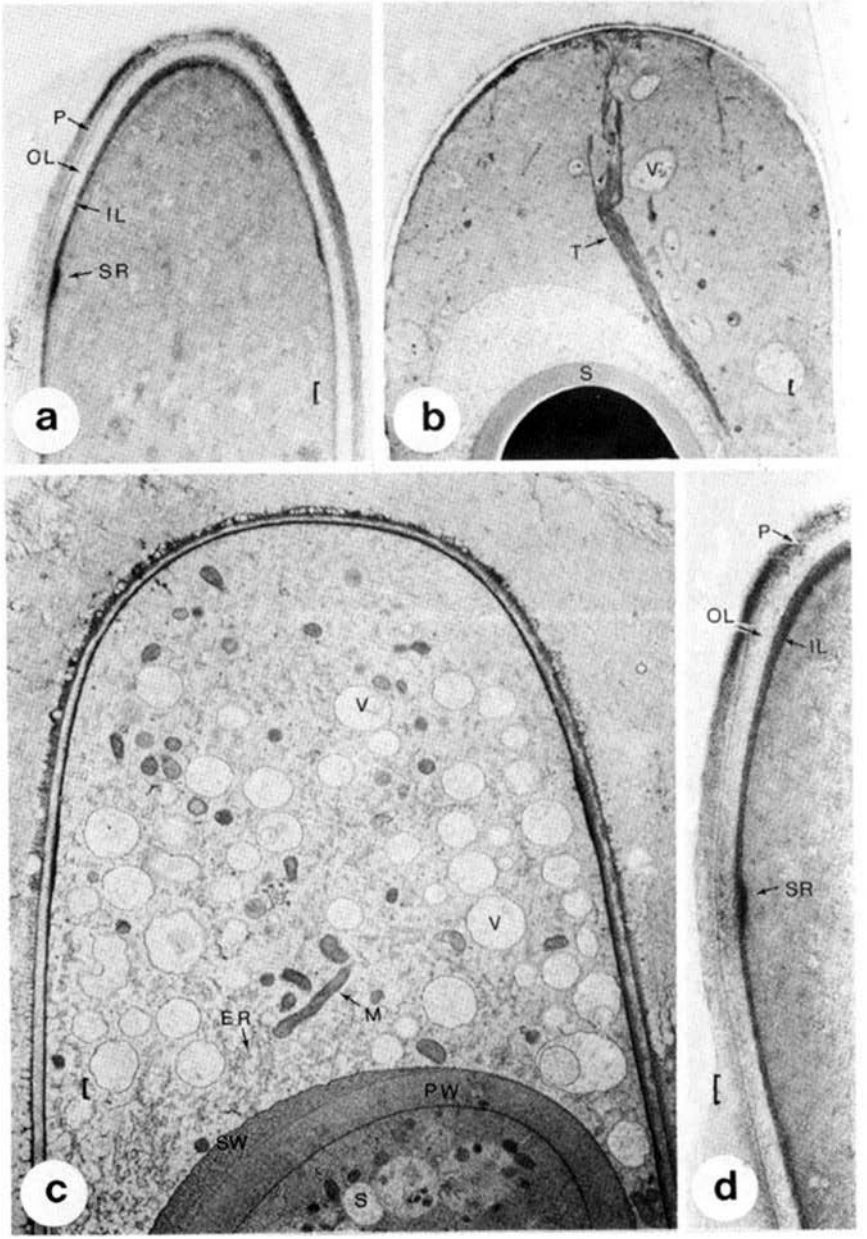

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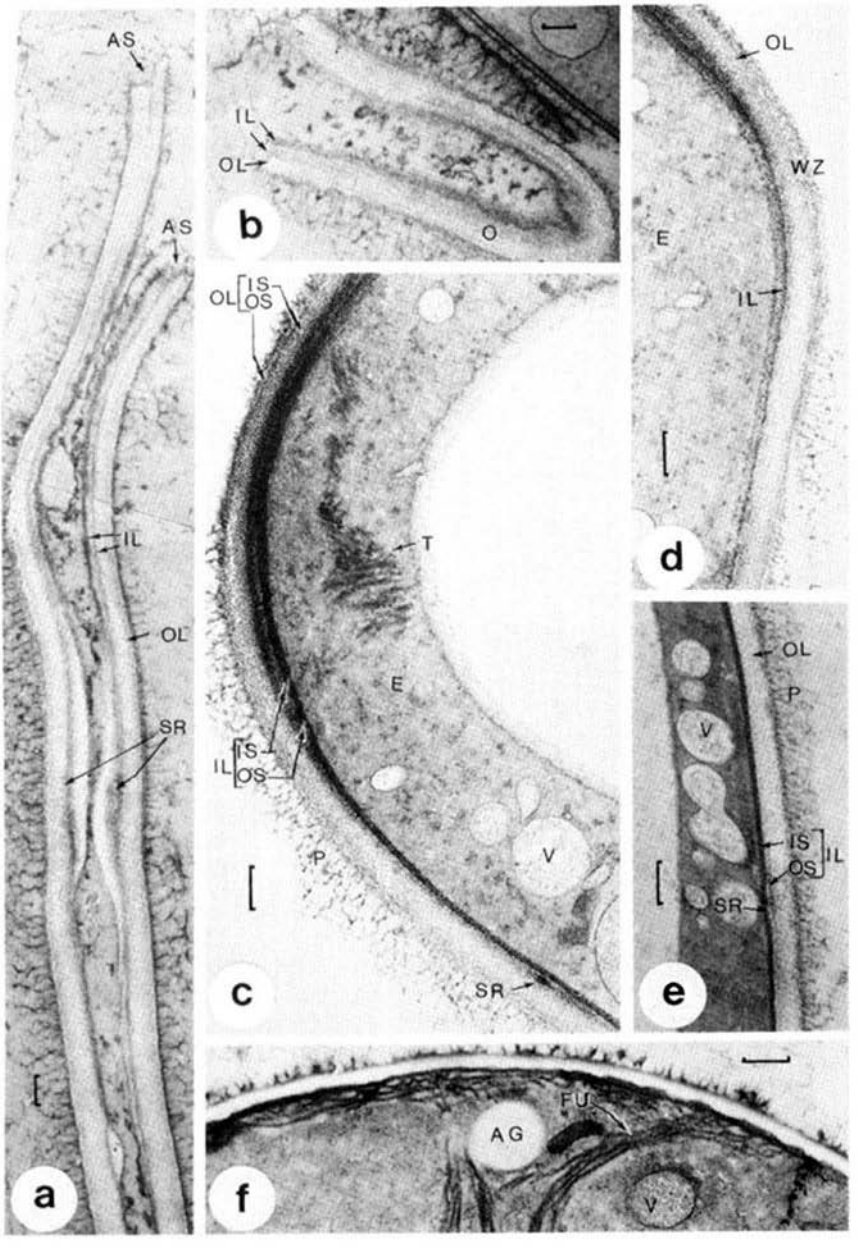

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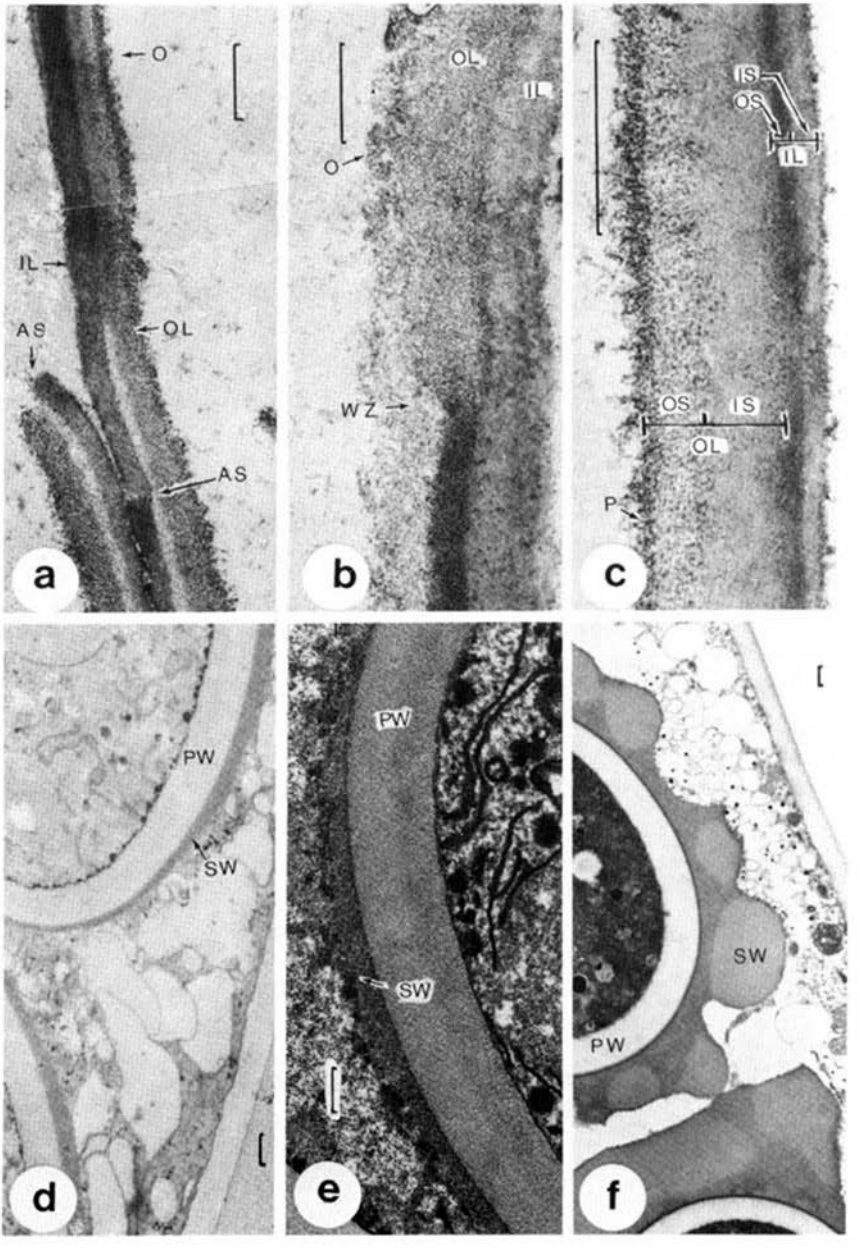

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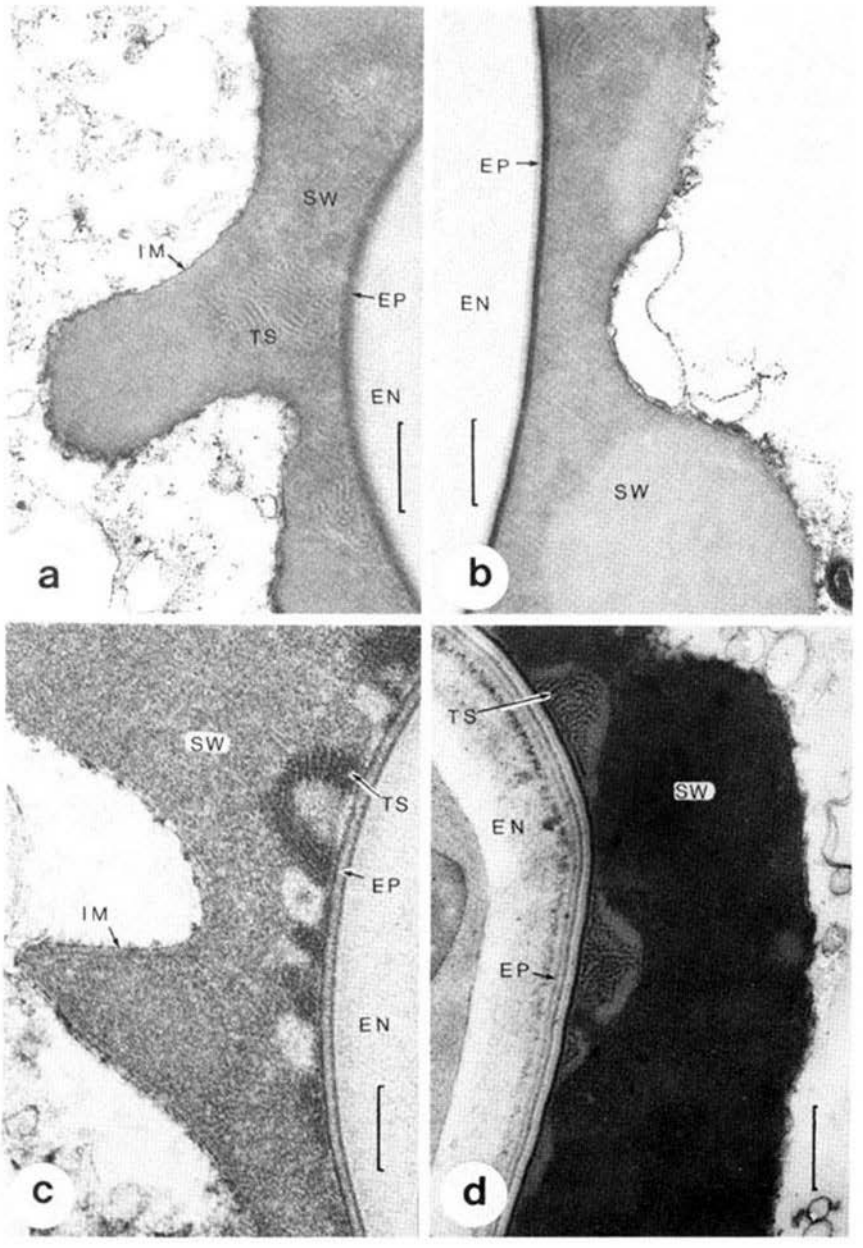

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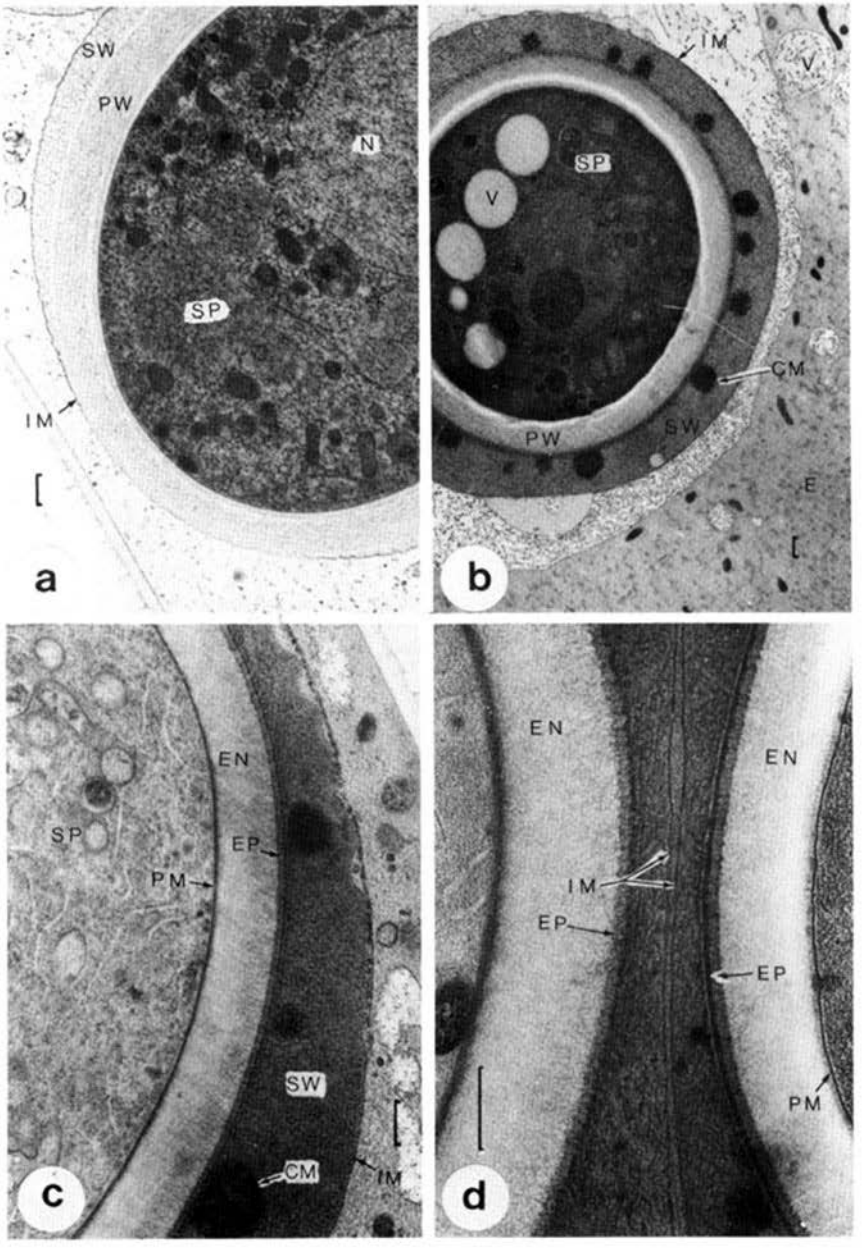

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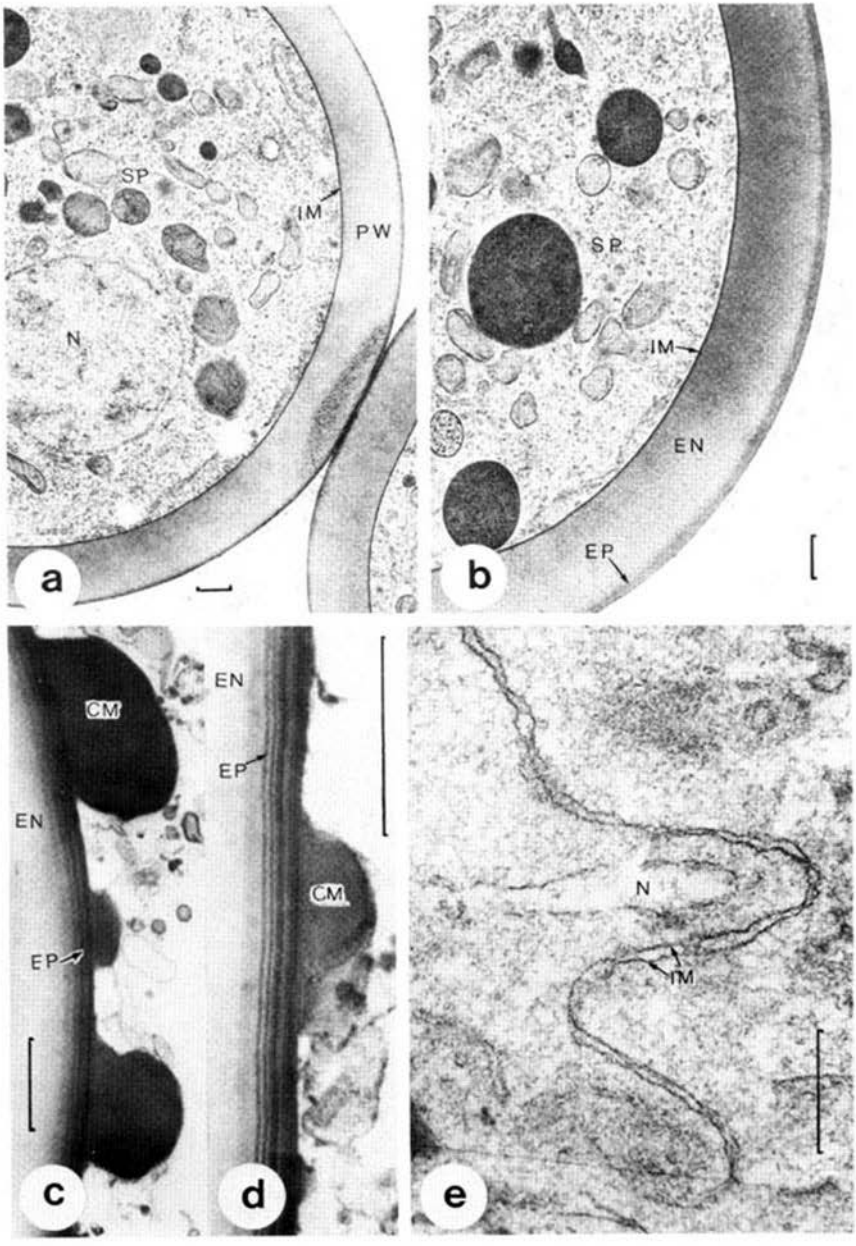

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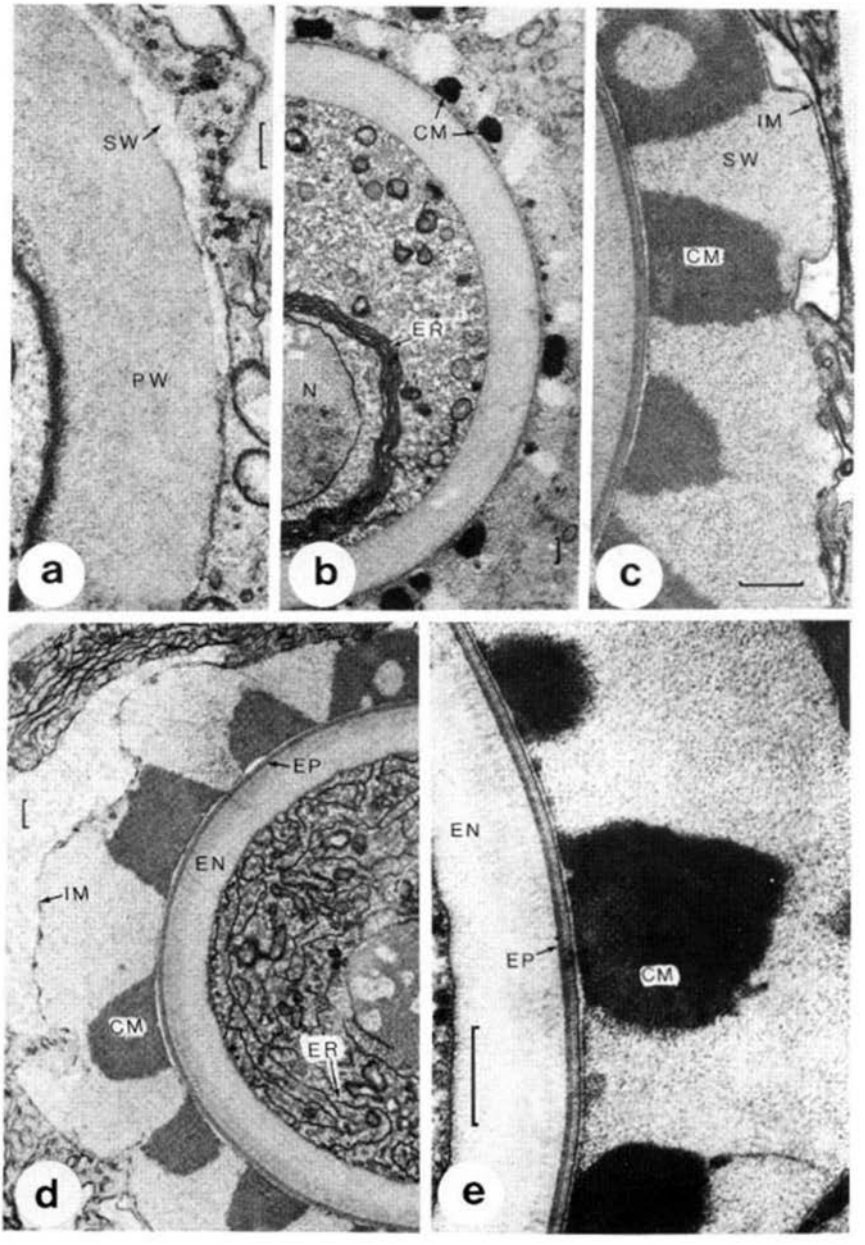

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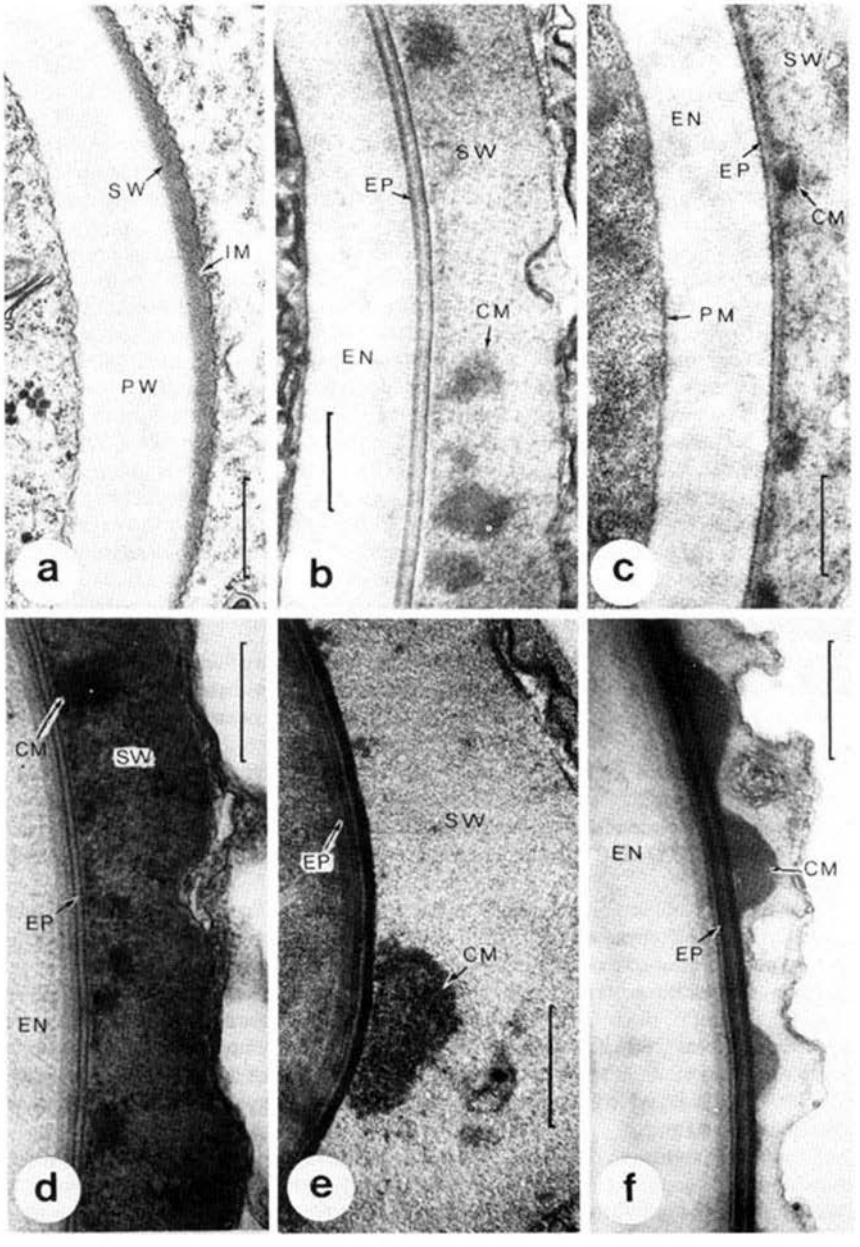

Fig. 10 (legend on page 131)

OBSERVATIONS

The ascus top

For a comparison of ascus apices among representatives of the Pezizales to be of value it is important to note the development and possible changes in the structure of the ascus wall and the apical ascoplasm. The regions of main importance in the wall of the ascus top are the operculum, the zone of dehiscence, and the subapical region.

Scutellinia pseudotrechispora — Figs. 1, 2

Mature asci are cylindrical with a rounded tip, 200–260 × 15–20 µm.

In the young ascus, before and during early ascospore formation, the ascan wall appears to be still undifferentiated, thicker throughout the lateral face, 540–630 nm, and thinner at the tip, 300–380 nm (Figs. 1a–d). From the beginning the outer surface of the whole ascus is covered with a rather electron dense extra-ascan layer or periascus, which increases in thickness from 80–110 nm at the lateral face to 180–250 nm at the top.

At the inner side of the lateral wall, about 5 µm under the tip, a ring-shaped band 800–1000 nm broad and 100–120 nm thick is formed (Figs. 1a–d). The initiation of this ring is often signalled by the presence of an adjacent band of lomasome-like structures in the ascoplasm (Figs. 1b, d). During further ripening at the inner face of the ascus wall an inner layer is produced. This layer can be distinguished in the opercular region and near the subapical ring (Fig. 1e) in $KMnO_4$-OsO_4-fixed material.

With the Thiéry technique a thin reactive stratum 15–20 nm thick just at the outside of the inner layer can be demonstrated in the top of almost mature asci (Fig. 2d). This outer stratum of the inner layer is more reactive in the region of the operculum and near the subapical ring.

In the mature ascus the inner layer increases in thickness from 30–45 nm in the lateral wall and 45–60 nm at the level of the subapical ring to 120–150 nm in the opercular region. Over the same distance the outer wall layer decreases from 500–540 nm in the lateral wall and 200–260 nm near the subapical ring to 180–210 nm in the opercular region.

The apical ascoplasm or 'acroplasm' is rich in endoplasmatic reticulum, the elements of which rearrange to form a more or less central bundle (Figs. 1c, 2c). This tract or funiculus can be followed from the inner face of the future operculum, where it is forming an apical funnel, down to the lateral side of the uppermost ascospore (Figs. 2a–d). The tubular elements of the funnel are usually found closely attached to the future operculum by a plate or sheet, 80–120 nm thick, of two or three layers of closely adpressed and interwoven tubules. These tubules reach a diameter of about 30 nm at the outside and 15 nm at the inside, which closely corresponds with the other elements of endoplasmatic reticulum in the ascus.

Even at full maturity no structural evidence for the rupturing of the operculum can be found in the ascus wall. No indentation or other preformed superficial structures demarcate the place of the future operculum (Fig. 2a). The place of the formation of a zone of dehiscence is just indicated by a region of wrinkling of the inner wall layer and the margin of the attachment of the funnel (Fig. 2d).

The lines of fracturing in the inner and outer layers do not exactly correspond, while the fracture will occur within a relatively broad zone. This results in rough, more or less torn, margins of the operculum and the ascostome. The operculum reaches a diameter of about 8 µm.

Scutellinia umbrorum — Figs. 3, 4f

Mature asci are cylindrical with a rounded or slightly flattened tip, 220–300 × 14–20 µm.

In the young ascus the wall is still undifferentiated, slightly thicker at the sides than at the tip. When examining material fixed by ultra-rapid freezing, followed by freeze substitution and contrasted for polysaccharides with the Thiéry technique the wall layers can be distinguished (Figs. 3a, c, d). Rather early a reactive (electron dense) subapical ring is formed at the inner face of the lateral wall about 6 µm behind the tip. At first the subapical ring is about 600–700 nm broad, but it may reach 1600 nm with maturity of the ascus.

At the later stages no increased activity of the endoplasmatic reticulum at the level of this ring could be seen. An electron dense inner layer, 130–180 nm thick in the lateral wall, reaches a thickness of 300 nm in the opercular region. An electron transparent outer layer is rather constant with a thickness of 310–350 nm. The reactive periascus is present from the beginning with a thickness of 300–350 nm over the whole ascan surface. At the top of the ascus it is often difficult to distinguish the delimitation of the periascus from the outer ascan layer, because a thin, also reactive, outer stratum has been differentiated in the latter (Figs. 3a, c, d).

The apical ascoplasm in the ripening ascus is rich in endoplasmatic reticulum, small vacuoles, and mitochondria (Fig. 3c). Elements of the endoplasmatic reticulum unite to form a more or less central tract (Fig. 3b), which connects the lateral side of the uppermost ascospore with the opercular region (Fig. 3b). At the top, the tubules of the tract form an obconical figure or funnel, usually with a central apical globule inside (Fig. 4f). A sheet of two or more layers of interwoven tubules of endoplasmatic reticulum above the funnel covers the inner face of the future operculum. The dehiscence mechanism shows the same pattern as in *S. patagonica*.

Scutellinia patagonica — Figs. 4a–e

Mature asci are cylindrical to subcylindrical with a rounded tip, 240–300 × 22–25 µm.

The young ascus shows an undifferentiated wall and an electron dense strongly mucilaginous periascus of varying thickness, 150–500 nm.

In material fixed by ultra-rapid freezing followed by freeze substitution and contrasted with the Thiéry technique the wall layers can be clearly distinguished. At the inner face of the lateral wall about 6.5 µm behind the tip a ring-shaped reactive band about 600 nm broad is formed. During further development this subapical ring is found again somewhat deeper as a reactive band at the outer face of the outer stratum of the inner wall layer (Figs. 4c, e), and after ascus dehiscence at the lower end of a strongly swollen ring-shaped zone of the inner wall (Fig. 4a). A rather strongly reactive inner layer is shown only about 50–60 nm thick in the lateral wall and in the subapical ring, increasing in thickness to 150–200 nm in the opercular region.

The less reactive outer layer is most conspicuous with a thickness of 260–350 nm in the lateral wall, decreasing to 180–220 nm in the tip.

Under optimal conditions a contrasting sublayering of both the inner as well as the outer layer can be observed. In the opercular region within the inner layer an inner stratum of about 110 nm thick of strong reactivity can be followed in close contact with a slightly less reactive outer stratum of 120–150 nm thick (Fig. 4c). At the margin of the future operculum the outer stratum decreases rather abruptly in thickness, while its delimitation becomes less distinct in the zone of dehiscence and again more evident around the subapical ring. In the outer layer a thin moderately reactive outer stratum of 40–60 nm can be followed in places where it sufficiently contrasts from the almost equally reactive periascus (Figs. 4c–e).

At maturity the site of the margin of the future operculum is not marked by an indentation or a preformed weakness zone. Dehiscence takes place in a zone between the subapical electron transparent zone and the area of abrupt decrease in the thickness of the outer stratum of the inner layer in the top.

In the apical ascoplasm of the ripening and mature ascus a funnel and a tract can be found (Fig. 4c). After discharge of the ascospores, the operculum, with a diameter of 9–13 µm, remains attached to the ascostome by a narrow hinge.

In the emptied ascus layers may swell considerably by imbibition. Especially the inner ascan layer near the subapical ring swells disproportionally (Fig. 4a). Cleavage of the wall of the operculum and of the ascostome occurs along the face between inner and outer layers or the 'thimble-shaped lamina' (van Brummelen, 1978).

Scutellinia trechispora — Figs. 5a–c

Mature asci are cylindrical with a rounded tip, 240–300 × 20–24 µm.

The development of the ascus top is very much the same as decribed here for *S. pseudotrechispora*. A short, more functional description of it was given earlier (van Brummelen, 1978; as *S. armatospora*).

The different layers of the apical wall are easily visible in the mature ascus just before dehiscence (Fig. 5b) and after spore discharge (Fig. 5a, c), when examining $KMnO_4$-OsO_4-fixed material.

Scutellinia scutellata

Mature asci are cylindrical with a rounded tip, 220–300 × 18–22 µm.

The development of the ascus top of this species also closely agrees with that described here for *S. pseudotrechispora* (see below). It has also been the subject of a study by Samuelson (1978).

The ascospore wall

The ultrastructure of the early development of ascospores in these species of *Scutellinia* closely accords with the general process, in which after three nuclear divisions eight nuclei are formed. Each nucleus becomes enclosed in a double unit membrane (Fig. 8e). The primary wall is formed between these membranes; the inner one becomes the sporoplasmalemma and the outer one the investing membrane of the ascospore. The substance of the primary wall is electron transparent in permanganate and glutaraldehyde fixed material.

In the species studied the young undifferentiated primary wall may reach 700–1000 nm in thickness. In mature spores this will be reduced to 500–750 nm.

The development of the primary wall continues during further ripening. In the outer zone of the primary wall a series of up to five closely spaced electron dense bands becomes evident, and form the epispore with a thickness of 90–110 nm (Figs. 6c, d; 8c, d; 9e; 10d–f). It is this layer which develops, at full maturity of the spores, a resistence against the chemicals of fixation and embedding. The primary wall is usually rather uniform in appearance and forms the most constant part of the ascospore wall.

Between the outer surface of the primary wall and the spore delimiting membrane the secondary spore wall is formed as an extra layer. The substance of this layer is rather homogeneous at first and increases in electron density. The development of the secondary wall is of great importance for the formation of the ornamentation on the ascospores and differs slightly in each of the species under investigation.

Scutellinia pseudotrechispora — Figs. 5d–f, 6

In material fixed in glutaraldehyde-OsO_4 or in permanganate-OsO_4 the secondary wall shows a moderate electron density and further increases in density without forming centres of condensation (Figs. 5d, e). Secondary wall material is deposited in very large quantities. The investing membrane becomes locally strongly elevated up to 2 µm or more high (Figs. 5f; 6a–d). The internal differentiation of the secondary wall becomes rather complex with large subglobose areas of somewhat lower electron density at the periphery and caps on the epispore, showing a tubular or laminose substructure (Figs. 6a, c, d). The ornamentation of mature ascospores consists of a wide network of crests up to 3.5–6.0 µm high.

Scutellinia umbrorum — Fig. 7

The material fixed by rapid freezing and freeze substitution with OsO_4 and contrasted with uranyl acetate and lead citrate shows an electron transparent initial secondary wall (Fig. 7a) gradually increasing in density and then developing centres of condensed material on the surface of the epispore (Figs. 7b, c). Between two developing spores an area of mutual contact between their investing membranes can often be observed (Fig. 7d).

The condensed material increases to form a pattern of isolated rounded warts of unequal size 0.6–1.5 µm high. With maturity the rest of the secondary wall disappears.

Scutellinia patagonica — Figs. 8a–d

The freeze fixation gives the young spores a very natural look (Figs. 8a, b). The sporoplasm shows a globular nucleus, endoplasmatic reticulum, many vesicles with different contents, mitochondria, and a smooth plasmalemma.

The differentiation of the secondary wall is very similar to the process described for *S. umbrorum*. Here also a pattern of isolated rounded warts, 0.5–1.0 µm high, develops.

Scutellinia trechispora — Figs. 8e, 9

The permanganate-OsO_4-fixed material has been given extra contrast with barium permanganate. This shows the development of the secondary wall clearly. The initial secondary wall is rather electron transparent (Fig. 9a). In the somewhat homogeneous substance of the secondary wall electron dense condensed material forms centres on the

surface of the epispore (Fig. 9b). With increase in thickness of the secondary wall these centres grow to form homogeneous electron dense conical warts on the outer surface of the globular spores.

The development of some of these warts is restricted by the contact of the spore investing membrane, which prevents free growth at the tip (Figs. 9c–e). At maturity the ornamentation consists of isolated conical and truncate warts 1.0–2.2 μm high.

Scutellinia scutellata — Fig. 10

In material fixed in permanganate-OsO_4 and in glutaraldehyde-OsO_4 the electron transparent primary wall develops on its outside a more electron dense secondary wall. This is homogeneous at first (Fig. 10a), but soon increases in thickness and develops centres of condensed material in the vicinity of the epispore (Figs. 10b–d).

The appearance of the secondary wall becomes more granular. On the epispore warts are formed that may fuse laterally (Figs. 10e, f). With maturity the rest of the secondary wall material disappears. The mature spores are ornamented with a rather irregular pattern of short lines and isolated warts 0.3–0.7 μm high.

DISCUSSION

The species of *Scutellinia* studied show a very similar structure of the ascus top. The results obtained with different methods of fixation and contrasting have given additional information. The combination of rapid freeze fixation and contrasting for polysaccharides with the Thiéry technique proved to be especially valuable. The results when compared with other methods were not found to be contradictory.

The structure of the ascus top is summarized in a diagrammatic scheme (Fig. 11). The ascus top in *Scutellinia* is characterized by the almost complete absence of structural indications of the demarcation of the operculum.

In the operculum an outer stratum of the inner layer be recognized which decreases rather abruptly in thickness at the margin of the operculum region. Somewhat at the outside of this region the wall becomes electron transparent with all methods used. Only after use of the Thiéry technique the outer stratum of the inner layer can be vaguely followed. This stratum becomes again more evident in the subapical region. It corresponds exactly with the earlier described 'interrupted thimble-shaped lamina' (van Brummelen, 1978).

The development of the subapical ring begins in the young ascus. Electron dense material is deposited as a band on the inner face of the wall rather far behind the tip of the ascus. Later the material of the inner layer is deposited over the whole inner face of the ascus and the band of the subapical ring becomes located at the limit of the inner and the outer wall layers.

In the living ascus the subapical ring is scarcely visible as a thickening of the wall. But in non-living material, when the turgor of the ascus has strongly decreased or the wall has collapsed, there is a strong swelling at this place in the inner layer. This swelling corresponds with the structure described as 'bourrelet sousapical' by Chadefaud (1942).

Both after physical and chemical fixation in the apical ascoplasm a tract, an apical funnel, and an apical globule are found, more or less shaped as described by Chaudefaud. The attachment of the tubules of the funnel to the wall of the opercular region strongly

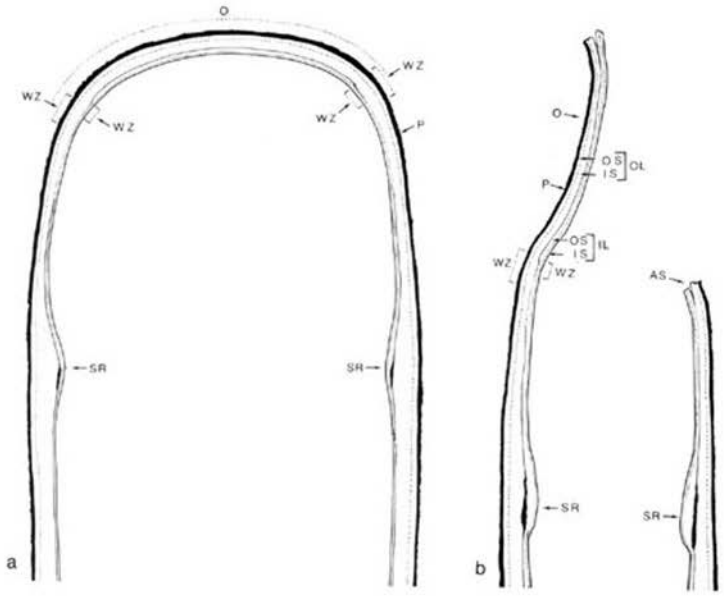

Fig. 11. Diagrammatic sections of ascus tops of *Scutellinia*, as seen with electron microscopy. a. Almost mature ascus. b. Ascus after spore discharge.

suggests a function in the opening mechanism of the ascus top. Samuelson (1978) was not able to find these plasmatic structures in the species of his '*Otidea-Aleuria* complex'.

The type of ascus top found in *Scutellinia* is closely related to that in genera such as *Anthracobia, Aleuria, Coprobia, Cheilymenia, Pyronema,* and *Octospora* and is considered to be characteristic of the family Pyronemataceae.

The development of the primary spore wall and its differentiation into an epispore and an endospore fully agrees with the general process in the Pezizales. But differences are found in the process of secondary wall formation.

In *Scutellinia umbrorum, S. patagonica, S. trechispora,* and *S. scutellata* a homogeneous, moderately electron transparent wall is formed. Within the substance of this wall local areas of condensed material are formed which concentrate on the epispore and develop into the elements of the spore ornamentation. In all stages of development the structure of these elements is homogeneous and electron dense. This is in contrast with the development in *S. pseudotrechispora*, where the secondary spore wall is only homogeneous at the beginning. But soon a rather complex structure develops with large subglobose areas of lower electron density and caps on the epispore with a tubular or laminose substructure.

This type of secondary wall development with a lasting complex structure is unusual among the Pyronemataceae (cf. Merkus, 1976).

The taxonomic position of *S. pseudotrechispora* within the genus *Scutellinia* is therefore probably more isolated than suggested in a classification mainly based on patterns of spore ornamentation and hair structures (cf. Schumacher, 1990).

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XYLARIA DIGITATA AND ITS ALLIES – DELIMITATION AND TYPIFICATION—II

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Xylaria bulbosa sensu Rogers is considered to be distinct from *X. bulbosa* s.str. *Xylaria guepini* is described and *X. corniformis*, *X. coronata*, and *X. torulosa* are discussed.

In the first part of this study (Læssøe, 1992) an introduction was given to the study of historical material of *Xylaria digitata* (L.: Fr.) Grev. and related taxa in order to stabilize the nomenclature for the taxa in question. The first part included the study of *Xylaria digitata* (L.: Fr.) Grev., *X. acuta* Peck, *X. cornu-damae* (Schw.) Fr., *X. friesii* Læssøe, and *X. bulbosa* (Pers.: Fr.) Berk. & Br. In addition to the taxa treated there, *X. bulbosa* sensu Rogers, *X. corniformis* (Fr.: Fr.) Fr., *X. guepini* (Fr.: Fr.) Fr., *X. coronata* Westendorp, and *X. tortuosa* Sow. ex Cooke are considered in this part.

Xylaria bulbosa sensu Rogers (1983) — Figs. 20, 21, 23

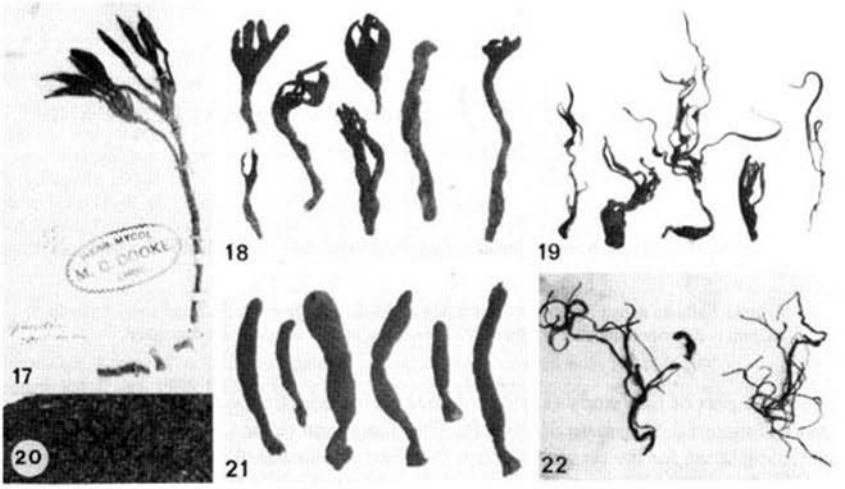
? *Xylaria badia* Pat., J. Bot., Paris (ed. Morot) 5 (19) (1891) 319. — Type specimen: Tonkin, Ke' So', Ha Noi, in vetustos palis, 14.VI.1890, *Bon 4417* (isotype K).

Illustrations. Rogers (1983: 459, figs. 10–14; 462, figs. 21–23).

Description. Rogers (1983: 458).

Specimens examined (selected). U.S.A.: Wisconsin, Sauk Co., Parfrey's Glen, on wood, 4.IX.1953, *C.T. Rogerson R3643* as *X. castorea* (NY); Ohio, *A.P. Morgan 76*, *X. acuta*/*X. bulbosa* det. J.D. Rogers (NYS); New York, Franklin Co., Floodwood, on maple, VIII, *Peck s.n.*, as *X. acuta*/*X. bulbosa* det. J.D. Rogers (NYS).

Rogers (1983) partly followed Miller (1942), when he assumed that *X. bulbosa* was a close relative of *X. digitata* and *X. hypoxylon*. Miller's concept of *X. bulbosa* was fairly confused, but he undoubtedly included *X. corniformis* within it. American specimens named by Miller are typically *X. bulbosa* sensu Rogers and in one case *X. longipes*. Although Rogers (1983) cited the habitat as including not only coniferous litter but also deciduous wood, he did not cite any material on the former substrate nor, indeed, any European specimens. The prime feature of *X. bulbosa* sensu Rogers is the dark yellow outer entostroma, which is not found in *X. bulbosa* in its original sense. Furthermore the original *X. bulbosa* is characterized by a thin, smooth, relatively light brown crust with evident perithecial outlines whilst *X. bulbosa* sensu Rogers is similar to species in the *Xylaria polymorpha* group with a fairly squamulose surface (ectostroma) and non-evident perithecial outlines. The spores in *X. bulbosa* sensu Rogers are dark brown while they are pale golden brown in the original species. *Xylaria bulbosa* sensu Rogers is closely related to the *X. corniformis* group and cannot be named with certainty before this group has been monographed. A likely name for this taxon is *X. badia* Pat., which was



Figs. 17–22. *Xylaria* species — 17–19. *X. guepini*; 17. holotype, *X. scotica* (K); 18. The Netherlands, Bilthoven, IX.1918, *Bouwman* (L); 19. *X. guepini* var. *eupiliaca*, holotype, herb. Cesatianum (RO). — 20 & 21. *X. bulbosa* sensu Rogers, Wisconsin, 4.IX.1953 (NY). — 22. *X. tortuosa*, holotype (K). — Fig. 17 × 0.5; Fig. 18 × 0.6; Fig. 19 × 0.3; Fig. 20 × 6; Fig. 21 × 0.8; Fig. 22 × 0.3. — The numbering of the figures is a continuation of that in the first part (Læssøe, 1992).

characterized by Patouillard (l.c.) as having a "médulle fauve et non blanche". I have examined a very small fragment of the type in the Kew herbarium and found the spores to be (9.9–)10.4–12.8 × (3.8–)4.1–5.1(–5.8) µm (av. 11.2 × 4.6 µm). This is a fraction larger than reported for *X. bulbosa* sensu Rogers. Bertault (1984) accepted all literature references of *X. bulbosa* and could thus 'confirm' that the species grew on substrates other than coniferous needles. He reported a specimen on *Acacia* from Morocco, which should be reinvestigated. *Xylaria digitata* var. *americana* Peck could possibly be conspecific with *X. bulbosa* sensu Rogers, but the material studied by Rogers (1984) was not the holotype cited by Barr et al. (1986). *Xylaria luteostromata* Lloyd is another competing name for this taxon.

Xylaria corniformis (Fr.: Fr.) Fr.

Sphaeria corniformis Fr.: Fr., Elenchus fung. 2 (1828) 57. — *Xylaria corniformis* (Fr.: Fr.) Fr., Summa veg. scand. (1849) 381.

Misapplied. Xylaria bulbosa sensu Miller p.p. (1942).

Illustration and description. Læssøe (1987: 82–84).

Xylaria corniformis was recently (Læssøe, 1987) redescribed from type fragments in the herbaria K and B and from fresh material collected in eastern Poland. Another presumed syntype has since been located in herb. E, communicated by Fries to Greville. This

part is in excellent condition and consists of five undamaged stromata. The taxonomy of the complex around *X. corniformis* is still in disorder and awaits a world monograph and more study of cultures.

A Swiss specimen under *X. digitata* in herb. Fries (UPS, F-02383, 35684) ex Schleicher is *X. corniformis*. It has sterile apices, which explains the misidentification. Three other collections filed as *X. digitata* from around the world (in K) belong in *X. corniformis* s.l. in addition to the collection cited below, named by Miller (1942) as *X. bulbosa*.

Specimen examined. SOUTH AFRICA: Transvaal, Pillansberg near Rustenberg, 1.X.1928, *V.A. Wager* (PREM) = *X. corniformis* s.str.(?).

Xylaria guepini (Fr.: Fr.) Fr. — Figs. 17–19, 24

Sphaeria guepini Fr.: Fr., Elenchus fung. 2 (1828) 59. — *Xylaria guepini* (Fr.: Fr.) Fr., Nov. Acta Soc. Sci. Upsal. III, 1 (1851) 128. — Type specimen: France, *Guépin*, herb. E. Fries [holotype, UPS; isotype(?) E].

Xylaria eupiliaca Ces., Bot. Ztg 13 (5) (1855) 78. — *Xylaria guepini* var. *eupiliaca* (Ces.) Ces., Comm. Soc. critt. ital. 1 (1861) 71. — Type specimen: Italy, *Hypocrea eupiliaca* Mihi in litt., ex fimi ..., 12.XI.1846, herb. Cesatianum and one marked F. Cavara in gen. herb. (holotype & isotype RO; isotypes K, PC).

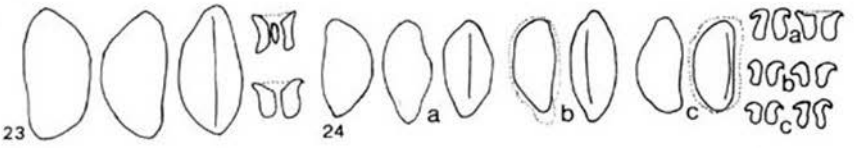
Xylaria scotica Cooke, Grevillea 4 (1876) 112. — Type specimen: Scotland, Perth, Meikloner, IX. 1875, *Mr. Matheson* [holotype (7 parts from same source) K; isotype RO in herb. Cesatianum].

Selected illustrations. Bull. trimest. Soc. mycol. Fr. 100 (1984) LXIV, fig. 6. — Cesati, l.c. (1861) tab. V.

Distribution. Italy, France, The Netherlands, and Scotland.

Stromata rooting in manured soil (always?), very pale yellowish brown to medium brown with fertile parts blackening with age, basal parts palest, very slender, branching up to 3 times, total length up to 10 cm, sterile and fertile parts smooth with more or less substrate sticking to underground parts, fertile parts oblong to cylindrical or bilobed, 5–16 × 1.5–5(–8) mm, with acute sterile apices, perithecial outlines indistinct, ostioles prominent, conical; entostroma white to pale brown, massive and very tough, the outer crust hardly carbonized and very thin; perithecia crowded, elongated c. 0.5 mm long and 0.1 mm broad.

Asci 8-spored (few observed, measurements not obtained), fertile part cylindrical; apical apparatus 1.1–1.3 × 1.3–2.3 µm, staining dark blue in Melzer's Reagent, with strongly flared apical rim; spores light golden brown, inequilaterally ellipsoid to citriform or constricted at one end, often with secondary appendages at both ends and hyaline epi-



Figs. 23 & 24. Ascospores and apical apparati stained in Melzer's Reagent. – 23. *Xylaria bulbosa* sensu Rogers, Wisconsin (NY). – 24. *X. guepini*; a. isotype (E); b. holotype *X. guepini* var. *eupiliaca*, herb. Cesatianum (RO); c. holotype, *X. scotica* (K). — Spores × 1800. Apical apparati × 3000.

spore, (5.7–)6.6–8.3(–9.2) × (2.9–)3.3–4(–5) µm [av. range 6.5–7.9 × 3.3–3.7 µm (–4.1 µm in collapsed spores)]; germ slit often difficult to observe, ventral, variable, mostly 2/3–4/5 of total spore length.

Specimens examined. ITALY: Italia bor., ad terram, XI.1846, *Cesati*, ex herb. Sydow (S, immature, possibly part of var. *eupiliaca* type). — FRANCE: Dép. Maine-et-Loire, Angers ("pauvre echantillon, mais le seul qui me reste disponible" in Guépin's handwriting), *Guépin* (PC, possibly isotype of *S. guepini*). — THE NETHERLANDS: prov. Utrecht, Bilthoven, (from potato plot in garden, manured, a former *Pinus* forest. The dung was obtained from animals fed on American fodder), IX.1918, *B.E. Bouwman* s.n. (L 962.286-999); prov. Gelderland, munic. Voorst, Wijkse Weg, Terwolde, on forest litter in hollow in mixed forest plantation (strongly rooting), 23.X.1976, *G. & H. Piepenbroeck 1011* and *1015* (L, both immature but macroscopically very close to *X. guepini*).

It remains uncertain whether *X. guepini* is a truly coprophilous species. A collection in S (ex herb. Rehm, sine loc., IX. 1904, 120, stipite radicoso albo! In stercore) has characters close to *X. friesii* (spores 9.8–11.5 × 3.4–4 µm, av. 10.5 × 3.6 µm; germ slit 1/2–2/3), but is labelled as *X. guepini* and is stated to be coprophilous. The perithecia are smaller than in *X. friesii* but clearly much larger than in *X. guepini* and the ostioles are slightly annulate-papillate. It is possibly a depauperate form of *X. friesii*. The ecology of the type collection was described as follows: "Je l'ai trouvé dans un carré d'artichauts, sur lequel on avait étendu de la fiente de porc." (Guépin in letter to Fries). An immature Dutch collection was described as having a *Phallus impudicus*-like smell when crushed. This collection was also described as having pink tinges. A collection from Brazil [São Leopoldo, in stercore, 1929, *Rick* (FH)] labelled *X. guepini* is immature but looks very much like true *X. guepini*. Material from Borneo (& Sri Lanka?) in RO labelled *X. guepini* is *Xylaria melanaxis* Ces. and *X.* aff. *feejeensis*. Petch (1939) and Cannon et al. (1985) gave *X. scotica* as a synonym of *X. digitata*. Petch even ridiculed Cooke by saying he mistook the cells at the base of the perithecium for spores. Petch stated the specimens to be 'quite immature'. They are, in fact, in very good condition and in every respect match the type of *X. guepini* including the abundant ascospores. *Xylaria scotica* was described as having a rooting stem and to grow on the ground without mention of added manure. Lloyd (1919) stated that records cited by Saccardo (1882) from Ceylon (Sri Lanka) and Borneo were based on misidentified specimens. He also excluded the Italian collections from true *X. guepini* in contrast to the present account. *Xylaria guepini* has a superficial similarity to the *X. nigripes*-group, but species belonging there normally have very dark spores, a tendency to dark entostroma and at least some are associated with termite nests. The very thin crust and conical ostioles also suggest species of *Cordyceps*. *Xylaria divisa* Lloyd was compared by Lloyd (1921) with Cesati's variety *eupiliaca* of *X. guepini* (as *Guepinia*) which Lloyd thought had nothing to do with true *X. guepini*. Judged from his photograph this species cannot be related to *X. guepini*.

Xylaria coronata Westendorp

Xylaria coronata Westendorp, Bull. Soc. r. Bot. Belg. 2, 3 (1863) (5). — Type specimen: not seen.

Westendorp (1863) gave *Sphaeria guepini?* in brackets after his new name, but Kickx (1867) noted that the lignicolous habitat and more robust appearance made this assumption unlikely. Also, the spores were given as 15 µm long, considerably longer than in *X. guepini*. I reserve my opinion until I have seen the Westendorp material.

Xylaria tortuosa Sow. ex Cooke — Fig. 22

Xylaria tortuosa Sowerby ex Cooke., Grevillea 8 (1879) 10. — Type specimen: England, *Sphaeria tortuosa*, found at Mead Place ("I have given Mr. Dickson the first publishing of it. I don't know what Mr. D. will call it."), *Xylaria tortuosa* Sow. mss, ex Herb. Dawson Turner (and a fragment ex herb. Cooke) (holotype, K).

Stromata in very poor condition, branching dichotomously with only a small apical, cylindrical, fertile piece, with the surface eroded, making an accurate description impossible; the sterile parts are almost filiform, smooth and twisted.

Asci and apical apparatus not present; spores 18.4–21.8(–23.0) × (4.9–)5.2–5.7 µm (av. 19.3 × 5.3 µm), (reddish) brown, relatively pale, inequilaterally fusiform with ventral side more or less concave; germ slit straight to slightly oblique, c. 1/4–1/3 of total length, ventral.

Petch (1939) wrote that the specimens were growing in a greenhouse. There is no such indication in the Cooke description, nor on the label, nor, indeed, of Cooke's claim that it grew on the ground. Petch regarded it as an abnormality of *X. digitata* following Lloyd (1924) who referred to it as an anomaly which should be ignored. Although the spores are close to those of *X. digitata* the habit is so different that I cannot accept this synonomy. However, I doubt that we will ever know how to apply this name.

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TYPE STUDIES IN CREPIDOTUS – II

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Types of Pilát's *Crepidotus* species available in PRM and K and other types of *Crepidotus* species from different authors, available in E, F, H, and NYS, have been studied. For each taxon concerned microscopical characters and SEM pictures of the spores are given, followed by a concise discussion of its status.

A critical study of the species in many genera requires a careful re-examination of the type material. This holds true for *Crepidotus* all the more, because since the last monographic study of European species of *Crepidotus* (Pilát, 1948) eight new species have been described by seven different authors.

The spore ornamentation proved to be one of the most distinctive morphological characters within this genus. But as details of these ornamentations all lie at the limit of light optical recognition, the scanning electron microscope is a powerful tool to solve such problems. This paper reconsiders species described by Pilát, which have hardly ever been found again after their original description, two species originally described by Peck (1878) and by Singer (1960) from North America, and two British species described by Orton (1960, 1984).

For methods and presentation see Senn-Irlet (1992) (scale bars in Figures = 10 µm).

SPECIES DESCRIBED BY PILAT

Crepidotus serbicus Pilát — Pl. 1A

Crepidotus serbicus Pilát, Bull. trimest. Soc. mycol. Fr. 53 (1937) 82. — Type: Jugoslavia, Serbia, Kapaonik Mountains, May 1936, *Černjanski* (det. A. Pilát; PRM 485751).

Cap 4 cm long, fan-shaped, brown, dull, pale ochre and strigose near point of attachment. Lamellae narrow, crowded, brown partly carbonized. Stipe absent.

Spores abundant, 5 × 5 µm, globose, with a short, obtuse apiculus, minutely punctate, warty, thick-walled, brown. Basidia slender, not yet fully developed. Hymenophoral trama regular, consisting of hyphae 4–6 µm wide, hyaline. Subhymenium consisting of short-celled, branched hyphae. Cystidia not found. Clamps present.

The absence of fully developed basidia and the fact that there are spores in large quantities suggest that these spores (see Pl. 1A) belong to another fungus. They would perfectly fit in with many gasteromycetes, and indeed some fragments of a capillitium could also be found. Therefore *Crepidotus serbicus* is best regarded as a nomen dubium. The specimen could not be identified. Pilát (1948) recorded only one collection, and since then no other record of this species has been published nor could specimens of it be traced.

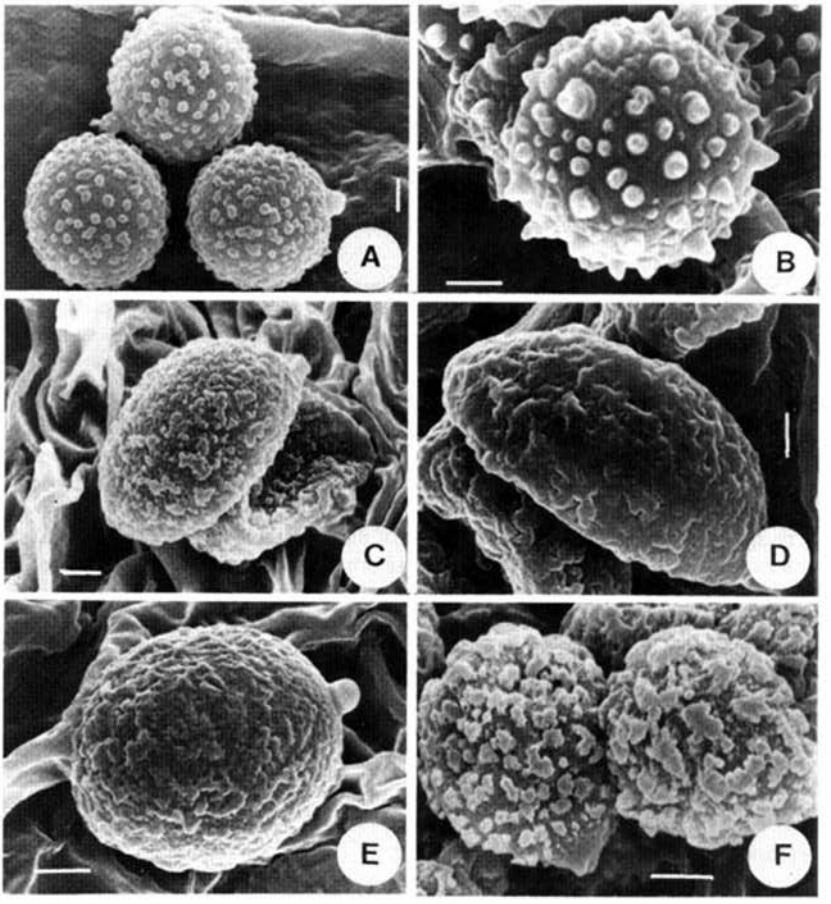

Plate 1. Scanning electron micrographs of spores from the type collections. — A. *Crepidotus serbicus*. — B. *Crepidotus subepibryus*. — C. *Crepidotus subverrucisporus*. — D. *Crepidotus velenovskyi*. — E. *Crepidotus versutus* var. *subglobisporus*. — F. *Crepidotus harperi*. — The scale markers in A–F represent 1 μm.

Crepidotus subepibryus Pilát — Pl. 1B; Fig. 1

Crepidotus subepibryus Pilát, Studia bot. čech. 10 (1949) 153. — Type: Czechoslovakia, Moravia, Žarošice, in *Picea* forest among mosses on naked soil, 10 Sept. 1943, *V. Vacek* (det. A. Pilát; PRM 149050).

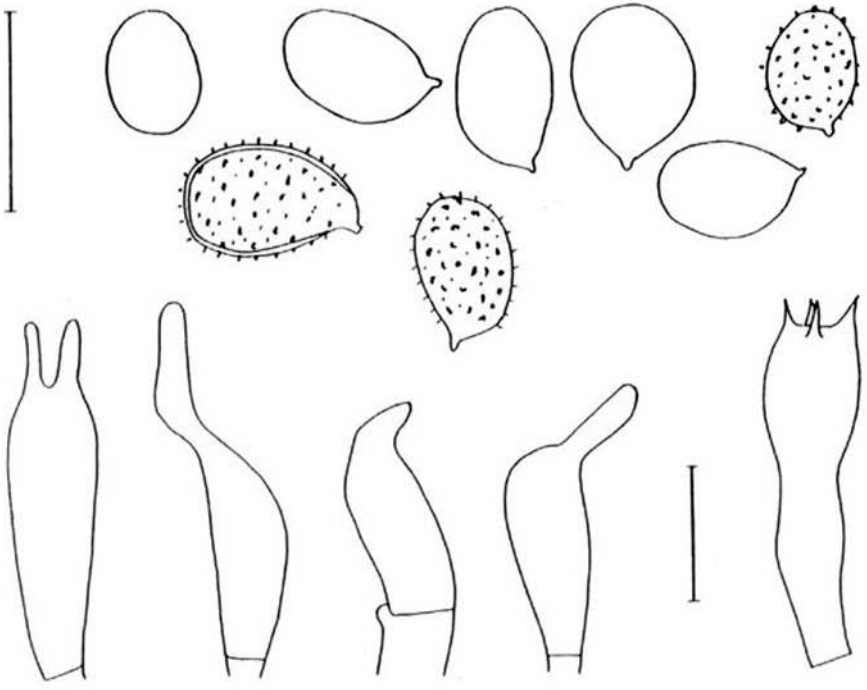

Fig. 1. *Crepidotus subepibryus*. — Basidioles, basidium, and spores.

The following description is based on unpublished notes of L.R. Hesler and own observations.

Spores 6.0–8.5 × 4.5–6.0 µm (Hesler: 5.5–7.5 × 4.3–5.7 µm), Q = 1.2–1.6, av. Q = 1.40, ellipsoid, only slightly or not inequilateral in profile, conspicuously punctate; ornamentation seen as small warts or spines in the optical section, mixed with some abnormally large ones, revealed by SEM as echinulate with isolated, conical spines (Pl. 1B); thick-walled spores, 12–14 × 6–6.5 µm; walls moderately strongly coloured. Basidia 20–28 × 5–8 µm, 4-spored, mixed with numerous 2-, and single-spored ones, with clamp-connections. Cheilocystidia scarce, 23–45 × 5–8 µm, mostly cylindrical, sometimes more or less ventricose and capitate. Pleurocystidia absent. Hymenophoral trama made up of subparallel to interwoven, 2.5–5 µm wide hyphae. Pileipellis a transition between a cutis and a trichoderm with tufts of more or less erect, undifferentiated, mostly straight, 2.5–5 µm wide hyphae; terminal cells at cap margin somewhat flexuose, never coiled. Clamp-connections present in all tissues.

The numerous 2-spored and even single-spored basidia indicate an abnormal development of this material and therefore it is very difficult to interpret this small collection,

consisting of only one and a half tiny, flattened fruit-body. Pilát (1948) mentions the apparently close relationship of this species with *Crepidotus epibryus* sensu Pilát. The ultrastructure of the spore ornamentation, however, indicate a close relationship with *C. cesatii*. Therefore *C. subepibryus* must be interpreted as an abnormality of *C. cesatii*, probably close to *C. cesatii* var. *subsphaerosporus*. No other records of this fungus are known.

Crepidotus subverrucisporus Pilát — Pl. 1C; Fig. 2

Crepidotus subverrucisporus Pilát, Studia bot. čech. 10 (1949) 151. — Type: Czechoslovakia, Bohemia, Chrustenica (near Prague), on twig of *Robinia pseudacacia*, 20 Aug. 1949, *V. Vacek* (det. A. Pilát; PRM 149034).

Spores 7–9 × 4.5–6 µm, Q = 1.4–1.7, av. Q = 1.54, ellipsoid or ovoid in frontal view, slightly amygdaliform in side view, conspicuously punctate-rugulose; walls mod-

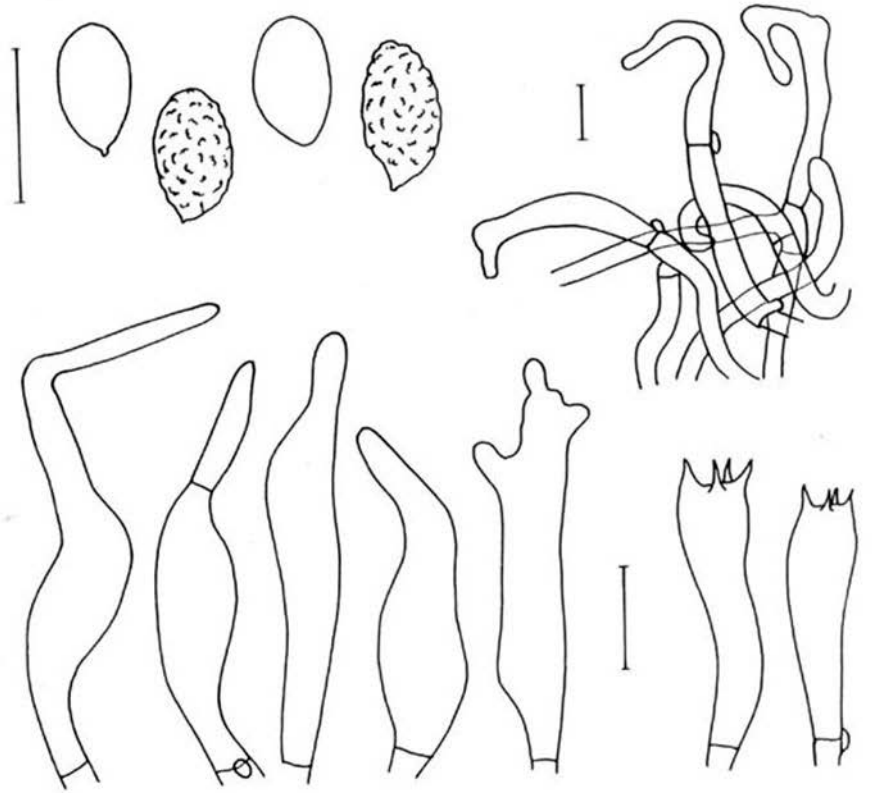

Fig. 2. *Crepidotus subverrucisporus*. — Cheilocystidia, basidia, spores, and pileipellis.

erately coloured. Basidia 22–27 × (5–)6–8 µm, 4-spored. Cheilocystidia 39–60(–73) × 5–8 µm, cylindrical to narrowly lageniform, often septate, sometimes branched, hyaline. Hymenophoral trama made up of subparallel, interwoven, 3–6 µm wide hyphae. Pileipellis a transition between a cutis and a trichoderm of cylindrical, 4–6 µm wide hyphae, bearing a turf of erect, flexuose, cylindric or rostrate, terminal cells. Clamp-connections present in all tissues.

In contrast with Pilát (1948), who believed in a close relationship of *C. subverrucisporus* with *C. lundellii*, re-examination of the type shows a great similarity of *C. subverrucisporus* with *C. epibryus* sensu Pilát. The spore ornamentation as seen in the SEM (Pl. 1C) belongs to the rugulose-vermiculose type, but is distinctly more pronounced than in *C. lundellii*. The shape of the cheilocystidia, too, resembles those of *C. epibryus* sensu Pilát much more than those of *C. lundellii*, as no clavate or capitate form could be found. The rostrate terminal cells of the pileipellis are a further indication of a close relationship with *C. epibryus* sensu Pilát. Nevertheless, there are some points of difference with *C. epibryus*: the spores are more faintly coloured and the cheilocystidia are septate at times, but more often branched. Perhaps *C. subverrucisporus* s. str. represents an ecotype on *Robinia* (see also notes on *C. bickhamensis*).

Crepidotus velenovskyi Pilát — Pl. 1D

Crepidotus velenovskyi Pilát, Studia bot. čech. 10 (1949) 152. — Type: Czechoslovakia, Bohemia, Solopisky near Prague, on *Juniperus communis*, 29 Oct. 1925, leg. & det. *J. Velenovský* (PRM 14309; as *Crepidotus juniperi* Velen., but not the type of *C. juniperi*!).

Scarcely any material is left of the type specimen, which consists of very small fruit-bodies with caps only 1–2 mm wide.

Spores 7.5–9 × 4.5–6 µm, Q = 1.4–1.7, av. Q = 1.54, ellipsoid to ovoid in frontal view, faintly punctate, with moderately to faintly coloured walls. Basidia no more left, except for two isolated elements which may represent 2-spored crassobasidia. Hymenophoral trama made up of subparallel to interwoven, 4–6 µm wide hyphae. Cheilocystidia destroyed in most parts, 30–40 × 7–10 µm, narrowly lageniform, cylindrical.

On account of the spore ornamentation, Pilát (1948) put this species in the group around *Crepidotus epibryus* sensu Pilát. I agree with this interpretation; but in my opinion the collection falls fully within the range of *C. epibryus* sensu Pilát and *C. subverrucisporus* respectively, mainly due to its rugulose-vermiculose spore ornamentation (Pl. 1D) and the shape of the cheilocystidia, although the shape of the spores is generally not so typically amygdaliform. The minute size of the fruit-bodies can hardly be regarded as of high taxonomic value. After the original description no other record of *C. velenovskyi* seems to have been published.

Crepidotus versutus var. **subglobisporus** Pilát — Pl. 1E; Fig. 3

Crepidotus versutus var. *subglobisporus* Pilát, Sb. nár. Mus. Praze 2 B (3) (1949) 74. — *Crepidotus lundellii* var. *subglobisporus* (Pilát) Pilát, Atl. champ. Eur. 6 (1948) 50. — Type: USSR, Ucraina, Kobylecká Polana (Rossia subcarpaticae), Svidovec-Krajná Rika, 600–1000 m, in *Fagus* virgin forest, July–Aug. 1937, leg. & det. *A. Pilát* (PRM 23529), on twig of hardwood and litter of *Fagus*.

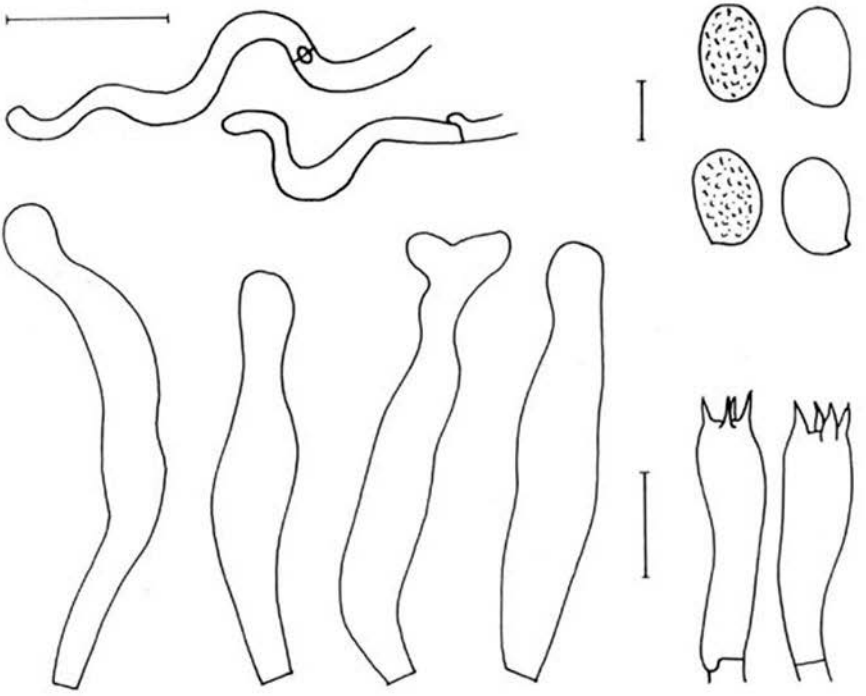

Fig. 3. *Crepidotus versutus* var. *subglobisporus*. — Cheilocystidia, basidia, spores, and terminal cells of the pileipellis.

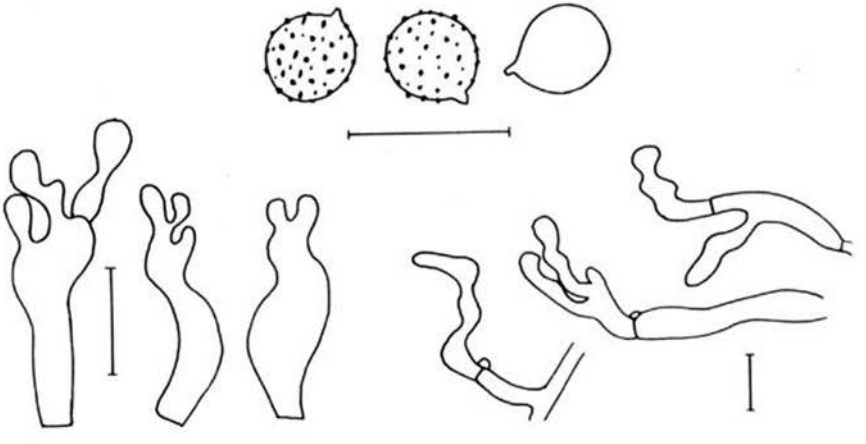

Fig. 4. *Crepidotus harperi*. — Cheilocystidia, spores, pileipellis.

Spores 5.5–7.5 × 4.5–6 µm, Q = 1.2–1.4, av. Q = 1.31, broadly ellipsoid to ellipsoid, with very faint punctate ornamentation; walls rather pale. Basidia 20-23 × 6-8 µm, 4-spored. Cheilocystidia cylindrical to narrowly utriform, sometimes flexuose, narrowly capitate, rarely branched and knobbed, hyaline. Hymenophoral trama subparallel to interwoven, of hyphae 4-10 µm wide. Pileipellis thin, a transition between a cutis and a trichoderm, of mostly repent to somewhat flexuose, cylindrical, 4–6 µm wide hyphae with yellowish segments, bearing scattered tufts of almost erect terminal cells, sometimes flexuose, slightly coiled and cylindrical or in the shape of the cheilocystidia. Clamp-connections abundant in all tissues.

The spore ornamentation as seen in the SEM (Pl. 1E), the shape of the cheilocystidia, and the structure of the pileipellis fit in perfectly well with *C. lundellii* Pilát. In agreement with Norstein (1990) I interpret *C. lundellii* (*C. inhonestus* sensu Norstein) as a species with great variation in the shape and the size of the spores and therefore *C. versutus* var. *subglobisporus* falls fully within its range of variability.

If based on the original description only, this species may be confused with *C. inhonestus* P. Karst., as was done by Norstein (1990) and Watling & Gregory (1989). A re-examination of the type material of *C. inhonestus* (in herb. P.A. Karsten, H), however, showed perfectly smooth spores with strongly coloured walls and an apical pore and finely incrusted hyphae in the pileipellis, which does not agree at all with *C. lundellii*.

In his earlier publications Pilát considered *Crepidotus versutus* (Peck) Sacc. to be identical with *C. lundellii*. Later he (Pilát, 1948) became convinced by Singer's publication (1947), that these species are not identical; *C. versutus* being a clamp-less species.

Crepidotus wakefieldiae Pilát

Crepidotus wakefieldiae Pilát, Studia bot. čech. 10 (1949) 152. — Type: Great Britain, Manchester, Donhead St. Mary, Oct. 1944, *Harthan* (K).

The type is no more in a good condition. Therefore I abstained from a further examination, as it has already been re-examined several times. Pearson (1952) gave a description, Orton (1960) described topotypical material, and Pegler & Young (1972) published SEM photographs of the spores of the type collection. This species is thus rather well known, and there is no doubt that Pilát (1929) has described this species earlier under the name *Crepidotus carpaticus* (see Senn-Irlet, 1992), which name has priority over *C. wakefieldiae*!

OTHER TYPE COLLECTIONS

Crepidotus harperi Singer — Pl. 1F; Fig. 4

Crepidotus harperi Singer, Mycologia 51 (1960, '1959') 586. — Type: U.S.A., Virginia, Bedford, May 1919, *Harper 1177* (F 1178).

The type collection is very large. Due to inappropriate drying, however, the trama and the hymenium are in poor condition. Moreover, crystals of a pesticide hamper proper examination. Only the spores are well preserved and abundantly present.

Spores 5–6 × 5–5.5 µm, Q = 1–1.1, globose, conspicuously punctate, warty in optical section, with pronounced apiculus; walls moderately coloured. Basidia 25–30 × 6–7

µm. Cheilocystidia 20–28 × 5–8 µm, clavate to narrowly utriform, with several short finger-shaped, coralloid protuberances. Hymenophoral trama made up of subparallel, 3.5–6 µm wide hyphae. Pileipellis a cutis with transitions to a trichoderm with tufts of erect terminal cells, at the cap margin as pileocystidia in the shape of the cheilocystdia, some segments yellowish. Clamp-connection present.

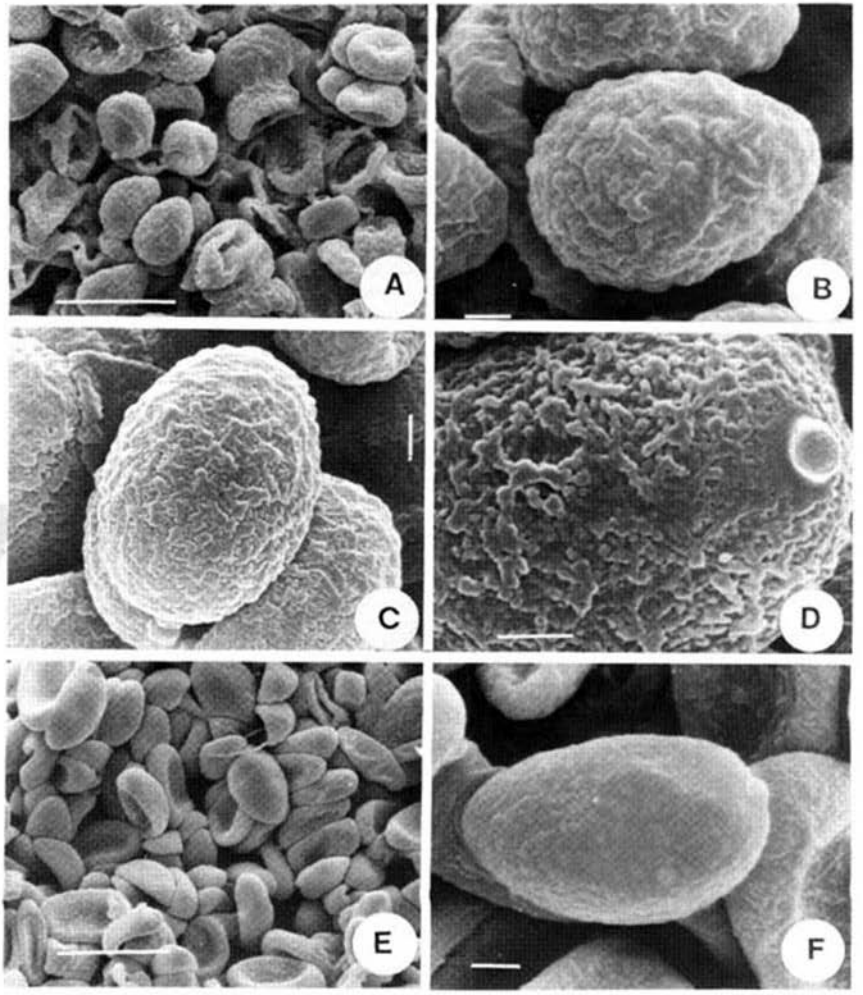

Plate 2. Scanning electron micrographs of spores from the type collections. — A, B. *Crepidotus bickhamensis*. — C, D. *Crepidotus subtilis*. — E, F. *Crepidotus versutus*. — The scale markers in A and E represent 10 µm, in B–D and F 1 µm.

Josserand (1965) already suggested that *Crepidotus harperi* would be identical with *C. wakefieldiae* Pilát. And indeed both species are found to be conspecific. The SEM (Pl. 1F) revealed the same type of spore ornamentation as shown by Pegler & Young (1972) for *C. wakefieldiae*, differing clearly from that of *C. applanatus*, although with the light microscope no differences could be seen in size, colour, and ornamentation of the spores.

Crepidotus bickhamensis P.D. Orton — Pl. 2A, B; Figs. 5, 6

Crepidotus bickhamensis P.D. Orton, Notes R. bot. Gdn Edinb. 41 (1984) 573. — Type: Great Britain, Somerset, Crawley, Bickham wood, on bark on *Salix*, 25 Sept. 1981, *Orton 5255* (E).

Spores 8.5–10.5 × 5.5–7.5 µm, Q = 1.3–1.6, av. Q = 1.49, ellipsoid, slightly amygdaliform in side view, sometimes with a suprahilar depression, conspicuously punctate-rugulose; walls strongly coloured. Basidia 22–30 × 7.5–10 µm, 4-spored, clamped. Cheilocystidia (23–)30–55 × 5–8(–10) × 3–6 µm, narrowly lageniform, cylindrical, sometimes slightly flexuose, very rarely septate, hyaline, thin-walled. Hymenophoral trama subregular, consisting of 3–7 µm wide hyphae. Pileipellis a trichoderm of erect, interwoven cylindrical hyphae with the terminal cell often differentiated as pileocystidia. Pileocystidia 30–40 × 4–6 µm, cylindrical, narrowly lageniform, flexuose or angled, rarely branched, sometimes rostrate at the tip. Clamp-connections present in all tissues.

Crepidotus bickhamensis is identical with *C. epibryus* sensu Pilát (1948). Orton established this new species in order to avoid further misleading interpretations of *Agaricus epibryus* Fr. (Fries, 1821: 275) as Pilát clearly did. However, Orton overlooked the similarity with *C. subverrucisporus* Pilát, a species which was placed by its author in the relationship of *C. lundellii* and *C. luteolus*. Pilát described a more fleshy cap, lamellae without reddish tints, and spores which are fainter ornamented than in *C. epibryus* sensu Pilát as distinguishing characters from *C. subverrucisporus*. A critical re-examination of *C. subverrucisporus* (see above), however, showed distinctly rugulose spores even with the light microscope. In the SEM exactly the same rugulose type of ornamentation is found (Pl. 1C) in *C. bickhamensis* (Pl. 2A, B).

The mean spore size of 43 European collections of this species is shown in Fig. 6. This figure illustrates the variability of spore size, with *C. bickhamensis* and *C. subverrucisporus* as two collections with opposing positions in the cluster. A similiar variability was found in the degree of the spore wall hue ranging from strongly to (more rarely) moderately coloured. Pilát (1948) indicated *Robinia* as the substrate for *C. subverrucisporus*, but he never attached much importance to that feature, and later he (Pilát, 1950) described collections from Poland on *Carpinus* with large spores (8–11 × 6–7.5 µm!).

From all these observations I conclude that *C. subverrucisporus* is an older synonym of *C. bickhamensis* and thus the correct name for *C. epibryus* sensu Pilát.

Crepidotus subtilis P.D. Orton — Pl. 2C, D; Fig. 7

Crepidotus subtilis P.D. Orton, Trans. Br. mycol. Soc. 43 (1960) 221. — Type: Great Britain, Devon, Roudon, Whitlands Landslip, on fallen twigs of *Sambucus* and *Hedera*, 2 Dec. 1958, *P.D. Orton* (K; paratype, E).

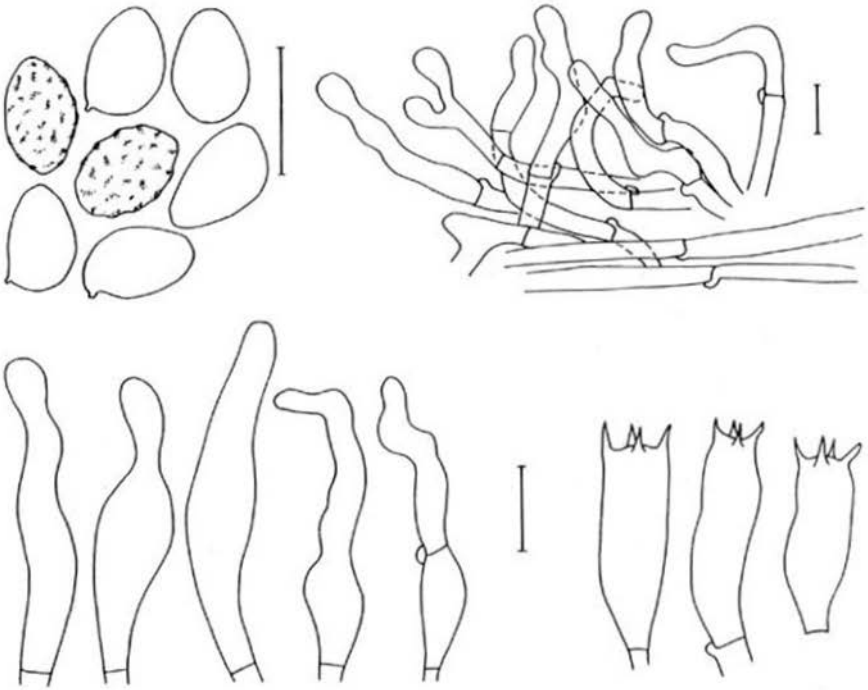

Fig. 5. *Crepidotus bickhamensis*. — Spores, pileipellis, cheilocystidia, and basidia.

Spores 7–9 × 4.5–6 µm, Q = 1.3–1.6, av. Q = 1.49, ellipsoid, slightly ovoid, faintly ornamented, with SEM minutely rugulose; walls pale brown in the light microscope. Basidia 28–36 × 7–9 µm, 4-spored, mixed with 2-spored, clamped. Cheilocystidia 28–68 × 5–8 µm, narrowly lageniform to narrowly utriform, sometimes slightly tibiiform (i.e. subcapitate or kneeled), hyaline, thin-walled, forming a sterile band at the lamellae edge. Pleurocystidia absent. Pileipellis a trichoderm, especially at the pileus margin with erect, 4–6 µm wide, cylindrical to narrowly lageniform, flexuose, sometimes angled terminal cells; in the centre of the pileus a transition between a trichoderm and a cutis; subterminal cells 6–8 µm wide. Clamp-connections present in all tissues.

Orton separated *C. subtilis* from the closely related *C. lundellii* because of its somewhat broader spores (4–5 µm versus mostly > 5 µm) and the spore ornamentation (smooth in *C. lundellii* versus very minutely punctate in *C. subtilis*). As is shown in a previous paper (Senn-Irlet, 1992), *C. lundellii* has spores which are undoubtedly ornamented, bearing the same rugulose-vermiculose type of ornamentation, as can be demonstrated in *C. subtilis* (Pl. 2C, D). The faint ornamentation is even visible with the light microscope. Equally the spore size does not differ significantly between the two type collections. As a conclusion, *C. subtilis* must be regarded as a synonym of *C. lundellii*.

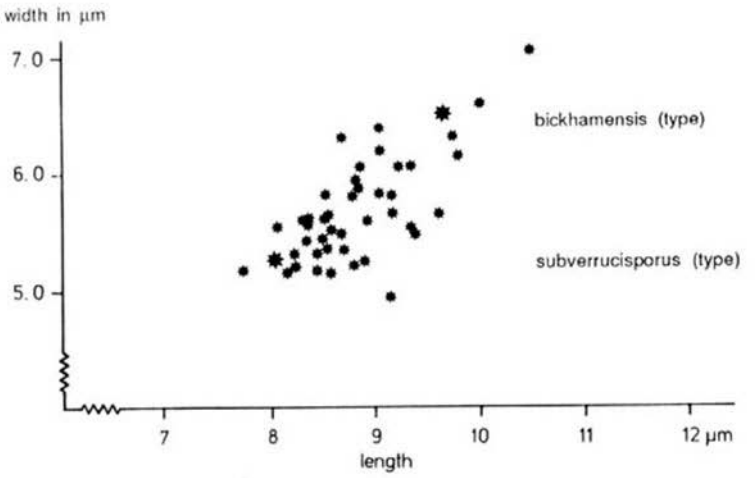

Fig. 6. Mean spore sizes of 43 European collections of *C. subverrucisporus*. The type collections are marked with larger symbols.

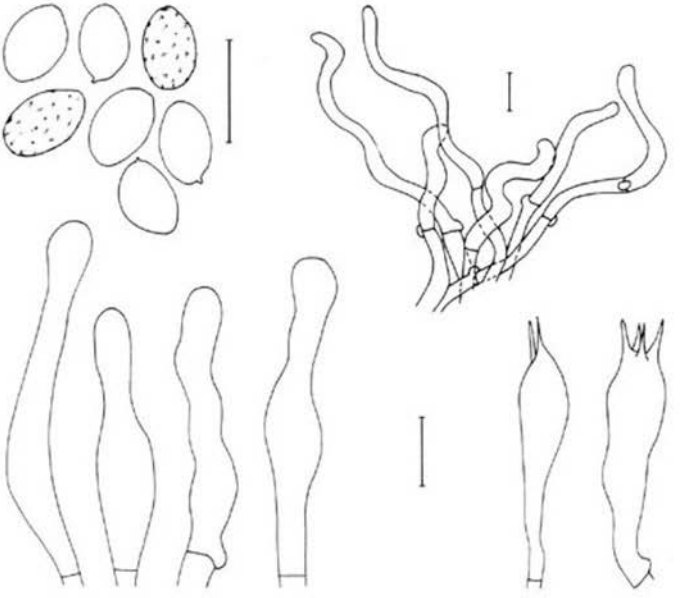

Fig. 7. *Crepidotus subtilis*. — Spores, pileipellis, cheilocystidia, and basidia.

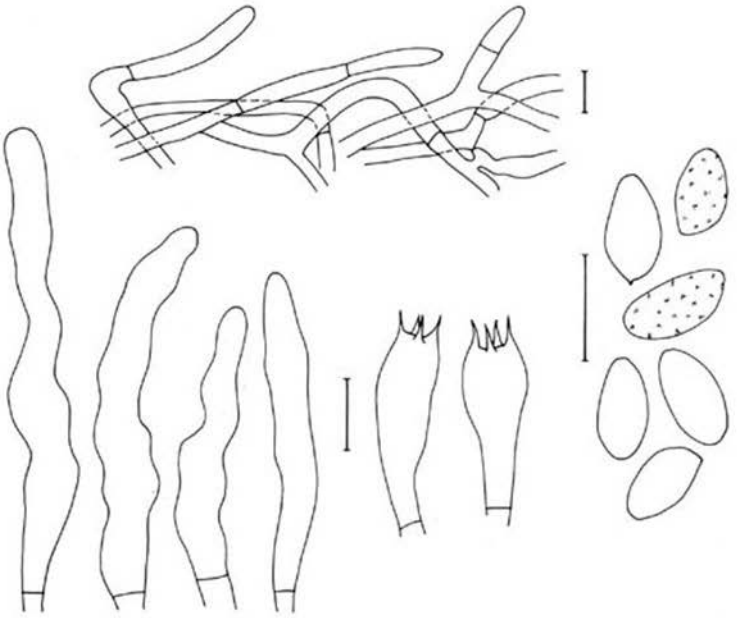

Fig. 8. *Crepidotus versutus*. — Pileipellis, cheilocystidia, basidia, and spores.

Crepidotus versutus (Peck) Sacc. — Pl. 2E, F; Fig. 8

Agaricus (Crepidotus) versutus Peck, Ann. Rep. N.Y. St. Mus. 30 (1878) 70. — *Crepidotus versutus* (Peck) Sacc., Syll. Fung. 5 (1887) 888. — Type: U.S.A., Forestburgh, Sept., *Peck* (NYS).

Spores 9–11.5 × 5–6.5 µm, Q = 1.6–2.1, av. Q = 1.87, elongate, amygdaliform in side view, with blunt apex, faintly marbled with the light microscope, rugulose in SEM; walls weakly coloured. Basidia 22–33 × 7.5–9 µm, 4-spored, clamp-less. Cheilocystidia 21–66 × 6–8 µm, cylindrical, narrowly lageniform, flexuose, hyaline, thin-walled. Pleurocystidia absent. Pileipellis a cutis of repent 3–6 µm wide, cylindrical, hyaline hyphae; terminal cells undifferentiated, straight, never coiled or branched. Clamp-connections absent in all tissues, also in the basal tomentum.

The type collection is well preserved and consists of several fruit-bodies. Already Singer (1947) and Hesler & Smith (1965) examined this collection and stressed the very faint but even with the light microscope clearly visible punctate ornamentation of the rather large spores. The SEM (Pl. 2E, F) reveals a very low ornamentation of the rugulose-vermiculose type. Such a faint ornamentation is also documented with SEM pictures of a British collection named *C. pubescens* Bres. by Pegler & Young (1972). As also the other characters of this collection agree with *C. versutus* (Peck) Sacc., there is no doubt that this species occurs also in Europe and that Peck's description has been neglected for many years by European mycologists.

ACKNOWLEDGEMENTS

I thank the curators or PRM, F, H, K, and NYS for their prompt loans and especially Kees Bas for useful discussions. I am grateful to Lucia Wick (Bern) and Christoph Scheidegger (WSL, Birmensdorf) for preparing the SEM pictures, and to Margrit Kummer for inking the drawings.

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THE FUNGI OF NORTH HOY, ORKNEY – II

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Seven new species and one new genus of Leotiales are described from North Hoy, Orkney.

The first part of this paper (Dennis & Spooner, 1992) provided an introduction to the area under consideration. It included a brief history of the collecting and recording of fungi on Orkney, and a list of 396 species of fungi collected during seven visits to North Hoy made between 1987 and 1990. In addition to the species listed there, the collections from Hoy yielded seven species of Leotiales which prove to be undescribed, and one which requires a new genus to accommodate it. Descriptions of these species and the new genus are provided in the present account.

Albotricha ammophilae Dennis & Spooner, *spec. nov.* — Fig. 1e–g

Apothecia 0.4–0.6 mm diam., brevistipitata, superficialia. Discus luteolus. Receptaculum cupulatum, pallide bubalinum, pilis albidis ornatum. Pili 80–120 × 3–4 µm, hyalini, angustati, granula superficialia ferentes. Asci 52–62 × 6.5–7 µm, octospori, ad apicem conici, poro in mixtura Melzeri caerulescenti. Ascosporae 10–16 × 2–2.5 µm, hyalinae, cylindrico-fusoideae, non-septatae, guttulatae. Paraphyses lanceolatae, 3–4 µm diam., quam asci 15–20 µm longiores. Excipulum ectale e cellulis prismaticus compositum.

Holotypus: Scotland, Orkney, Hoy, Rackwick, 17 Sept. 1990, on *Ammophila arenaria*, *R.W.G. Dennis* (K).

Apothecia 0.4–0.6 mm diam., short-stipitate, superficial, commonly on inner surface of culms, scattered, solitary or in small groups. Disc plano-concave, smooth, yellowish or pale straw, obscured by hairs when dry. Receptacle cupulate, pale buff or straw-coloured, densely covered with whitish hairs, incurved at the margin when dry. Hairs hyaline, narrow, tapered, obtuse at the apex, 80–120 µm long, 3–4 µm wide at the base narrowed to 1.5–2 µm at the apex, 4–6-septate, wall appearing thickened, bearing irregular granules which are mostly soluble in Melzer's Reagent. Asci 8-spored, 52–62 × 6.5–7 µm, cylindric-clavate, short-stalked, conical at the apex, pore small, outlined blue in Melzer's Reagent. Ascospores (10–)11–15(–16) × 2–2.5 µm, hyaline, cylindric or cylindric-fusoid, straight, sometimes slightly inequilateral, non-septate, guttulate, biseriate within the ascus. Paraphyses lanceolate, 3–4 µm diam., exceeding the asci by 15–20 µm, thin-walled, 1–2-septate. Ectal excipulum composed of hyaline, irregular prismatic cells 8–15 × 4–6 µm arranged in rows at a low angle to the surface, walls slightly thickened.

The narrow, tapered hairs which bear loosely attached granules are characteristic of *Albotricha*, as are the large, lanceolate paraphyses. Several species are described from grasses, but all differ most notably in spore and hair characters.

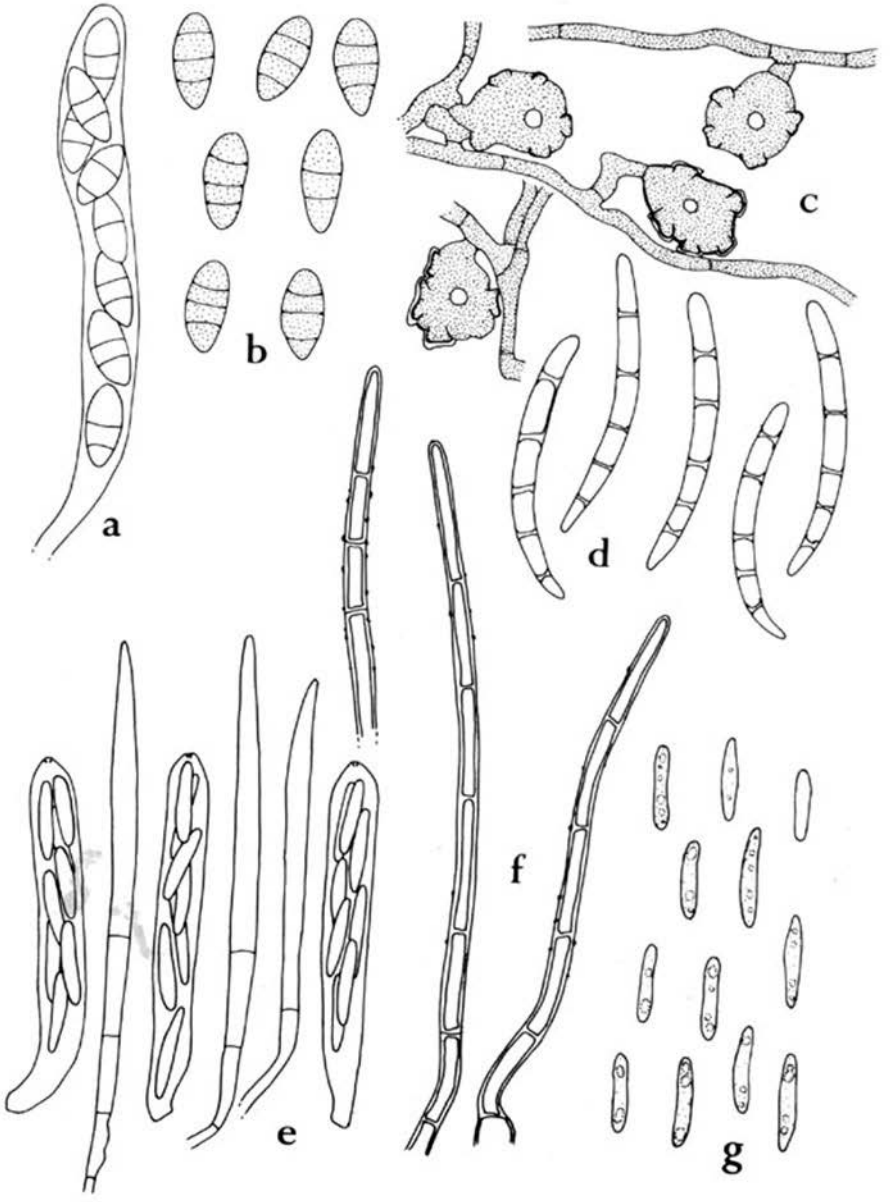

Fig. 1a, b. *Lepteutypa* cf. *hippophaes*. a. Ascus; b. ascospores. — Fig. 1c, d. *Gaeumannomyces* sp. c. Hyphopodia; d. ascospores. — Fig. 1e–g. *Albotricha ammophilae*. e. Asci and paraphyses; f. hairs; g. ascospores. — All × 1000.

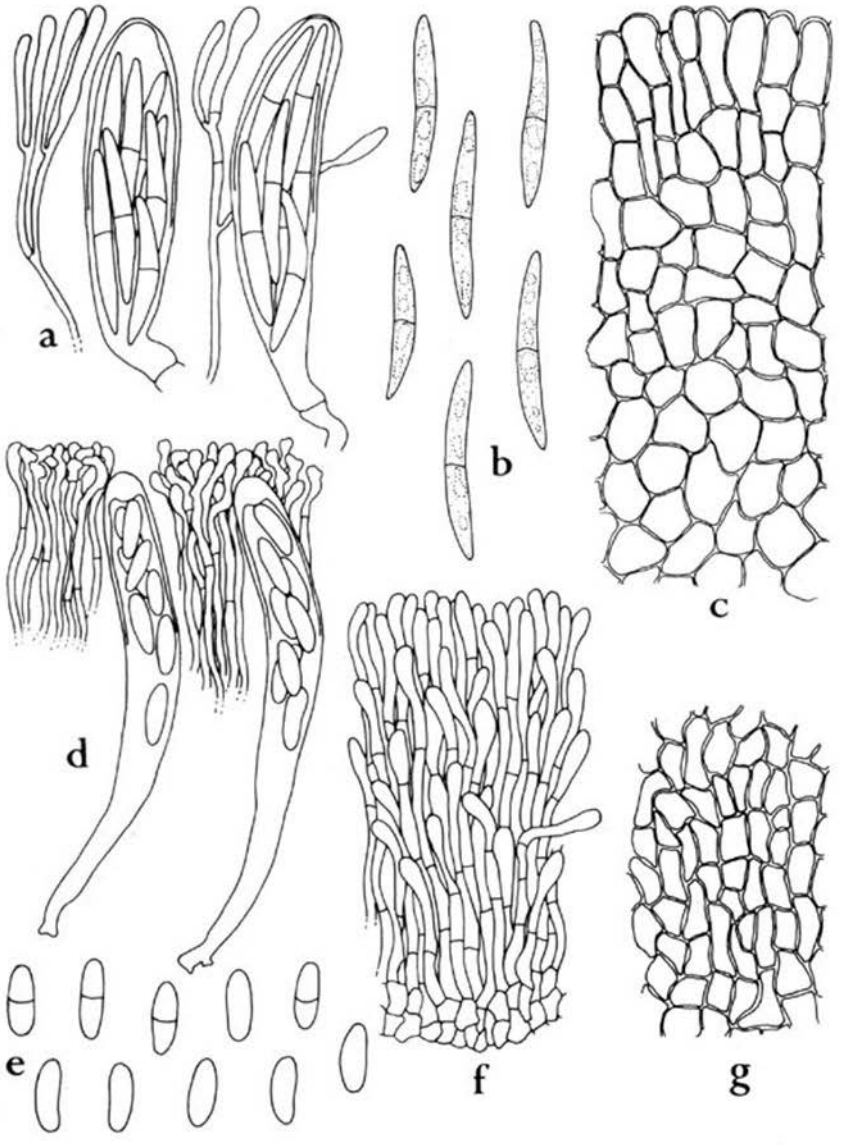

Fig. 2a–c. *Niptera ambigua*. a. Asci and paraphyses; b. ascospores; c. ectal excipulum. — Fig. 2d–g. *Calycellina calycelloides*. d. Asci and paraphyses; e. ascospores; f. marginal excipulum; g. ectal excipulum. — All × 1000.

Calycellina calycelloides Dennis & Spooner, *spec. nov.* — Fig. 2d–g

Apothecia 0.2–0.3 µm diam., sessilia, laevia, luteola. Asci 70–76 × 7.5–8 µm, octospori, cylindrico-clavati, ad apicem rotundati, poro in mixtura Melzeri non colorato. Ascosporae hyalinae, anguste ellipsoideae vel aliquantum clavatae, saepe 1-septatae. Paraphyses 1–1.5 µm diam., flexuosae, agglutinatae. Excipulum ectale e cellulis parvis et ad muros aliquantum incrassatis compositam.

Holotypus: Scotland, Orkney, Hoy, Berriedale, on rotten wood of *Salix*, 4 Oct. 1989, *R.W.G. Dennis* (K).

Apothecia 0.2–0.3 mm diam., gregarious, sessile, narrowed at the base, with a few anchoring hyphae, pale yellow throughout. Disc plane, smooth, without a raised margin. Receptacle shallow cupulate, appearing smooth or virtually so. Asci 8-spored, 70–76 × 7.5–8 µm, cylindric-clavate, tapered to the base, arising from croziers, apex broadly rounded, pore not blue in Melzer's Reagent. Ascospores 9.5–11(–12) × 3.2–3.8 µm, hyaline, narrowly ellipsoid, commonly slightly clavate or inequilateral, often 1-septate, biseriate within the ascus. Paraphyses hyaline, narrow, 1–1.5 µm diam., flexuous, sometimes lobed and agglutinated at the apex, apical wall firm, slightly refractive. Ectal excipulum composed in the lower receptacle of hyaline, subglobose cells 4.5–7 × 3–5 µm with slightly thickened walls, at the margin of narrow, parallel septate hyphae 1.5–2 µm diam., with free, slightly clavate tips.

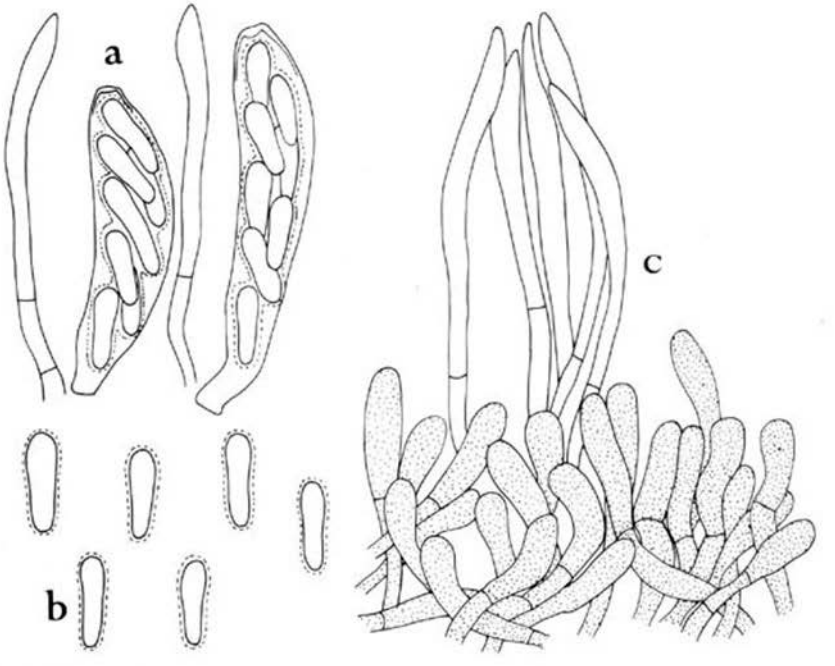

Fig. 3. *Hysteronaevia fimbriata*. a. Asci and paraphyses; b. ascospores; c. marginal structure. — All × 1000.

Differs from typical species of *Calycellina* in lacking a basal ring of brown cells and in the ascus pore remaining unstained in Melzer's Reagent. However, it agrees structurally with this genus. The slightly thickened excipular cell walls and agglutinated paraphyses are characteristic and create a superficial resemblance to species of *Calycella*, for which the species is named.

Hysteronaevia fimbriata Dennis & Spooner, *spec. nov.* — Fig. 3

Apothecia 250–300 µm diam., erumpentia. Discus albidus vel pallide aurantiacus, margine albida fimbriata. Receptaculum infra marginem atro-brunneum. Asci 47–59 × 10–14 µm, octospori, late clavati, poro in mixtura Melzeri non colorato. Ascosporae 12.5–15 µm, hyalinae, non-septatae, cylindrico-clavatae, aliquantum constrictae, vagina gelatinosa circumcinctae. Paraphyses anguste lanceolata, quam asci 5–8 µm longiores. Excipulum ectali e cellulis brunneo-muratis compositum sed ad marginem zonum hypharum hyalinarum lanceolatarumque 3.5–4.5 µm diam. ferens.

Holotypus: Scotland, Orkney, Hoy, on dead leaf tip of *Carex panicea*, 21 June 1987, *R.W.G. Dennis* (K).

Apothecia 250–300 µm diam., at first immersed, becoming erumpent, solitary, gregarious. Disc plane, whitish or pale orange, with distinct white fimbriate margin. Receptacle blackish below, becoming whitish at the margin. Asci 8-spored, 47–59 × 10–12 (–14) µm, broadly clavate, short-stalked, apex truncate-conical, pore not stained in Melzer's Reagent. Ascospores 12.5–15 × 3.5–4.5 µm, hyaline, cylindric-clavate, often slightly constricted near the centre, non-septate, surrounded by a gel sheath. Paraphyses hyaline, narrowly lanceolate, 0–1-septate, 3–3.5 µm diam., exceeding the asci by 5–8 µm. Ectal excipulum composed basally of brown, thin-walled cells, towards the margin becoming hyphal, at the surface developing irregularly arranged septate hyphae, with obtuse free ends 4–5 µm diam., terminating at different levels and overlying at the margin a zone of lanceolate, hyaline, 0–1-septate structures 3.5–4.5 µm diam. which form a distinct fringe to the disc.

The lanceolate marginal hyphae form a distinctive white fringe to the disc. Several other species have similar, though less obvious, marginal hyphae and differ otherwise most notably on spore characters.

Mollisia orcadensis Dennis & Spooner, *spec. nov.* — Fig. 4a–c

Apothecia 200–400 µm diam., superficialia, discoidia, sessilia, late affixa. Discus plano-convexus, albidus, in sicco atro-cinereus. Receptaculum laeve, cinereo-brunneum, ad marginem albidum. Asci 50–60 × 6–7.5 µm, octospori, brevistipitati, ad apicem conici, poro in mixtura Melzeri caerulescenti. Ascosporae 7.5–9.5 × 2.5–3 µm, hyalinae, non-septatae. Paraphyses obtusae, 2.5–3.5 µm diam. Excipulum ectali e cellulis subglobosis tenui-muratis compositum.

Holotypus: Scotland, Orkney, Hoy, Berriedale, on wet, rotten wood of ? *Betula* or *Sorbus*, 13 May 1990, *R.W.G. Dennis* (K).

Apothecia 200–400 µm diam., superficial on rotten, decorticated wood, gregarious, sessile, discoid, broadly attached, sometimes with pale anchoring hyphae, drying dark grey with slightly paler raised margin. Disc whitish or pale grey when fresh, plano-convex, without a raised margin. Receptacle smooth, whitish at the margin, grey-brown below. Asci 8-spored, 50–60 × 6–7.5 µm, narrowly clavate, short-stalked, conical at the

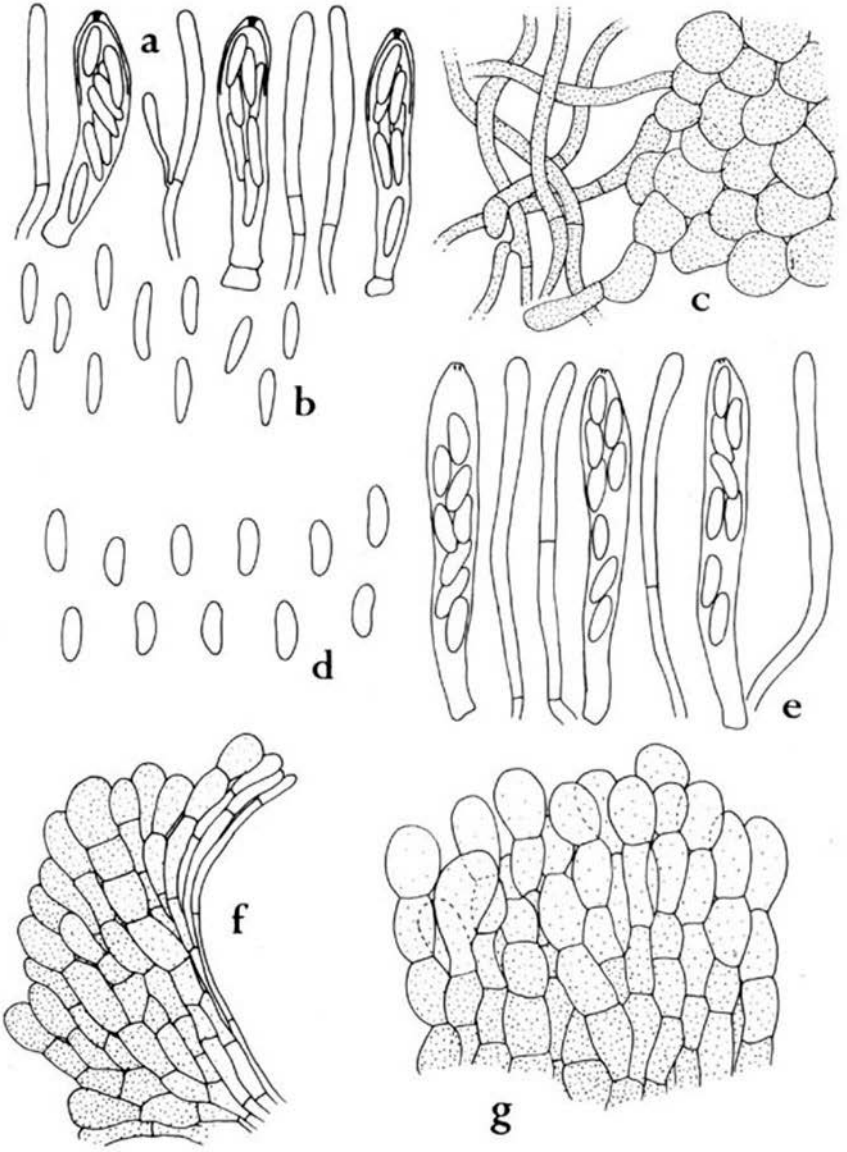

Fig. 4a–c. *Mollisia orcadensis*. a. Asci and paraphyses; b. ascospores; c. ectal cells and anchoring hyphae. — Fig. 4d–g. *Mollisia stromaticola*. d. Ascospores; e. asci and paraphyses; f. vertical section of margin; g. marginal excipulum, surface view. — All × 1000.

apex, pore outlined blue in Melzer's Reagent. Ascospores 7.5–9(–9.5) × 2.5–3 µm, ellipsoid, often inequilateral or slightly curved, hyaline, non-septate, biseriate in the upper part of the ascus. Paraphyses hyaline, obtuse, cylindric, not or slightly enlarged at the apex, sparsely septate, 2.5–3(–3.5) µm diam. Ectal excipulum composed of radial rows of subglobose or subangular thin-walled cells, more elongated and prismatic towards the margin, brown-walled below, paler upwards and almost hyaline at the margin.

Distinguished by its small, discoid apothecia which have a flat or slightly convex disc, and by the comparatively broad spores.

Mollisia stromaticola Dennis & Spooner, *spec. nov.* — Fig. 4d–g

Apothecia 300–500 µm diam., gregaria. Discus concavus, cremeus sed cinereo-brunneo-tinctus. Receptaculum laeve, ad marginem albidum, ad basin cinereo-brunneum. Asci 36–47 × 6.5–7.5 µm, octospori, clavati, brevistipitati, ad apicem conici, poro in mixtura Melzeri caerulescenti. Ascosporae 8.5–11 × 1.8–2.2 µm, hyalinae, non-septatae. Paraphyses cylindricae, obtusae, 2.5–3 µm diam. Excipulum ectali e cellulis subglobosis tenui-muratis compositum, ad basin pallide brunneum et ad marginem hyalinum.
Holotypus: Scotland, Orkney, Hoy, Berriedale, on pyrenomycete stromata on *Betula*, 13 May 1990, *R.W.G. Dennis* (K).

Apothecia gregarious, sessile, 0.3–0.5 mm diam., circular or commonly lobed or irregular in outline, seated on or adjacent to old pyrenomycete stromata. Disc concave, smooth, cream, with greyish brown tinge, especially at the centre. Receptacle smooth, pale, whitish or cream at the margin, pale greyish brown below, with narrowed attachment and anchoring hyphae. Asci 8-spored, 36–40(–47) × 6.5–7.5 µm, clavate, with short, broad base, apex conical, somewhat thickened, pore 1.2–1.8 µm deep, outlined strongly blue in Melzer's Reagent. Ascospores hyaline, 8.5–10(–11) × 1.8–2.2 µm, non-septate, cylindric-clavate or cylindric-fusoid, straight, often slightly inequilateral, biseriate within the ascus. Paraphyses hyaline, cylindric, obtuse, 2.5–3 µm diam., 1(–2)-septate in lower part, and sometimes branched near the base. Ectal excipulum composed of subglobose or subangular thin-walled cells arranged in radial rows, hyaline or virtually so at the margin, pale brown on the lower receptacle, 9–13 × 7–11 µm. Basal hyphae 2–3 µm diam., with thin, brown walls, septate, branched.

Distinguished by the pale apothecia, broad paraphyses, deep apical pore to the ascus and habitat on old pyrenomycete stromata.

Niptera ambigua Dennis & Spooner, *spec. nov.* — Fig. 2a–c

Apothecia 150–200 µm diam., superficialia, sessilia. Discus pallide aurantiacus. Receptaculum laeve, brunneum. Asci 55–65 × 13–14 µm, octospori, late cylindrico-clavati, poro in mixtura Melzeri non colorato. Ascosporae 23–31 × 3–3.2 µm, hyalinae, fusoideae, 1-septatae, guttulatae. Paraphyses hyalinae, multi-ramosae, obtusae, ad apicem 2.5–3.5 µm diam. Excipulum ectali e cellulis subglobosis muris brunneis aliquantum incrassatis compositum, cellulis ad marginem magis elongatis et pallidioribus.
Holotypus: Scotland, Orkney, Hoy, on *Eriophorum*, 21 June 1987, *R.W.G. Dennis* (K).

Apothecia 150–200 µm diam., superficial, gregarious, sessile. Disc plane, smooth, pale orange. Receptacle shallow cupulate, smooth, brownish to the margin. Asci 8-spored, 55–65 × 13–14 µm, broadly cylindric-clavate, thick-walled when young, short-stalked, pore not stained in Melzer's reagent. Ascospores (23–)26–31 × 3–3.2 µm, hyaline, fu-

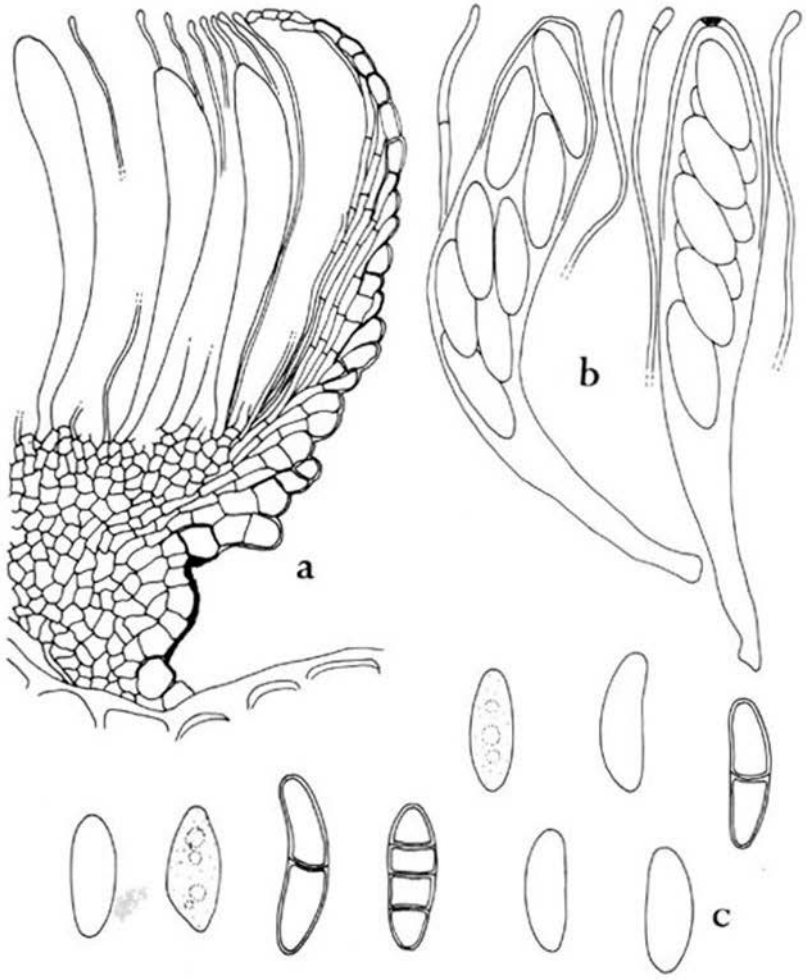

Fig. 5. *Pseudonaevia caricina*. a. Vertical section, × 650; b. asci and paraphyses, × 1000; c. ascospores, × 1000.

soid, slightly curved, guttulate, 1-septate, arranged in 3–4 rows within the ascus. Paraphyses hyaline, sparsely septate, 1–1.5 µm, much-branched, apex obtuse, enlarged to 2.5–3.5 µm diam. Ectal excipulum composed basally of subglobose or subangular cells 6–8 µm diam., with brown, slightly thickened walls, near the margin the cells becoming more elongated and pale brown to almost hyaline.

Asci, spores and paraphyses are similar to those of *Nimbomollisia eriophori* (Kirchn.) Nannf., but we have been unable to demonstrate a gel sheath to the spores.

PSEUDONAEVIA Dennis & Spooner, *gen. nov.*

Apothecia superficialia, sessilia, laete colorata, laevia. Asci clavati, poro in mixtura Melzeri caerulescento. Ascosporae hyalinae, ellipsoideae, 0–3-septati. Paraphyses filiformes, obtusae. Excipulum e cellulis parvis hyalinis muris aliquantum incrassatis compositum.

Holotypus: *Pseudonaevia caricina* Dennis & Spooner.

Apothecia superficial, sessile, light coloured, smooth. Asci clavate, pore blue in Melzer's Reagent. Ascospores hyaline, ellipsoid, 0–3-septate. Paraphyses filiform, obtuse. Excipulum of small, hyaline cells, ectal layer thin, of radial rows of cells with slightly thickened walls.

Pseudonaevia caricina Dennis & Spooner, *spec. nov.* — Fig. 5

Apothecia 400–500 µm diam., luteola, cupulata. Asci 80–110 × 16–19 µm, octospori, clavati, ad apicem angustati. Ascosporae 17–28 × 5.5–8 µm, 0–1(–3)-septatae, biseriatae. Paraphyses obtusae, ad apicem 1.2–1.8 µm diam.

Holotypus: Scotland, Orkney, Hoy, Berriedale, on dead leaf of *Carex ?binervis*, 4 Oct. 1989, *R.W.G. Dennis* (K).

Apothecia 400–500 µm diam., superficial, sessile, pale yellow throughout, drying amber, scattered or gregarious. Disc flat, smooth, without a raised margin. Receptacle smooth, cupulate, with narrowed attachment. Asci 8-spored, 80–110 × 16–19 µm, clavate, tapered below, apex narrowed, pore, at least in young asci, outlined blue in Melzer's Reagent. Ascospores (17–)18–23(–28) × 5.5–7(–8) µm, hyaline, ellipsoid or slightly clavate, often inequilateral or curved, 0–1(–3)-septate, biseriate within the ascus. Paraphyses filiform, obtuse, 1 µm diam., slightly enlarged at the apex to 1.2–1.8 µm diam. Medullary excipulum composed of small, thin-walled cells 4–6 µm diam. Ectal excipulum c. 20 µm thick below, narrowed to the margin, composed of radial rows of hyaline, slightly thick-walled cells 7–10 × 5–8 µm, smaller towards the margin.

The genus differs from *Laetinaevia* and related genera accepted in Naevioideae by Hein (1976) most notably in having superficial apothecia.

ACKNOWLEDGEMENTS

We thank Melanie Wilmott-Dear for assistance in preparing the Latin diagnoses.

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REZENTE ASCOMYCETENFUNDE – XI
STERIGMATE FORMEN IN DER GATTUNG PEZIZA (2. Teil)

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Beschrieben werden sterigmate Formen von *Peziza bovina, P. vesiculosa, P. echinospora* und *P. perdicina*. Derartige Formen entstehen unter speziellen kleinklimatischen Bedingungen. Es zeigen sich Modifikanten unterschiedlicher Arten ohne eigene Artberechtigung.

Im ersten Teil dieses Forschungsberichts (Häffner, 1992) wurden sterigmate Formen von *Peziza cerea* beschrieben. Obwohl für *Peziza* als Gattungsmerkmal 'sitzend' bis allenfalls 'angedeutet gestielt' gilt, kommen doch gelegentlich deutlich gestielte Formen vor. Solche Formen werden als sterigmat bezeichnet. Neben *Peziza cerea* werden drei weitere Arten (*P. bovina, P. vesiculosa* und *P. echinospora*) vorgestellt mit sterigmatem Habitus, exakt der Tafel 266 von Boudier (1905–1910) entsprechend, und eine weitere *(P. perdicina)* mit sterigmater Wuchsform, aber dunkleren Pigmenten. Damit wird aufgezeigt, daß solche Wuchsformen artübergreifend und somit als Modifikanten ohne eigenen Artrang einzustufen sind. *Peziza asterigma* ist als selbständige Art zu streichen. *Peziza perdicina* wird als sterigmate Form von *P. moravecii* aufgefaßt, wodurch das ältere Taxon *P. perdicina* vorrangig *P. moravecii* ersetzt. Die besonderen kleinklimatischen Verhältnisse, welche die Ursache sind für die Bildung sterigmater Modifikanten, lassen bei *P. perdicina* weitere morphologische Umwandlungen erkennen.

Peziza bovina Phillips in J. Stevenson

Peziza bovina Phillips in J. Stevenson, Mycol. Scot. (1879) 308. — *Humaria bovina* (Phillips) Sacc., Syll. Fung. 8 (1889) 146. — *Aleuria bovina* (Phillips) Boud., Hist. Class. Disc. Eur. (1907) 44.

Sterigmate Form. Fruchtkörper einzeln. Anfangs säulig gestielt, urnenförmig. Basis einem kräftigen weißen Hyphenfilz entspringend, Außenseite blaß ockergelb, zuerst flockig besetzt mit schwindenden weißen Hyphenflöckchen, alsbald von unten bis Randnähe mit braunen Pusteln besetzt; Spitze mit sich gerade öffnendem Hymenium. Später gerandet, scheibig, schwach genabelt. Ausgereift irregulär trichterförmig mit herabgeschlagenem Apothecienrand, 1,3 cm im Durchmesser breit, stets deutlich gestielt, Stiel 0,8 cm hoch, 0,4–0,8 cm breit. Hymenium blaßockergelb, bräunend, trocken hellbraun, karamel. Außenseite und Stielspitze mit braunen, schwindenden Wärzchen auf hellockergelbem Grund. Hymenium 152 (am Übergang zum Rand) bis 255 µm. Subhymenium ockerbraun gezont, bis 77 µm breit, zum Rand schwindend, aus kleinzelliger, hyphig untermischter Textura angularis/globulosa. Excipulum total 125–410 µm breit in Rand-

nähe, am Rand bis 215 µm vorstehend, rechtwinkelig zur Außenseite ausgerichtet; Textura angularis/globulosa, angulare Zellen bis 50 × 30 µm, ohne mittlere Textura intricata, nicht hyphig untermischt. Äußeres Excipulum nicht deutlich abgegrenzt, dunkler gezont; 35 µm bis bei Pusteln 100 µm breit, Zellengröße nach außen abnehmend, Zellen zunehmend gelbbräunlich pigmentiert und leicht dickwandiger, Endzellen angular, in den Pusteln braun- und dickwandig. Ascus 273–306 × 12,6–18,8 µm, zylindrisch, J^+, langgestielt, pleurorhynch, 8-sporig. Ascosporen (16,0–)17,5–20,0 × (7,9–)8,5–11,4 µm, unregelmäßig uniseriat, ellipsoid (seltener leicht verlängert ellipsoid), hyalin, glatt, innen mit undeutlichem Zellkern, ohne Guttulen (jedoch unter Ölimmersion undeutlich körnelig). Paraphysen-Spitzen 4–6,5 µm, fädig bis keulig verdickt, gerade, nicht moniliform, fast hyalin.

Untersuchte Kollektion. DEUTSCHLAND: Schleswig Hollstein, Bad Schwartau, Substrataufsammlung, 2.V.1988, auf Pferdemist in feuchter Kammer entwickelt, Untersuchungen bis 3.VI.1988, *E. Jahn* (Herb. Häffner 257).

Diskussion. Die Jahnsche Kollektion hatte auch bei Reife fädige, nicht moniliforme Paraphysen. Das untersuchte Material ist jedoch viel zu spärlich, um absolute Aussagen treffen zu können. Gemäß dem Wunsch zu herbarisieren, wurde nicht bis zum Vergehen abgewartet. Die gezielter untersuchten sterigmaten Formen von *P. cerea* haben bezeichnenderweise im unteren Paraphysendrittel Moniliformität entwickelt, das Aufblähen der Zellen begann von der Basis aus, die oberen Zellen waren noch filiform. Fehlende Moniliformität kann m.E. taxonomisch nicht gewertet werden (siehe Fortoulismus). Als wesentlich gewichtet wurden Sporengröße und Ökologie, das Vorkommen auf Pferdemist.

Boudier gibt für seine *P. asterigma*, hier als Mitglied des *P. cerea*-Komplexes aufgefaßt, dementgegen Mulm, Humus zwischen Moosen an. Es ist nicht sicher bekannt, ob beide Substrate identische Nährstoffe abgeben können. Die Erfahrungen sprechen dagegen, wenn auch eine Unsicherheit bleibt. Geht man davon aus, daß mistbewohnende Arten verschieden sind von Bewohnern von Waldhumus, kommt man in den Formenkreis von *P. fimeti*, *P. bovina* und *P. vesiculosa*. Über den Formenkreis wurde erst jüngst berichtet (Häffner & Kasparek, 1989). *Peziza bovina* wurde bislang von den meisten Mykologen als Synonym von *P. fimeti* aufgefaßt. Die vorliegenden Untersuchungen ergeben eine große Konstanz der Sporenmaße. *Peziza fimeti* – ähnlich wie die Arten des *P. cerea*-Komplexes – überschreitet kaum Sporenlängen von 17 µm. Für *P. bovina* wird 19–22 × 9(–10) µm (Dennis, 1978) angegeben. Die Jahnsche Kollektion liegt mehr in diesem Bereich. Nach den eigenen Untersuchungen ist *P. fimeti* eine sitzende, *P. bovina* hingegen eine gestielte Art. Leider findet man auch gegenteilige Angaben (Ellis & Ellis, 1988), wobei es unklar ist, ob Eigenuntersuchungen zugrunde liegen.

Bei der engen Nachbarschaft der Arten bleiben einige Zweifel um die Eigenständigkeit der *P. bovina*. Auf eine interessante Parallelität wird hingewiesen: nach Sporengrößen entspricht die Mist bewohnende *P. fimeti* der Schutt und Debris bewohnenden *P. cerea* (sowie den Debris- und Holzbewohnern des Komplexes), die Mist bewohnende *P. bovina* der Debris und Humus bewohnenden *P. hortensis* Crouan sensu Le Gal (siehe *P. asterigma*; Häffner, 1992). Die längstsporige *P. vesiculosa* besiedelt alle Standorte. Das 'Kartenhaus der Arten' stürzt zusammen, wenn die Substrate gleichwertig sind.

Peziza echinospora P. Karst. — Fig. 1

Peziza echinospora P. Karst., F. Fenn. exs. (1886) 541; Not. Sällsk. F. Fl. Fenn., Förh. 10 (1869) 115. — *Galactinia echinospora* (Karst.) Svrček & Kubička, Česká Mykol. 15 (1961) 74; Le Gal., Bull. trimest. Soc. mycol. Fr. 78 (1962) 209.

Plicaria echinospora var. *autumnalis* Velen., Mon. Disc. Boh. (1934) 348. — *Galactina echinospora* var. *autumnalis* (Velen.) Moravec, Česká Mykol. 23 (1969) 33.

Peziza umbrina Boud. apud Cooke, Mycogr. I (1879) 226, pl. 106, fig. 378. — *Aleuria umbrina* Boud., Icon. mycol., livr. 5 (1905) pl. 279 (= prov. no. 66); tome 4 (1911) 152.

Peziza anthracophila Dennis, Brit. cup fungi (1960) 13.

Sterigmate Form. Fruchtkörper einzeln. Anfangs säulig gestielt, urnenförmig, Basis einem weißen Hyphenfilz entspringend, Außenseite blaß ockergelb, in Randnähe mit groben braunen Pusteln besetzt, Spitze mit sich gerade öffnendem Hymenium; 1,2 cm hoch, maximal 0,6 cm breit. Ausgereift zunächst mit scheibig ausgebreitetem Apothecium, Mitte schwach genabelt; überreif irregulär trichterförmig mit herabgeschlagenem Apothecium. Hymenium blaßockergelb, bräunend, trocken hellbraun, karamel. Außenseite und Stielspitze mit braunen Wärzchen auf hellockergelbem Grund, Stielbasis weißfilzig. Hymenium bis 300 µm; Subhymenium fuchsigocker gezont, 60–90 µm breit, aus kleinzelliger, hyphig untermischter Textura angularis/globulosa. Mittleres Excipulum dreischichtig. Schicht 1 (unter Subhymenium) maximal 600 µm, aus hyphig untermischter Textura globulosa/angularis, angulare Zellen bis 60/35 µm; Schicht 2 (mittlere) aus Textura intricata, bis 11 µm, mit globulosen Zellen untermischt; Schicht 3 aus Textura angularis, Zellen verlängert, zum Teil keulig oder limoniform, rechtwinkelig zur Außenseite ausgerichtet. Äußeres Excipulum nicht deutlich abgegrenzt, zusammen mit Schicht 3 bis 460 µm breit; Zellengröße nach außen abnehmend; Endzellen angular bis keulig, bis 30 × 14 µm. Ascus 260–300 × 10–12,5 µm, zylindrisch, J+, langgestielt, pleurorhynch, 8-sporig. Ascosporen 14,0–15,6 × 6,4–7,2 µm (ohne Ornament), 15,0–17,3 × 7,0–8,0 µm (mit Ornament); unregelmäßig uniseriat, ellipsoid bis abgerundet prismatisch, hyalin, glatt, ohne Guttulen (jedoch unter Ölimmersion undeutlich körnelig und mit undeutlichem Zellkern), Ornament aus feinen, isolierten Stacheln, in den Polen teilweise länger und breiter (teils tropfig). Paraphysen-Spitzen keulig bis kopfig, 3–8(–14) µm breit, oft leicht gebogen, auf ganzer Länge deutlich moniliform, bis 15 µm breit, fast hyalin.

Untersuchte Kollektion. DEUTSCHLAND: Rheinland-Pfalz, Gebhardshain, MTB 5212/2, verschneite Brandstelle auf einer Kuhweide (ehemaliger Holzkohlenmeiler), 20.II.1983. Substrataufsammlung: Holzkohle/Erdscholle, gehalten in feuchter, transparenter Kammer (bei ca. 15°C), *J. Häffner 1039* (Herb. Häffner). Untersuchungen der Entwicklungsstadien am 3., 17., 22. und 25.III.1983.

Diskussion. Auch diese Kollektion stimmt habituell exakt mit Boudiers sterigmaten Formen überein. Überraschend entwickelte sich ein stacheliges Sporenornament; ein Merkmal, welches als prägnant und typisch gilt für die Brandstellen bewohnende *P. echinospora*. Somit sind sterigmate Formen nicht auf glattsporige Arten beschränkt.

Das zweite ungewöhnliche Merkmal ist die starke Moniliformität der Paraphysen. In der eingesehenen Literatur fehlen klare Aussagen zur Art, nur Donadini (1979) hat Anfangsentwicklungen gesehen: "Paraphyses ... à peu près cylindriques (parfois quelques articles légèrement renflés) ... ." Vermutlich ist der Paraphysen-Fortoulismus bei *P. echinospora* den meisten Beschreibern entgangen, weil sie nicht überreife Stadien einbezogen haben oder ein ungünstiges Kleinklima die Ausprägung moniliformer Zellen nicht förderte. Es scheint sicher, daß für viele Arten genaue Kenntnisse fehlen.

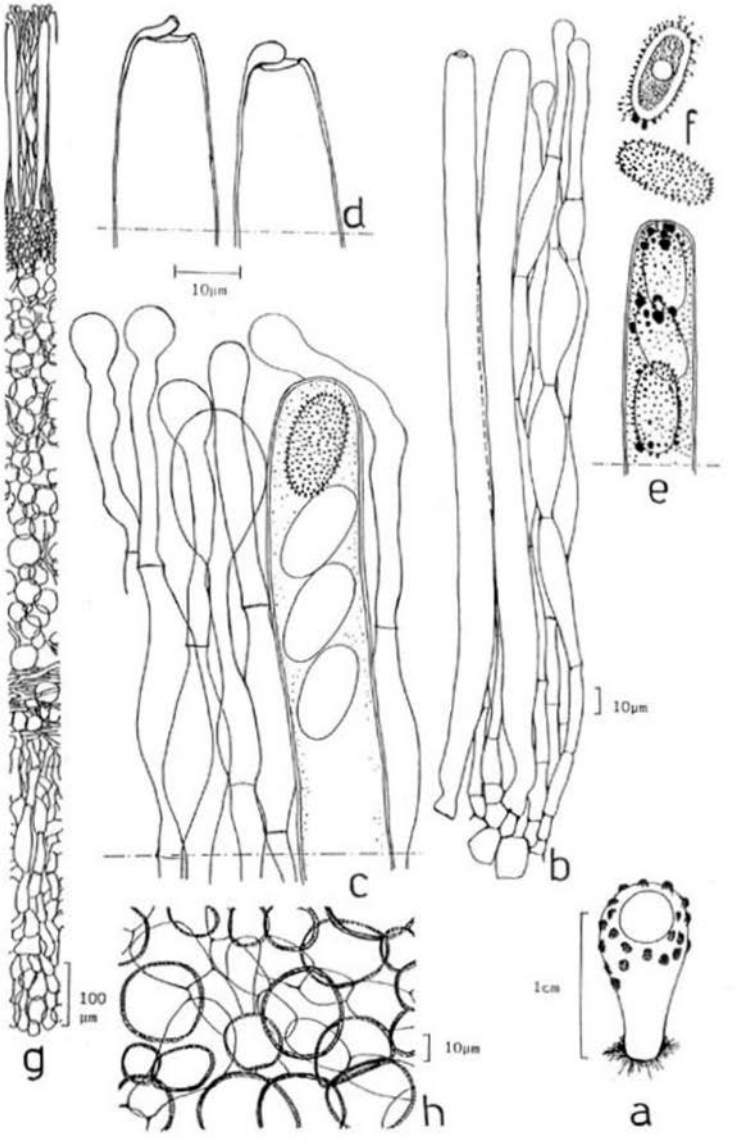

Fig. 1. *Peziza echinospora* (*Häffner 1039*). – a. Habitus, Anfangsstadium (3.III.83); b. Asci und moniliforme Paraphysen; c. Ascus- und Paraphysenspitzen; d. Ascispitzen mit geöffnetem Operculum; e, f. Ascosporen mit Ornament; g. Apothecium (Ausschnitt) mit Hymenium, Subhymenium, Mittleres Excipulum aus Schicht 1, Mittlere Textura intricata (Schicht 2) und Schicht 3, Äußeres Excipulum; h. Außenseite (Aufsicht) mit bräunlichen Pusteln, globulose Endzellen braun- und dickwandig.

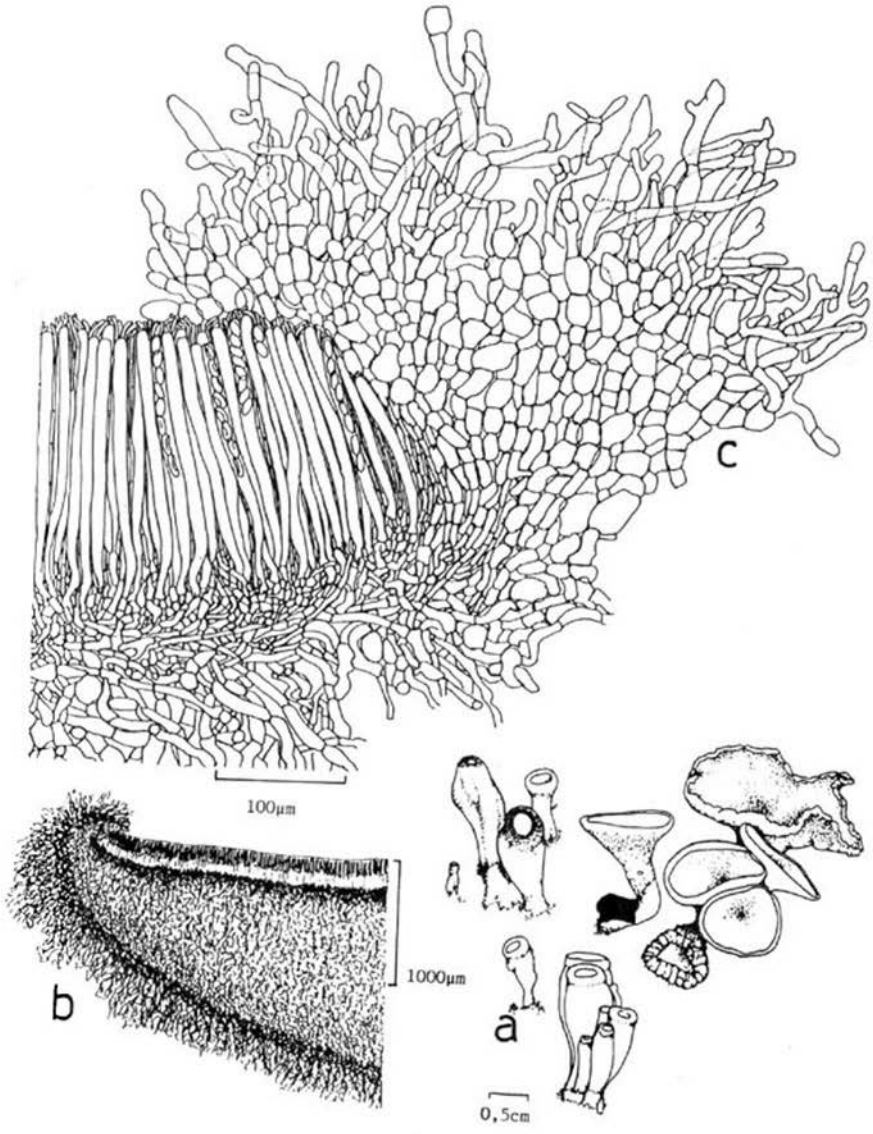

Fig. 2. *Peziza perdicina* (*Riethmüller*, 9.VI.1986). – a. Habitus, unterschiedliche Stadien; b. Randschnitt, schematisch; c. Rand (Detail).

Peziza perdicina (Velen.) Svrček — Fig. 2

Plicaria perdicina Velen., Novit. mycol. noviss. (1947) 150. — *Peziza perdicina* (Velen.) Svrček, Česká Mykol. 30 (1976) 139.

? *Galactinia moravecii* Svrček, Česká Mykol. 22 (1968) 90. — *Peziza moravecii* (Svrček) Donadini, Doc. mycol. 9 (1979) 1.

Fruchtkörper gesellig, gedrängt, mit separaten Basen. Anfangs säulig, bis 1,3 cm hoch, 0,2–0,3 cm breit, außen weißkleiig bis feinfilzig; Spitze nicht verdickt und abgeflacht geschlossen; Rand abgerundet, hellocker, olivbraun bis olivschwarz. In der Folge im oberen Drittel bauchig verdickt bis 0,9 cm, daher urnenförmig; Stiel bis 2,1 cm hoch, gerade bis gekrümmt, kreisrund, faltig oder irregulär kurz gerippt, mit weißem Basalfilz; Außenseite allmählich bräunend, rauh bis feinfilzig; Thecium (Oberseite des Hymeniums) kreisförmig sich öffnend, nicht stark vertieft. Schließlich trichterförmig; die Stielspitze verbreitet sich zu einem scheibigen, schwach genabelten Apothecium mit aufgewölbtem, körnigem bis stark filzigem Rand, zunächst kreisrund, bis ca. 1,5 cm Durchmesser, am Ende irregulär wellig, lappig verbiegend, maximal 3 cm breit; Rand hellocker bis olivschwarz; Hymenium hellocker bis olivgraubraun. Hymenium 205–245 µm, lichtbraun. Subhymenium tief braun gezont (in Lactophenol), 45–95 µm breit, aus kleinzelliger, hyphig untermischter Textura angularis/globulosa; Zellen ca. 3–12 µm lang und breit. Excipulum total beim Stielansatz bis ca. 1400 µm breit. Mittleres Excipulum bis ca. 1050 µm breit, zum Rand schwindend; hyphig untermischte Textura globulosa (angularis); globulose Zellen bis 70 × 64 µm; ohne Textura intricata (jedoch in der Apotheciummitte einige parallel zum Hymenium verlaufende Hyphenstränge inmitten des Mittleren Excipulums). Äußeres Excipulum 50–120 µm breit, kaum deutlich abgegrenzt; 3–4 globulose Zellen zu einer senkrecht nach außen laufenden Kette regelmäßig aneinander gereiht; Zellen rasch kleiner werdend. Dem Äußeren Excipulum folgt eine wechselnd mächtige Schicht wirr verwobener Hyphen (Textura intricata), 30–250 µm breit; Hyphen 2–6 µm breit, kurz septiert, verbogen, oft verzweigend, vielzellig; Spitzen abgerundet, haarartig verlängert und abstehend, mit zunehmender Länge ausblassend; am Apothecienrand oft mächtig ausgebildet, wodurch dieser filzig bis haarig wirkt (Lupe). Asci 188–230 × 8,1–12 µm, zylindrisch, J+, langgestielt, pleurorhynch, 8-sporig. Ascosporen (11,7–)14,0–16,2 × (5,0–)6,7–8,7 µm, unregelmäßig uniseriat, ellipsoid (seltener leicht verlängert ellipsoid oder schwach subfusiform), hyalin, feinpunktiert; punktförmige Wärzchen gelegentlich eng benachbart, dann irregulär kurzliniert; lebend in Wasser innen mit zahlreichen kleinen Guttulen, gelegentlich zu ein oder zwei mittelgroßen vereint, begleitet von kleineren; häufig schwinden die Guttulen und die Spore ist innen optisch leer. Paraphysen-Spitzen 2–6,4 µm, fädig bis schwach keulig verdickt, meist etwas überstehend und schwach gekrümmt, eng septiert, teilweise sehr schwach moniliform; innen mit wenigen Tropfen.

Untersuchte Kollektion. DEUTSCHLAND: Rheinland-Pfalz, Wissen/Sieg, MTB 5212/1, aus frischer Torferde um *Dieffenbachia*-Reste in einem Blumenkübel, geheiztes Wohnzimmer, 9.VI.1986, *Riethmüller*.

Summary

Stipitate forms of *Peziza bovina*, *P. vesiculosa*, *P. echinospora*, and *P. perdicina* are described. Ascomata with the habit of *P. asterigma* should be regarded as sterigmated forms. Those forms are the result of special microclimatic conditions. They are modifications of distinct species which do not need a taxonomical rank of their own.

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NOTULAE AD FLORAM AGARICINAM NEERLANDICAM – XX
A revision of Dermoloma (J. Lange) Sing. – 2[1]

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A key to the western European species of *Dermoloma* with amyloid spores is provided. Descriptions of the accepted taxa are given. Special attention is paid to the variation in spore size. *Dermoloma hygrophorus* and *D. pragensis* are regarded as synonyms of *D. josserandii* var. *josserandii* and *D. phaeopodium* is reduced to a variety of that species.

A previous paper (Arnolds, 1991) treated the taxonomic position of the genus *Dermoloma*, the variability in some diagnostic characters and the indigenous taxa with inamyloid spores. This paper completes the revision of *Dermoloma* by describing and discussing the species with amyloid spores.

KEY TO THE SPECIES
with amyloid spores

1a. Spores on the average 6.2–7.3 × 4.1–4.7 µm, av. Q = 1.5–1.7, ellipsoid to ellipsoid-oblong. Basidiocarps usually more slender: pileus c. 7–25 mm, stipe c. 12–50 × 1–3 mm. Pileus medium to dark brown. Lamellae, L = 11–21, usually dark brown to smoke-grey, sometimes pale grey-brown or beige brown .... *D. pseudocuneifolium*

b. Spores on the average 5.0–6.2 × 3.6–4.8 µm, av. Q = 1.15–1.4, broadly ellipsoid to ellipsoid. Basidiocarps usually rather thick-set: pileus c. 15–50 mm, stipe c. 20–60 × 2–8 mm. Pileus colour variable: whitish, pale grey-brown to dark brown. Lamellae, L = 18–34, usually white, beige or pale grey-brown, sometimes darker grey-brown ..... *D. josserandii*

Dermoloma pseudocuneifolium Herink ex M. Bon — Fig. 1

Dermoloma pseudocuneifolium Herink ex M. Bon, Doc. mycol. 17 (65) (1986) 52.

Dermoloma pseudocuneifolium Herink, Acta Musei Horti bot. Bohemiae borealis 1 (1958) 62 (invalidly published, without Latin diagn.).

Misapplied. Tricholoma cuneifolium sensu Joss., Bull. trimest. Soc. mycol. Fr. 59 (1943) 14. — *Dermoloma cuneifolium* sensu Horak, Syn. Gen. Agar. (1968) 219.

Selected icon. Joss., Bull. trimest. Soc. mycol. Fr. 59 (1943) pl. 1, fig. 2 (as *Tricholoma cuneifolium*).

Selected literature. M. Bon, Bull. trimest. Soc. mycol. Fr. 86 (1970) 152; Horak, Syn. Gen. Agar. (1968) 219–221, figs. a–e (as *D. cuneifolium*); Joss., Bull. trimest. Soc. mycol. Fr. 59 (1943) 14–15, fig. 2, right (as *Tricholoma cuneifolium*).

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1) Comm. no. 445 of the Biological Station, Centre of Soil Ecology, Wijster, The Netherlands.

Pileus (5–)7–25 mm, hemispherical or convex, then plano-convex, sometimes with weak umbo, finally sometimes with recurved margin, weakly to strongly hygrophanous, when moist first blackish brown, chocolate-brown or dark grey-brown (e.g. K&W 7F4-8, 6F5–8), then centre dark brown to grey-brown (e.g. K&W 7E4, 6F7, 6E4, 6E5), to the margin and on drying horn-brown to ochraceous brown (e.g. K&W 7D4, 6D4, 5C4), first smooth and micaceous, then usually irregularly cracked, showing whitish context in the cracks, not striate or translucently striate up to 2/3 of the radius when moist. Lamellae, L = 11–21, l = 1–3, rather crowded to subdistant, usually deeply emarginate or sinuate, often with decurrent tooth, ventricose, thickish, sometimes in small specimens adnate to subdecurrent, dark brown, dark grey-brown, smoke-grey, pale grey-brown or beige brown (e.g. K&W 6F3–5, 6E3–5, 6D3–5), usually slightly paler than pileus. Stipe (8–)12–50(–65) × 1–3(–4) mm, subcylindrical or slightly tapering downwards, solid to fistulose, concolorous with pileus or slightly paler, apex slightly whitish pruinose to subfloccose, smooth towards the base. Context brown or grey in cortex, inner part pale brown to white, rather fragile, especially in lamellae. Smell often absent when undamaged, but strongly farinaceous or rancid when cut. Taste farinaceous. Spore print white.

Spores (5.5–)6.0–8.0(–9.0) × 3.5–5.0 µm, av. 6.2–7.3 × (3.9–)4.1–4.7 µm, Q = 1.4–1.8(–1.9), av. Q = 1.5–1.7, ellipsoid to ellipsoid-oblong, in part often slightly thick-walled, distinctly amyloid. Basidia 22–33 × 5.5–8 µm, Q = 3.2–4.9, 4-spored or a few 2-spored, sometimes exclusively 2- and 1-spored, in some collections a few thick-walled (crassobasidia, Fig. 1J). Lamella edge fertile. Cystidia absent. Hymenophoral trama subregular, made up of subcylindrical or inflated cells, 32–145 × 6–35 µm. Pileipellis a pluristratous hymeniderm made up of erect, branched hyphae with strongly inflated, clavate, pyriform, spheropedunculate or subglobose terminal cells, 17–43 × 11–31 µm, often also subterminal cells slightly inflated, with brown parietal pigment, smooth to strongly incrusted, often with more or less thickened walls. Stipitipellis a dry cutis, made up of repent hyphae, 2–7 µm wide, hyaline or with pale brown parietal pigment. Apex of stipe with densely packed clavate caulocystidia or erect hyphae with swollen terminal cells, 13–48 × 4–20 µm, smooth, hyaline or with pale brown parietal pigment. Clamp-connections present at basidia and scattered in trama, absent in 2-spored basidiocarps.

Habitat & distribution. Usually subgregarious in poor, unfertilized meadows and hayfields on dry, weakly to strongly calcareous clay, loam and sand (Mesobromion, Arrhenatheretum elatioris, Galio-Koelerion). Rare in the coastal dunes, along the big rivers (fluviatile district) and in S. Limburg (cretaceous district). Widespread in West and Central Europe, but uncommon. Oct.–Nov.

Collections examined. NETHERLANDS: prov. Noord-Holland, Texel, 'Eijerlandse duinen', 26 Oct. 1968, *C. Bas 5070* (L); Texel, old dike near Wagejot, 31 Oct. 1984, *M. Groenendaal s.n.* (WAG-W); Texel, dike near Wezenspijk, 19 Oct. 1987, *M. Groenendaal s.n.* (WAG-W); prov. Zeeland, Haamstede, 21 Oct. 1966, *C. Bas 4821* (L); prov. Noord-Brabant, Drunen, 'Drongelens Kanaal', 21 Oct. 1981, *H. Huijser s.n.* (Herb. H. Huijser); idem, 7 Nov. 1983, *H. Huijser s.n.* (Herb. F. Benjaminsen); prov. Limburg, Geulle, along Julianakanaal, 21 Sept. 1980, *H. Huijser s.n. (Benjaminsen 800903)* (Herb. F. Benjaminsen); idem, 21 Sept. 1980, *H. Huijser s.n. (Benjaminsen 800905)* (Herb. F. Benjaminsen); idem, 30 Oct. 1982, *Th.W. Kuyper 2325* (L); Bemelen, 'Bemelerberg', 20 Oct. 1984, *E. Arnolds 5328* (WAG-W); Maastricht, Cannerberg, 30 Oct. 1988, *J. Schreurs s.n.* (WAG-W). — FRANCE: Bôle-Boudry, 1 Oct. 1968, *H. Huijsman s.n.* (L). — GERMANY: 'Müritz-see', 23 Oct. 1975, *J. Barkman s.n.* (WAG-W).

This species has been named *Dermoloma cuneifolium* by several authors, but the latter fungus is characterized by inamyloid spores and much paler lamellae. For a discussion on the nomenclature of *Dermoloma cuneifolium*, and the designation of a lectotype, see Arnolds (1991).

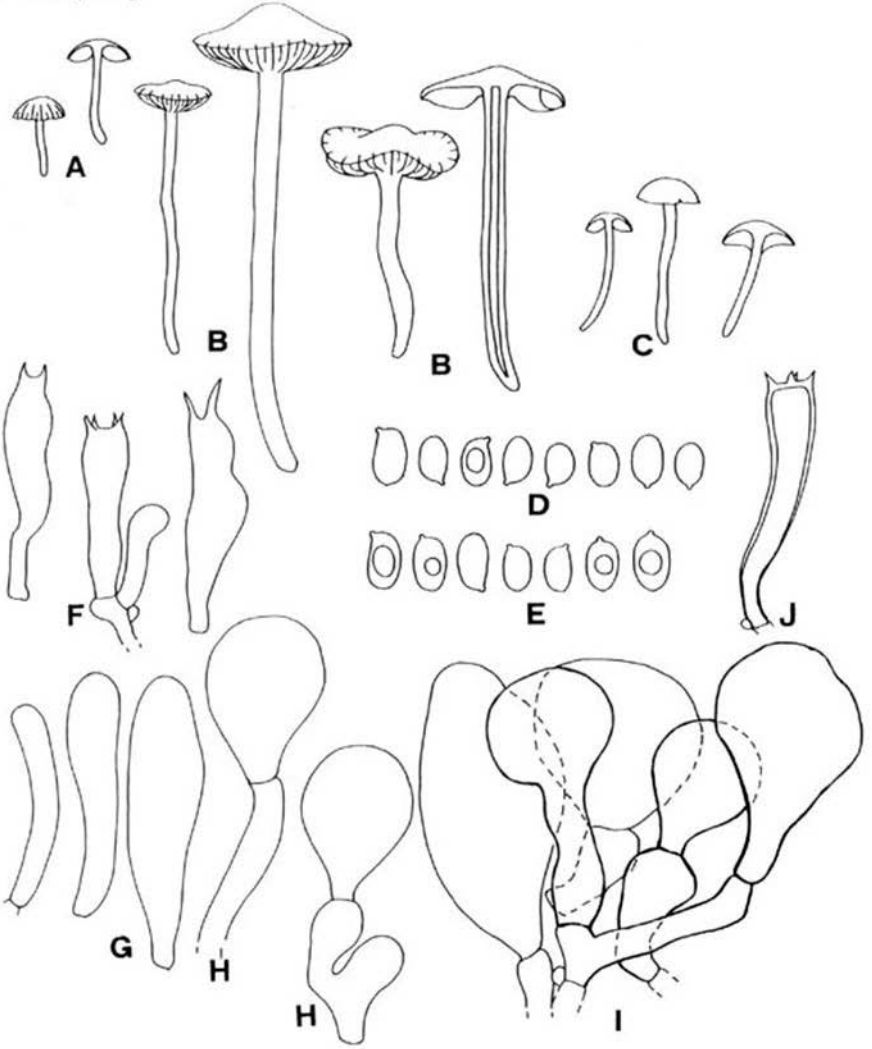

Fig. 1. *Dermoloma pseudocuneifolium*. A–C. Basidiocarps, × 1; D, E. spores, × 1000; F, J. basidia, × 1000; G, H. caulocystidia, × 1000; I. radial section through pileipellis, × 1000 (A, D, H and I from *Arnolds 5328*; B from *Huijser s.n.*, 21 Oct. 1981; C, E, F, G from *Schreurs s.n.*, 30 Oct. 1988; I from *Barkman s.n.*, 23 Oct. 1975).

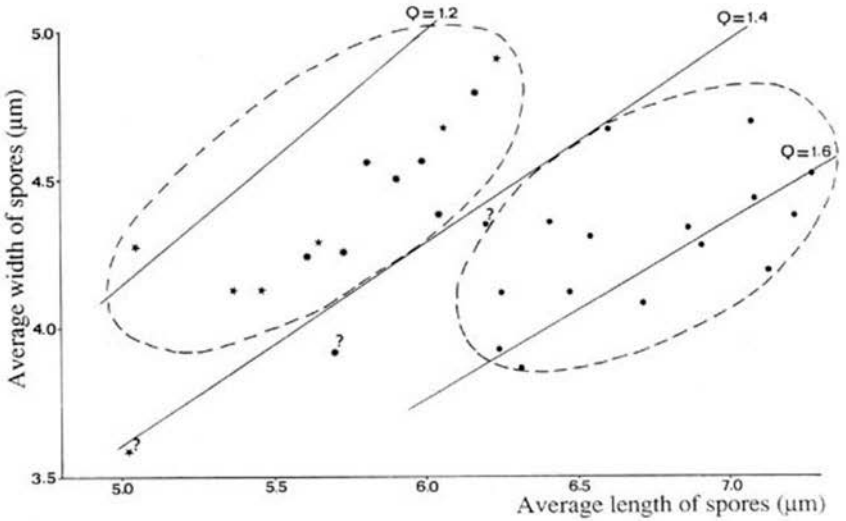

Fig. 2. Scatter diagram of average spore size in species of *Dermoloma* with amyloid spores. ★ = *D. josserandii* var. *josserandii*, ✻ = *D. josserandii* var. *phaeopodium*, • = *D. pseudocuneifolium*. — Each point represents the average size of at least 10 spores measured in a single basidiocarp.

Dermoloma pseudocuneifolium can often be recognized in the field by the relatively small and dark basidiocarps (especially lamellae) and the tendency to be more hygrophanous than other species. The relatively elongate, amyloid spores are the most characteristic microscopic feature. Shape (expressed in Q-value) appears to be more diagnostic than spore size (Fig. 2). However, collection *Groenendaal* 19 Oct. 1987 has spores which are almost intermediate between *D. pseudocuneifolium* and *D. josserandii* with an average size of 6.2 × 4.35 µm, av. Q = 1.43. It falls slightly outside the cluster of *D. pseudocuneifolium* in Fig. 1 (dot with ?). Collection *Barkman* 23 Oct. 1975 is interesting since it consists of two basidiocarps, one with spores 6.5–8.5 × 4–5 µm and exclusively 2- and 1-spored basidia, the other with spores (5.5–)6–6.5(–7) × 3.5–4.5 µm and, at least in part, 4-spored basidia (but most basidia collapsed).

Dermoloma josserandii Dennis & P.D. Orton

Dermoloma josserandii Dennis & P.D. Orton, Trans. Br. mycol. Soc. 43 (1960) 226.

KEY TO THE VARIETIES

1a. Pileus ivory white to beige, in centre occasionally pale grey-brown; lamellae and stipe whitish or very pale greyish brown ..... var. *josserandii*
b. Pileus dark grey-brown to sepia brown; lamellae and stipe with greyish or brownish tinge ..... var. *phaeopodium*

var. **josserandii**. — Fig. 3

Tricholoma hygrophorus Joss., Bull. trimest. Soc. mycol. Fr. 74 (1958) 482 (nom. nud.). — *Dermoloma hygrophorus* (Joss. ex) Joss., Bull. mens. Soc. Linn. Lyon 39 (1970) 6. — *Dermoloma pragensis* Kubička, Česká Mykol. 29 (1975) 3. — *Dermoloma pseudocuneifolium* var. *pragensis* (Kubička) M. Bon, Doc. mycol. 17 (65) (1986) 52.

Misapplied. Dermoloma cuneifolium sensu Svrček, Česká Mykol. 20 (1966) 149.

Excluded. Dermoloma pragensis sensu Ballero & Contu, Bol. Soc. Brot., Sér. 2, 60 (1987) 115 (= var. *phaeopodium*).

Selected literature. Dennis & P.D. Orton, Trans. Br. mycol. Soc. 43 (1960) 226, figs. 379, 514; Gröger, Boletus 12 (1988) 29–32, figs. 1, 2; Jahn, Westf. Pilzbr. 8 (1970) 25–27, figs. 1, 2; Joss., Bull. trimest. Soc. mycol. Fr. 74 (1958) 482–491, figs. 1–4 (as *Tricholoma hygrophorus*); Svrček, Česká Mykol. 20 (1966) 149 (as *D. cuneifolium*).

Pileus 14–33 mm, convex, then plano-convex to depressed, with or without obtuse umbo, not or weakly hygrophanous, ivory-white, pale greyish ochre to beige (e.g. K&W 5B3; Munsell 10 YR 7/2, 7/3), often slightly darker and more grey-brown at centre (e.g. Munsell 10 YR 6/4, 5/3), at first smooth and submicaceous, then often cracking into small irregular patches, showing pale context in the cracks, dry, with margin sometimes translucently striate. Lamellae, L = 20–34, l = 1–3(–7), subdistant, thickish, sinuate-adnate or emarginate, often with decurrent tooth, sometimes almost subdecurrent, ventricose, up to 5 mm wide, almost white to very pale brownish or greyish buff (Munsell 10 YR 7/2, 5Y 7/3). Stipe 20–42 × 2–5 mm, subcylindrical or tapering to the base, solid, then stuffed to fistulose, pale brownish grey to whitish, smooth or appressed white-fibrillose, apex pruinose to subfloccose. Context concolorous with surface or slightly darker in stipe, rather brittle, especially in pileus. Smell strongly farinaceous when handled or cut. Taste farinaceous to slightly bitterish. Spore print 'white'.

Spores 4.5–7.0(–7.5) × 3.5–5.0 µm, av. 5.0–6.1 × 3.6–4.7 µm, Q = (1.05–)1.1–1.5, av. Q = 1.2–1.4, broadly ellipsoid to ellipsoid, in part usually slightly thick-walled, always (greyish) violet in Melzer's. Basidia 21–28 × 4.5–7.5 µm, Q = 3.5–5.5, clavate or narrowly clavate, predominantly 4-(2-)spored or 4- and 2-spored intermixed. Lamella edge fertile. Cystidia absent. Hymenophoral trama subregular, made up of ellipsoid to cylindrical elements, 45–160 × 7.5–32 µm. Pileipellis a pluristratous hymeniderm, as seen from above made up of rounded elements, in section made up of erect, branched hyphae with short, inflated elements, broader towards pileus surface, with subglobose to pyriform terminal cells, c. 20–45 × 9–20 µm, with pale grey parietal pigment. Apex of stipe with scattered to densely packed caulocystidia, often in clusters, 20–66 × 5–14 µm, narrowly to broadly clavate, thin-walled.

Habitat & distribution. Solitary or in small groups, sometimes subfasciculate, in old, unfertilized grasslands on dry, basic river clay and limestone (Arrhenatheretum elatioris, Mesobromion) and in parks and forests under deciduous trees on basic soils. In the Netherlands very rare along the big rivers, also known from Great Britain, Germany, Czechoslovakia and France, but apparently very rare everywhere. (July–)Sept.–Oct.

Collections examined. NETHERLANDS: prov. Zuid-Holland, Ridderkerk, Huys ten Donk, 14 Oct. 1976, *F. Tjallingii s.n.* (L); idem, 28 July 1984, *Th.W. Kuyper (Bas 8255)* (L); prov. Noord-Brabant, Dussen, Biesbosch, dike along Spijkerboor, 11 Oct. 1989, *Arnolds 6051* (WAG-W). — GERMANY: Taubertal, Werbach, Boxberg, 3 Sept. 1977, *W. Winterhoff 77.67* (Herb. W. Winterhoff).

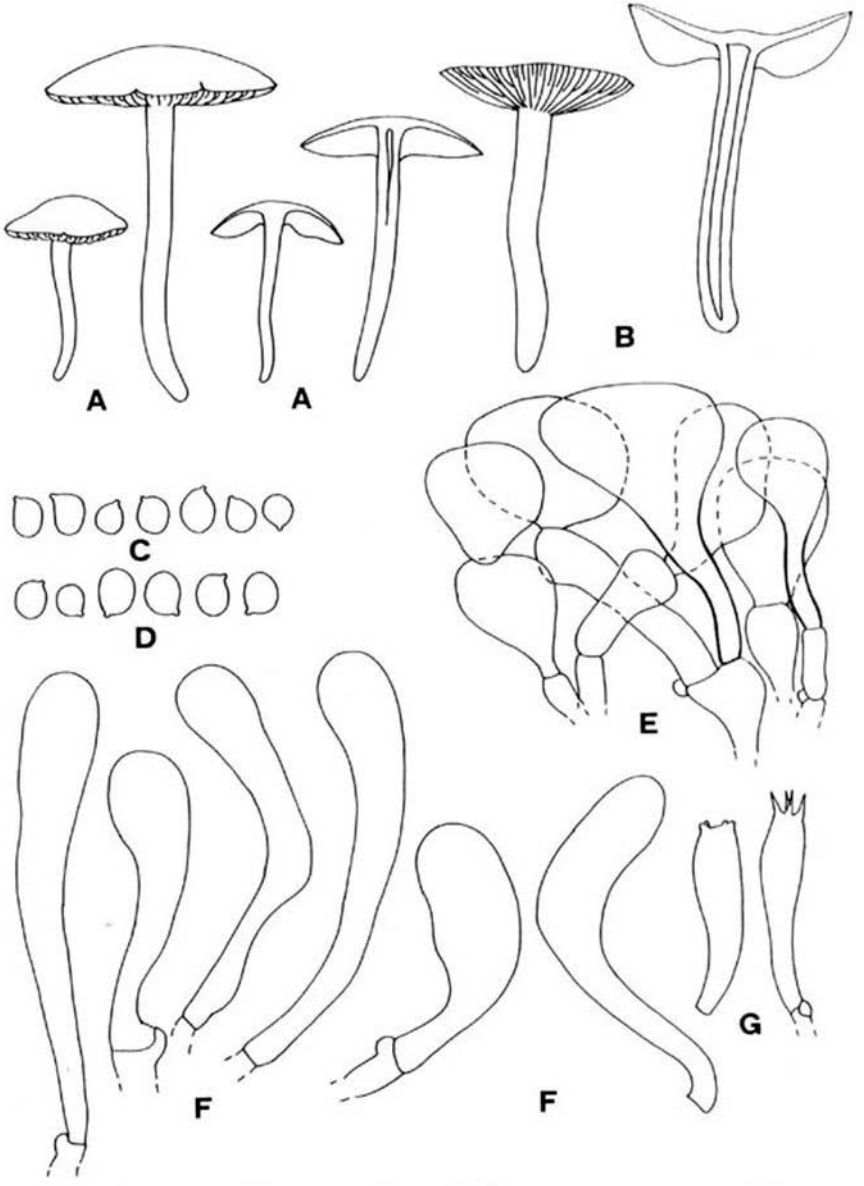

Fig. 3. *Dermoloma josserandii* var. *josserandii*. A, B. Basidiocarps, × 1.; C, D. spores, × 1000; E. radial section through pileipellis, × 1000; F. caulocystidia, × 1000; G. basidia × 1000 (A, C from *Tjallingii s.n.*, 14 Oct. 1976; B from *Arnolds 6051*; D–F, G from *Bas 8255*).

Dermoloma josserandii is rather variable concerning the colour of the pileus (almost white to beige or pale greyish brown), the attachment of the lamellae (from emarginate to subdecurrent), spore size (Fig. 1) and shape of caulocystidia. The spore size shows even considerable variation within a single collection. For instance, in *Bas 8255* (28 July 1984) spores were measured by different observers as 4.8–6.5 × 3.6–4.8 and 5.6–7.0 × 4.2–5.7 µm, respectively. Eight years before a collection was made in the same locality (*Tjallingii s.n.*, 14 Oct. 1976) in which spores were measured by two observers as 4.5–5.6 × 3.6–4.9 and 4.9–5.8(–6.5) × 3.7–4.7 µm, respectively. The former collection had initially been identified as *D. josserandii*, the latter as *D. pragensis*.

Dermoloma josserandii was originally described by Dennis & Orton (in Orton, 1960: 226) with spores measuring 6–8 × 4.5–5.5 µm, consequently slightly larger than in the four collections described here. Dennis & Orton (l.c.) intended to rename *Tricholoma hygrophorus* Joss., which was at that time invalidly published (Josserand, 1958: 488), but later validly described by Josserand (1970: 6) as *Dermoloma hygrophorus* Joss. Jahn (1970) discovered *Dermoloma hygrophorus* in Westfalen and extensively discussed the relationship between *D. hygrophorus* and *D. josserandii*, which in his opinion were different species. This point of view was shared by Moser (1978: 185), Ballero & Contu (1987) and, with some hesitation, by Orton (1980: 324). *Dermoloma hygrophorus* was said to differ in the whitish pileus (pale grey-brown in *D. josserandii*), stouter habit with convex pileus and stipe 5–10 mm thick, smaller spores [5.9–6.5(–7.0) × 4.5–5.2 µm], reflexed, broad caulocystidia and habitat in grasslands (*D. josserandii* was originally described from deciduous forest). The collections studied for the present paper combine several characteristics of the two species. The basidiocarps are consistently smaller than described for *Dermoloma hygrophorus*, but the spores are in better agreement with that species and smaller than in *D. josserandii*. Caulocystidia were present in all collections, but narrower than in *D. hygrophorus* and rarely reflexed. Gröger (1988) described a collection from Eastern Germany as *D. hygrophorus* combining small basidiocarps (pileus 16–24 mm, stipe 2–5 mm thick), with a pale ochraceous pileus and an intermediate spore size [(5.0–)5.6–7.5(–8.4) × (3.8–)4.0–5.0(–5.5) µm]. On the basis of this pattern of variability it is inevitable in my opinion to regard all collections as variants of one single taxon.

Dermoloma pragensis Kubička is a third, recently described species with broadly ellipsoid, amyloid spores. Moser (1978: 185) and Bon (1986: 52) regarded it as invalidly published and the latter author intended to validate the name by providing a Latin diagnosis. However, this is superfluous since Kubička (1975: 31) provided in his key (in Latin) an – extremely short – diagnosis ('Sp. 5–6 × 3.5–4.5 µm, amyloideae') and indicated a type collection. The spore size of *Dermoloma pragensis* fits into the variation of *D. josserandii* (Fig. 2) but because details on macroscopic characters are lacking in the diagnosis it is not clear at once whether it is identical with var. *josserandii* or var. *phaeopodium*. This explains why Moser (1978: 185) described the pileus of *Dermoloma pragensis* as pale grey, but Ballero & Contu (1987: 115) as greyish bistre or brown-grey. However, Kubička (1975) referred to a description of *D. cuneifolium* sensu Svrček\ (1966: 149), which appeared to have a pale grey pileus. Consequently, *D. pragensis* is in my opinion another synonym of *D. josserandii* var. *josserandii*.

Bon (1986: 51) claimed that *D. josserandii* is conspecific with the sanctioned name *Agaricus glauconitens* Fr.: Fr. However, Fries (1821: 116) described this fungus (as

A. nitens) with a blackish brown pileus ('nigrescente-umbrino') and bluish grey lamellae ('glauco-cinereis'), features that are not found in *Dermoloma josserandii* but characteristic of some variants of *D. cuneifolium* (Arnolds, 1991).

Dermoloma murinellum was recently described by Horak (1987: 110) from alpine grasslands in Switzerland. It seems to be closely related to *D. josserandii*, but it has smaller basidiocarps [pileus up to 12 mm, stipe up to 15 × 1(–1.5) mm] with a mouse-grey to pale grey-brown pileus and smaller, amyloid spores, 4.5–5.5 × 3–4 µm. Collection *Arnolds 6051* has equally small spores [4.4–5.4(–5.6) × (3.3–)3.5–3.7(–3.9) µm, av. 5.0 × 3.6 µm, Q = 1.40 (asterix with ? in Fig. 1)], but larger basidiocarps with the pileus 27–33 mm and the stipe 5 mm thick. The taxonomic status of *D. murinellum* is not yet clear.

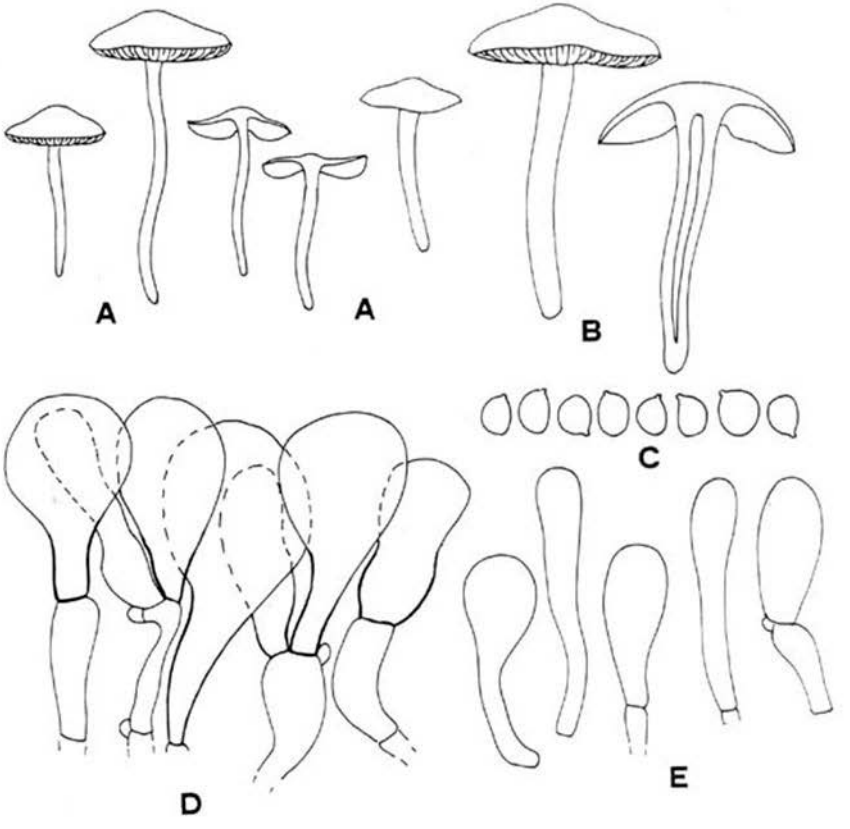

Fig. 4. *Dermoloma josserandii* var. *phaeopodium*. A, B. Basidiocarps, × 1; C. spores, × 1000; D. radial section through pileipellis, × 1000; E. caulocystidia, × 1000 (A from *Piepenbroek 1070*; B–E from *Groenendaal s.n.*, 25 Oct. 1983).

Dermoloma josserandii var. **phaeopodium** (P.D. Orton) Arnolds, *comb. nov.* – Fig. 4

Basionym. Dermoloma phaeopodium P.D. Orton, Notes R. bot. Gdn Edinb. 28 (1980) 327.
Misapplied. Dermoloma pragensis sensu Ballero & Contu, Bol. Soc. Brot., Sér. 2, 60 (1987) 115.
Selected literature: Orton, Notes R. bot. Gdn Edinb. 28 (1980) 327–328.

Pileus 10–35 mm, broadly conical to conico-convex or convex, soon plano-convex or slightly depressed, sometimes with obtuse umbo, not to rather hygrophanous, sepia brown, dark grey-brown to dark clay-brown when young (e.g. Munsell 7.5 YR 4/4, 10 YR 4/3, 5/4; K&W 7F4, 7F5), gradually pallescent to greyish brown, clay-brown or beige with darker centre, at first smooth, dull, submicaceous, then usually cracking into many rounded or polygonate patches showing pallid cracks in between, margin in some smaller specimens short translucently striate. Lamellae, L = 18–26, l = 1–3, rather crowded to subdistant, emarginate, sinuate, adnate to nearly free, sometimes with long decurrent tooth, weakly to strongly ventricose, up to 6 mm wide, rather thin to thick, grey, grey-brown, pale clay-brown or beige, paler than the pileus. Stipe 18–48 × (1.5–)2–5 mm, subcylindrical or often tapering from the apex, stuffed or fistulose, grey-brown, grey or pale greyish brown, ± concolorous with lamellae, slightly to strongly silvery white striate lengthwise, apex whitish pruinose to subfloccose. Context pale grey, pale brown-grey or pale brown, rather brittle in pileus, fibrillose in stipe. Smell strongly farinaceous to rancid when handled or cut. Taste similar. Spore print white.

Spores (4.5–)5.0–6.5(–7.5) × 3.5–5.0(–6.0) µm, av. 5.6–6.2 × 3.9–4.8 µm, Q = 1.15–1.5, av. Q = 1.2–1.4(–1.45), broadly ellipsoid to ellipsoid, in part often slightly thick-walled, always distinctly amyloid, violet in Melzer's. Basidia 23–31 × 6–7 µm, Q = 3.6–4.9, clavate to narrowly clavate, 4-spored or a few 2-spored. Lamella edge fertile. Cystidia absent. Hymenophoral trama subregular. Pileipellis a pluristratous hymeniderm, made up of erect, branched hyphae with clavate, pyriform and spheropedunculate terminal cells, 18–46(–56) × 7–24 µm, smooth, with pale brown parietal pigment, especially lower part of cell walls often slightly thickened. Stipitipellis a dry cutis, made up of repent hyphae 2–5 µm wide, hyaline or pale brown, smooth or minutely encrusted. Apex of stipe with scattered or clustered caulocystidia, 16–44 × 4.5–11 µm, narrowly to broadly clavate, often in part slightly thick-walled, smooth, hyaline or pale brown. Clamp-connections frequent.

Habitat & distribution. Solitary or in small groups in poor, unfertilized pastures and hayfields on dry, weakly acid to basic clay, loam, sand and limestone (Arrhenatheretum elatioris; Galio-Koelerion; Mesobrometum). In the Netherlands very rare in the coastal dunes, on dikes in the western part of the country and along the big rivers. Also known from Great Britain, Germany and Switzerland, but apparently very rare. Oct.–Nov.

Collections examined. NETHERLANDS: prov. Noord-Holland, Callantsoog, Zwanenwater, 1 Nov. 1981, *H. Huijser s.n.* (Herbarium F. Benjaminsen); Texel, polder Ceres, 25 Oct. 1983, *M. Groenendaal s.n.* (WAG-W); Texel, dike along Waddensea, 31 Oct. 1981, *H. Huijser s.n.*, (Herbarium H. Huijser); Texel, Oudeschild, Ankerpark, 28 Oct. 1984, *M. Groenendaal s.n.* (WAG-W); prov. Overijssel, Olst, dike along IJssel near estate 'Haere', 28 Nov. 1977, *Piepenbroek 1070* (L). — GERMANY: Schwäbische Alb, Eselsburger Tal, 8 Oct. 1984, W. Winterhoff 84580 (Herb. W. Winterhoff). — SWITZERLAND: Uri, Gurtnellen, 24 Sept. 1981, *E. Arnolds 4530* (WAG-W).

Dermoloma josserandii var. *phaeopodium* is characterized by the combination of dark basidiocarps and small, ellipsoid, amyloid spores. Macroscopically it is often similar to

D. cuneifolium, but that species has inamyloid spores. It is very close to *D. josserandii* and the only difference seems to be the much darker colours of the basidiocarps. The collection *Piepenbroek 1070* is almost intermediate, the pileus being described as pale clay brown (Munsell 10 YR 6/4) with dark brown centre (10 YR 4/3–5/4). In view of these features *D. phaeopodium* is reduced to a variety of *D. josserandii*.

Orton (1980: 327) originally described *Dermoloma phaeopodium* with spores 5–7 × 3.5–4.5 µm and regarded the spore width as a distinctive character with regard to *D. pseudocuneifolium* and *D. josserandii*. However, on the basis of my observations it appears that spore size in *D. phaeopodium* is much more variable and comparable to that in *D. josserandii* (Fig. 2).

Dermoloma pseudocuneifolium has usually smaller, more slender basidiocarps with darker lamellae and in addition longer, more elongate spores. Collection *Arnolds 4530* is exceptional in its relatively narrow spores (average 5.7 × 3.9 µm, Q = 1.46; asterix with ? in Fig. 2), and is in that respect a transition to *Dermoloma pseudocuneifolium*, but the spores in the latter species are usually longer (Fig. 2).

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CONTRIBUTIONS TOWARDS A MONOGRAPH OF PHOMA (COELOMYCETES) – II
Section Peyronellaea

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Seventeen taxa in *Phoma* sect. *Peyronellaea* are keyed out and briefly described by their characteristics in vitro. The following new taxa are described: *Phoma narcissi* (Aderh.) Boerema, de Gruyter & Noordeloos comb. nov., *Phoma pomorum* var. *calorpreferens* Boerema, de Gruyter & Noordeloos var. nov. and *Phoma subglomerata* Boerema, de Gruyter & Noordeloos nom. nov. Indices on host/substratum-fungus and fungus-host relations are included and short comments on the ecology and distribution of the taxa are given.

A comparative study in vivo and in vitro of the anamorphic genus *Phoma* resulted in its division into a number of sections, see e.g. van der Aa, Noordeloos & de Gruyter (1990). In the first contribution towards a planned monograph of *Phoma* (nr. I–1) some typical species of sect. *Phoma* have already been treated (de Gruyter & Noordeloos, 1992). This second contribution deals with all species so far placed in *Phoma* sect. *Peyronellaea* (Goid. ex Togl.) Boerema (van der Aa et al., l.c.: 6). For the history of the original genus *Peyronellaea* Goid. ex Togl. see Boerema, Dorenbosch & van Kesteren (1965).

The species of sect. *Peyronellaea* are characterized by the production of conspicuous multicellular chlamydospores, a phenomenon which only can be assessed by study in vitro. The morphology of these structures is important for species differentiation and identification in this section. In most cases they show much resemblance with certain types conidia in the dematiaceous hyphomycete genus *Alternaria* Nees: Fr., see Figs. 1–5, 6A: typical alternarioid to irregular botryoid configurations.[1]

The original genus *Peyronellaea* was based on species with this kind of 'dictyochlamydospore' (a term first applied to them by Luedemann, 1959), often occurring in combination with unicellular chlamydospores. In *Phoma* sect. *Peyronellaea* are now also included species in which the chlamydospores are aggregated into large irregular masses, looking like pseudosclerotia (see Fig. 6B, 7A; pseudosclerotioid appearance). To this section has also been added a fungus which, apart from having *Phoma*-pycnidia, produces multicellular chlamydospores indistinguishable from the conidia of *Epicoccum nigrum* Link (Fig. 7B).

[1] This example of evolutionary convergence refers especially to the similarity with the conidia in *Alternaria alternata* (Fr.) Keissler (dictyosporous, catenate) *A. chrysanthemi* Simmons & Crosier (phragmo/dictyosporous, solitary), *A. citri* Ellis & Pierce (variable dictyosporous, solitary and in short chains), *A. radicina* Meyer et al. (variable dictyosporous, solitary, rarely in short chains) and *A. raphani* Groves & Skolko (dictyo/phragmosporous to irregular botryoid, solitary, rarely in short chains). Compare the figures in Ellis (1971).

This is supported by the similarity in the genesis of the spores, and the fact that heavily melanized and roughened dictyochlamydospores sometimes look like *Epicoccum* spores (see Fig. 3B; epicoccoid appearance). The above concept of sect. *Peyronellaea* is in line with the opinion of White & Morgan-Jones (1983) about the *Phoma* species belonging to "A group ... characterized by possession of phaeodictyochlamydospores."

The pycnidia and the chlamydospores occur as two different asexual forms (anamorphs) adapted to the conditions of growth. In both the carbon-nitrogen (C/N) ratio of the medium proved to be a determining factor; at low values there is greater production of pycnidia, at higher values the development of chlamydospores usually increases (first shown by Lacoste, 1955). However, genetical differences are also involved. Sometimes the chlamydospores may also develop separately and independently. Most of the species occasionally produce micropycnidia in the mycelium or developing from a single chlamydospore cell (mp in Figs. 1–3).

In vitro the conidia are always mainly one-celled, but some species show secondary septation of long conidia. In vivo the septate condition is often more prominent and sometimes even dominant. Conidia in old pycnidia may become light-brown and occasionally also form extra septa.

Members of the section occurring on leaves have in the past repeatedly been classified in *Phyllosticta* Auct. Species producing in vivo a variable number of septate conidia have formerly often been arranged under *Ascochyta* Lib., *Diplodina* Auct. or *Stagonospora* (Sacc.) Sacc.

None of the species of this section so far has been associated with a teleomorph.

MATERIAL AND METHODS

The isolates studied include most of the strains used in previously published cultural studies of the *Phoma* species now classified in sect. *Peyronellaea*; compare Boerema, (1983), Boerema, Dorenbosch & van Kesteren (1965, 1968, 1971, 1973, 1977), Boerema & Dorenbosch (1973), Brooks (1932), Dorenbosch (1970), Hauptmann & Schickedanz (1986), Jooste & Papendorf (1981), Morgan-Jones & White (1983), Morgan-Jones & Burgh (1987), Punithalingam, Tulloch & Leach (1972) and White & Morgan-Jones (1983, 1986, 1987).

For each species only one representative culture has been listed. The methodology applied conforms with that described in the first part of this series (de Gruyter & Noordeloos, 1992), but the descriptions are mainly restricted to the characteristics on oatmeal agar (OA). On that medium the pycnidia as well as the characteristic multicellular chlamydospores are usually well-developed. The growth-rate on OA and malt agar (MA) refers to the diameter of the colonies after 7 days growth in darkness at 20–22 °C.

KEY TO THE SPECIES AND THE VARIETIES

1a. Colonies in addition to pycnidia producing multicellular chlamydospores resembling the conidia in *Alternaria*: typical alternarioid to irregular-botryoid; sometimes looking like pseudosclerotia: pseudosclerotioid; often also unicellular chlamydospores occur (Figs. 1–6, 7A). 2

b. Colonies in addition to pycnidia producing multicellular chlamydospores indistinguishable from the conidia of *Epicoccum nigrum* Link (Fig. 7B); pycnidia subglobose, stromatic, intermixed with pycnosclerotia; conidia variable, mostly 3–7 × 1.5–3 µm ..... 14. *P. epicoccina*

2a. Pseudosclerotioid chlamydospores absent 3

b. Pseudosclerotioid chlamydospores present (Figs. 6B, 7A); pycnidia to varying degrees covered by hyphae (semi-pilose). 17

3a. Colonies conspicuously dark cyan blue; chlamydospores and pycnidia also cyan blue; conidia mostly 5–7 × 2–3 µm ..... 1. *P. cyanea*

b. Colonies not blue pigmented 4

4a. Pycnidia glabrous. 5

b. Pycnidia to varying degrees covered by hyphae; conidia occasionally two-celled 12

5a. Multicellular chlamydospores typical alternarioid-dictyosporous or phragmosporous, mostly terminal (catenate or solitary), but sometimes also intercalary (Figs. 1–3) 6

b. Multicellular chlamydospores, more irregular botryoid-alternarioid in shape, intercalary or terminal, mostly solitary (Figs. 4–5). 13

6a. Multicellular chlamydospores frequently catenate and explicitly dictyosporous (solitary dictyosporous chlamydospores also occur). 7

b. Multicellular chlamydospores mostly solitary, dictyosporous or phragmosporous (some catenation may occur). 8

7a. Abundant production of chains of alternarioid chlamydospores; no unicellular chlamydospores; pycnidia variable; conidia variable one-celled, mostly 4–8.5 × 1.5–3 µm. ..... 2. *P. glomerata*

b. Apart from short chains of alternarioid chlamydospores also chains of unicellular chlamydospores; pycnidia usually subglobose; conidia relatively large, 7–12 × 2–3.5 µm, occasionally two-celled, 12–17 × 3–4 µm ..... 3. *P. subglomerata*

8a. Apart from alternarioid chlamydospores (mainly solitary) always many unicellular chlamydospores, relatively large with conspicuous guttules. 9

b. Solitary alternarioid chlamydospores in sympodial arrangement; unicellular chlamydospores – if present – relatively small; pycnidia usually ampulliform 10

9a. Pycnidia variable, often globose-divided; conidia variable, mostly 5–7 × 1.5–2.5 µm; no growth at 30°C ..... 4a. *P. pomorum* var. *pomorum*

b. Variety adapted to relatively high temperatures: good growth at 30°C; pycnidia not divided; conidia relatively large, mostly 5–8.5 × 2–3 µm
4b. *P. pomorum* var. *calorpreferens*

10a. Pycnidia abundantly produced at 22°C; conidia variable in shape and dimensions 11

b. Pycnidia occur only at temperature ranges of 28–30°C; at room temperature only alternarioid chlamydospores, often with a kind of halo; conidia consistent in shape, ellipsoid-obovoid, eguttulate, mostly 4–5.5 × 2.5–3 µm
5c. *P. jolyana* var. *sahariensis*

11a. Conidia biguttulate and eguttulate, mostly 4–7 × 2–4 µm; predominantly tropical or subtropical in distribution ..... 5a. *P. jolyana* var. *jolyana*

b. Variety adapted to cold climate: at room temperature abundant sympodial clusters of alternarioid chlamydospores; conidia often with several polar guttules, relatively long, mostly 5–9 × 2–3.5 µm ..... 5b. *P. jolyana* var. *circinata*

12a. Multicellular chlamydospores alternarioid, terminal and intercalary (Fig. 3B), solitary; unicellular chlamydospores usually single and with conspicuous guttules; pycnidia globose, often 'hairy' and confluent; conidia mostly 5–8 × 2–3 µm, occasionally two-celled, 8–12 × 3–3.5 µm; so far only known from North America
6. *P. americana*

b. Multicellular chlamydospores irregular botryoid-alternarioid, generally intercalary, solitary or in complexes with series of unicellular chlamydospores (Figs. 5A, 6A) 16

13a. Colonies extremely variable, reverse usually with reddish-lilac or pinkish discolouration; botryoid-alternarioid chlamydospores intercalary or terminal, often with discrete individual cellular elements (Fig. 4); mainly in subtropical regions 14

b. Colonies rather uniform, felted, reverse greyish to black; extremely irregular botryoid-alternarioid chlamydosporal configurations 15

14a. Abundant production of intercalary botryoid-alternarioid chlamydospores and series of unicellular chlamydospores; pycnidia papillate-rostrate; conidia variable, mostly 4.5–7 × 2–3 µm; often a reddish or yellowish discolouration below the colony
7. *P. sorghina*

b. Production of botryoid-alternarioid chlamydospores usually scarce, intercalary and terminal; pycnidia papillate-rostrate; conidia relatively broad, mostly 6–7 × 3.5–4 µm . . . . . 8. *P. pimprina*

15a. Apart from botryoid-alternarioid chlamydosporal configurations also pseudosclerotioid structures present 17

b. No pseudosclerotioid structures present; botryoid-alternarioid chlamydospores mostly intercalary and solitary; pycnidia subglobose; conidia eguttulate, variable in dimensions, mostly 4–7 × 2.5–3.5 µm; pathogenic to *Zantedeschia aethiopica*
9. *P. zantedeschiae*

16a. Botryoid-alternarioid chlamydospores usually intercalary and solitary; also short chains of unicellular chlamydospores; pycnidia subglobose and often hairy; conidia finely guttulate, mostly 5–7.5 × 2.5–3.5 µm, occasionally larger and two-celled, 8–15 × 3–5.5 µm; pathogenic to Amaryllidaceae, esp. *Narcissus* and *Hippeastrum* spp. . . . . 10. *P. narcissi*

b. Complexes of botryoid-alternarioid chlamydospores and series of unicellular chlamydospores, usually intercalary; pycnidia papillate, often hairy around the ostiole; conidia usually 4–8.5 × 2–3 µm, frequently also two-celled, 9–13 × 3–4 µm; pathogenic to *Clematis* spp. . . . . 11. *P. clematidina*

17a. Production of irregular botryoid-alternarioid chlamydospores, unicellular chlamydospores and pseudosclerotioid masses; pycnidia subglobose, papillate or rostrate, often hairy; conidia relatively large, biguttulate, mostly 9–10 × 2–3 µm; pathogenic to *Viola* spp. . . . . 12. *P. violicola*

b. Usually abundant production of irregular pseudosclerotioid masses of chlamydospores; often a reddish or yellowish discolouration below the colony; pycnidia subglobose, sometimes confluent, often hairy; conidia mostly 4–5.5 × 1.5–2 µm; saprophytic soil fungus; a specific pathogenic form commonly occurs on cultivated chrysanthemums . . . . . 13. *P. chrysanthemicola*

HOST/SUBSTRATUM–FUNGUS INDEX

Plurivorous (but often with special host or substratum relation, see below): *P. americana*, *P. chrysanthemicola*, *P. epicoccina*, *P. glomerata*, *P. jolyana* var. *sahariensis*, *P. jolyana* var. *jolyana*, *P. jolyana* var. *circinata*, *P. pomorum* var. *pomorum*, *P. pomorum* var. *calorpreferens*, *P. sorghina*, *P. subglomerata*.

Isolated from soil: *P. chrysanthemicola*, *P. cyanea*, *P. glomerata*, *P. jolyana* var. *sahariensis*, *P. jolyana* var. *jolyana*, *P. jolyana* var. *circinata*, *P. pimprina*, *P. pomorum* var. *pomorum*, *P. pomorum* var. *calorpreferens*, *P. sorghina*.

Isolated from seeds and fruits: *P. epicoccina*, *P. glomerata*, *P. jolyana* var. *jolyana*, *P. pomorum* var. *pomorum*, *P. sorghina*.

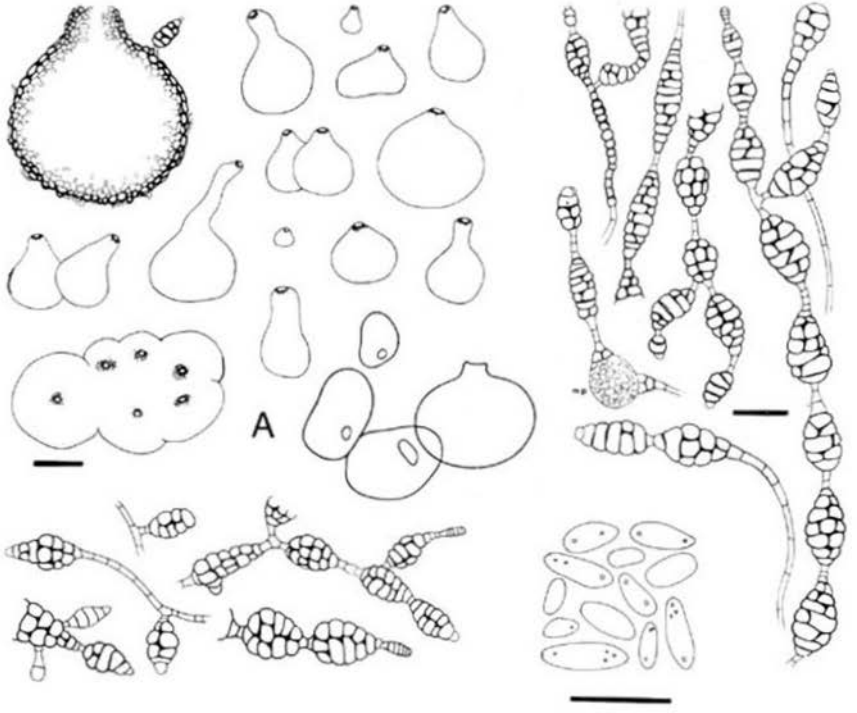
Isolated from substrata of animal (human) and inorganic origin: *P. epicoccina*, *P. glomerata*, *P. pomorum* var. *pomorum*, *P. sorghina*.

Frequently isolated from specific plants:

Amaryllidaceae (esp. *Narcissus* and *Hippeastrum*)	*P. narcissi*
Zantedeschia aethiopica (Araceae)	*P. zantedeschiae*
Chrysanthemum morifolium (Compositae)	*P. chrysanthemicola* f. sp. *chrysanthemicola*
Gramineae	*P. americana*
Gramineae (esp. in warm regions)	*P. sorghina*, *P. subglomerata*
Clematis spp. (Ranunculaceae)	*P. clematidina*
Pomoideae (Rosaceae)	*P. pomorum* sensu lato
Fragaria × *ananassa* (Rosaceae)	*P. pomorum* var. *pomorum*
Viola spp. (Violaceae)	*P. violicola*
Vitis vinifera (Vitaceae)	*P. glomerata*

FUNGUS–HOST INDEX

P. americana	Gramineae
P. chrysanthemicola f. sp. *chrysanthemicola*	*Chrysanthemum morifolium* (Compositae)
P. clematidina	*Clematis* spp. (Ranunculaceae)
P. glomerata	e.g. *Vitis vinifera* (Vitaceae)
P. narcissi	Amaryllidaceae, esp. *Narcissus* and *Hippeastrum* spp.
P. pomorum var. *pomorum*	e.g. *Fragaria* × *ananassa*; Pomoideae (Rosaceae)
P. sorghina	Gramineae
P. subglomerata	Gramineae
P. violicola	*Viola* spp. (Violaceae)
P. zantedeschiae	*Zantedeschia aethiopica* (Araceae)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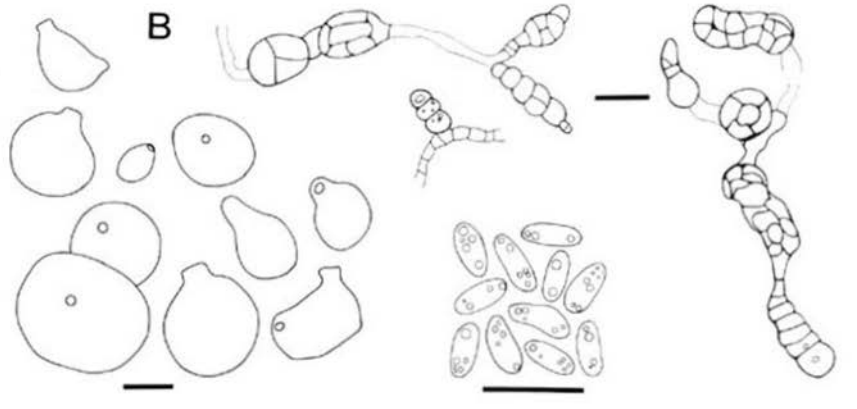
B

DESCRIPTIVE PART

Section Peyronellaea

1. **Phoma cyanea** Jooste & Papendorf — Fig. 1B

Chlamydospore-anamorph uni- and multicellular. Alternarioid.

Phoma cyanea Jooste & Papendorf, Mycotaxon 12 (2) (1981) 444–447.

Description in vitro

OA: growth-rate 50–60 mm, regular, mycelium cottony-floccose, consisting of hyaline or light to dark cyan blue hyphae, occasionally encrusted in cyan blue crystals, colony colour conspicuous dark cyan blue.

MA: growth-rate 60–70 mm.

Pycnidia 100–300 µm diam., mostly solitary, subglobose to globose, usually with a short neck and a wide 'collaretted' ostiole, conspicuous cyan blue. Conidial exudate whitish. Conidia (4–)5–7(–10) × 2–3(–4) µm, oblong ellipsoidal or obovoid, sometimes slightly curved, occasionally clavate, usually with minute guttules.

Chlamydospores variable and irregular, uni- or multicellular; unicellular mostly 8–10 µm diam., usually in short chains, intercalary or terminal, with somewhat thick walls encrusted in blue crystals; multicellular, variable-dictyosporous, 14–50 × 9–20 µm, common in older cultures, solitary, or in chains of 2 or rarely 3 elements, intercalary or terminal on branched hyphae, often in combination with unicellular chlamydospores, with relatively thick walls encrusted in blue crystals.

Ecology and distribution. This fungus is so far only known from wheat field debris in South Africa. The blue pigment is unique among *Phoma* species.

Representative culture. (type) CBS 388.80.

2. **Phoma glomerata** (Corda) Wollenw. & Hochapf. — Fig. 1A

Chlamydospore-anamorph multicellular. Alternarioid.

Phoma glomerata (Corda) Wollenweber & Hochapfel, Z. ParasitKde 8 (1936) 592. — *Coniothyrium glomeratum* Corda, Icon. Fung. 4 (1840) 39. — *Aposphaeria glomerata* (Corda) Saccardo, Sylloge Fung. 3 (1884) 175. — *Peyronellaea glomerata* (Corda) Goidanich, Atti Accad. nac. Lincei Rc. VIII, 1 (1936) 455, 658 (name of the genus not validly published, Art. 43) ex Togliani, Annali Sper. agr. II, 6 (1952) 93.

For full synonymy see Boerema, Dorenbosch & van Kesteren (1977). It includes 15 other combinations in *Phoma* and also 15 in *Peyronellaea*. The dictyochlamydosporal anamorph in vitro has been described three times in *Alternaria*.

Fig. 1. A. *Phoma glomerata*, type species of the section. Structure of pycnidia, conidia and alternarioid multicellular chlamydospores as found in cultures of different strains of the fungus. Note the variable shape and size of the latter, depending mainly on genetic strain differences; mp = micropycnidium; bar pycnidia = 100 µm, chlamydospores = 20 µm and conidia = 10 µm (collage of drawings from Boerema et al., 1965 and 1977). – B. *Phoma cyanea*, differentiated by its cyan-blue pycnidia, hyphae and chlamydospores. The latter are variable, unicellular and multicellular-alternarioid.

Description in vitro

OA: growth-rate 35–70 mm, most variable in appearance, strains (sectors) with rather sparse aerial mycelium and abundant production of pycnidia and strains (sectors) with abundant aerial mycelium, dense and woolly in places, olivaceous, greenish olivaceous, olivaceous buff or dull green; reverse dark olivaceous to blackish beneath sectors with dense mycelium, paler elsewhere.

MA: growth-rate 65–75 mm.

Pycnidia 100–300 µm diam., subglobose to obpyriform, papillate or with necks of various length, usually solitary but sometimes coalescing. Conidial exudate at first rosy-buff to salmony, later becoming olivaceous-brown. In aerial mycelium and arising from a single dictyochlamydospore cell frequently fertile micropycnidia occur, 20–50 µm diam. Conidia (3.5–)4–8.5(–10) × 1.5–3(–3.5) µm, variable in shape and dimensions, mostly ovoid-ellipsoidal, sometimes slightly curved, usually biguttulate (sometimes at one pole more guttules), hyaline but with age becoming pale olive-brown and minutely roughened.

Chlamydospores highly variable in shape and dimensions, but generally multicellular-dictyosporous, occasionally solitary-terminal, but usually in branched or unbranched chains of 2–20 or more elements, smooth at first, later roughened, dark brown to black, (18–)30–65(–80) × (12–)15–25(–35) µm.

Ecology and distribution. A ubiquitous soil-borne fungus, isolated from various kinds of plants as well as from animal (human) and inorganic material. It occurs frequently on dead seed coats and has been found in association with a variety of blights, rots and other diseases (ex.: *Vitis vinifera*, Blight of vine flowers and grapes). Generally it is considered to be a secondary invader or opportunistic parasite. The cosmopolitan distribution explains its wide variability and the numerous synonyms.

Representative culture. CBS 528.66.

3. **Phoma subglomerata** Boerema, de Gruyter & Noordel., *nom. nov.* — Fig. 2A

Chlamydospore-anamorph uni- and multicellular. Alternarioid.

Ascochyta trachelospermi Fabricatore, Annali Sper. agr. II, 5 (1951) 1445; not *Phoma trachelospermi* Tassi, Boll. R. Orto bot. (Boll. Lab. Orto Bot.) Siena 3 (2) (1900 ['1899']) 30.

Description in vitro

OA: growth-rate 50–60 mm, usually only sparse greyish green aerial mycelium and abundant production of pycnidia.

Pycnidia 135–225 µm diam., subglobose to obpyriform, papillate, usually solitary but sometimes coalescing. Conidial exudate usually salmony in colour. Fertile micropycnidia frequently occur. Conidia (5–)7–12(–15) × 2–3.5(–4) µm, variable in shape and dimensions, generally oblong ellipsoidal, with two or more polar guttules, mostly continuous but frequently longer and becoming 1-septate and constricted at the septum, (8.5–)12–17 × 3–4(–4.5) µm.

Chlamydospores mostly multicellular-dictyosporous, partly in short branched and unbranched chains; partly solitary on hyphal branches and lateral from hyphal strands, dark brown to black, mostly measuring 30–65 × 15–35 µm. In addition chains of unicellular chlamydospores and series of irregular short, olivaceous cells may occur.

Ecology and distribution. The original description of this species refers to an isolate from leaves of the star jasmine *Trachelospermum jasminoides* in Italy (spots often embedded in lesions). The fungus appeared to be a plurivorous opportunistic parasite also found in Central America (Mexico) and South Africa (especially in association with leaf spotting on Gramineae: triticale, wheat and maize). Owing to the production of chains of alternarioid dictyochlamydospores the fungus has been repeatedly mistaken for *Phoma glomerata* (no. 2; compare Boerema et al., 1965 and Hosford, 1975).

In the original paper by Fabricatore it was suggested that species which under certain conditions may produce *Ascochyta*-like uniseptate conidia, should be included in '*Peyronellaea*'.

Representative culture. CBS 110.92.

4a. **Phoma pomorum** Thüm. var. **pomorum** — Fig. 2B-a

Chlamydospore-anamorph uni- and multicellular. Alternarioid.

Phoma pomorum Thümen, Fungi pomicoli (1879) 105, var. *pomorum.*

Depazea prunicola Opiz, Malá Encyclop. Nauk. Náklad cesk. Mus. 10 (1852) 120 (nomen nudum).

Phyllosticta prunicola Saccardo, Michelia 1 (2) (1878) 157 [as '(Opiz?) Sacc.']. — *Phoma prunicola* (Sacc.) Wollenweber & Hochapfel, Z. ParasitKde 8 (1936) 595 [as '(Opiz) n.c.']; not *Phoma prunicola* Schweinitz, Trans. Am. phil. Soc. II, 4 (1832) 249 ('1834' = Synopsis Fung. Am. bor.). — *Coniothyrium prunicola* (Sacc.) Husz, Magy. kertész Főisk. Közl. 5 (1939) 23 (as '*prunicolum*'). — *Peyronellaea prunicola* (Sacc.) Goidanich, Atti Accad. Nac. Lincei Rc. VIII, 1 (1946) 455 [as '(Opiz) comb. nov.'; genus then not valid, Art. 43]. — *Sphaceloma prunicola* (Sacc.) Jenkins, Arg. Inst. Biol. S. Paulo 39 (1971) 233 (misapplied).

Phoma cyperi Upadhyay, Strobel & Hess, Can. J. Bot. 68 (1990) 2059–2064; cf. holotype IMI 330492 (erroneously cited as '330402' and '230492').[1]

For full synonymy and discussion of the complicated nomenclatural history of this fungus (formerly commonly known as *Phoma prunicola*) see Boerema, Dorenbosch & van Kesteren (1971, 1977). The synonymy of the fungus includes 6 other combinations in *Phoma,* 5 in *Phyllosticta* and 6 in *Peyronellaea.*

Description in vitro

OA: growth-rate 45–60 mm, variable in appearance, strains with abundant olivaceous aerial mycelium and scattered pycnidia, others with flat colonies and pycnidia in sectors; reverse brownish to blackish beneath dense mycelium, cream-coloured elsewhere.

MA: growth-rate 55–75 mm. (In contrast with var. *calorpreferens* the various strains of *P. pomorum* s.s. did not grow at 30°.)

Pycnidia mostly 100–200 µm diam., usually subglobose-ampulliform with a distinct ostiole, and often furrowed surface, solitary but frequently confluent in groups up to 1000 µm diam. Conidial exudate usually whitish to cream, often later darkening to olivaceous brown. Fertile micropycnidia frequently occur. Conidia (4–)5–7(–8) × 1.5–2.5(–3) µm, variable in shape and dimensions, mostly ovoid-ellipsoidal, frequently with one large guttule and several slightly smaller ones, hyaline, but with age becoming light brown.

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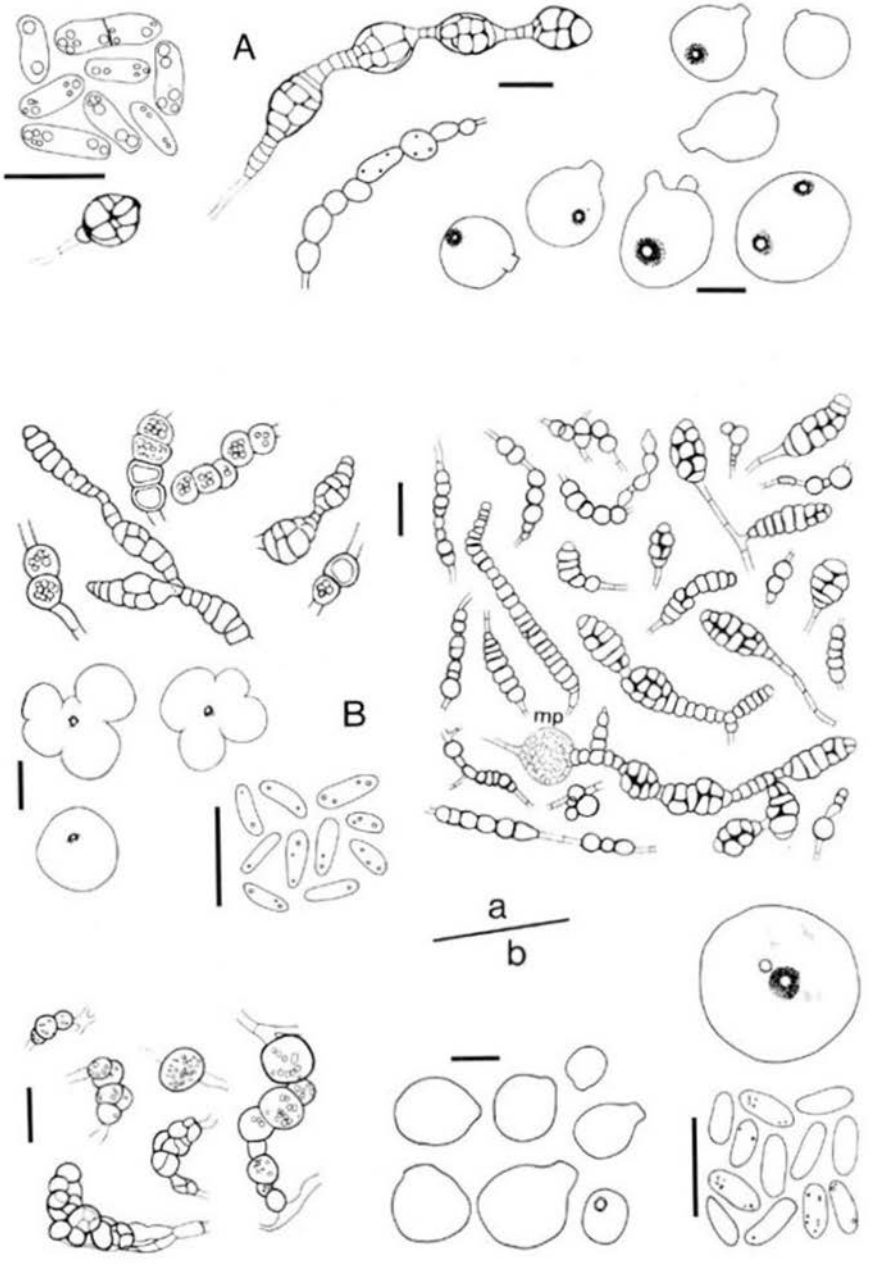
[1] The description of this most recent synonym also fits in completely with *P. pomorum.* The distinction as a separate species was mainly based on the differences from *P. glomerata* (no. 2) which it was first mistaken for.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Chlamydospores highly variable in shape, unicellular and multicellular, i.e. dictyosporous-phragmosporous, where unicellular often in long chains, usually guttulate, thick-walled, smooth or roughened, pale brown to brown, 8–10 µm diam., where multicellular usually dictyosporous, mostly terminal, on mycelial branches, occasionally intercalary in combination with chains of unicellular chlamydospores, smooth later roughened, brown to black, mostly 18–60 × 12–30 µm.

Ecology and distribution. A world-wide recorded soil- and seedborne opportunistic parasite. Records from tropical regions may refer to the warmth preferring variety *calorpreferens* treated below. The fungus is frequently found in association with leaf spots on the Pomoideae of the Rosaceae (apple, pear, stone fruits). In Europe it is also often isolated from roots of stunted strawberry plants, *Fragaria* × *ananassa* (Black root rot complex).

Representative culture. CBS 539.66.

4b. **Phoma pomorum** var. **calorpreferens** Boerema, de Gruyter & Noordel., *var. nov.* — Fig. 2B-b

Chlamydospore-anamorph uni- and multicellular. Alternarioid.

A varietate typica differt circa 30°C crescens.
Holotypus: Siccus in L conservatus est no. 990.290 418.

Description in vitro

OA: growth-rate similar to that of var. *pomorum,* often abundant production of pycnidia and tufts of whitish aerial mycelium; reverse usually with yellowish (citrine) tinges. (In contrast with var. *pomorum,* the various strains of this variety grow well at 30°C.)

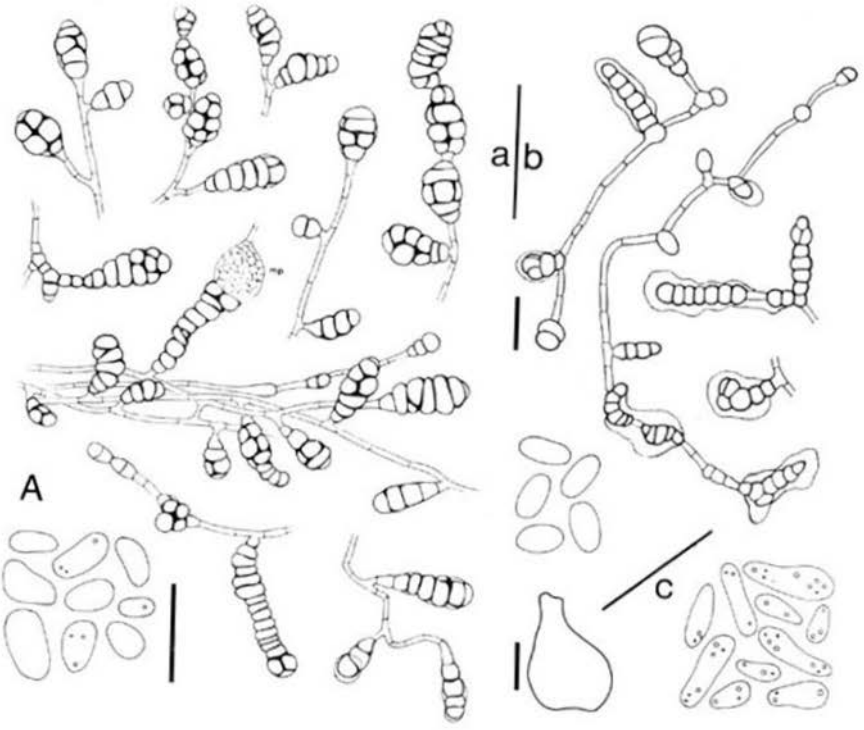
Pycnidia similar to those of var. *pomorum,* subglobose non-papillate, but usually smooth and not furrowed, conidial exudate usually pinkish and not whitish-cream as in var. *pomorum*. Conidia (4–)5–8.5(–12) × 2–3(–3.5) µm, in average larger than those of var. *pomorum,* and often oblong-ellipsoidal.

Chlamydospores like those of var. *pomorum* highly variable, unicellular and multicellular-dictyosporous; the unicellular chlamydospores may be very dark and sometimes extremely large, up to 25 µm diam.

Ecology and distribution. This newly recognized warmth preferring variety of *Phoma pomorum* has been found in Europe as well as in North America. The isolate sources indicate a plurivorous behaviour, corresponding to that of var. *pomorum.* Various records of the latter may refer in fact to var. *calorpreferens.*

Representative culture. CBS 109.92.

Fig. 2. A. *Phoma subglomerata,* e.g. characterized by short chains and solitary alternarioid multicellular chlamydospores. Conidia relatively long and sometimes two-celled. – B. Varieties of *Phoma pomorum.* Complex unicellular and alternarioid multicellular chlamydospores. Above (a) var. *pomorum,* often producing divided pycnidia; mp = micropycnidium (collage of drawings from Boerema et al., 1965 and 1977). At bottom (b) the southern var. *calorpreferens* without divided pycnidia and often somewhat larger conidia.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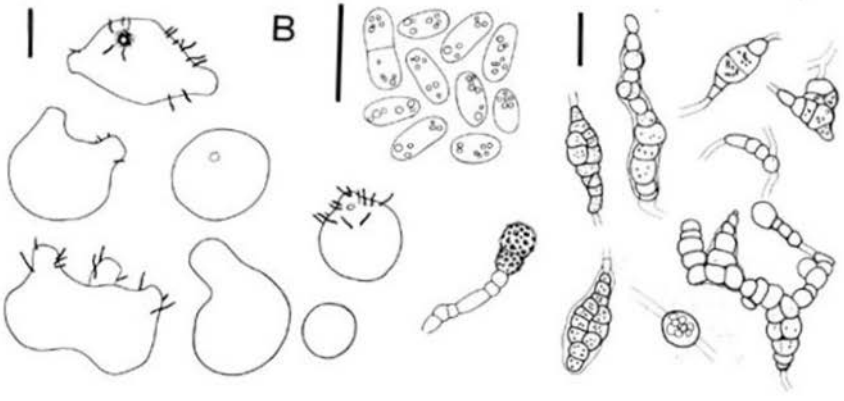
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5a. **Phoma jolyana** Pirozynski & Morgan-Jones var. **jolyana** — Fig. 3A-a

Chlamydospore-anamorph multicellular. Alternarioid.

Phoma jolyana Pirozynski & Morgan-Jones, Trans. Br. mycol. Soc. 51 (June, 1968) 200, var. *jolyana*.

Peyronellaea musae Joly, Revue mycol. 26 (July, 1961) 97. — *Phoma musae* (Joly) Boerema, Dorenbosch & van Kesteren, Persoonia 4 (1965) 63; not *Phoma musae* (Cooke) Saccardo, Sylloge Fung. 3 (1884) 163; not *Phoma musae* Carpenter, Rep. Hawaii agric. Exp. Stn 1918 (1919) 39.

Phoma jolyi Morelet, Bull. Soc. Sci. nat. Archéol. Toulon Var 177 (July, 1968) 9.

Peyronellaea nainensis Tandon & Bilgrami, Curr. Sci. 30 (Dec., 1961) 344; not *Phoma nainensis* Bilgrami, Curr. Sci. 32 (1963) 175.

Description in vitro

OA: growth-rate 50–55 mm, aerial mycelium felted, blackish, greenish olivaceous to dull black; reverse dark olivaceous buff to amber. (Optimum growth at c. 25°C; no growth at 30°C.)

Pycnidia 150–200 µm diam., subglobose to obpyriform, papillate, mostly uniostiolate and solitary. Conidial exudate usually salmony in colour. In aerial mycelium frequently fertile micropycnidia occur. Conidia (3.5–)4–7(–8.5) × 2–4 µm, variable in shape and dimensions, mostly broad ellipsoidal to obovoid or somewhat allantoid, often biguttulate but also eguttulate.

Chlamydospores generally multicellular-dictyo/phragmosporous, occasionally intercalary, but frequently as terminal elements of short lateral branches, sometimes becoming lateral through continued growth of a constituent cell, usually solitary, smooth or irregular roughened, tan to dark brown, 13–45(–50) × 7–20(–25) µm.

Ecology and distribution. A common soil-borne fungus in subtropical regions of Eurasia and Africa. In Siberia and in the Sahara adapted varieties of the fungus occur, see below (var. *circinata* and var. *sahariensis*). Although *P. jolyana* occasionally has been recorded as a plant pathogen this fungus is probably always only a secondary invader of diseased or weakened plant tissue.

Representative culture. CBS 463.69.

5b. **Phoma jolyana** var. **circinata** (Kuznetz.) Boerema, Dorenbosch & van Kesteren Fig. 3A-c

Chlamydospore-anamorph multicellular. Alternarioid.

Phoma jolyana var. *circinata* (Kuznetz.) Boerema, Dorenbosch & van Kesteren, Kew Bull. 31 (3) (1997) 535 ('1976'). — *Peyronellaea circinata* Kuznetzova, Nov. Sist. Nas. Rast 8 (1971) 189.

Peyronellaea nigricans Kuznetzova, Nov. Sist. Nas. Rast 8 (1971) 191.

Fig. 3. A. Varieties of *Phoma jolyana*. Terminal alternarioid multicellular chlamydospores becoming more or less lateral by continued growth of the hyphae. Note the alternating arrangement. Left (a) var. *jolyana*, right (b) var. *sahariensis* and bottom right (c) var. *circinata* (drawings after Boerema et al., 1965, 1977 and Boerema, 1983). – B. *Phoma americana*, pycnidia often covered by hyphae (semi-pilose), conidia (occasionally two-celled), chlamydospores variable, unicellular and alternarioid multicellular. The latter may become heavily melanized and roughened like *Epicoccum*-conidia (drawing from Morgan-Jones & White, 1983).

Description in vitro

OA: growth-rate about the same as that of var. *jolyana*, differing in the powdery appearance (clusters of dictyochlamydospores) and honey discolouration below the colony.

MA: reverse citrine-olivaceous. (No growth at 30°C.)

Pycnidia similar to those of var. *jolyana*. Conidia (3.5–)5–9 × 2–3.5 µm, i.e. generally somewhat longer, smaller and more irregular in shape than those of var. *jolyana*, often with several small polar guttules.

Chlamydospores multicellular-dictyo/phragmosporous, similar to those of var. *jolyana*, but much more abundant, forming large irregular clusters.

Ecology and distribution. This variety refers to Russian isolates made in Novosibirsk. The abundant production of thick-walled dictyochlamydospores may be interpreted as an adaptation to the cool continental climate.

Representative culture. CBS 285.76.

5c. **Phoma jolyana** var. **sahariensis** (Faurel & Schotter) Boerema, Dorenbosch & v.d. Aa — Fig. 3A-b

Chlamydospore-anamorph multicellular. Alternarioid.

Phoma jolyana var. *sahariensis* (Faurel & Schotter) Boerema, Dorenbosch & van der Aa apud Boerema, Versl. Meded. Plziektenk. Dienst Wageningen 159 (Jaarb. 1982) (1093) 27. — *Sphaeronaema sahariense* Faurel & Schotter, Revue mycol. 30 (1965) 156; not *Phoma sahariensis* Faurel & Schotter, Revue mycol. 30 (1965) 154.

Description in vitro

OA: growth-rate about the same as that of var. *jolyana*, but distinguished by conspicuous yellow-olivaceous aerial mycelium and a somewhat *Epicoccum*-like appearance, yellow discolouration below the colony and absence of pycnidia. (Optimum growth and pycnidia production at c. 28–30°C.)

Pycnidia occur only at temperature ranges of 28–30°C, but do not differ essentially from those of var. *jolyana*; however, they may have a pronounced neck. Conidia 4–5.5 (–6) × (2–)2.5–3 µm, ellipsoidal-obovoid, somewhat shorter and much more consistent in shape than those of var. *jolyana*, usually eguttulate.

Chlamydospores multicellular-dictyo/phragmosporous, similar to those of var. *jolyana*, but often with a kind of halo.

Ecology and distribution. This variety is recorded from hare droppings in Central Sahara, desert soil in Egypt and seed of *Cucumis sativus* of European origin. Apparently a variety adapted to relatively high temperatures. The frequently occurring pronounced neck of the pycnidia explains its originally classification in the genus *Sphaeronaema*.

Representative culture. CBS 448.83.

6. **Phoma americana** Morgan-Jones & White — Fig. 3B

Chlamydospore-anamorph uni- and multicellular. Alternarioid.

Phoma americana Morgan-Jones & White, Mycotaxon 16 (2) (1983) 406–412.

Description in vitro

OA: growth-rate 52–58 mm diam., aerial mycelium tenuous, particularly in a wide marginal zone, underground greenish olivaceous, reverse also greenish olivaceous. (At 30°C also fast-growing, even up to 65 mm diam.)

MA: growth-rate always rather slow, usually c. 35 mm diam.

Pycnidia 100–220 µm diam., subglobose, papillate or with a short cylindrical neck, often multiostiolate and confluent reaching up to 850 µm diam., covered to varying degrees by hyphae. Conidial exudate salmony in colour. Conidia mostly 5–8(–8.5) × 2–3(–3.5) µm, irregular cylindrical-ellipsoidal, frequently biguttulate, occasionally 1-septate, 8–12(–13.5) × 3–3.5(–4) µm.

Chlamydospores very variable, terminal or intercalary, solitary or in chains, uni- or multicellular, when septate phragmosporous or dictyosporous, smooth or roughened, pale brown to brown, occasionally heavily melanized and roughened as in *Epicoccum*-conidia, mostly 15–25 µm diam. Unicellular chlamydospores mostly 7–18 µm diam. and with conspicuous guttules.

Ecology and distribution. This seems to be a plurivorous soil-borne fungus of American origin. The isolates were obtained from the southeastern United States, mainly in regions with a subtropical climate. This explains its ability to grow fast at 30°C. The host-plants so far recorded are Gramineae (wheat, maize). The fungus resembles in some respects *Phoma pomorum* var. *calorpreferens*.

Representative culture. CBS 185.85

7. **Phoma sorghina** (Sacc.) Boerema, Dorenbosch & van Kesteren — Fig. 4A

Chlamydospore-anamorph uni- and multicellular. Botryoid-alternarioid.

Phoma sorghina (Sacc.) Boerema, Dorenbosch & van Kesteren, Persoonia 7 (1973) 139. — *Phyllosticta sorghina* Saccardo, Michelia 1 (2) (1878) 140.

Phoma insidiosa Tassi, Boll. R. Orto Bot. Siena 1 ('1897') (1898) 8.

Peyronellaea indianensis Deshpande & Mantri, Mycopath. Mycol. appl. 30 (1966) 341–344. — *Phoma indianensis* (Deshpande & Mantri) Boerema, Dorenbosch & van Kesteren, Persoonia 5 (2) (1968) 203.

Peyronellaea stemphylioides Kuznetzova, Nov. Sist. Niz. Rast 8 (1971) 199.

For full synonymy see Boerema, Dorenbosch & van Kesteren (1977). It includes 4 other combinations in *Phoma* and 10 in *Phyllosticta*.

Description in vitro

OA: growth-rate 50–70 mm diam., aerial mycelium fluffy, sometimes compact with greyish-green or whitish-salmon pink tinges and occasionally reddish exudate droplets; reverse often with reddish discolouration and occasionally needle-like crystals (anthraquinone pigments; yellow in acid conditions). About 50 percent of the strains showed a positive reaction with the sodium hydroxide test: on application of a drop NaOH green → red (E+).

MA: growth-rate 50–80 mm diam.

Pycnidia 50–200 µm diam., subglobose, usually with a distinct straight or somewhat curved neck up to 80 µm long, occasionally touching but usually not confluent. Conidial exudate usually salmony in colour. In aerial mycelium occasionally aberrant small non-osti-

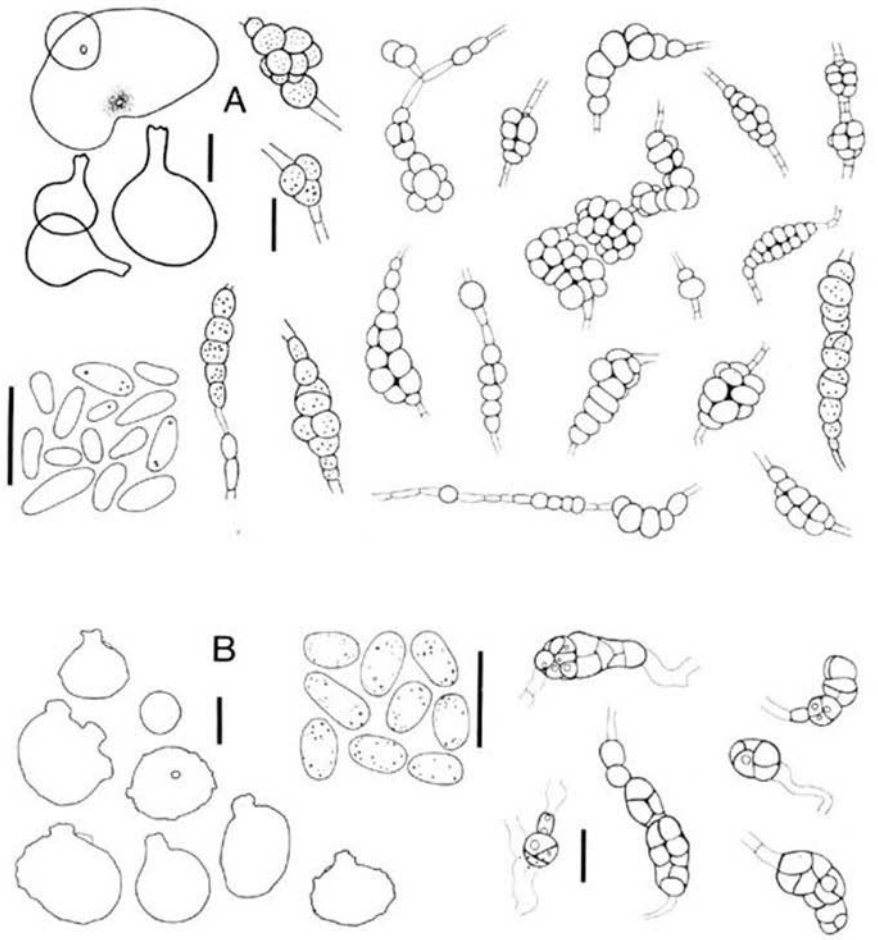

Fig. 4. A. *Phoma sorghina*, characterized by irregular, botryoid-alternarioid multicellular chlamydospores and intermediate stages between unicellular and multicellular chlamydospores. The pycnidia of this species are often rostrate (collage of drawings from Boerema et al., 1968 and 1977). – B. *Phoma pimprina*, resembles multicellular chlamydospores and pycnidia of *P. sorghina*, but easily differentiated by the broad conidia.

olate pycnidia occur, 5–23 µm diam. Conidia (4–)4.5–7(–8.5) × (1.5–)2–3(–3.5) µm, most variable in shape and dimensions, mostly ovoid-ellipsoidal, sometimes curved, mostly eguttulate, occasionally with 1–3 polar guttules, hyaline, or sometimes very pale brown.

Chlamydospores highly variable and irregular, uni- or multicellular, mostly intercalary, sometimes terminal-lateral, solitary or in chains, when septate usually dictyosporous, of-

ten with a botryoid configuration, smooth, verrucose or, rarely, tuberculate, subhyaline to brown, 8–35 µm diam., non-septate chlamydospores 5–15 µm diam.

Ecology and distribution. A common soil-borne fungus in the tropics and subtropics, which occasionally also has been recorded in temperate regions – especially on plants in glasshouses – and in regions with a continental climate. The fungus is most frequently associated with Gramineae, such as rice, sorghum, sugar-cane and wheat: spots on leaves, glumes and seed; root-rot and dying-off. Usually, the fungus only behaves like a weak parasite and secondary invader of diseased or weakened plants. Some strains of the fungus can produce a metabolite which is toxic to rats, chickens and insects. *Phoma sorghina* is further reported as an opportunistic pathogen of man and mammal (erethematous lesions on the skin).

Representative culture. CBS 284.77.

8. **Phoma pimprina** Mathur, Menon & Thirumalachar — Fig. 4B

Chlamydospore-anamorph uni- and multicellular. Botryoid-alternarioid.

Phoma pimprina Mathur, Menon & Thirumalachar apud Mathur & Thirumalachar, Sydowia 13 (1959) 146a–147.

Description in vitro

OA: growth-rate 40–55 mm, flat, with scarce aerial mycelium and abundant production of pycnidia; reverse often with lilac-pinkish discolouration.

Pycnidia mostly 115–230 µm diam., subglobose to globose, usually with pronounced necks and wide ostioles, mostly solitary and not confluent. Conidial exudate salmony. Conidia (4–)6–7(–8.5) × (3–)3.5–4(–4.5) µm, broad oblong-ovate, usually fine guttulate.

Chlamydospores usually scanty, variable and irregular, uni- or multicellular, intercalary or terminal, mostly solitary, when septate usually dictyosporous, often somewhat botryoid, smooth-verrucose, subhyaline to brown, 8–35 µm diam., when non-septate usually in chains, 5–15 µm diam.

Ecology and distribution. This fungus is thus far only known from soil in India (various isolates). The fungus in many respects resembles *Phoma sorghina*, treated before (no. 7), but can be differentiated very easily by the consistent broad oblong-ovate conidia.

Representative culture. CBS 246.60.

9. **Phoma zantedeschiae** Dippenaar — Fig. 5B

Chlamydospore-anamorph multicellular. Irregular botryoid-alternarioid.

Phoma zantedeschiae Dippenaar, S. Afr. J. Sci. 28 (1931) 284.

Phyllosticta richardiae Halsted, Rep. New Jers. agric. Coll. Exp. Stn 6 [= Rep. New Jers. St. agric. Exp. Stn 14 (1893)] (1894) 400 (without description).

Phyllosticta richardiae Brooks, Ann. appl. Biol. 19 (1932) 18, 19; not *Phoma richardiae* Mercer, Mycol. Centbl. (Mykol. Zentbl.) 2 (1913) 244, 297, 326 [= *Phoma glomerata* (Corda) Wollenw. & Hochapf.].

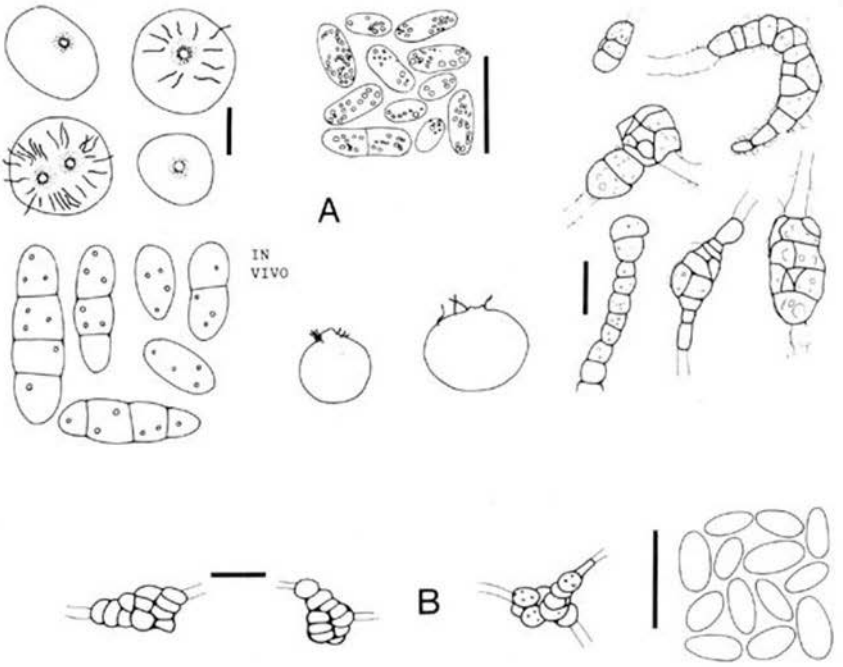

Fig. 5. A. *Phoma narcissi*, produces irregular complex unicellular chlamydospores and botryoid-alternarioid multicellular chlamydospores. Pycnidia often covered by hyphae (semi-pilose). Conidia fine guttulate and occasionally two-celled; in vivo often much larger and 2–3-septate. – B. *Phoma zantedeschiae*, characterized by irregular botryoid-alternarioid multicellular chlamydospores. Conidia eguttulate, unicellular and variable in dimensions (reproduced from Jauch, 1947).

Description in vitro (partly adopted from Brooks, 1932 and Jauch, 1947)

Growth-rate 70–80 mm, aerial mycelium fairly abundant, white when young but rapidly becoming greyish brown; reverse grey to almost black in the centre.

Pycnidia 90–180 µm diam., subglobose or depressed, usually uni-ostiolate, mostly solitary, sometimes compound. Conidial exudate greyish. Conidia variable in dimensions, (3–)4–7(–8) × (2–)2.5–3.5(–4) µm, oval or ellipsoidal, often pointed at one end, eguttulate.

Chlamydospores variable-multicellular, mostly intercalary, occasional terminal, usually solitary, irregular botryoid-dictyosporous, dark brown, 15–40 µm diam.

Ecology and distribution. This fungus may cause large brown blotches on the leaves and 'flowers' (i.e. spathes) of the arum- or calla lily, *Zantedeschia aethiopica* (formerly *Richardia africana*). The disease – known as Leaf Blotch – is recorded from South Africa (centre of diversity for *Zantedeschia* spp.), western Europe, North and South America.

The fungus has been confused with the ubiquitous *Phoma glomerata* (no. 2); compare Boerema & Hamers (1990).

Representative culture. CBS 267.31 (type culture of *Phyllosticta richardiae* Brooks).

10. **Phoma narcissi** (Aderh.) Boerema, de Gruyter & Noordel., *comb. nov.* — Fig. 5A

Chlamydospore-anamorph uni- and multicellular. Irregular botryoid-alternarioid.

Phyllosticta narcissi Aderhold, Centbl. (Zentbl.) Bakt. ParasitKde Abt. 2, 6 (May, 1900) 632, 633 (basionym).

Hendersonia curtisii Berkeley apud Cooke, Nuovo G. bot. ital. 10 (1878) 19 ('Berk., herb. Curt.'); not *Phoma curtisii* Saccardo, Sylloge Fung. 3 (1884) 860. — *Stagonospora curtisii* (Berk.) Saccardo, Sylloge Fung. 3 (1884) 451. — *Stagonosporopsis curtisii* (Berk.) Boerema apud Boerema & Dorenbosch, Versl. Meded. Plziektenk. Dienst Wageningen 157 (Jaarb. 1980) (1981) 19, 20.

Phyllosticta narcissi Oudemans, Ned. kruidk. Archf III, 2 (1) (August, 1900) 227. — *Phyllosticta oudemansii* Saccardo & P. Sydow, Sylloge Fung. 16 (1902) 849.

Stagonospora narcissi Hollós, Annls hist.-nat. Mus. natn. hung. 5 (1906) 354, 355.

Stagonospora crini Bubák & Kabát, Hedwigia 47 (1908) 361.

Phyllosticta hymenocallidis Seaver, N. Am. Flora 6 (1) (1922) 12 (second impression 1961).

Phoma amaryllidis Kotthoff & Friedrichs, Obst- u. Gartenbau Ztg 18 (1929) 32, 33.

Phyllosticta gemmipara Zondag, Tijdschr. PlZiekt. 35 (1929) 97–107.

Description in vitro

OA: growth-rate 80–84 mm, aerial mycelium compact woolly-fluffy, smoky-grey; reverse grey-olivaceous to olivaceous-grey, locally leaden-grey, centre olivaceous-black.

Pycnidia 110–275 µm diam., globose, usually somewhat compressed, with a definite ostiole, often covered by hyphae. Conidial exudate rosy-buff. Conidia usually one-celled, broadly ellipsoidal, finely guttulate, 4–7.5(–8) × (2–)2.5–3.5(–4) µm, occasionally larger and two-celled, 8–15 × 3–5.5 µm. (In vivo the conidia may be extremely large and mainly 2–4-celled, in length varying from 8–28 µm and in width from 3–8 µm!)

Chlamydospores uni- and multicellular, where unicellular usually intercalary in short chains, dark brown, 8–15 µm diam., where multicellular mostly intercalary, occasionally terminal, usually solitary, sometimes in series of 2–3 elements, irregular botryoid-dictyosporous, mostly somewhat curvate and very dark brown, 8–35 µm diam. Hyphae and chlamydospores often bearing more or less hemispherical or flattened droplet-like deposits, which, when becoming darker give an impression of ornamentation.

Ecology and distribution. A world-wide recorded pathogen of *Narcissus, Hippeastrum* and various other Amaryllidaceae: Leaf Scorch, Neck Rot, Red Spot Disease, Red Leaf Spot. The synonymy reflects, apart from its plurivorous character, the extreme variability of its conidia.

On leaves and scales the fungus produces mostly pycnidia with only relatively small aseptate *Phoma*-like conidia, similar to those in vitro, but pycnidia with much larger multiseptate *Stagonospora*-like conidia often also occur (Fig. 5A). On account of this phenomenon there has been much discussion about the generic classification of the fungus. Formerly the solution to this difficulty was by the placement of this pathogen (and similar fungi) in a separate genus, viz. *Stagonosporopsis* Died.; compare Boerema & Hamers

(1989). However, on the basis of the characteristics in culture (identification-possibility in vitro) the fungus has to be classified in *Phoma*, as done above. A similar case is *Phoma clematidina* (no. 11).

Representative culture. CBS 251.92.

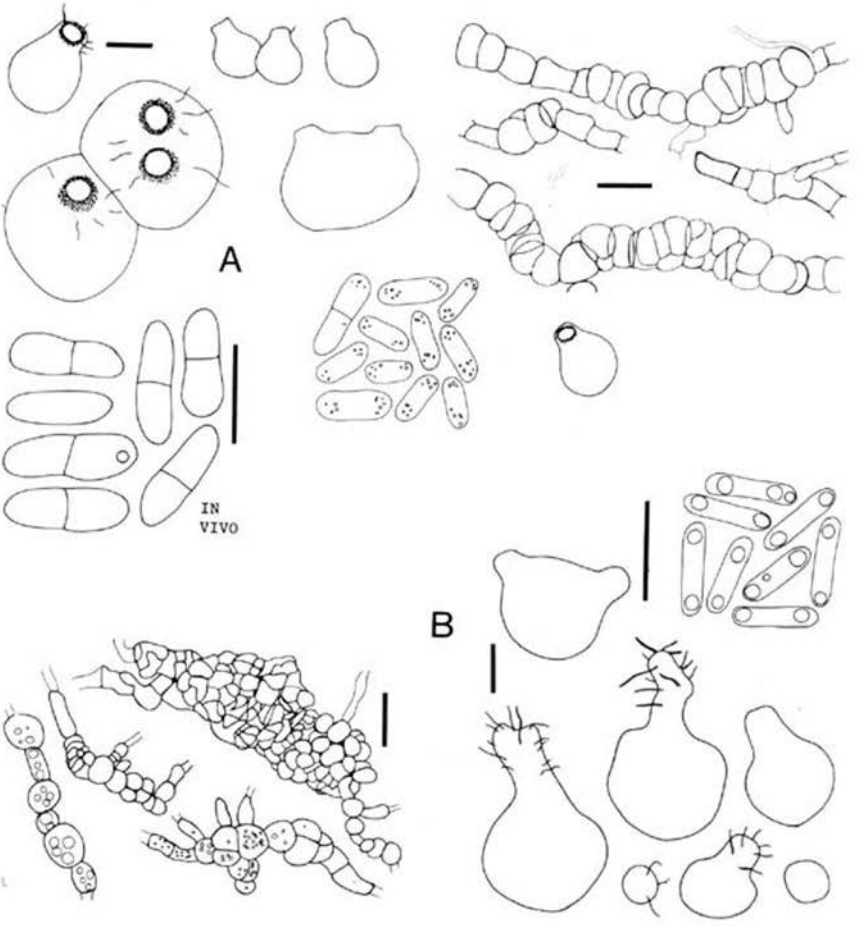

Fig. 6. A. *Phoma clematidina*, produces irregular complexes and series of unicellular and multicellular botryoid-alternarioid chlamydospores. The pycnidia may have some hyphae around the ostiole (semi-pilose). The large conidia are occasionally two-celled; in vivo they are usually much larger and mainly two-celled. – B. *Phoma violicola*, characterized by various intermediate stages between irregular botryoid-alternarioid and pseudosclerotioid chlamydosporal structures. The necks of the pycnidia are often covered by hyphae (semi-pilose). Conidia relatively large, with two conspicuous guttules.

11. **Phoma clematidina** (Thüm.) Boerema — Fig. 6A

Chlamydospore-anamorph uni- and multicellular. Irregular botryoid-alternarioid.

Phoma clematidina (Thüm.) Boerema apud Boerema & Dorenbosch, Versl. Meded. Plziektenk. Dienst Wageningen 153 (Jaarb. 1978) (1979) 17, 18. — *Ascochyta clematidina* Thümen, Bull. Soc. imp. Nat. Moscou 55 (1880) 98.

Diplodina clematidina Fautrey & Roumeguère apud Roumeguère, Revue mycol. 14 (1892) 105.

Ascochyta vitalbae Briard & Hariot apud Briard, Revue mycol. 13 (1891) 17. — *Diplodina vitalbae* (Briard & Har.) Allescher, Rabenh. Krypt.-Flora (ed. 2) Pilze 6 (Lief. 69) (1900) 683.

Ascochyta indusiata Bresadola, Hedwigia 35 (1896) 199.

Ascochyta davidiana Kabát & Bubák, Öst. bot. Z. 54 (1909) 25.

Description in vitro

OA: growth-rate 45–55 mm, aerial mycelium whitish to olivaceous-grey, reverse buff-yellowish, often with needle-like crystals (anthraquinone derivatives).

MA: growth-rate 25–40 mm. Hyphae often conspicuously curved.

Pycnidia 110–120 µm diam., usually subglobose with dark circumvallated ostioles, often with some hyphae around, mostly solitary. Conidial exudate honey-coloured or salmony. Conidia usually (3.5–)4–8.5(–9) × 2–3(–3.5) µm, occasionally larger and 1-septate, 9–13 × 3–4 µm, variable in shape, subellipsoidal to cylindrical, usually guttulate. (In vivo the conidia may vary in length from 6 to 28 µm and in width from 3 to 6 µm!)

Chlamydospores usually scanty, uni- or multicellular, where unicellular usually intercalary in short chains, guttulate, thick-walled, green-brown, 8–10 µm diam., where multicellular, irregular dictyo/phragmosporous, often somewhat botryoid and in combination with unicellular chlamydospores, tan to dark brown 3–50 × 12–25 µm.

Ecology and distribution. In Eurasia, Australasia and North America this fungus is frequently found in association with leaf spots and stem lesions on naturally-wilting cultivars and hybrids of *Clematis* spp. It may be regarded as an opportunistic parasite.

As noted above, in vivo the conidia of this fungus are extremely variable in dimensions; besides they are mainly two-celled (Fig. 6A). This explains the extensive synonymy of the fungus in the genera *Ascochyta* Lib. (on leaves) and *Diplodina* Auct. (on stems). In old pycnidia the conidia may become dark coloured and occasionally three-celled. Such conidia were found in an isotype of *A. clematidina* [LE; see Mel'nik (1977) 181: "= *Phaeostagonosporopsis* sp."]. Compare the note under *Phoma narcissi* (no. 10).

Representative culture. CBS 108.79.

12. **Phoma violicola** P. Syd. — Fig. 6B

Chlamydospore-anamorph uni- and multicellular. Irregular botryoid-alternarioid and pseudosclerotioid.

Phoma violicola P. Sydow, Beibl. Hedwigia 38 (1899) 137.

Phyllosticta violae f. *violae-hirtae* Allescher, Rabenh. Krypt.-Fl. (ed. 2) Pilze 6 (Lief. 61) (1898) 156 (vol. dated '1901').

Phyllosticta violae f. *violae-sylvaticae* Fragoso, Trab. Mus. nac. Cienc. nat. (Bot). Madr. 7 (1914) 35.

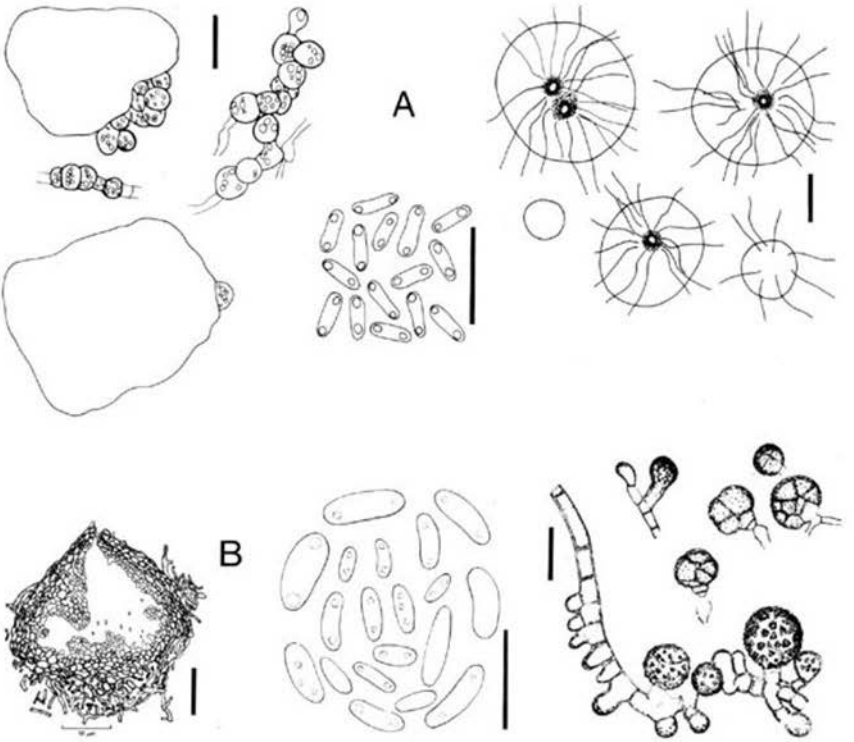

Fig. 7. A. *Phoma chrysanthemicola*, characterized by aggregates of unicellular chlamydospores forming large irregularly-shaped pseudosclerotioid masses. Pycnidia usually semi-pilose, conidia biguttulate, and often somewhat dumb-bell shaped. – B. *Phoma epicoccina*, in vitro characterized by the presence of a typical *Epicoccum*-anamorph. Pycnidia more or less stromatic, usually intermixed with pycnosclerotia. Conidia highly variable in shape and dimensions (drawings after Punithalingam, Tulloch & Leach, 1972).

Description in vitro

OA: growth-rate 18–20 mm diam., aerial mycelium felted, whitish to pale olivaceous-grey, underground grey-olivaceous to dull-green, with olivaceous-black concentric zones of pycnidia, reverse similar.

Pycnidia 125–250 µm diam., usually subglobose, mostly uniostiolate, sometimes papillate or with a cylindrical neck of variable length, often covered by hyphae, mostly solitary but sometimes aggregated; exudate whitish. Fertile micropycnidia also occur, 60–100 µm diam., both in aerial mycelium and in the agar. Conidia (7.5–)9–10(–11) × 2–3 µm, cylindrical usually biguttulate.

Chlamydospores highly variable and irregular, mostly intercalary but sometimes terminal, where unicellular usually in short chains, olivaceous-brown, 5–11 µm diam., where multicellular forming dictyosporous-botryoid configurations or pseudosclerotioid structures, olivaceous-brown in colour and very different in size and shape.

Ecology and distribution. In Europe this fungus is repeatedly found in association with leaf spots on various wild species of *Viola*. It seems to be an opportunistic parasite which may also affect cultivated *Viola* spp. In some reports the fungus has been identified as '*Phyllosticta violae* Desm. s.s.', but the holotype of that species refers to unripe ascomata (pers. inform. Dr. H.A. van der Aa, CBS-Baarn).

Representative culture. CBS 306.68.

13. **Phoma chrysanthemicola** Hollós (sensu lato) — Fig. 7A

Chlamydospore-anamorph uni- and multicellular. Pseudosclerotioid.

Phoma chrysanthemicola Hollós, Annls hist.-nat. Mus. natn. hung. 5 (1907) 456.

Description in vitro

OA: growth-rate 30–40 mm, regular, but variable in appearance, strains with abundant woolly aerial mycelium, and strains with less conspicuous loose velvety mycelium, in both cases pale olivaceous-grey, the agar grey-olivaceous to dull green; reverse similar, but in most strains after a few days a sienna discolouration of the agar occurs, associated with the formation of orange-red crystals. Occasionally the discolouration is more red-violet and sometimes yellow (apparently a complex of pigments is involved). Addition of NaOH causes the colour to fade.

Pycnidia 150–350 µm diam., subglobose, papillate or flask-shaped, solitary but often coalescing to large irregular fructifications with many ostioles, usually covered by hyphae. Fertile micropycnidia frequently occur, 40–100 µm diam. Conidial exudate white-yellowish. Conidia (3.5–)4–5.5(–6.5) × 1.5–2(–2.5) µm, cylindrical with two guttules, often somewhat dumb-bell shaped, hyaline.

Chlamydospores numerous, globose or subglobose, 5–11 µm diam., olivaceous, single or in long chains and often aggregated into large irregularly-shaped olivaceous-black pseudosclerotioid masses. These structures may be present in abundance in the aerial mycelium; however, it may take several weeks before they appear.

Ecology and distribution. A common saprophytic soil fungus in most temperate regions. It has been isolated from roots and stems of various Compositae and other herbaceous plants in central and western Europe, southeastern Asia, North America and Australasia. In Belgium the fungus is frequently found in association with stunted roots of scorzonera (in the Netherlands ascribed to free living nematodes).

f. sp. **chrysanthemicola** [Schneider & Boerema, Phytopath. Z. 83 (1975) 242.]

The selected type of the species refers to a specialized pathogenic form on florists' chrysanthemums, *C. morifolium* (*indicum*). This pathogen has been recorded in western Europe and North America (United States and Canada): Root Rot or Basal Stem Rot.

Representative cultures. CBS 522.66, CBS 172.70.

14. **Phoma epicoccina** Punith., Tulloch & Leach — Fig. 7B

Chlamydospore-anamorph multicellular. Epicoccum sp.

Phoma epicoccina Punithalingam, Tulloch & Leach, Trans. Br. mycol. Soc. 59 (1972) 341–344.

Description in vitro

OA: growth-rate 60–70 mm, aerial mycelium floccose, extremely variable in pigmentation, mostly yellowish to bright yellow or pink to purple-red. The pigment also diffuses into the agar, but the colour of the mycelium and the agar are not always the same; reverse also variable in colour, but mostly grey to almost black in the centre.

Pycnidia 120–200 µm diam., subglobose to globose, solitary or confluent, intermixed among 'pycno'sclerotia, 200–400 µm diam. Pycnidial wall and sclerotia composed of compressed brown cells, heavily pigmented and thick-walled on the outer side. Conidial exudate whitish. Conidia 3–7(–10) × 1.5–3(–3.5) µm, most variable in shape and dimensions, usually shortly cylindrical, sometimes slightly curved, eguttulate or with 2–3 polar guttules.

Chlamydospores produced in sporodochia (representing the *Epicoccum*-anamorph), multicellular-phragmosporous, but the septa being obscured by the dark-brown to black verrucose outer wall, subglobose-pyriform, often with a paler basal cell, variable in dimensions, but mostly 15–35 µm diam., arising in gradually growing clusters as solitary, terminal elements of mycelial side branches, from a more or less globose pseudoparenchymatous stroma. The sporodochia may be present in abundance, scattered or aggregated.

Ecology and distribution. A world-wide recorded seed-, air- and soil-borne saprophyte. It appeared to be a common contaminant of grass seeds. The fungus has been isolated once from a human toe-nail. The *Epicoccum*-anamorph is indistinguishable from *Epicoccum nigrum* Link; therefore it is quite possible that *P. epicoccina* has often been confused with the latter.

Representative culture. CBS 173.73 (= IMI 164070 = ATCC 24428).

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ERRATA

Gruyter, J. de & M.E. Noordeloos: Contributions towards a monograph of Phoma (Coelomycetes) I – 1. Section Phoma. Persoonia 15 (1) (1992) 71–92.

Page 73 line 17 from bottom: replace 3. *Phoma anigozanthi* by 13. *Phoma anigozanthi*

Page 75 line 3 from top: replace Fig. 1 by Figs. 1, 21

Page 81 line 17 from bottom: replace Figs. 9, 21 by Fig. 9

Page 88 in figure caption: replace *Phoma multipora* by *Phoma minutispora*

Figs. 1–24: addition ⟵⟶ bar means 10 µm (delete '× 1250').

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NOTULAE AD FLORAM AGARICINAM NEERLANDICAM – XXI
Lepiota section Stenosporae

ELSE C. VELLINGA[1] & HENK A. HUIJSER[2]

Descriptions are given of five species of *Lepiota* sect. *Stenosporae* with grey-brown to dark green pileus. *Lepiota tomentella* sensu Candusso & Lanzoni (1990) is described as *L. pilodes* Vellinga & Huijser and *L. griseovirens* sensu Reid (1972) as *L. poliochloodes* Vellinga & Huijser. *Lepiota pseudofelina* J. Lange is regarded as a nomen dubium. *Lepiota fulvella* Rea is synonymous with *L. boudieri* Bres.

Lepiota sect. *Stenosporae* (J. Lange) Kühner is microscopically characterized by the shape of the spores. These are provided with a lateral outgrowth at base, called a spur, or are triangular in outline (in side view). Characteristics to distinguish species in this section are colour of the basidiocarp, shape and size of the spores and shape, size, septation and pigmentation of the elements of the pileus covering.

Several species complexes occur and much confusion about names and delimitation of the species involved exists in literature. The group of the brownish grey to dark green species with a pileus covering made up of more or less erect cylindrical elements (*L. tomentella* J. Lange, *L. pseudofelina* J. Lange, *L. griseovirens* Maire, and *L. grangei* (Eyre) Kühner) and the complex of *L. fulvella* Rea and *L. boudieri* Bres. are treated in this paper.

Fresh and herbarium material of all species involved have been studied carefully; type material of several taxa has been studied. Spores are measured in 5% $KOH_{(aq)}$ or 10% $NH_{3(aq)}$, stained by Congo red; spores are measured in side view, length from apex to spur and width including spur. The notation [130/5/3] stands for '130 spores from 5 basidiocarps of 3 collections measured'. The following abbreviations are used: K. & W. – Kornerup, A. & Wanscher, J.H., Methuen handbook of colour; Farver i farver. Mu. – Munsell soil color charts, Q – quotient of length and width, av. Q – average quotient, av. l – average length, av. w – average width.

I. The group of brown-grey to (dark) greenish species

Since the publication of the dark green and green species *L. grangei*, *L. griseovirens*, and *L. pseudofelina* many authors have tried to interpret these names. Kühner (1934) wrestled with the differences between *L. grangei* and *L. griseovirens*, Romagnesi & Locquin (1944) devoted part of a paper to all green *Lepiota*-species, giving interpretations of *L. griseovirens* and *L. grangei*; and more recently Migliozzi & Coccia (1990) tried to interpret the description of *L. pseudofelina*. The interpretation of the original, and of later

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descriptions is hampered by the, in our eyes, inadequate and not very exact descriptions in former days, especially concerning spore size and shape and the shape and size of the elements of the pileus covering.

Another problem is the variation of the taxa concerned. During the development from closed to expanded pileus the colours change, due to discolouration of the context and in *L. grangei* e.g. the pigment is soluble in H_2O (rain). It is possible that young specimens have been described as independent taxa, for instance *L. griseovirens* ssp. *obscura* (Locquin, 1945). Other characteristics like spore size also show a wide variation within one species; most specimens produce some 2-spored basidia between the normal 4-spored basidia. Spores of 2-spored basidia are longer and have a more pronounced spur than normal spores.

The most important and reliable characteristics are spore size (though variable) and shape, and the type of covering of pileus and stipe and the size, shape and pigmentation of the elements. The species involved can be unequivocally identified by using microscopic characteristics only.

Lepiota tomentella J. Lange — Fig. 1

Lepiota tomentella J. Lange, Dansk bot. Ark. 4 (4) (1923) 48.

Excluded. Lepiota tomentella sensu Candusso & Lanzoni, Fungi eur. 4 (1990) 226–228; sensu M. Bon, Docum. mycol. 11 (43) (1981) 36–37; sensu Kelderman, Coolia 31 (1988) 43–44 (= in all cases *L. pilodes*).

Selected illustrations. J. Lange, Dansk bot. Ark. 4 (4) (1923) pl. 1d; J. Lange, Fl. agar. dan. 1 (1935) pl. 14D.

Selected descriptions and figures. M. Bon, Bull. trimest. Soc. mycol. Fr. 92 (1976) 324–326, fig. 6; P.D. Orton, Trans. Br. mycol. Soc. 91 (1988) 562.

Characteristics. Pileus when young with pinkish brown or greyish brown tinges, showing no orange discolouring with age; spores av. l × av. w = 7.6–9.0 × 3.5–3.8 µm, av. Q = 2.1–2.4; cheilocystidia 5–12 µm broad; elements on pileus long, up to 320(–440) µm, with 0–2(–3) clampless septa.

Pileus 10–28(–34) mm, when young paraboloid to campanulate with inflexed margin, expanding to convex, plano-convex or slightly plano-concave with low broad umbo, at centre dark grey-brown, ochre brownish or grey-brown with pinkish tinge (Mu. 7.5 YR 3/4, 5 YR 3–5/3–4, K. & W. 7–8E4, 7F6–5, 5–6D6), paler towards margin: ± pepper & salt colour (7.5 YR 5–7/4), felted at centre, around centre flocculose-felty or broken up in more or less distinct appressed or slightly uplifted felty squamules; margin with some white velar remnants when young. Lamellae, L = 28–44, l = 1–3, rather crowded or crowded, free, (sub)ventricose, up to 5 mm broad, whitish at first, later cream or pale beige with slight pinkish reflex, with whitish finely flocculose edge. Stipe 15–50 × 2–4.5(–6.5) mm, cylindrical and mostly with broadened base, subfistulose, when young whitish, cream-brown, finely fibrillose, later from base upwards reddish brown, pale brown rusty, in lower 1/2 to 2/3 with scattered squamules and girdles, like covering on pileus, without distinct annulus, when young sometimes with a white fugacious ring-zone, with white mycelium cords at base. Context in pileus whitish cream, in stipe white at first, later brownish or pale brown. Smell indistinct to slightly sweetish. Taste slightly bitter. Spore print colour white.

Spores [170/12/11] in side view (6.4–)7.0–9.6(–10.4) × 3.2–4.2(–4.5) µm, av. l × av. w = 7.6–9.0 × 3.5–3.8 µm, Q = 1.7–2.7, av. Q = 2.1–2.4, with straight or outgrown broad spur, sometimes allantoid or phaseoliform, mostly rather cylindrical, some attenuate towards base, in frontal view subcylindrical, pale brown or orange-brown in Melzer's reagent, red in Congo red; wall not coloured in cresyl blue, ± swollen in 10% $NH_{3(aq)}$ plus 10% $CH_3COOH_{(aq)}$. Basidia (16.5–)20–32 × 6–9.5 µm, 4-spored, rarely (3-)2-spored. Lamella edge sterile; cheilocystidia (17–)20–40(–48) × 5–12 µm, cylindrical,

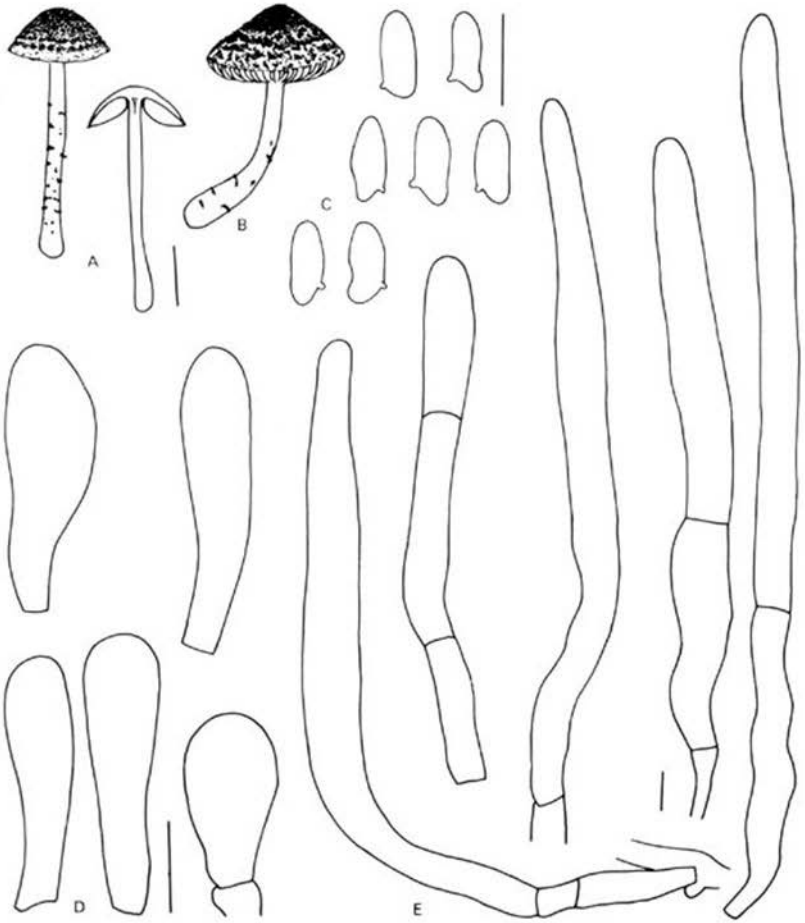

Fig. 1. *Lepiota tomentella*. A, B. Basidiocarps; C. spores; D. cheilocystidia; E. elements of pileus covering. — A from *Huijser*, 21.IX.1986, B from *Huijser* 30.X.1982, C, D, and E from neotype. — Scale bar basidiocarps 10 mm, scale bar with microscopic characteristics 10 µm.

narrowly clavate, or rarely narrowly utriform, slightly thick-walled, not coloured. Pleurocystidia not observed. Pileus covering a trichoderm, made up of cylindrical elements, (35–)45–320(–440) × 6–19 µm, with 0–2(–3) clampless septa, with coloured, slightly thickened walls, mostly narrowed into a pedicel, clamped at base. Stipitipellis a cutis of cylindrical hyphae, 2–8 µm in diam., with some patent colourless hyphae; squamules on stipe made up of brown-walled elements, as on pileus, but shorter, 30–160 × 5.5–15(–18.5) µm. Clamp-connections present in all tissues.

Habitat & distribution. Gregarious or more rarely solitary, terrestrial in deciduous woods on rich loamy-sandy soils, often rich in lime, in the Netherlands very rare, only in southern Limburg (Cadier en Keer, Örenberg and Riesenberg; Valkenburg, Schaelsberg and St. Jansbosch). Known from Belgium, France, Denmark, Germany, and England, everywhere rare except in England. End of August to October.

Collections examined. NETHERLANDS: prov. Limburg, Cadier en Keer, Örenberg, 4.X.1989, *E.C. Vellinga 1612* and 9.X.1991, *E.C. Vellinga 1776* (L); Cadier en Keer, Riesenberg, 30.X.1982, *H.A. Huijser* (L); Valkenburg, Schaelsberg, 21.IX.1986, *H.A. Huijser* (L) and 23.X.1991, *H.A. Huijser* (L). — BELGIUM: prov. Liège, Aywaille, 15.IX.1981, *J. Schreurs 626* (L); prov. Namur, Nismes, 30.IX.1984, *G.A. de Vries* (L); Source d'Ave, 11.IX.1975, *G. Tjallingii-Beukers* (L); Resteigne, Bois de Resteigne, 5.X.1977, *C. Bas 7234* (L). — DENMARK: Falster, Oct. 1939, *J. Lange* (C); Sjaelland, Parnas near Sorø, students' excursion (neotype) (C); Bangsebro Skov, 25.IX.1960, *L. Døssing* (C); Hamborgskoven, 11.IX. 1960, *F.H. Møller* (C); Systofte Skov, 6.X.1960, *L. Døssing* (C). — FRANCE: dépt Pas-de-Calais, Forêt de Guines, 13.X.1991, *J. Schreurs* (coll. *E.C. Vellinga 1785*) (L).

Unfortunately no type material of *L. tomentella* is preserved at the Herbarium at Copenhagen (C). Recent freeze dried material [collected by students' excursion, 27 Sept. 1980, Denmark, Sjaelland, Parnas near Sorø, (C)] is chosen as neotype (see Fig. 1).

Several authors, e.g. Candusso & Lanzoni (1990), describe *L. tomentella* as a species with fulvous and ochraceous colours at the pileus, with broad cheilocystidia and with elements of the pileus covering without septa. Lange (1923) states that his species is pale brown argillaceous, with narrow (7 µm) cheilocystidia; information about size and shape of the pilear elements is not given. Basidiocarps agreeing with the macroscopical description of Lange (1923) always have septate elements of the pileus covering and narrow cheilocystidia. *Lepiota tomentella* in the sense of Candusso & Lanzoni differs sufficiently from *L. tomentella* in the original sense to warrant a description as a new species (see below).

Lepiota pilodes Vellinga & Huijser, *spec. nov.* — Fig. 2

Misapplied name. Lepiota tomentella sensu Candusso & Lanzoni, Fungi eur. 4 (1990) 226–228; sensu M. Bon, Docum. mycol. 11 (43) (1981) 36–37; sensu Kelderman, Coolia 31 (1988) 43–44.

Selected description & figure. Candusso & Lanzoni, Fungi eur. 4 (1990) 226–228, fig. 42 (as *L. tomentella*).

Ex affinitate *Lepiotae tomentellae* et *L. poliochloodis*.

Pileus 13–34 mm latus, campanulatus, dein convexus vel plano-convexus, velo obtectus, si cum ceteris comparatur, tenui, disco tomentosus, squamulis parvis velutinis et mollissimis, prima aetate fuscocinereus, cito canastro-flaveo-fuscus supra fundum carnis ochraceo-aurantiacae. Lamellae liberae, albidae vel cremeae, interdum aurantiaco-maculatae. Stipes 15–50 × 2–4 mm, obtectus squamulis dispersis et cingulis non bene compositis, coloribus eisdem ac pilei, cremeus, versus basim aurantiacus, badius in senescendo. Odor debilis, haud similis ei *L. cristatae*.

Sporae (6.8–)7.2–10.2(–11.6) × (3.0–)3.2–4.2(–4.6) µm, Q = 1.9–2.8(–3.0), calcarigerae. Cellulae steriles aciei lamellarum 5–15(–18) µm latae. Cellulae squamularum pilei erectae, elongatae, usque 280(–330) µm longae, sine septo (perraro cum uno septo), pigmento membranario subfusco. Fibulae numerosae adsunt.

In silvis frondosis ubero luteo solo, vel in fusis lapidibus excisis e metallis, autumno.

Typus: '*E.C. Vellinga 1603*, 4.X.1989, the Netherlands, Cadier en Keer, Örenberg, L.'

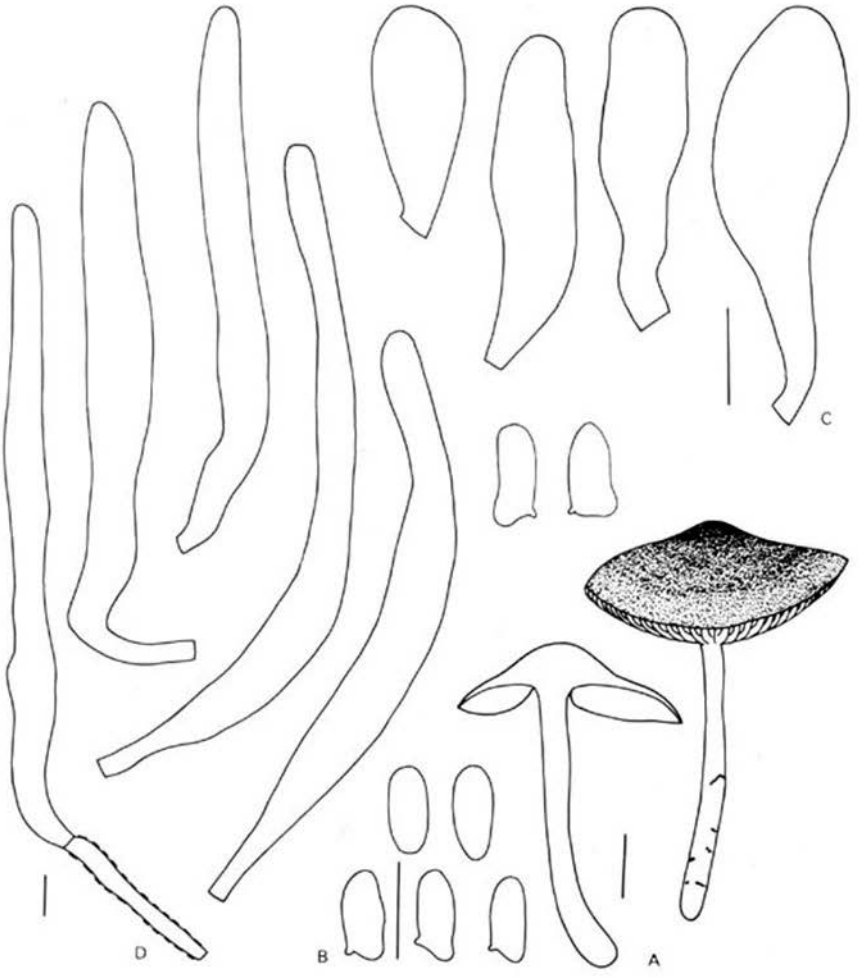

Fig. 2. *Lepiota pilodes*. A. Basidiocarps; B. spores; C. cheilocystidia; D. elements of pileus covering. — All from holotype. — Scale bars as in Fig. 1.

Characteristics. Pileus when very young with dark greyish or fuligineous covering sometimes with a hue of green or olive, with context rapidly discolouring orange, later on more beige-brown and context fading to ochre, sometimes strongly resembling *L. poliochloodes* or when old *L. tomentella*; spores av. l × av. w = 7.8–9.6 × 3.5–3.8 µm, av. Q = 2.2–2.6; cheilocystidia broad, 5–15(–18) µm; elements of pileus long, up to 280 (–330) µm, mostly without septa.

Pileus 13–34 mm, expanding from campanulate to convex or plano-convex, with or without broad umbo, when young with margin exceeding lamellae, at centre dull orange brown, dark brown or ochraceous brown (Mu. 2.5 YR 4/4, 10 YR 3–4/4), towards margin fading to pale brown-beige (e.g. 10 YR 7/6), at first at outmost margin very pale, when very young and undamaged with dark fuligineous colours sometimes with a hue of green or olive, discolouring orange when touched and with age, completely covered with a relatively thin covering of small plush-like squamules, at centre closed and velutinous-tomentose, towards margin more fibrillose to arachnoid with context showing in between squamules. Lamellae, L = 31–35, l = 1–3, moderately distant to rather crowded, free, not or slightly cream-coloured, with age more orange brownish tinged or with orange-brown spots, with whitish or white, even to flocculose edge. Stipe 15–50 × 2–4 mm, cylindrical with broadened to bulbous base, fistulose, cream to pale pinkish cream at base, discolouring orange to reddish brown especially at base, lengthwise innately fibrillose, in upper half more or less pruinose, lower with faint girdles and scattered squamules (rarely without), concolorous with pileus, with white mycelium cords at base. Context in pileus white and dull, in stipe creamy, especially in cortex discolouring orange, with age in lower part reddish brown (5 YR 4/4). Smell faint, sweetish, fruity-fungoid or farinaceous, not like *L. cristata*. Taste not known. Spore print colour white.

Spores [160/12/9] in side view (6.8–)7.2–10.2(–11.6) × (3.0–)3.2–4.2(–4.6) µm, av. l × av. w = 7.8–9.6 × 3.5–3.8 µm, Q = 1.9–2.8(–3.0), av. Q = 2.2–2.6, cylindrical, subcylindrical, with rounded apex or tapering towards apex, without or with lateral spur, with rounded or spur-like base, in frontal view subcylindrical or ovoid, with distinct patent hilar appendage, red-brown in Melzer's reagent, red in Congo red; wall not colouring in cresyl blue, slightly swelling in 10% $NH_{3(aq)}$ plus 10% $CH_3COOH_{(aq)}$. Basidia (19–)22–34(–38) × 6.5–9.5 µm, 4-spored, also some 2-spored. Lamella edge sterile; cheilocystidia (16–)20–45(–50) × 5–15(–18) µm, narrowly clavate, clavate, narrowly utriform to more or less cylindrical, not coloured. Pleurocystidia not observed. Covering of pileus made up of erect cylindrical to slightly fusiform elements, 60–280(–330) × (6.5–)8–21 µm, narrowed into pedicel, without (very rarely with one) clampless septa, with some basal clavate elements in between, with membranal and intracellular brown pigment, when fresh also with grey colours. Stipitipellis a cutis of narrow 2–6.5 µm wide cylindrical hyphae; squamules on stipe made up of elements as those on pileus but 25–160 × 8–23 µm. Clamp-connections present in all tissues.

Habitat & distribution. Gregarious in small groups, often together with *L. tomentella* and other *Lepiota*-species, in deciduous forests on rich loamy soils, also on mine waste heaps. In the Netherlands only known from some localities in southern Limburg. Known from France, Germany and Italy. September and October.

Etymology. πιλωδης = tomentose.

Collections examined. NETHERLANDS: prov. Limburg, Bemelen, 10.X.1990, *H.A. Huijser* (L), 9.X.1991, *E.C. Vellinga 1781* (L); Cadier en Keer, Örenberg, 4.X.1989, *E.C. Vellinga 1603* (holotypus) (L), 9.X.1991, *E.C. Vellinga 1777* (L), Cadier en Keer, Riesenberg, 4.X.1989, *E.C. Vellinga 1621* (L); Kerkrade, mine Laura-Julia, 8.IX.1980, *P.H. Kelderman 891* (L) and 26.X.1991, *H.A. Huijser* (coll. *E.C. Vellinga 1814*) (L); Valkenburg, Schaelsberg, 26.IX.1990, *H.A. Huijser* (L). — GERMANY: Rheinland-Westfalen, Mönchengladbach, 18.X.1984, *H. Bender* (Herb. Bender).

Lepiota pilodes differs from *L. tomentella* in the orange to ochraceous discolouration of the pileus surface, the broad cheilocystidia and the mostly non-septate elements of the pileus covering.

In dry conditions basidiocarps do not always show the orange-like discolouration of the pileus very well, but they have more ochraceous tinges. The same applies to older specimens. In those cases, microscopical data are of paramount importance for the identification.

Lepiota poliochloodes Vellinga & Huijser, *spec. nov.* — Fig. 3

Misapplied name. *Lepiota griseovirens* sensu D. Reid, Fung. rar. Ic. col. 6 (1972) 14–16; *Lepiota griseovirens* var. *griseovirens* sensu M. Bon, Docum. mycol. 11 (43) (1981) 38.

Selected illustrations. Knudsen & Vesterholt, Truede Storsvampe Danmark (1990) 33 (as *L. griseovirens*); D. Reid, Fung. rar. Ic. col. 6 (1972) pl. 43c, d (as *L. griseovirens*).

Selected description & figures. D. Reid, Fung. rar. Ic. col. 6 (1972) 14–16 (as *L. griseovirens*).

Ex affinitate *Lepiotae pilodis* et minore modo *L. griseovirentis*.

Pileus 10–31 mm latus, campanulatus, convexus, dein applanatus et leviter obtuse umbonatus, velo tenui obtectus, disco tomentosus, squamulis parvis fibrillosis, glauco-canus vel pallido-olivaceo-brunneus supra fundum carnis roseo-luteae vel pallide aurantiaco-brunneolae. Lamellae liberae, cremeae, in senescendo pallide aurantiaco-brunneolae. Stipes 20–55 × 2–4 mm, squamulis dispersis et cingulis non bene compositis coloribus eisdem ac pilei obtectus, versus basim aurantiacus in senescendo. Odor debilis, haud similis ei *L. cristatae*.

Sporae (5.8–)6.0–8.0(–8.8) × (3.2–)3.4–4.4(–4.7) µm, Q = 1.4–2.3, basi rotundato vel truncato, raro calcarigerae. Cellulae steriles aciei lamellarum 4–10(–11) µm latae. Cellulae squamularum pilei erectae, (45–)70–180(–200) × 6.5–20(–26) µm, elongatae, medio dilatatae, cum uno septo vel sine septo, pigmento membranario brunneo. Fibulae numerosae adsunt.

In silvis frondosis ubero luteo vel arenoso solo, et in fusis lapidibus excisis e metallis, mense octobri.

Typus: '*H.A. Huijser* (coll. *E.C. Vellinga 1788*), 15.X.1991, France, dépt Pas-de-Calais, Forêt de Hardelot. L.'

Characteristics. Macroscopically resembling *Lepiota pilodes*, but covering on pileus slightly more greenish or less greyish, microscopically with shorter spores (av. l × av. w = 6.6–7.4 × 3.7–4.1 µm, av. Q = 1.7–2.0) and cheilocystidia less broad (4–11 µm). Also resembling *Lepiota griseovirens*, but less black when young, floccules on pileus and stipe often less developed, spores little shorter, elements of pileus and stipe shorter and more clavate. In fresh material all elements full of little granules or oil drops.

Pileus 10–31 mm, when young spherical to ellipsoid, expanding to convex, campanulate, finally applanate with low obtuse umbo, at first with a closed, relatively thin covering, green-grey, grey-olive, grey-brown, light olive-brown (Mu. 5 Y 6–5/3–4, 10 YR 5–2/3, 2.5 YR 6–5/2–4), towards margin splitting up into very small fibrillose squamules with age; underlying context discolouring, pink-yellow to light orange-brown (10 YR 8–

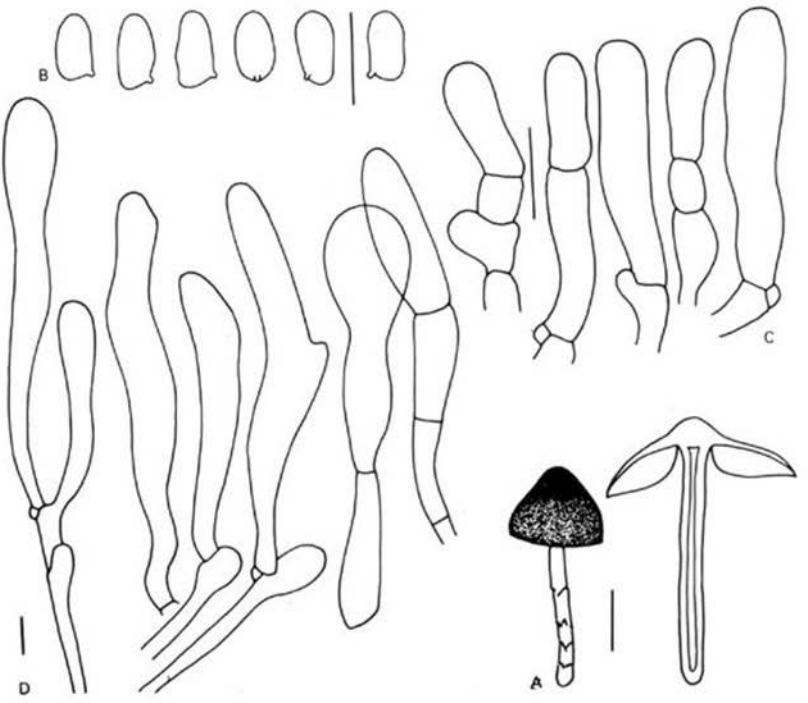

Fig. 3. *Lepiota poliochloodes*. A. Basidiocarps; B. spores; C. cheilocystidia; D. elements of pileus covering. — All from holotype. — Scale bars as in Fig. 1.

7/6–8, 2.5 Y 8–7/6–8); margin when young fringed by velar remnants, exceeding lamellae. Lamellae moderately crowded, L = 36–42, l = 1–3(–7), free, (sub)ventricose, up to 4 mm broad, rounded near stipe, cream-coloured, with white somewhat flocculose edge, discolouring light orange-brown on handling and with age. Stipe 20–55 × 2–4 mm, slightly broadening downwards, when young white and lengthwise fibrillose, with scattered squamules and girdles like covering on pileus, at base discolouring orange when touched and with age. Context in pileus white, in stipe white at first, in lower parts later on mainly in the cortex brown-orange to red-brown. Smell faint, slightly sweetish or unpleasant, not like *L. cristata*. Taste unknown. Spore print colour white.

Spores [125/7/4] in side view (5.8–)6.0–8.0(–8.8) × (3.2–)3.4–4.4(–4.7) µm, av. l × av. w = 6.6–7.4 × 3.7–4.1 µm, Q = 1.4–2.3, av. Q = 1.7–2.0, mostly oblong to cylindrical, with rounded or truncate base, more rarely with distinct spur, showing lateral hilar appendage, in frontal view more ellipsoid, orange-brown in Melzer's reagent, red in Congo red; wall not coloured in cresyl blue, not or scarcely swelling in 10% $NH_{3(aq)}$ plus 10% $CH_3COOH_{(aq)}$. Basidia 20–32 × 6.0–9.0 µm, 4-spored, some (3-)2-spored. Lamella edge sterile; cheilocystidia (12–)16–35(–40) × 4–10(–11) µm, variable in shape,

long and slender, ± cylindrical, short clavate, narrowly utriform, often with basal broad element, colourless with fine granular contents when fresh. Pleurocystidia not observed. Covering on pileus rather irregular and made up of elements (45–)70–180(–200) × 6.5–20(–26) µm, often broadened at middle and narrowed into pedicel, with 0–1(–2) clamp-less septa, with short clavate elements in between; pigment brown, membranal, in lower parts also intracellular, in basal parts of terminal elements incrusting. Stipitipellis a cutis of narrow hyphae, 1.5–6.5 µm broad; elements of squamules and girdles as those on pileus or shorter 25–120(–180) × 9–25(–33) µm. Clamp-connections present in all tissues. In fresh material all elements are full of little granules or oil drops; sometimes these granules are also visible in exsiccata.

Habitat & distribution. Gregarious in small groups in deciduous forests on rich soils, loamy or sandy, but also on mine waste heaps; very rare in the Netherlands, only known from Valkenburg (Schaelsberg) and Kerkrade (Laura-Julia). Known from Denmark, France and Great Britain, apparently very rare. October.

Etymology. πολιος = grey; χλοωδης = greenish.

Collections examined. NETHERLANDS: prov. Limburg, Valkenburg, Schaelsberg, 20.X.1991, *P.J. Keizer* (L), 23.X.1991, *H.A. Huijser* (L); Kerkrade, mine Laura-Julia, 26.X.1990, *H.A. Huijser* (L). — FRANCE: dépt Pas-de-Calais, Forêt de Hardelot, 15.X.1991, *H.A. Huijser* (coll. *E.C. Vellinga 1788*) (holotype) (L).

For discussion see under *L. griseovirens*.

Lepiota griseovirens Maire — Fig. 4

Lepiota griseovirens Maire, Bull. trimest. Soc. mycol. Fr. 44 (1928) 37.

Lepiota griseovirens ssp. *obscura* Locq., Bull. mens. Soc. linn. Lyon 14 (1945) 61–62 (nom. nud.). — *Lepiota griseovirens* var. *obscura* M. Bon, Docum. mycol. 6 (24) (1976) 44. — *Lepiota obscura* (Locq.) Babos, Annls hist.-nat. Mus. natn. Hung. 50 (1958) 89 (nom. nud.).

Lepiota grangei f. *brunneoolivacea* Pilát, Acta Mus. nat. Prag. 11B (1955) 9.

Excluded names. Lepiota griseovirens sensu D. Reid, Fung. rar. Ic. col. 6 (1972) 14–16; *Lepiota griseovirens* var. *griseovirens* sensu M. Bon, Docum. mycol. 11 (43) (1981) 38 (in both cases *L. poliochloodes*).

Selected illustrations. Candusso & Lanzoni, Fungi eur. 4 (1990) pl. 22a, 22b (as *L. griseovirens* and *L. pseudofelina* resp.); Lanzoni & Candusso, Boll. Gr. micol. G. Bresadola 26 (1983) 104; Migliozzi & Coccia, Boll. Ass. micol. ecol. rom. 19 (1990) 20 (as *L. pseudofelina*).

Selected descriptions & figures. Van de Bergh, Coolia 23 (1980) 54–56 (as *L. grangei*); Candusso & Lanzoni, Fungi eur. 4 (1990) 218–220, 223–225, figs. 40, 41 (as *L. griseovirens* var. *griseovirens* and *L. pseudofelina* resp.); Courtecuisse, Bull. semest. Soc. mycol. Nord 42 (1988) 8–9, figs. 12–14; Kühner, Bull. trimest. Soc. mycol. Fr. 52 (1936) 236–237 (as *L. pseudofelina*); Lanzoni & Candusso, Boll. Gr. micol. G. Bresadola 26 (1983) 103–107, fig. 2; Migliozzi & Coccia, Boll. Ass. micol. ecol. rom. 19 (1990) 17–19 (as *L. pseudofelina*); A. Pearson, Trans. Br. mycol. Soc. 29 (1946) 192 (as *L. pseudofelina*); Romagn. & Locq., Bull. trimest. Soc. mycol. Fr. 60 (1944) 54–55.

Characteristics. Young pileus especially at centre dark grey-, black- or soot-coloured mixed with some shade of green, olive, blue or violet, slowly discolouring orange-brown or ochre-brown with age, macroscopically resembling *L. poliochloodes* and *L. grangei*; spores av. l × av. w = 7.0–9.0 × 3.5–4.1 µm, av. Q = 1.8–2.4; cheilocystidia 20–42 × 5–10.5 µm; elements on pileus tightly packed up to 320(–400) µm long, sometimes in lower parts with 1(–2) clampless septa.

Pileus 12–32 mm, at first conico-campanulate, expanding to plano-convex or slightly plano-concave with broad umbo, when young with whitish margin exceeding lamellae, at centre with a closed velvety-tomentose covering with small tufts (plush-like), dark grey to black or greyish olive-brown, sometimes with a hue of green, blue or violet, towards margin cracked into small wart-like squamules, paler than at centre to pale olive-beige brownish or grey-brown (Mu. 2.5 YR 3/2, 5 Y 2.5/1 to 2.5 Y 7/6, 2.5 Y 6/2, 10 YR 6/4) on a pale cream to isabella background, slightly pallescent and more brownish with age and sometimes discolouring yellow-brown, orange-brown or salmon-brown at margin. Lamellae, L = 36–41, l = 1–5, crowded, free, subventricose or ventricose and round-

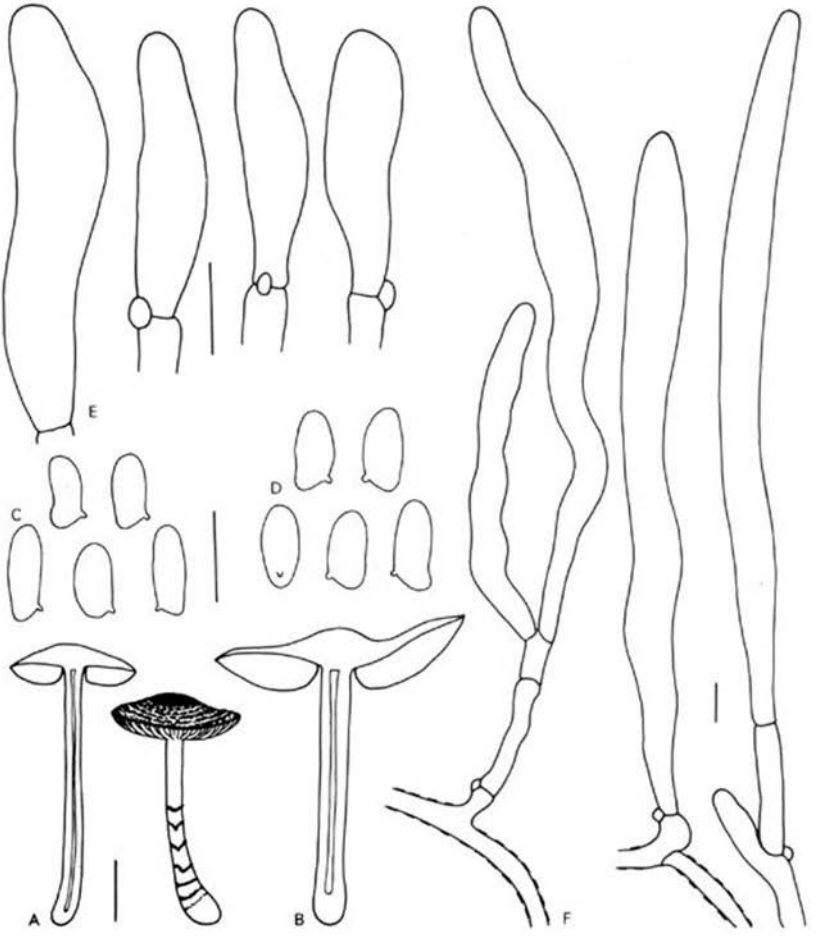

Fig. 4. *Lepiota griseovirens*. A, B. Basidiocarps; C, D. spores; E. cheilocystidia; F. elements of pileus covering. — A and C from *Vellinga 1766*, B, D–F from *Vellinga 1700*. — Scale bars as in Fig. 1.

ed near stipe, 2–4 mm broad, white to cream (10 YR 8/2), when young sometimes with greyish tinge, turning orange brownish or with orange-brown spots when old, with white finely flocculose edge. Stipe 20–60 × 2–5 mm, cylindrical and slightly broadened at base, fistulose, in upper half pale, whitish to greyish, lengthwise fibrillose, without real annulus, but especially when young with an annular zone, in the lower half covered with guirlandes or many scattered grey-black to grey-brown squamules as on pileus; background turning orange brownish at base; with white mycelium cords. Context in pileus white, with glassy line above lamellae, in stipe cortex pale yellow or brownish, at base of stipe turning orange-brown with age, inner part of stipe white cottony. Smell in young and undamaged specimens fruity, when damaged or with age more like *L. cristata*, lacking the rubber component, astringent. Taste rather strong, unpleasant, resembling smell. Spore print colour white.

Spores [420/26/17] in side view (6.1–)6.4–9.5(–10.8) × (3.0–)3.3–4.3(–4.6) µm, av. l × av. w = 7.0–9.0 × 3.5–4.1 µm, Q = 1.6–2.5(–2.7), av. Q = 1.8–2.4, oblong to cylindrical, with truncate base, the bigger the more distinctly spurred, in frontal view ± cylindrical, with thickened wall and patent hilar appendage, in Melzer's reagent dark red-brown, red in Congo red; wall in cresyl blue not colouring, slightly swelling in 10% $NH_{3(aq)}$ plus 10% $CH_3COOH_{(aq)}$. Basidia 17–31 × 5.5–9.0 µm, 4-spored, often also 2-spored. Lamella edge sterile with tufts of cheilocystidia; cheilocystidia (16–)20–42(–50) × 5.0–10.5 µm, mostly narrowly utriform, also obovoid to narrowly clavate to nearly cylindrical. Pleurocystidia not observed. Pileus covering made up of tightly packed, erect rather straight elements, (55–)85–320(–400) × 6.5–20(–24) µm, cylindrical or fusiform, often with attenuate apex, rarely furcate, with greyish-brownish parietal and in basal hyphae incrusting pigment, also with some vague coloured granules in H_2O, sometimes in lower part with 1(–2) clampless septa. Stipitipellis a cutis of cylindrical, not coloured hyphae 2.5–8 µm in diameter; elements of squamules like those on pileus but slightly shorter 35–240 × 6.5–22 µm. Clamp-connections present in all tissues.

Habitat & distribution. Gregarious in small groups, terrestrial in deciduous forests on sandy to loamy soils rich in humus and nutrients; known in the Netherlands from several localities at the inner coastal dunes, the Fluviatiel and Haf district and from southern Limburg. In the Netherlands the most common species of the dark, greenish taxa. Rare in Europe. End of August to November.

Collections examined. NETHERLANDS: prov. Noord-Holland, Aerdenhout, Naaldenveld, 2.X.1975, *E. Kits van Waveren* (L); Amsterdam, Amsterdamse Bos, 25.IX.1990, *J. Reijnders* (coll. *C. Bas 8749*) (L); Heiloo, Heiloočr Bos, 11.X.1975, *F.A. van de Bergh* (L); IJmuiden, Midden Heerenduin, 13.X.1990, *P.J. Keizer 90032* (WAG-W); Vogelenzang, Bekslaan, 12.X.1966, *C. Bas 4809* (L); Vogelenzang, Amsterdamse Waterleidingduinen, 1.XI.1984, *I. Wijtenburg* (coll. *Uljé 50* & coll. *M.E. Noordeloos 84394*) (L); prov. Zuid-Holland, Ter Aar, de Put, 25.VIII.1985, *I. Wijtenburg* (coll. *Uljé 578*) (L); Wassenaar, Rust en Vreugd, 6.X.1990, *E.C. Vellinga 1700* (L); Gelderland, Doorwerth, 23.IX.1972, *F. Tjallingii* (herb. Tjallingii); prov. Limburg, Cadier en Keer, Örenberg, 9.X.1991, *E.C. Vellinga 1766* (L); Brunssum, mine Hendrik, 26.IX.1990, *H.A. Huijser* (L). — DENMARK: west Sjaelland, Bildsø Skov, 1.X.1961, *K. Bülow* (C). — GERMANY: Baden-Württemberg, Gottheim, 9.IX.1975, *M. Bon 750948* (holotypus of *L. griseovirens* var. *obscura*) (Herb. M. Bon); Berlin-Spandau, Heerstraße/Scharfe Lanke, 8.X.1985, *E. Gerhardt* (L); Rheinland-Pfalz, Eifel, Daun, Mittleres Maar, 30.IX.1987, *E. Ludwig* (L). — SWITZERLAND: canton Bern, Aneth (Ins), Schwarzgraben, 14.X.1959, *H.S.C. Huijsman* (L). — CZECHOSLOVAKIA: Praha-Kinského zahrada, 16.IX.1954, *Wichansky* (holotypus of *L. grangei* f. *brunneoolivacea*) (PRM No. 189408).

Many authors list this species under the name *L. pseudofelina* J. Lange. Migliozzi & Coccia (1990) have already pointed out that *L. pseudofelina* is a dubious taxon, an opinion shared by the present authors. The long spores (9.0–10.75 µm), the small size of the basidiocarps, the quick discolouration of the context (as young specimens show a reddish stipe), and the intracellular pigment in the elements of the pileus covering, as described and depicted by Lange (1935, 1938) set this taxon apart. Kühner (1936), however, considered the differences in spore size and the type of pigment as not important. It is possible that it represents a small basidiocarp of *L. grangei*. Original material is not present at C.

The description of *L. griseovirens* by Maire (1928) has been interpreted in several ways either in the same sense as presented here, or in the sense of *L. poliochloodes* (= *L. griseovirens* s.s. Reid). The code for the colour of the pileus is of great significance. Maire (1928) mentions for the pileus the code Klincksieck & Valette 174; this is the same as Séguy 434, a dark greyish-greenish colour. This applies better to the species described here as *L. griseovirens* and not to the mostly paler coloured *L. poliochloodes*. The circumscription of the spore shape ('sporae oblongae basi apophysatae, subtriangulares') does not apply to the shape of the spores of *L. poliochloodes*. Unfortunately, the elements of the pileus covering are not mentioned by Maire. However, the type material should be studied for a final decision about its identity. In spite of repeated requests no type material was sent from Algeria.

Several French authors regarded *L. griseovirens*, in contrast with *L. grangei*, as a dark species with non-intracellular pigment (Kühner, 1934; Romagnesi & Locquin, 1944), in the same sense as presented here. Candusso & Lanzoni (1990) and Kühner & Romagnesi (1953) presented *L. griseovirens* as well as *L. pseudofelina*, but without virtual differences mentioned.

Reid (1972) interpreted *L. griseovirens* as a species with short and broad spores and paler tinges of the mature basidiocarp and his interpretation is described here as *L. poliochloodes*. Another difference with *L. griseovirens* is found in the rather irregular pileus covering made up of moderately short elements.

Type material of *L. griseovirens* var. *obscura* M. Bon was studied. It was not in very good shape. The microscopical characteristics are as follows: spores [45/2/1] in side view (7.2–)7.6–8.8(–10.0) µm, av. l × av. w = 8.1–8.4 × 3.8–3.9 µm, Q = 1.9–2.3(–2.6), av. Q = 2.1–2.2, with rather inconspicuous spur; cheilocystidia present but difficult to observe, due to the state of preservation, 6.5–10 µm broad; elements of pileus covering more or less erect, 80–280 × 10–20 µm, more or less cylindrical and narrowed into pedicel, with an occasional clampless septum in lower part; lower hyphae with incrusted pigment. This taxon does not represent *L. griseovirens* sensu Reid (and sensu Bon, 1981), on account of size and shape of the spores and size of the pilear elements, but it belongs to *L. griseovirens* in the present sense.

Type material of *L. grangei* f. *brunneoolivacea* Pilát was also studied. The microscopical characteristics are as follows: spores [30/2/1] in side view (6.4–)7.0–9.5(–10.4) × 3.3–4.2(–4.8) µm, av. l × av. w = 8.0–8.1 × 3.7–3.9 µm, Q = 1.8–2.45, av. Q = 2.0–2.2, with rather inconspicuous spur; basidia 4- and also some 2-spored; cheilocystidia abundant, 24–40 × 5–9 µm, elements of pileus covering more or less erect, cylindrical or slightly fusiform with rounded apex, 150–225(–320) × 15–18 µm, some with 1 or 2 clampless septa. On account of the shape of the elements of the pileus covering this taxon clearly does not belong to *L. grangei*, but fits in *L. griseovirens*.

Lepiota grangei (Eyre) Kühner — Fig. 5

Schulzeria grangei Eyre in A.L. Sm. & Rea, Trans. Br. mycol. Soc. 2 (1903) 37. — *Hiatula grangei* (Eyre) W.G. Smith, Synopsis Brit. Basidiomyc. (1908) 27. — *Lepiota grangei* (Eyre) Kühner, Bull. mens. Soc. linn. Lyon 3 (1934) 79. — *Lepiotula grangei* (Eyre) Horak, N. Z. J. Bot. 18 (1980) 184.

Lepiota ochraceocyanea Kühner, Bull. mens. Soc. linn. Lyon 3 (1934) 43.

Misapplied name. Lepiota forquignonii sensu Barbier, Bull. mens. Soc. linn. Lyon 3 (1934) 76–78.

Excluded. Lepiota grangei sensu Van de Bergh, Coolia 23 (1980) 54–56 (= *L. griseovirens*).

Selected illustrations. Candusso & Lanzoni, Fungi eur. 4 (1990) pl. 21; Enderle, Z. Mykol. 51 (1985) between p. 16 and p. 17; J. Lange, Fl. agar. dan. 1 (1935) pl. 10A; Lanzoni, Boll. Gr. micol. G. Bresadola 29 (1986) 85; Locq., Bull. trimest. Soc. mycol. Fr. 60 (1944) pl. 2, fig. 3.

*Selected descriptions & figures.*Candusso & Lanzoni, Fungi eur. 4 (1990) 213–216; Enderle, Z. Mykol. 51 (1985) 19–22; Herink, Česká Mykol. 16 (1962) 228–234; Kelderman, Coolia 31 (1988) 91–92, fig. 2; Lanzoni, Boll. Gr. micol. G. Bresadola 29 (1986) 83–87, fig. 2; Locq., Bull. trimest. Soc. mycol. Fr. 60 (1944) 41–42.

Characteristics. Young pileus especially at centre with dark green-black or blue-black squamules, with context discolouring orange-brown with age; spores av. l × av. w = 8.9–11.2 × 3.8–4.3 µm, av. Q = 2.2–2.9; cheilocystidia 20–45 × 5–13 µm; elements of pileus with 0–3(–5) clampless septa, with parietal and intracellular pigment.

Pileus 13–40 mm, when young campanulate or hemispherical with inflexed margin, expanding to plano-convex with umbo, at centre green-black, dark grey-green, grey-blue or blue-green, then green-brown or blue-brown to brown, velvety-tomentose with small erect squamules, around centre with concolorous or slightly paler small to very small uplifted or erect squamules on pale cream to pale brown background, with age mostly discolouring orange-brown, more glabrous and squamules less conspicuous; margin irregular and with some velar remnants especially when young. Lamellae, L = c. 30, l = 1–3, moderately to rather crowded, free, ventricose or broadly ventricose, up to 6 mm broad, when young whitish to cream, when old with orange-brown spots, with white finely floccose edge. Stipe 25–60 × 3–6 mm, cylindrical or slightly broadening downwards or with subbulbous base, fistulose with age, at apex glabrous and whitish or pale pinkish, lower down more orange (5 YR 5/8) or orange-brown, especially on handling, in lower half with some scattered girdles of squamules, as on pileus, blackish green-blue, blue-green or grey-green, without distinct annulus. Context in pileus white, in stipe concolorous with surface. Smell unpleasant, rubber-like, musty-stuffy or like *L. cristata*. Taste 'mild-aromatic'. Spore print colour white.

Spores [240/14/9] in side view (7.3–)8.0–13.0(–14.4) × 3.4–4.6 (–5.0) µm, av. l × av. w = 8.9–11.2 × 3.8–4.3 µm, Q = 1.9–3.0(–3.2), av. Q = 2.2–2.9, with truncate to distinctly spurred base, in frontal view cylindrical or subcylindrical, not or uniguttulate, slightly thick-walled, with distinct patent hilar appendage, immediately orange-brown in Melzer's reagent, reddish pink in Congo red; wall not coloured in cresyl blue, swelling in 10% $NH_{3(aq)}$ plus 10% $CH_3COOH_{(aq)}$. Basidia (20–)22–35 × 6.5–11.5 µm, 4-spored, rarely some 2-spored. Lamella edge sterile, made up of cheilocystidia, (16–)20–45(–55) × 5–13(–15) µm, ± cylindrical, narrowly utriform or narrowly clavate, colourless, often on broad basal element or septate in lower part. Pleurocystidia not observed. Pileus covering made up of more or less erect elements, (30–)50–300(–400) × (6.5–)8–20(–24) µm, cylindrical with rounded apex, attenuate towards base, mostly septate, with 0–3(–5) clampless septa, with thickened walls and with basal clamp-connection; pigment brownish

parietal and intracellular, when fresh blue-green intracellular, in dried material in granules, visible in H_2O. Stipitipellis a cutis of narrow 2–7 µm wide cylindrical colourless hyphae; elements of squamules and girdles as those on pileus but less septate, 35–310 × 8–21 µm. Clamp-connections present in all tissues.

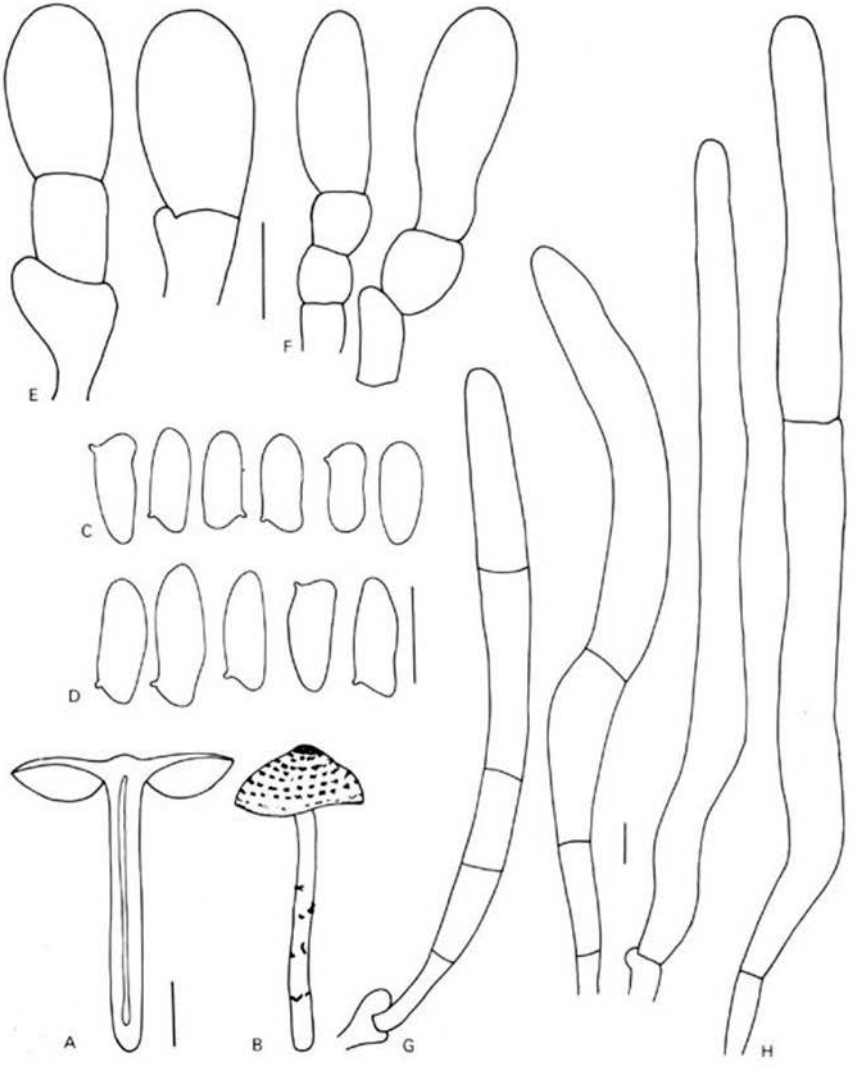

Fig. 5. *Lepiota grangei*. A, B. Basidiocarps; C, D. spores; E, F. cheilocystidia; G, H. elements of pileus covering. — A, C, E, and G from *Kelderman 873*, B, D, F, and H from *Vellinga 1015*. — Scale bars as in Fig. 1.

Habitat & distribution. Gregarious, in small groups, terrestrial in deciduous woods, especially in *Fagus* woods on ± calcareous, loamy or sandy and humous soils, but also on mine waste heaps under *Salix* and *Betula*. In the Netherlands very rare ('s-Graveland; Cadier en Keer, Riesenberg; Kerkrade, mine Laura-Julia; Valkenburg, Schaelsberg); more common in south-eastern Belgium, western Germany (Eifel) etc. Known from Eurasia, Argentina and New Zealand. End of September and October.

Collections examined. NETHERLANDS: prov. Noord-Holland, 's-Graveland, 23.IX.1955, *J. Daams* (L); prov. Limburg, Kerkrade, mine Laura-Julia, 26–28.IX.1980, *P.H. Kelderman 873* (L), 24.X.1990, *H.A. Huijser* (L) and 26.X.1991, *H.A. Huijser* (L); Cadier en Keer, Riesenberg, 30.IX.1989, *H.A. Huijser* (L); Valkenburg, Schaelsberg, 26.X.1991, *H.A. Huijser* (L). — BELGIUM: prov. Namur, Matagne la Grande, Les Mires, 21.IX.1986, *E.C. Vellinga 1015* (L). — GERMANY: Rheinland-Pfalz, Eifel, Gerolstein, Heiligenstein, 25.IX.1980, *C.M. den Held-Jager* (L); Meerbusch, Dreimüllerwald, 28.IX.1987, *E.C. Vellinga 1193* (L).

This species shows a wide variation in colour of the pileus, i.e., blue-green to more brown-green tinges can dominate. Possibly these differences are due to atmospheric conditions, as the pigment in the pileus covering is intracellular and soluble in H_2O. Spore size is highly variable within one collection and between separate collections, even from the same locality, and such a wide range of spore size in this species group is only found in this species. Elements of the pileus covering of small specimens have in average less septa than those of big basidiocarps.

II. Lepiota fulvella and L. boudieri

Lepiota boudieri Bres. — Fig. 6

Lepiota boudieri Bres., Fungi trident. 1 (1884) 43, non *L. boudieri* Gueguen, Bull. trimest. Soc. mycol. Fr. 24 (1908) 127.

Lepiota fulvella Rea, Trans. Br. mycol. Soc. 6 (1917) 61.

Lepiota fulvella f. *gracilis* J. Lange, Fl. agar. dan. 1 (1935) 32 (not valid, without Latin diagn.).

Misapplied name. Lepiota castanea sensu Pilát, Acta Mus. nat. Prag. 11B (1955) 3–5.

Excluded. Lepiota fulvella sensu M. Bon, Docum. mycol. 11 (43) (1981) 35–36 (= ?*L. castanea*).

Selected illustrations. Krieglsteiner, Z. Mykol. 51 (1985) opposite p. 132; Kühner, Bull. trimest. Soc. mycol. Fr. 53 (1937) Atlas pl. 74 I; J. Lange, Fl. agar. dan. 1 (1935) pl. 12D, 12F; R. Phillips, Paddest. Schimm. (1981) 29 (all as *L. fulvella*).

Selected descriptions & figures. Babos, Annls hist.-nat. Mus. natn. Hung. 66 (1974) 69 (as *L. fulvella*); Bres., Fungi trident. 1 (1884) pl. 46; Kelderman, Coolia 31 (1988) 39–41, fig. 1; Krieglsteiner, Z. Mykol. 51 (1985) 108–109 (as *L. fulvella*); Kühner, Bull. trimest. Soc. mycol. Fr. 52 (1936) 234–236 (as *L. fulvella*); J. Lange, Dansk bot. Ark. 4 (4) (1923) 48.

Characteristics. Pileus 20–65 mm, orange-brown to dark red-brown at centre and paler towards margin, fading with age to more ochraceous tinges, completely covered with radial fibrillose squamules, not or scarcely showing the underlying context; lamellae crowded, free, white to pale cream, often red-spotted with age, with concolorous flocculose edge; stipe 30–70 × 3–8 mm, at apex whitish to pinkish, when young with white flocculose annular zone, below annulus with adnate orange-brown fibrillose squamules; smell fungoid-terroid to sweetish, fruity etc.

Spores in side view 7.0–10.0(–11.0) × 3.0–4.0(–4.5) µm, Q = (1.9–)2.1–2.9(–3.1), av. Q = 2.2–2.7, with truncate to spurred base; basidia mostly 4-spored; lamella edge

sterile; cheilocystidia 13–38 × 5–12 µm, subutriform, clavate to ovoid, often articulate; pileus covering made up of adnate to uplifted bundles of hyphae, with elements articulate and clamped at septae, with brown intracellular pigment, dissolving in $NH_{3(aq)}$; terminal elements 40–215 × 8–24 µm, more or less cylindrical or tapering towards apex, with rounded apex.

This taxon is rather variable in colour; in typical variants it is rather orange-brown tinged, but also dark, more purple-tinged basidiocarps and even basidiocarps without pigments can be found. The colour of the pileus changes from orange-brown to more ochraceous brown with age, and the lamellae occasionally have reddish spots or even a reddish or purplish tinged edge with age.

This species, microscopically characterized by a pileus covering made up of articulate elements with intracellular pigment, is known in literature either as *L. fulvella* Rea (e.g. Moser, 1984; Krieglsteiner, 1985) or as *L. boudieri* Bres. (e.g. Bon, 1981; Candusso & Lanzoni, 1990). Bon (1981) misinterprets *L. fulvella* as a species with non-articulate elements on the pileus (with intracellular pigment).

Original material of *L. boudieri*, present in S, collected by Bresadola in 1888, 'In silva tertiolasii' (i.e. in Valle di Sole, the type locality), is old and rather brittle, but nevertheless the important characteristics could be observed.

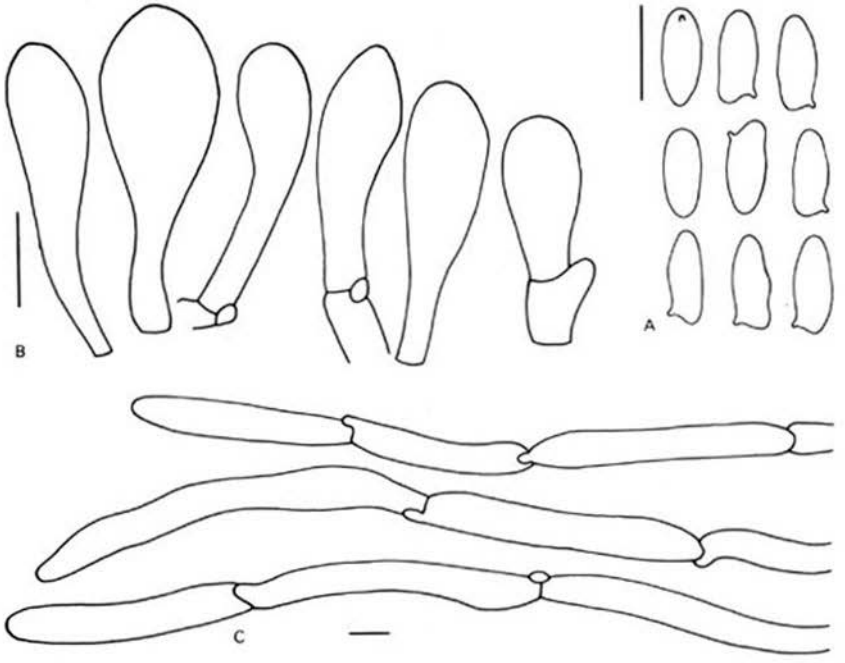

Fig. 6. *Lepiota boudieri*. a. Spores; b. cheilocystidia; c. elements of pileus covering. — All from *Bresadola*, 1888. — Scale bar = 10 µm.

Spores [61/2/1] in side view (7.2–)7.8–10.0(–10.6) × (3.2–)3.4–4.2(–4.5) µm, av. l × av. w = 8.6–8.9 × 3.6–3.8 µm, Q = (1.9–)2.0–2.65, av. Q = 2.25–2.45, with or without conspicuous spur; cheilocystidia difficult to observe, 20–35 × 5.5–10(–12) µm, narrowly clavate to clavate, some more fusiform, some articulate; hyphae on the pileus articulate, consisting of cylindrical to slightly inflated elements, 55–90 × 8–12 µm, with clamp-connections.

The original plate of *L. boudieri* (Bresadola, 1884) shows a rather pale coloured fungus with radiating fibrillose covering on pileus with a purplish tinged lamella edge, representing a rather old and faded specimen. On account of the colour of the lamella edge Kühner (1936) decided to call his finds *L. fulvella*, as he had typical material, and not old specimens.

The type material of *L. fulvella* has been lost, but a water-colour of the original material is preserved at the Herbarium at Kew. This water-colour shows an orange-brown *Lepiota* with a more or less fibrillose covering, without doubt identical with the present interpretation of the species. Spore sizes as given by Rea (1917) also agree with the modern interpretations.

The conclusion of these studies is that *L. boudieri* and *L. fulvella* are synonyms.

Material in Bon's herbarium identified as *L. acerina* Peck actually represents also this species; this exsiccate (leg. W. Winterhoff 86360, 9.IX.1986, Germany, Oberrheinebene) has the following characteristics: spores [15/1/1] 8.8–9.6(–10.0) × 3.2–4.0 µm, av. l × av. w = 9.25 × 3.5 µm, Q = 2.5–2.85, avQ = 2.65; lamella edge sterile; elements of pileus covering articulate with intracellular pigment, soluble in $NH_{3(aq)}$.

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Many mycologists kindly put collections of fresh or dried specimens to our disposal. Our gratitude extends to the curators of the herbaria at Copenhagen, Kew, Praha (PRM), and Stockholm and Mr. M. Bon for sending collections on loan. Several people were so kind as to give help with foreign languages as Czech and Latin. Thanks are also due to Thomas W. Kuyper for his critical comments on the manuscript of this paper.

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STUDIES IN CLITOPILUS (BASIDIOMYCETES, AGARICALES) IN EUROPE

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Clitopilus paxilloides Noordel., spec. nov., a grey-brown paxilloid taxon from mixed boreal forest is described from Norway. Descriptions are given of *C. rhodophyllus* (Bres.) Sing. and *C. passeckerianus* (Pilát) Sing. with a discussion on the taxonomic and nomenclatural problems involved with these pleurotoid taxa. A key is given to all taxa known from Europe.

The genus *Clitopilus* is a small genus in the Entolomataceae, characterized by a clitocyboid, omphalioid, or pleurotoid basidiocarp, pink or pinkish brown spore-print, and ellipsoid spores, with more or less conspicuous longitudinal ribs, appearing angular in polar view. The basidiocarps are usually white, rarely pigmented. Although the genus is relatively well known (Fayod, 1889; Josserand, 1937, 1955; Pegler, 1975; Singer, 1946; 1978; Noordeloos, 1984, 1988), there still is the need of a critical revision of the taxa in section *Pleurotelloides*. This group comprises small, whitish, pleurotoid taxa of variable size and shape, that now are mainly distinguished on account of their growth-form, smell, spore-size and habitat. A critical study, also based on cultural, genetical, physiological and ecological characteristics would be very helpful to create a more sound species concept in this section.

KEY TO THE SPECIES

1a. Basidiocarp with well developed, centrally or more rarely eccentrically inserted stipe 2
b. Basidiocarp pleurotoid with short, eccentric or lateral, or entirely lacking stipe . . . 7
2a. Basidiocarp white or pallid, without visible pigmentation in cortical layers 3
b. Basidiocarp grey or grey-brown, with pigments in cortical layers 5
3a. Pileus 30–80 mm broad, hemispherical to convex, rarely concave, often with low, broad umbo; spores 10.5–12.5 × 5.0–6.5 µm . . . . . *C. prunulus*
b. Pileus 5–25 mm broad, convex, applanate or concave, with slightly depressed centre, rarely with small umbo; spores less than 10 µm long 4
4a. Smell none or farinaceous; spores 6.0–8.5 × 3.5–5.0 µm
C. scyphoides (Fr.: Fr.) Sing. var. *scyphoides*
b. Smell sweetish (fruit, aniseed); spores 7.0–10.0 × 3.5–5.0 µm
C. scyphoides var. *intermedius*
5a. Basidiocarp omphalioid; pileus 5–15 mm broad, umbilicate to infundibuliform, pale greyish-brown; pigment intracellular in pileipellis . . . . . *C. giovanellae*
b. Basidiocarp clitocyboid; pileus 20–65 mm broad, convex-umbonate, relatively intensely coloured; pigment incrusting in pileipellis 6

6a. Pileus 45–65 mm broad, relatively thick-fleshed, with strongly involute margin, grey to grey-brown, often with concentrically arranged darker spots; spores 9.5–13.5 × 5.5–7.0 µm ..... *C. paxilloides*
b. Pileus about 20 mm broad, relatively thin-fleshed, reddish brown; spores 8.0–9.5 × 4.0–4.5 µm. ..... *C. quisquiliaris*
7a. Basidiocarp growing on beds of cultivated mushrooms (on sterilized Horse-dung) 8
b. Basidiocarp growing on various types of vegetal debris, including wood, herbaceous plants and other fungi 9
8a. Spores 4.5–6.0 × 3.0–3.5(–4.0) µm; basidiocarp growing in dense, head-like clusters ..... *C. fasciculatus*
b. Spores 6.0–8.0 × 3.5–5.5 µm; basidiocarp single or in small groups *C. passeckerianus*
9a. Spores 3.5–4.0 µm broad ..... *C. scyphoides* f. *reductus*
b. Spores in average more than 5 µm broad 10
10a. Pileus 15–45 mm broad; lamellae ochre-pink or brownish pink; on deciduous logs *(Quercus, Ulmus)* in large groups; spores 7.0–9.5(–11.0) × 4.5–6.0 µm *C. rhodophyllus*
b. Pileus 2–15 mm; lamellae white then pale pink; on herbaceous plants, other fungi, rarely on rotten wood 11
11a. Spores (6.5–)7.5–8.5(–10.0) × 5.0–5.5(–6.0) µm ..... *C. hobsonii*
b. Spores (7.0–)8.0–11.5(–12.5) × 5.0–7.0 µm ..... *C. daamsii*

SECTION CLITOPILUS

Clitopilus paxilloides Noordel., *spec. nov.* — Fig. 1

Basidiomata solitaria vel subcongregata, paxillus similis. Pileus 45–65 mm latus, convexus, leviter depressus, toto griseo-brunneus vel griseo-brunneo maculatus, leviter hygrophanus, velutinus; lamellae decurrentes, arcuatae, albidae demum griseo-roseae; stipus 25–50 × 10–15 mm, versus basim attenuatus, griseo-brunneus pileo concolor vel pallide griseus; odore saporeque farinaceis.

Sporae 9.5–11.5 × 5.5–7.0 µm, amygdaliformae vel fusiformae, 5–8 costatae; basidia 4-sporigera, fibulata, cystidia nulla; pileipellis cutis vel trichoderma hyphis cylindraceae, 1.5–4 µm latae; subpellis compacta, elementis curtis distincte incrustatae; fibulae abundantae.

Ad terram inter muscos in silvis mixtis.

Holotypus. 'Fungi Norvegici / *Clitopilus paxilloides* Noordel. / leg. Thor Lunder s.n. / 19 Oct. 1984 / Buskerud, Helgelandsmoen near Hönefoss' (O, L).

Etymology. Paxilloides = resembling *Paxillus*.

Basidiocarps solitary or in small groups. Pileus 45–65 mm, convex with slightly depressed centre and involute margin, weakly hygrophanous, not translucently striate, uniformly grey-brown (K&W 5BC3, 5D3-4, 6D4-5), or with numerous grey-brown spots on slightly paler beige-grey background, dry, velutinous, somewhat pubescent at margin. Lamellae crowded, arcuate-decurrent, occasionally forked, cream-coloured then pinkish-grey with entire, concolorous edge. Stipe 25–50 × 10–15 mm, straight, usually tapering towards base, concolorous with pileus or paler, fibrillose lengthwise, white tomentose at base. Context firm and thick, grey in cortex of pileus and stipe, white in inner parts. Smell and taste strongly farinaceous.

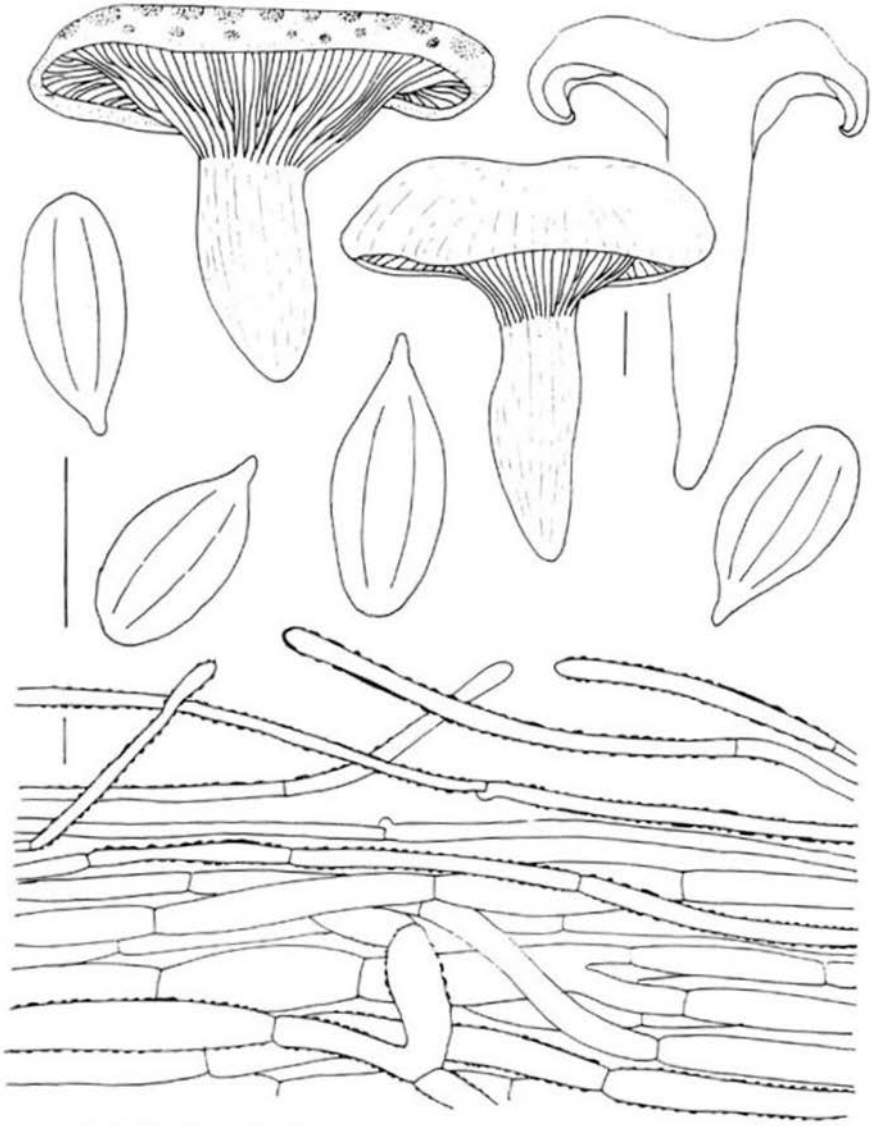

Fig. 1. *Clitopilus paxilloides*. Habit, spores, and pileipellis (bar equals 1 cm/10 μm).

Spores 9.5–13.5 × 5.5–7.0 µm average 11.5 × 6.0 µm, Q = 1.45–2.1, average Q = 1.75, very variable from ellipsoid to amygdaliform with 5–8, distinct longitudinal ribs, thin-walled, colourless in water, pinkish brown in mass. Basidia 30–50 × 8–10 µm, 4-, rarely also 2-spored, clamped. Lamella edge fertile. Cheilo- and pleurocystidia absent. Hymenophoral trama regular to subregular, made up of 4–10 µm wide, cylindrical or slightly inflated hyphae. Pileipellis a transition between a cutis and a trichoderm, made up of narrow, 2–5 µm wide, cylindrical hyphae, subpellis well developed, made up of short, inflated 2–10 µm wide elements. Pigment coarsely encrusting the hyphae of subpellis and upper pileitrama. Clamp-connections rare, only seen with certainty in hymenium.

Terrestrial among moss in mixed forest.

Collections examined. NORWAY, Buskerud, Helgelandsmoen near Hönefoss, 19 Oct. 1984, *Thor Lunder s.n.* (holotype, O, L); same locality: 13 Oct. 1985, *Thor Lunder s.n.* (O, L); Oslo, Lörenskog, 17 Oct. 1991, *L. Joly* (O).

The distinctive characters of *Clitopilus paxilloides* are the grey-brown colour of pileus and stipe, the habit with thick-fleshed pileus with strongly involute margin, resembling *Paxillus involutus,* and the encrusting pigment in the pileipellis. *Clitopilus prunulus* has whitish to very pale grey or cream carpophores, thinner flesh in the pileus, and lacks encrusting pigments. *Clitopilus quisquiliaris* (P. Karst.) Noordel. is a slender fungus with red-brown pileus and smaller spores (Noordeloos, 1981) and needs to be rediscovered.

SECTION PLEUROTELLOIDES SING.

Clitopilus rhodophyllus (Bres.) Sing. — Fig. 2

Pleurotus rhodophyllus Bres., Annls. mycol. 3 (1905) 159. — *Clitopilus rhodophyllus* (Bres.) Sing., Sydowia 15 (1961) 80.

Misapplied name. Clitopilus pinsitus sensu auct. (Josserand, Kühner & Romagnesi, Courtecuisse, and others).

Selected icones. Bres., Iconogr. mycol. (1929) tab. 295, fig. 1; Cetto, Funghi Vero 5 (1987) tab. 1858 (as *C. pinsitus*).

Selected literature. Josserand, Bull. Soc. mycol. Fr. 53 (1937) 212–213 (as *Pleurotus pinsitus*); Watling & Gregory, Br. Fung. Fl. 6 (1989) 115 (as *C. pinsitus*).

Original diagnosis

"*Pleurotus rhodophyllus* Bres. Caespitosus, raro simplex; pileus carnosis, flabelliformibus, siccis, albis, glabris, 1.5–4 cm latis, 1–3 cm productis; lamellis albis, dein incarnato-isabellinis, confertis, postice attenuato-decurrentibus; stipite laterali, albo, 2–3 mm longo crassoque, in caepitibus tuberculoso, unico; sporis hyalinis, in cumulo carneolis, oblongo-obovatis, 7–9 × 4–5 µ; basidiis clavatis, 20–25 × 8 µ; carne alba, molli, odore et sapore haud notabilis. Hab. ad truncos Ulmi campestris."

Description

Basidiocarp pleurotoid, growing in dense clusters. Pileus semicircular to spathulate, about 10–25 mm broad and up to 25 mm wide, more or less plano-convex with involute or deflexed margin, not hygrophanous, not translucently striate, whitish or rather pale cream-coloured with slight pink tinge, smooth, glabrous or somewhat hairy. Lamellae very crowded, L ≥ 40, l = 3–9, adnate or adnexed, narrowly ventricose, white then pale pink, finally brownish pink, with entire or slightly pruinose, concolorous edge. Stipe completely lacking. Context white. Smell and taste farinaceous.

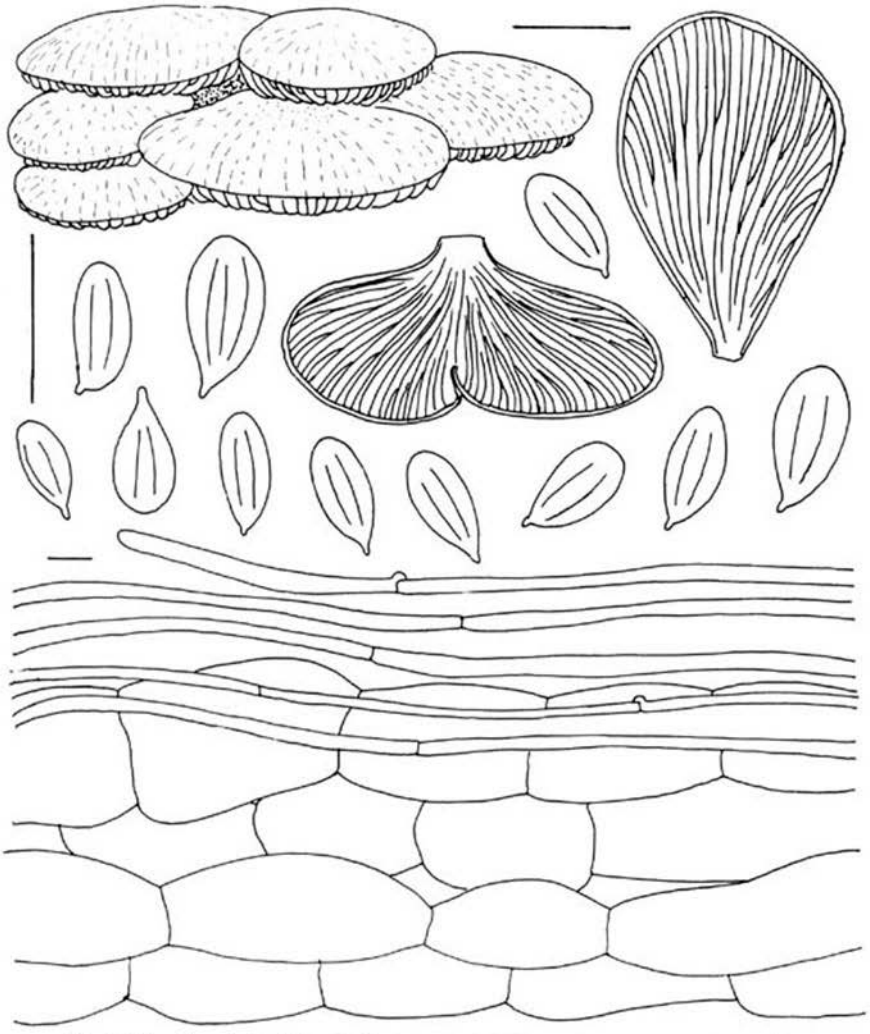

Fig. 2. *Clitopilus rhodophyllus*. Habit, spores, and pileipellis (bar equals 1 cm/10 µm).

Spores 7.0–9.5(–11.0) × 4.5–6.0 µm, average spore 8.5 × 5.2 µm, Q = 1.4–1.85, average Q = 1.6, ellipsoid to ovoid in side-view with weak longitudinal ridges, somewhat angular in polar view, thin-walled, colourless, cyanophilous. Basidia 23–27 × 5.5–7.5 µm, 4-spored, clampless. Lamella edge fertile. Cheilo- and pleurocystidia absent. Pileipellis a cutis of narrow, cylindrical hyphae, 2–4(–5) µm wide, without visible pigmenta-

tion. Pileitrama fairly irregular, made up of short, inflated elements, 15–45 × 7–20 µm. Clamp-connections absent.

In dense, imbricate clusters on decayed wood of *Ulmus* in old Park-forest.

Collection examined. THE NETHERLANDS, Prov. Utrecht, Nijenrode, 28 Oct. 1988, *Th.W. Kuijper 2965* (WBS).

The collection described above agrees well with *Clitopilus pinsitus* Fr. sensu Josserand (1937). *Agaricus pinsitus* Fr. in its original concept is a species with white spore-print (Fries, 1821), and furthermore there is no indication of pink lamellae. In our collection, and in the description of Josserand, the lamellae are definitely ochraceous-pink to brown-pink when mature, and the spore-print, which is produced abundantly, is pinkish-brown, like in other *Clitopilus* species. Therefore Josserand's interpretation of *Agaricus pinsitus* Fr. is considered as a misapplication. *Pleurotus rhodophyllus*, however, as described by Bresadola (1929), agrees in a very satisfactory way with our fungus, except for the smell, that is said to be indistinct.

Clitopilus rhodophyllus is a relatively poorly known species, that lacks modern descriptions. Kühner & Romagnesi (1953) key out both *Clitopilus pinsitus* sensu Josserand and *C. rhodophyllus*, and distinguish them on smell (*C. pinsitus* with strong farinaceous smell, *C. rhodophyllus* with inconspicuous smell), and a distinct separating zone between the pileitrama and hymenophoral trama, consisting of collapsed hyphae in the latter. I have not noticed such a layer in the Netherlands' collection. Courtecuisse (1986) keys out both taxa. *Clitopilus pinsitus* with pileus more broad than long, with strong farinaceous smell and growing on leaves, and *C. rhodophyllus* without smell, a pileus longer than broad, and growing on wood. The collection from the Netherlands is intermediate in this respect with relatively broad pilei, strong farinaceous smell growing on wood. Therefore the existence of two species is questioned. *Clitopilus passeckerianus* (Pilát) Sing. is also very similar (see below).

Clitopilus passeckerianus (Pilát) Sing. — Fig. 3

Pleurotus passeckerianus Pilát, Atl. Champ. Eur. II (1935) 49 (nom. nud., no Latin diagnosis). — *Clitopilus passeckerianus* (Pilát) Sing., Farlowia 2 (1946) 560.

Selected literature. Nathorst-Windahl, Friesia 9 (1969) 161; Runge, Z. Mykol. 50 (1984) 13–16; Watling & Gregory, Br. Fung. Fl. 6 (1989) 114–115.

Basidiocarp solitary or in small clusters. Pileus 5–50 mm broad, reniform to flabelliform or spathulate, not hygrophanous, white, silky-shining, fibrillose to subtomentose. Lamellae adnate to slightly decurrent, white then pale pink. Stipe strongly reduced, lateral or lacking, white, pruinose.

Spores 6.0–8.0 × 3.5–5.5 µm, average spore 6.5–7.7 × 4.0–5.0 µm, Q = 1.45–2.25, elliptical to elongate with 5–9, distinct ribs. Basidia 4-spored, clamped. Pileipellis a simple cutis of narrow hyphae, 2–5 µm wide. Clamp-connections present.

On mushroom-beds, but also found on decayed paper and on a waste heap in the open field; once found on snail-eggs.

Collections examined. UNITED KINGDOM, Herthshire, Chestnut, 25 Oct. 1951, *R.E. Taylor* (K); Kent, Canterbury, 8 Dec. 1934, *W.M. Ware* (K); Huntshire, Monk's Woods Experimental Station, 15 Dec. 1972, *S. Wells* (K); Kent. Worthing, 3 Febr. 1955, *Wood* (K); Northern Ireland, Belfast, 25 Sept. 1937,

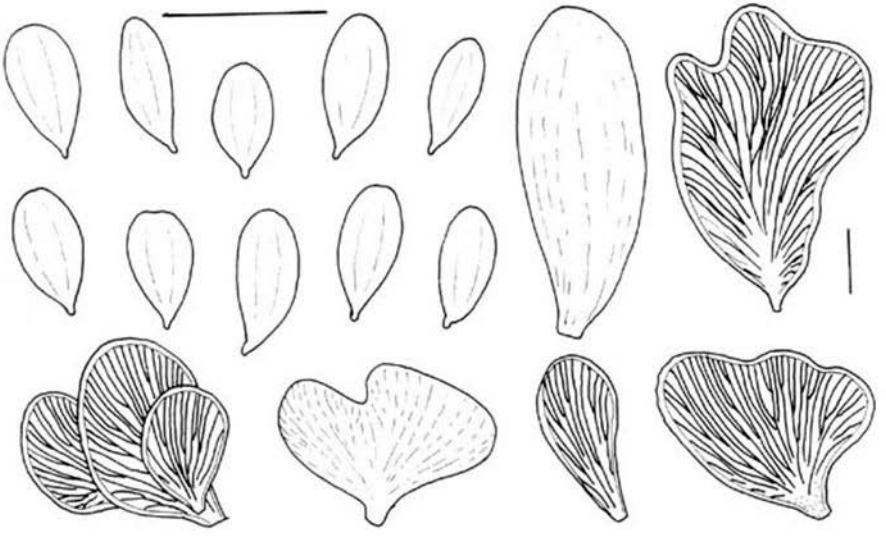

Fig. 3. *Clitopilus passeckerianus*. Habit and spores (bar equals 1cm/10 μm).

J.C. Taylor; Sweden, Västergötland, Göteborg, 22 Oct. 1942, *F. Karlvall* (Lundell & Nannfeldt, Fungi Exs. Suecici 2015, K).

I have not seen original material from Pilát, but I was able to study a number of collections of *Clitopilus passeckerianus* in the herbarium of the Royal Botanic Gardens, Kew. In general these collections strongly resemble *Clitopilus rhodophyllus*, except for the basidiocarps growing solitary or in small clusters, and the slightly smaller, and more distinctly ribbed spores. This agrees also with the description given by Watling & Gregory (1989). *Clitopilus fasciculatus* Noordel., also growing on mushroom-beds, has still smaller spores, and in addition a completely different growth-form with very dense, cauliflower-like clusters (Noordeloos, 1984). *Clitopilus hobsonii* is also very similar, but differs in having broader spores with distinct ribs, and usually has smaller basidiocarps, growing on vegetal debris, grasses etc. I agree with Watling & Gregory (l.c.) that the differences are small. It would be very interesting to study representatives of all taxa concerned in culture, trying to find out genetic differences, and studying the influence of substrate. For this reason I refrain from a formal validation of the epithet *passeckerianus*, awaiting more evidence as to the status of this taxon.

ACKNOWLEDGEMENTS

The author is grateful to Dr. Gro Gulden, Botanical Museum, Oslo, for sending good material and notes of *Clitopilus paxilloides*. The director and staff of the Herbarium, Royal Botanic Gardens, Kew are thanked for their hospitality and help.

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A NEW SPECIES IN SECTION HYDROPHILAE OF THE GENUS PSATHYRELLA

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A new species of *Psathyrella* (Section *Hydrophilae*) is described from a mediterranean coastal pine forest *(Pinus pinaster, Pinus pinea)* in Italy, that was burnt on July 31st, 1989. It is dedicated to Dr. E. Kits van Waveren.

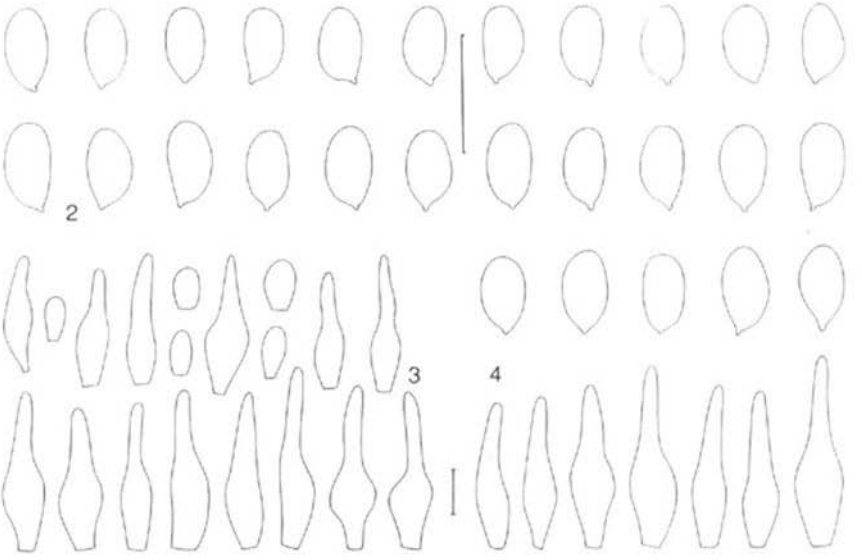
Psathyrella wavereniana M. Marchetti, *spec. nov.* — Figs. 1–4

Pileus primo 10–20 mm latus, globoso-parabolicus, badius, maturitate 20–40(–50) mm latus, campanulatoconvexus, badio-aurantiacus, subumbonatus, laevis, estriatus, tenui margine, hygrophanus, in sicco pallide-brunneus, manifeste roseotinctus. Velum album, fibrillosum atque floccosum, initio efficiens marginem pilei copiose appendiculatum, dein pruinosum et marginem versus parvis floccis. Lamellae 3–5 mm latae, confertae, adnatae, subventricosae, brunneae et purpureofuscae, rubea linea sub acie integra. Stipes 30–40(–50) × 2–4 mm, cylindraceus, aequalis, cavus, eradicatus, haud bulbosus, albidus signis violaceis infra velum, annulo haud striato munitus. Caro pilei centro 2–3 mm crassa, in margine tenuis, rubro-vinosa, rubro-ochracea in stipite, rubro-vinosa ad basim. Sporae 6.3–7.2 × 3.6 µm, ellipsoideae, poro germinativo destitutae, nec opacae, in aqua observatae rubro-brunneae. Basidia 12.5–16 × 5.5–7 µm, clavata, 4-sporigera. Pleurocystidia 40–52.5 × 7.5–12.5 µm collum (× 4–7.6 µm latum), lageniformia, tenuitunicata, sine colore. Cellulae marginales: cheilocystidia pleurocystidioidea 30–40(–50) × 7.5–12.5 µm, numerosa, cellulae spheropedunculatae et clavatae 12.5–15 × 6–7 µm intermixtae, omnes tenuitunicatae et sine colore. Trama lamellarum colorata. Pileipellis e cellulis formata. In locis deustis, in terra sabulosa, gregaria, subcaespitosa, hieme.

Holotypus: *M. Marchetti s.n.*, 3.II.1990, Calambrone (Pisa), Italia (L).

Pileus in early stages 10–20 mm diam., globose, hemispherical to paraboloid with narrow incurved margin, reddish brown, with white veil forming fibrils and circularly arranged flocci reaching up to almost 3/4 of pileus and an appendiculate uninterrupted fringe at margin, also connecting margin of pileus with stipe, covering it with velar fibrils and fine flocci. At maturity pileus 20–40(–50) mm, gradually expanding via paraboloid to campanulate convex, vaguely umbonate, smooth, not striate; with even margin; with pruinose veil, reduced to small flocci at margin; hygrohanous, when moist reddish brown orange (Séguy, 1936: 186); pallescent on drying to pale brown with a distinct pink tinge. Lamellae 3–5 mm broad, crowded, segmentiform to subventricose, brown to slightly purplish brown (Séguy, 1936: 178–177); with entire edge that becomes red underlined at maturity. Stipe 30–40(–50) × 2–4 mm, cylindrical, equal, hollow, white with violaceous tinge, covered with velar zones, with a non-striate annular zone halfway; not rooting, not bulbous. Context of pileus fleshy, 2–3 mm thick at centre, thin at margin, reddish-vinaceous; context of stipe ochraceous-reddish, in base reddish-vinaceous as in pileus.

Spores 6.3–7.2 × 3.6 µm (mean values of 20 measured spores: 6.8 × 3.6 µm), ellipsoid, adaxial flattened, without germ pore (at most a callus present), with distinct hilar



Figs. 1–4. *Psathyrella wavereniana*. 1. Habit; 2. spores; 3. cheilocystidia; 4. pleurocystidia (bar = 10 µm).

appendix, not opaque, in water reddish brown (Mu 2.5 YR 3/4–5 YR 4/4), in 10% NH_4OH warm brown (Mu 7.5 YR 4/4). Basidia 12.5–16 × 5.5–7 µm, clavate, 4-spored. Pleurocystidia 40–52.5 × 7.5–12.5 µm (neck 4–7.5 µm thick), lageniform, thin-walled, colourless, scarce. Marginal cells: pleurocystidioid cheilocystidia 30–40(–50) × 7.5–12.5 µm (neck 4.5–7.5 µm thick), abundant; spheropedunculate and clavate cells only very few seen, 12.5–15 × 6–7 µm, in between these cells some primordial basidia and undefined tissue. All cells thin-walled and colourless. Hymenophoral trama observed in NH_4OH 10% under binocular lens against well lit white background: pale greyish brown with many distinctly fairly pale brown tissue strands, running from base of gill to edge and mutually merging near base of gill. Hyphae of the hyphal strands pale brown from membranal pigment, without encrustations and only a few yellow septa; very distinct red underlining of edge. Pileipellis a 3–4 cells deep layer of globose and subglobose cells, 30–55 µm in diam.

Habitat. Gregarious (12 specimens), subcaespitose, in coastal pine forest *(Pinus pinaster, Pinus pinea)* burnt on July 31st 1989, on sandy soil around stumps of *Pinus pinaster* with *Funaria hygrometrica* together with *Tephrocybe atrata, Plicaria endocarpoides,* and *Geopyxis carbonaria.* The pH of the soil slightly basic, 7.30–7.70.

Collection examined. ITALY: Calambrone (Pisa), 3.II.1990, *M. Marchetti* (holotype, L).

On account of the very small spores (average size of the spores 6.8 × 3.6 µm) *Psathyrella wavereniana* by definition belongs to *Psathyrella* section *Hydrophilae.* Accordingly, as in many species of that section, its spores have no germ pore and it has in the lamellae, running through the hymenophoral trama from base to edge, tissue strands of which the pigmentation is stronger than in the tissue between the strands. *Psathyrella wavereniana* is distinguished from the other taxa within section *Hydrophilae,* in particular from *P. rannochii,* that also has a strongly developed veil, forming an annular zone on the stipe, and growing in coniferous woods, by the presence of subhymenial red underlining of the edge of the lamellae, and a striking vinaceous coloration of the context of pileus and stipe.

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We are greatly indebted to Dr. E. Kits van Waveren for his assistance in writing this paper, and in particular for checking the microscopical features of the species and producing the drawings of the cystidia. We also wish to thank Prof. C. V. di Bari for providing the Latin diagnosis.

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A. Achhammer. *Pleurotus unter Stress. Ökofysiologische Untersuchungen zu Wasserhaushalt und Sporulation.* (Bibliotheca mycologica 141, J. Cramer in der Gebrüder Borntraeger Verlagsbuchhandlung, Berlin, Stuttgart. 1992). Pp. 206, 104 text-figs. and black-and-white photographs. Price: DM 130.-

Pleurotus ostreatus and *P. pulmonarius*, wood-destroying and edible basidiomycetes, were the subject of an ecophysiological study with regard to the connection between water household in the fruitbody and sporulation. Field observations were combined with controlled laboratory experiments on cultivated fruit-bodies. In the field it appeared that when it is about freezing point during the day, sporulation is mainly determined by temperature factors.

In milder periods, water content of the fruit-bodies is the major factor influencing the sporulation. There was not found a daily pattern in sporulation nor endogenic rhythm. In cultivated fruit-bodies, the field observations were confirmed as to the influence of relative humidity for the duration of the sporulation, but a change in humidity during the day did not influence sporulation in a uniform way. In the range of 8–22°C, temperature proved to be the most important factor, always positively correlated with sporulation intensity. *Pleurotus* is considered as a poikilohydric organism, as its water household is mainly determined by physical laws, not hampered by special structures preventing dehydration, etc. Fruit-bodies proved to be able to tolerate rather long periods of frost or dehydration, starting sporulation again under favourable conditions. The hymenial elements are able to withstand frost and/or drought, which is also demonstrated with SEM pictures of these structures.

R. Agerer (Editor). *Colour atlas of ectomycorrhizae Issue 6.* (Einhorn Verlag. Eduard Dietenberger GmbH, Schwäbisch Gmünd. 1992). 8 col. pls. Price: DM 28.-.

The sixth issue of this loose-leaf colour atlas of ectomycorrhizae comprises only 8 plates, each with 4 photos in natural colour, two pages in half-tone photos showing important anatomical features, and extensive legends. Of these ectomycorrhizae 5 are identified: *Cortinarius bolaris (Fagus sylvatica), Cortinarius cinnabarinus (Fagus sylvatica), Gomphidius roseus (Pinus sylvestris), Lactarius acris (Fagus sylvatica),* and *Tricholoma sciodes (Fagus sylvatica).* The other three are unidentified and denominated *Fagirhiza arachnoidea, Fagirhiza globulifera,* and *Piceirhiza bicolorata* respectively. Up till now 74 plates have been delivered in this series, that eventually will comprise 200–300 plates.

T.E. Brandrud, H. Lindström, H. Marklund, J. Melot & S. Muskos. *Cortinarius, Flora Photographica. Vol. 2.* (Cortinarius HB Svamp Konsult, Matfors, Sweden. 1992). Pp. 40, 60 col. pls., in ring binder. Price: approximately DM 120 excl. postage.

This is the second volume of the English version of this flora, presenting colour photographs and descriptions of another 60 taxa of *Cortinarius* in Europe. The text booklet provided offers an appendix with a systematic arrangement of the plates, explanations of terms and abbreviations, addenda and corrigenda on vol. 1, references to supplementary descriptions, nomenclatoral discussions and typification, Latin diagnoses and new combinations, author abbreviations, and references. The coloured photographs are of the same good quality as in the first volume of this series, that will be continued.

O. Constantinescu. *An annotated list of Peronospora names.* (Thunbergia 15, Botanical Museum, Uppsala). Pp. 110, 1 text-fig. Price: SEK 110 excl. postage.

This compilation lists information on 787 names of taxa referred to *Peronospora,* of which 551 epithets are valid and legitimate. For each taxon the author, bibliographical citation, host(s), and original specimen(s) are indicated. The nomenclatoral status is revised and 36 taxa are lectotypified. For most of the taxa the location of the original specimen(s) was checked. Comment on taxonomy are added. In some cases, particularly for species of economic importance, the generally accepted conspecifity is indicated. 113 names are excluded from *Peronospora.*

This compilation is very useful both for taxonomists and phytopathologists.

G. Gulden, K. Höiland, K. Bendiksen, T.B. Brandrud, B.S. Voss, H.B. Jenssen, and D. Laber. *Macromycetes and air pollution. Mycocoenological studies in three oligotrophic spruce forests in Europe.* (Bibliotheca mycologica 143, J. Cramer in der Gebrüder Borntraeger Verlagsbuchhandlung, Berlin, Stuttgart. 1992). Pp. 81, 31 text-figs., 22 tables. Price: DM 50.-.

The mycoflora of oligotrophic forests of *Picea abies* was examined at three different localities in Central Norway, Southern Norway, and South-west Germany. These forest stands were considered to be comparable with regard to climate, bedrock, soil, and phytosociological composition. The northernmost station has little atmospheric pollution, whereas the other two stations are exposed to air-pollution in varying degrees. Great differences were observed in the mycoflora between the three stations, both in number of macromycete species, diversity, and production, with clear trends in higher performance at the northern, least polluted station. The ectomycorrhizal species and terricolous saprophytes were more divers, abundant and productive in the north, with about twice the number of species and fruit-bodies, than in the German locality. The higher number of lignicolous species observed in the Norwegian localities were probably due to a difference in forest management between Norway and Germany. Attention has been paid to the adequacy of the methods applied for this research. The short period of investigation (3 years), and the impact of weather conditions in that period, made it impossible to obtain statistically significant results.

Various means of mycological assessment of forest decline are discussed. Recording of quantitative parameters and of genus and species composition is considered useful in early detection of forest decline. The need for more detailed studies on autecology in both natural, undisturbed and polluted ecosystems and standardisation of methods is acknowledged.

G. Guzmán & L. Guzmán-Dávalos. *A checklist of Lepiotaceous Fungi*. (Koelz Scientific Books, 1992). Pp. 216. Price: US $ 69.95 excl. postage.

The *Lepiotaceae* as defined by the authors, comprise three tribus: *Lepioteae*, with 6 genera (incl. *Lepiota* and *Cystolepiota*); tribus *Leucocoprineae*, with 8 genera (incl. *Chlorophyllum*, *Leucocoprinus*, *Leucoagaricus*, and *Sericeomyces*), and tribus *Cystodermateae* (*Cystoderma*, *Phaeolepiota*, *Pseudopaeospora*, and *Squamanita*). The checklist presents all the names of species, varieties and forms known to the authors, listed in alphabetical order. Each entry contains the name with author(s) name(s), without reference to the place where it was published. Sometimes synonyms are added, also without reference. The authors admit that they did not consult original literature in many cases. For the so-called 'accepted' species the world distribution is given, as well as a list of references (author and date), in chronological, not alphabetical order. The literature references can be traced in an extensive bibliography.

The present checklist is of limited use, which is also hampered by the incomplete references that are presented in unlogical order.

L. Hansen & H. Knudsen (Eds.). *Nordic Macromycetes. Vol. 2. Polyporales, Boletales, Agaricales. Russulales*. (Nordsvamp, Copenhagen). Pp. 474, 1020 figs. Price: Dkr 375.- plus postage.

This long awaited book is the first of two volumes on Nordic macromycetes to be published. The main part of the present volume is a treatment of four orders of agaric, bolets and polypores; the last one taken in a very restricted sense (*Polyporus* s.str., *Pleurotus*, *Phyllotopsis*, *Lentinus*, and *Faerberia*). The other groups of macrofungi will be published in volume 1, to be expected in the near future.

The framework of this flora closely resembles that of the well-known "Die Röhrlinge und Blätterpilze" by M. Moser, as descriptive notes on macroscopy and microscopy of the species are incorporated in the keys. Distribution data for the Nordic countries are rather precisely given.

Probably because of the long period of preparation and the great number of authors (31) there is a certain disproportion in respect of the manner in which the genera are treated, e.g. in *Boletus*, *Lactarius*, and *Russula* all species known from the Nordic countries, in *Mycena* about 90%, in *Hebeloma* and *Coprinus* about 60%.

The book is very well edited and printed. Indices to the vernacular generic names used in the different Nordic countries are added. The more than 1000 figures illustrating single microscopic features are brought together on 23 pages at the end of the book, together with 12 pages of references and an index of 33 pages.

G. Monti, M. Marchetii, L. Gorreri & P. Franchi. *Funghi e cenosi di aree bruciate*. (Ed. Pacini, Pisa.) Pp. 149, 45 col. photographs, 40 text-figs., 3 tables. Price: Lit. 25.000 excl. postage.

This publication gives a very interesting survey of the developments in the mycoflora of two forests near Pisa, Italy, after forest fires. These typical mediterranean forests, mainly consisting of *Pinus pinaster*, *Pinus pinea*, and *Quercus ilex*, with additional *Phil-*

lyrea angustifolia, P. latifolia, Erica arborea, E. scoparia, Juniperus oxycedrus, and *Tamarix africana,* were burnt in august 1989. The mycoflora was investigated in two years following the fire. The recorded fungi are listed in alphabetical order with information on the first date of observation. The most interesting 40 species are described in full detail, with very good coloured photographs and line-drawings of microscopical characters. The book, written in Italian, offers a very interesting survey or the ecology and taxonomy of fire-place fungi.

A.F.M. Reijnders & J.A. Stalpers. *The development of the hymenophoral trama in the aphyllophorales and the agaricales. Studies in Mycology 34.* (Centraal Bureau voor Schimmelcultures, Baarn.) Pp. 109, incl. 21 black-and-white tables. Price: Hfl. 45.-.

The authors studied the structure of the hymenophoral trama of many species of freshly collected Aphyllophorales and Agaricales with both SEM and light microscopy. Although this character generally is considered of great importance in the classifications of Agaricales, it has not been studied systematically in related Aphyllophorales. The results of the present study fill a gap, and help to solve a number of problems, and provide much new information. Five types of trama have been recognized: the trametoid type, the cantharelloid type, the boletoid type, the agaricoid type (with the coprinoid, russuloid and plutoid subtype), and the amanitoid type. Much attention has been paid to the relationships between the types. The authors made the following taxonomic conclusions based on these studies.

- The genera *Lentinellus* and *Bondarzewia* have a trametoid trama, and are in this respect related to Aphyllophorales rather than Agaricales.
- The genera *Lentinellus, Panus,* and *Pleurotus* cannot be distinguished on account of their hymenophoral trama, which shows a transition between the trametoid and the agaricoid type. This is especially true for *Panellus,* in which two groups (subgenera) can be distinguished with either typical trametoid, or agaricoid trama.
- *Hygrophoropsis* and *Omphalotus* fit in the Paxillaceae according to their trama, despite the cantharelloid hymenophoral trama. In *Gomphidius* transitions from boletoid to cantharelloid type are also found.
- In *Ripartites* the trama is agaricoid, which shows that it is not related to *Paxillus.*
- The hymenophoral trama of *Coprinus* deviates from the agaricoid type by the lack of development in the mediostratum.
- Within the Russulaceae there is a big difference between *Russula,* with a rather uniform type of trama, and *Lactarius* with a more complicated type than generally recognized.

The publication offers clear descriptions and photographs of the structures studied, interesting discussions, and is indispensable for all interested in the morphology and taxonomy of Agaricales and Aphyllophorales. It offers essential and often new material for a better definition of genera and higher taxa, and the relationships between them.

T. Schumacher & K.M. Jenssen. *Discomycetes from the Dovre mountains, Central South Norway. Arctic and Alpine Fungi – 4.* (Soppkonselenten A/S, Lyngveien 3, N-1430 As, Norway. 1992) Pp. 66, 25 col. pls., 2 black-and-white Pls. and 25 text-figs. Price: NOK 200.-.

In this fourth fascicle of a series on arctic and alpine fungi 21 species of Pezizales and 4 species of Leotiales from the Grimsdalen-valley and the surrounding mountains, in the Dovre area in Central South Norway are described and depicted. Of each species a very good colour photogaph and an anatomical section of the fruit body are presented. The two black-and-white plates show nice SEM-graphs of the ascospores of 13 species. The species included are very rare and characteristic of the nordic alpine habitats. Of most of them this is the first published illustration. Some of the species are new and formally published by the first author elsewhere.

Sneh, B., L. Burpee & A. Ogoshi. *Identification of Rhizoctonia species*. (APS Press, American Mycological Society, 3340 Pilot Knob Rd., St. Paul, MN 55121-2097, USA.) Pp. 133. Price: US$ 27 (USA), $ 34 (elsewhere), incl. postage.

This publication gives an introduction to the taxonomy, identification, anastomosis groups and techniques required to study these organisms. Keys are given to *Rhizoctonia* species and their teleomorphs, based on cultural and cytomorphological characters. All known anastomosis groups of *Rhizoctonia* are fully described, both of binucleate and multinucleate strains. One chapter is dedicated to *Rhizoctonia* spp. associated with orchids, a biological interesting group of mycorrhizal fungi. An extensive list of references concludes this book that is very useful to all taxonomists and plant-pathologists working with this group of fungi.

J.D. Zhao & X.Q. Zhang. *The Polypores of China*. (Bibliotheca mycologica 145, J. Cramer in der Gebrüder Borntraeger Verlagsbuchhandlung, Berlin, Stuttgart. 1992). Pp. 524, 318 text-figs. Price: DM 190.-.

The present monograph included the poroid species usually ranged in the Polyporaceae, Hymenochaetaceae, and some poroid representatives of other families, except the Ganodermataceae and Fistulinaceae. A short introduction offers information on history and taxonomic status, economic importance, morphology, and ecology and distribution. The taxonomic part starts with a key to the families and genera. The genera are treated in alphabetical order. The generic treatments are all build up in the same way. A concise nomenclature is followed by a generic description and sometimes short remarks on status, generic limits, etc. Key to the species are given, followed by extensive descriptions of each species, often with short remarks on differences with other species, affinities etc. Numerous line-drawings give good and clear pictures of diagnostic microscopical details. An appendix lists the Polypores recorded from Taiwan. The work is concluded with a list of references and an index on scientific names. This very comprehensive monograph gives a thorough survey of the polypores in China and is indispensable for all interested in this group of macrofungi.