PERSOONIA
Published by the Rijksherbarium, Leiden
Volume 10, Part 1, pp. 23–31 (1978)

NOTES ON MICROASCACEAE WITH THE DESCRIPTION OF TWO NEW SPECIES

J. A. VON ARX

Centraalbureau voor Schimmelcultures, Baarn

The Microascaceae are briefly discussed and a key to the accepted genera is given. The new species described are *Pithoascus langeronii* with an arthric anamorph (*Arthrographis langeronii*) and *Petriellidium fimeti* with a *Graphium*-like anamorph. Pure culture descriptions are given of the psychrophilic *Leuconeurospora pulcherrima* and also of *Faurelina elongata* which has an arthric anamorph with 2-celled conidia.

The Microascaceae represent a group of Ascomycetes related to the Ophiostomataceae, Xylariaceae, and Sordariaceae (including Chaetomiaceae). Malloch (*1970*) restricted the family to genera characterized by ascospores with one or two germ pores and included the genera *Microascus*, *Kernia*, *Lophotrichus*, *Petriella*, *Petriellidium*. Von Arx (*1963a*, *b*) removed some species without germ pores from *Microascus* and placed them in a separate genus *Pithoascus*. Udagawa & Furuya (*1973*) considered the genus *Leuconeurospora*, comprising two species with ornamented ascospores without germ pore, to belong to the Microascaceae. A fungus similar to the second species, *L. elongata*, was described by Locquin-Linard (*1975*) as the type of the genus *Faurelina*. An additional genus, *Enterocarpus*, has recently been described by Locquin-Linard (*1977*). It is characterized by a non-ostiolate ascoma with an apical tuft of hairs and by the presence of an hyphal 'capillitium' surrounding the ascospores.

The position of some of these genera in the Microascaceae is questionable. If it is accepted that the family is comprised of species with ascospores which may or may not have one or two germ pores, then the genera would have to be distinguished by the following key characters.—

1a. Ascospores smooth, less than twice as long as broad, with 1 or 2 germ pores 2
b. Ascospores ornamented or smooth and more than twice as long as broad, without observable germ pores 7
2a. Ascomata with a wall of 'textura epidermoidea', ascospores with 2 germ pores, anamorphs *Graphium*, *Scedosporium*, or *Arthrographis* 3
b. Ascomata with a pseudoparenchymatous wall of angular, dark cells, ascospores with 1 or 2 germ pores, anamorphs absent or *Scopulariopsis*-like 4
3a. Ascomata ostiolate, ascospores reddish-brown, often asymmetrical. . . . . *Petriella*
b. Ascomata usually non ostiolate, ascospores symmetrical, yellowish, rarely reddish . *Petriellidium*
4a. Ascospores embedded in a hyphal 'capillitium' when mature, about 12×9 µm, with a single, prominent germ pore . . . . . *Enterocarpus*
b. Ascospores smaller or with 2 germ pores 5

5a. Ascomata ostiolate, ascospores asymmetrical, with a single germ pore . . . . . *Microascus*
b. Above characters not combined 6
6a. Ascomata usually ostiolate, with an apical tuft of thick-walled hairs, ascospores about 8.5 × 7.5 μm, with two germ pores, yellowish or brownish . . . . . *Lophotrichus*
b. Ascomata non-ostiolate, with or without tufts of hairs, ascospores of different size, with 1 or 2 germ pores, hyaline, yellowish, brownish or reddish . . . . . *Kernia*
7a. Ascospores smooth, ascomata thick-walled, dark, ostiolate or non-ostiolate . . . . . *Pithoascus*
b. Ascospores ornamented, ascomata non-ostiolate, but with an easily disarticulating wall 8
8a. Ascomata spherical, cephalothecoid, ascospores nearly hyaline, with anastomosing ridges; asci not catenulate . . . . . *Leuconeurospora*
b. Ascomata vertically elongated, often pustulate, ascospores reddish-brown, finely striate; asci catenulate, in vertical rows . . . . . *Faurelina*

Monographic studies exist for most of the genera, e.g. *Microascus* (Barron, Cain & Gilman, *1961b*; von Arx, *1975*), *Petriella* (Barron, Cain & Gilman, *1961a*), *Petriellidium* (von Arx, *1973b*), *Pithoascus* (von Arx, *1973b*), *Kernia* (Malloch & Cain, *1971*; Locquin-Linard, *1977*). The genus *Lophotrichus* is close to *Kernia* and the three species *L. ampullus* R. K. Benjamin, *L. martinii* R. K. Benjamin and *L. bartletii* (Massee & Salmon) Malloch & Cain (= *Lophotrichus brevirostratis* Ames) are close to each other. In the last mentioned species the ascomata are usually non-ostiolate.

In this paper new species are added to the genera *Pithoascus* and *Petriellidium* and the species of the genera *Leuconeurospora* and *Faurelina* are described and discussed from pure cultures.

Pithoascus langeronii v. Arx, *spec. nov.*—Figs. 1, 4a, d.

Coloniae in agaro farina maydis addita 25°C vix 1 mm in dies crescunt, in obscuritate pro maxima parte submersae, ex hyphis plus minusve hyalinis constant, ascomatibus 14–20 diebus maturantibus fuscescentes. Ascomata submersa vel raro superficialia, globosa, primum flava, maturitate nigrescentia, non ostiolata, 75–160 μm diametro, pariete e cellulis hyphalibus 2–4 μm crassis et strato interno cellularum applanatarum, 7–13 μm diametro, composito, demum fuscescente, incrustato vel amorpho. Asci numerosi, in seriebus radiantibus dispositi, ellipsoidei, clavati vel cylindrici, nonnumquam pedicellati, tenuitunicati, fere persistentes, 8-spori, 8–13 × 4–7 μm; ascosporae fusiformes ad naviculares, primum dextrinoideae, maturitate stramineae, leves, poris germinationis carentes, 3.5–5.0 × 2.0–2.5 μm.

Typus: CBS 203.78, contaminatio culturae Petriellidii fimeti CBS 129.78.

Colonies on cornmeal agar at 25°C with a daily growth rate of less than 1 mm, in darkness flat, consisting mainly of immersed, hyaline or subhyaline hyphae, with no aerial mycelium, becoming dark due to the ascomata which ripen within 2–3 weeks; initials compact, 17–24 μm in diameter, composed of a central cell surrounded by swollen, 5–7 μm hyphal cells, soon becoming covered by a number of radial hyphae; ascomata immersed, rarely superficial, spherical, yellowish when young, black when ripe, non-ostiolate, 75–160 μm in diameter, with a wall composed of 2–4 μm broad hyphal cells and an inner layer of flattened, 7–13 μm cells, outer wall later becoming dark, encrusted and nearly amorphous; asci numerous, arranged in radiating, clustered rows, ellipsoidal, clavate or cylindrical, sometimes stalked, thin-walled, rather persistent, 8-spored, 8–13 × 4–7 μm; ascospores fusiform-navicular, dextrinoid when young, straw-coloured or yellow-brown when ripe, smooth, without germ pores, 3.5–5 × 2–2.5 μm (Fig. 4a).

Colonies incubated in daylight form aerial hyphae and buff- or tan-coloured, downy or powdery conidial tufts; vegetative hyphae hyaline, septate, 1.5–3 μm broad, forming chla-

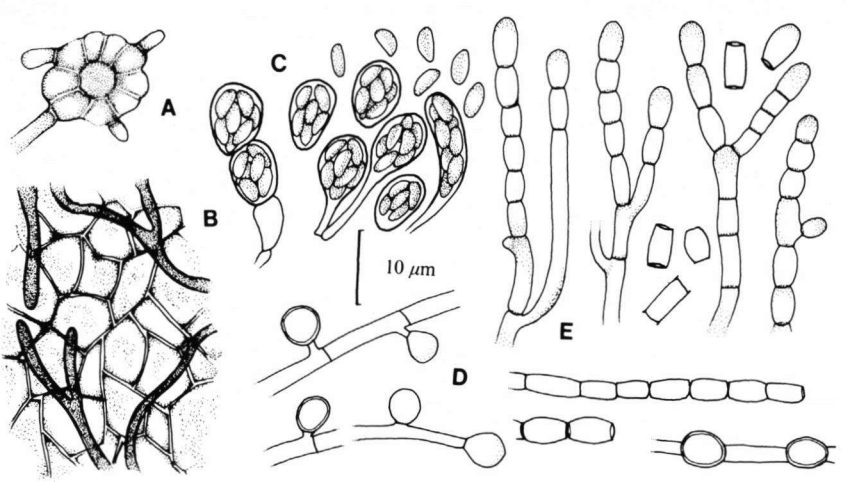


Fig. 1. *Pithoascus langeronii.* — a. Initial. — b. Ascomata wall. — c. Asci and ascospores. — d. Chlamydospores. — e. Arthroconidia.

mydospores and often disarticulate into arthroconidia; chlamydospores terminal or lateral, single or occasionally in chains, spherical or obovate, smooth, hyaline, thin-walled, 3.5–5.5 µm; conidiogenous hyphae 2–3 µm broad, usually erect and branched, forming short synchronous or basipetal rows of dry arthroconidia; arthroconidia cylindrical or swollen, clavate when apical, hyaline, 1-celled, rarely septate, without distinct disjunctive structures, 3–7 × 2–3.5 µm (Fig. 1e).

TYPE.—CBS 203.78, received as a contamination in the fresh isolate of CBS 129.78, *Petriellidium fimeti.*

Von Arx (*1973b*) distinguished six *Pithoascus* species, characterized by dark, thick-walled, ostiolate or non-ostiolate ascomata, by ascospores without germ pores and by the absence of anamorphs (conidial states). *Pithoascus langeronii* is the first species of the genus with an anamorph and can also be distinguished by its small and only slightly pigmented ascospores, and the dark ascomata wall which is nearly amorphous with age. These differentiating characters would probably allow the fungus to be classified in a separate, undescribed genus. The initials of *Pithoascus langeronii* are similar to those of *Petriellidium boydii* (Shear) Malloch (= *Allescheria boydii* Shear).

Pithoascus langeronii is the teleomorph of the hyphomycete, described as *Arthrographis langeroni* Cochet (*1939*), *Oidiodendron kalrai* Tewari & Macpherson (*1971*) and *Arthrographis kalrai* (Tewari & Macpherson) Sigler & Carmichael (*1976*). Only the conidial state was present in most of the subcultures, ascomata were mainly obtained on oatmeal agar incubated in the dark at 25°C.

Arthrographis langeroni is keratinophilic, usually isolated from humans but also from soil and dung. The description of the anamorph given by Sigler & Carmichael (*1976*) is incomplete: the chlamydospores, the swollen arthroconidia and the clavate apical conidium are not mentioned. An anamorph rather similar to that of *Pithoascus langeronii* is known in

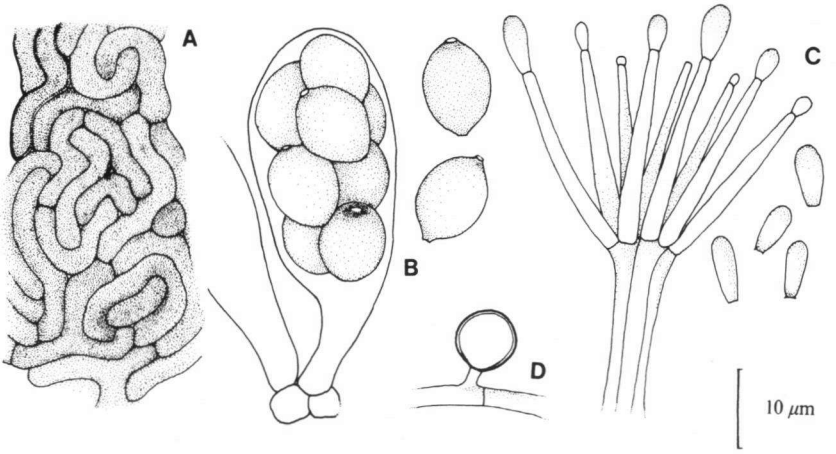


Fig. 2. *Petriellidium fimeti.* — a. Ascomata wall. — b. Ascus and ascospores. — c. *Graphium* anamorph. — d. Chlamydospore.

Petriellidium desertorum v. Arx & Moustafa (von Arx, *1973b*), a related species with larger and darker ascospores with two germ pores.

Sigler & Carmichael (*1976*) treated *Geotrichum microsporum* Smith [= *Coremiella cuboidea* (Sacc. & Ellis) Ciferri & Caretta] as a second species of *Arthrographis*. However, this cellulolytic and fast growing fungus forms compact synnemata and the short cylindrical arthroconidia develop from the conidiogenous hyphae in unbranched long chains and separate from each other by disjunctive structures. This fungus without doubt is not close to the *Arthrographis* anamorph of *Pithoascus langeronii* and should be maintained in *Coremiella* or *Briosia* (von Arx, *1972*).

Petriellidium fimeti v. Arx, Mukerji & N. Singh, *spec. nov.*—Fig. 2

Coloniae in agaro farina avenacea addita 25°C in dies 3–4 mm crescunt, primum albidae vel grisellae, mycelio aerio floccoso vel lanoso obtecta, deinde griseo-brunneae. Ascomata immersa vel fere superficialia, globosa, fusca, glabra vel nonnullis hyphis fuscis, incrustatis, 50–130 µm longis, 2–3 µm latis obtecta, non ostiolata, 230–360 µm diametro, pariete 5–8 µm crasso, e cellulis viridibrunneis, 2–4 µm latis, hyphalibus composito (textura epidermoidea). Asci clavati, saepe breviter pedicellati, fasciculati, tenuitunicati, evanescentes vel fere persistentes, 8-spori, 40–70 × 18–25 µm; ascospore ellipsoideae, primum dextrinoideae, maturitate stramineae vel brunneae, duobus poris germinationis praeditae, 11–13 × 8–10 µm; conidia seu Graphii modo seu chlamydosporae ellipsoideae vel subglobosae formata.

Typus: CBS 129.78, isolatus e fimo antilopae Nilgai dictae, in horto zoologico Delhiensi in India a K. G. Mukerji lecto, 1977.

Colonies on oatmeal agar with a daily growth rate of 3–4 mm at 25°C, at first whitish or greyish with a floccose or lanose aerial mycelium, later becoming grey brown; ascomata immersed or nearly superficial, spherical, dark, glabrous or covered with some dark, encrusted, 50–130 µm long and 2–3 µm broad hyphae, non-ostiolate, 230–360 µm in diam., with a 5–8 µm thick wall of greenish brown, 2–4 µm broad hyphal cells (textura epider-

moidea); asci clavate, often with a short, broad stalk and fasciculate, thin-walled, evanescent or rather persistent, 8-spored, 40–70 × 18–25 µm; ascospores ellipsoidal, hyaline and dextrinoid when young, later straw coloured or light brown, a germ pore at both ends, 11–13 × 8–10 µm; conidia of 2 types: (1) *Graphium*-state: coremia brush-like, with a 25–120 µm long and a 5–8 µm broad, brown stalk, composed of parallel, septate, 2–3 µm broad hyphae; conidiogenous brush 70–90 µm broad; conidiogenous cells divergent, cylindrical, hyaline, 12–25 × 1.5–2.5 µm; conidia basipetal or percurrent, ellipsoidal or slightly clavate, apically rounded, with a truncate base, hyaline, 5–12 × 2–4 µm; (2) chlamydospores ellipsoidal or nearly spherical, hyaline or brownish, 5–7 µm in diam., rather thick-walled, usually arising laterally on short stalks from septate, branched, hyaline or brownish, 2.5–4 µm broad hyphae.

TYPE.—CBS 129.78, isolated from nilgai dung, collected in Delhi Zoo (India), sent by Dr. K. G. Mukerji.

Petriellidium desertorum v. Arx & Moustafa is similar in the size and shape of the ascospores, but differs by its smaller, 80–110 µm sized ascomata and by the formation of an arthric anamorph.

Faurelina elongata (Udagawa & Furuya) v. Arx, *comb. nov.*—Fig. 2, 4c, e

Leuconeurospora elongata Udagawa & Furuya *in* J. Jap. Bot. *48*: 112. 1973. (basionym).

Colonies on oatmeal agar with a daily growth rate of 1–1.5 mm at 25°C, soon becoming dark brown, with irregular tufts of aerial mycelium; vegetative hyphae thick-walled, hvaline or light brown, usually 4–15 µm thick, often composed of swollen, up to 25 µm thick cells; arthroconidia in aerial tufts, mainly formed on thinner, aerial hyphae, cylindrical or slightly swollen, 1- to 2-celled, hyaline, with truncate ends, separating from each other by disjunc-

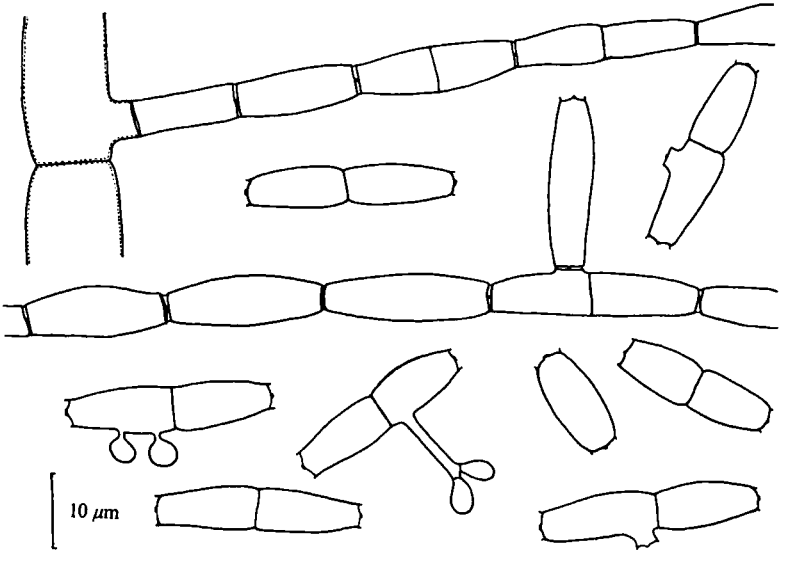


Fig. 3. *Faurelina elongata*, arthro- and blastoconidia.

tive structures, 15–30 × 4–6 μm; blastoconidia mainly formed on arthroconidia either directly or on shorter or longer stalks, clavate, with a truncate base, hyaline, 3–5 × 1.5–2.5 μm; ascomata immersed at the base, hemispherical or broadly clavate-pustulate, rounded above, smooth, 180–250 μm in diam., 170–300 μm high, non-ostiolate; wall of the ascomata at base light; in the superficial parts green to black, composed of vertical rows of elongated, 5–7 μm broad, thick-walled, encrusted hyphal cells; asci in fasciculate chains (vertical rows), formed in basipetal succession, spherical, clavate, ellipsoidal or irregular in shape, rather thin-walled, 8-spored, 12–18 × 8–12 μm; ascospores fusiform-navicular or rhomboidal, light brown, with some furrows, finely striated by irregular, usually longitudinal thickenings of the wall, without germ pores, 6–8 × 4–5.5 μm (Fig. 4c).

Fresh isolates could be compared with some specimens collected on herbivore dung in India and with the type specimen (2 slides) of *Leuconeurospora elongata*. The preceding description is based on CBS 126.78, isolated from goat dung, received from K. G. Mukerji (Delhi University).

Faurelina fimigenes Locquin-Linard, the type species of the genus *Faurelina*, is very close to *Faurelina elongata*. It can be distinguished by its more thick-walled and slightly larger, 7–10 × 4–5.5 μm sized ascospores and by the absence of an anamorph with 2-celled arthroconidia. A small dried specimen and the type strain (CBS 352.78) of *Faurelina fimigenes* could be studied.

The anamorph of *Faurelina elongata* could be observed only in pure culture (CBS 126.78 and CBS 301.78, isolated from cow dung, Nainital, Delhi, India) and not on the specimens on dung; the anamorph is rather close to the *Arthrographis* state of *Pithoascus langeronii*, but differs by much larger, usually 2-celled arthroconidia with distinct disjunctive structures.

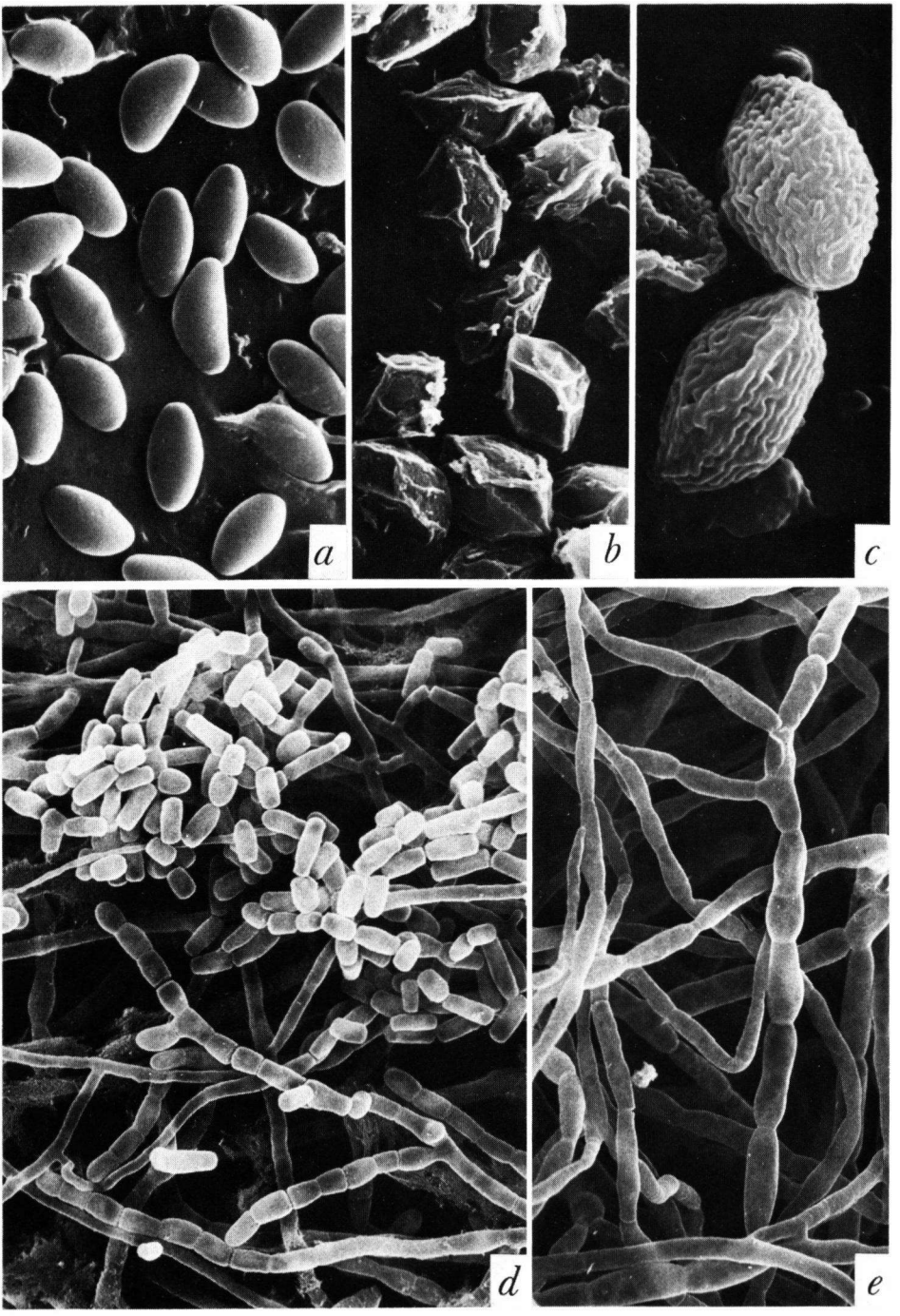
A detailed description of the development of the ascomata of *Faurelina fimigenes* has been given by Parguey-Leduc & Locquin-Linard (1976). The classification of the genus *Faurelina* in the Microascaceae is not satisfactory, but no closer taxa are known in the Ascomycetes.

LEUCONEUROSPORA PULCHERRIMA (Winter) Malloch & Cain

Eurotium pulcherrimum Winter *in* Vid. Meddr. dansk naturh. Foren. 1876: 311. 1877. — *Cephalotheca pulcherrima* (Winter) Höhnel *in* Annls Mycol. **15**: 360. 1917. — *Leuconeurospora pulcherrima* (Winter) Malloch & Cain *in* Can. J. Bot. **48**: 1820. 1970.

Colonies developing at temperatures between 0 and 15°C, with a daily growth rate of less than 1 mm at 6°C, white or greyish, often without aerial mycelium, often developing white mycelial tufts; hyphae regularly branched and septate, 2–3.5 μm thick, sometimes forming chlamydospores; chlamydospores clavate or obpyriform, with a truncate base, thin-walled, 7–11 × 4–5 μm; initials coiled, composed of 2–3 μm broad hyphal cells; ascomata ripening within 2–4 months at temperatures between 4 and 10°C, scattered, superficial, initially light

Fig. 4. Scanning electron micrographs. — a. *Pithoascus langeronii*, ascospores, × 4200. — b. *Leuconeurospora pulcherrima*, ascospores, × 3500. — c. *Faurelina elongata*, ascospores, × 6000. — d. *Pithoascus langeronii*, conidiogenous hyphae and conidia, × 1600. — e. *Faurelina elongata*, conidiogenous hyphae, × 900.


a
b
c
d
e

brown, with a wall of interwoven hyphae (textura epidermoidea), at maturity spherical, cephalothecioid, non-ostiolate, reddish brown or black, smooth, 120–300 μm in diameter, ascomatal wall composed of polygonal, 30–80 μm broad plates, consisting of flattened, isodiametrical or elongated, thick-walled, dark, 5–15 μm cells; asci borne laterally on much branched, 2–5 μm broad ascogenous hyphae, often with a short stalk, spherical or broadly clavate, usually 4-spored, evanescent, 8–11 μm in diameter, often surrounded by hyaline, branched hyphae (especially in younger states); ascospores irregularly ellipsoidal or fusiform, with a few longitudinal or oblique, anastomosing ridges forming an irregular reticulum, remaining long hyaline, at maturity straw coloured or light green, en masse yellow green, without germ pore, 6–8 × 3–4 μm (Fig. 4b).

The preceding description is based on CBS 343.76, a culture received from Professor E. Müller (Zürich, Switzerland), isolated from soil collected near Zuoz, Engadin, Swiss Alps.

Adequate descriptions and illustrations based on dried, but probably immature herbarium specimens have been given by Malloch & Cain (*1970*) and by Udagawa & Furuya (*1973*). The former authors tentatively classified the fungus in the new family Pseudeurotiaceae, while the latter considered it to belong to the Microascaceae. The classification of *Leuconeurospora pulcherrima* is difficult as it may also be related to certain Sordariaceae, e.g. *Pidoplichkoviella* Kirilenko (*1975*), *Aporothielavia* Malloch & Cain (*1973*) and *Zopfiella* Winter, e.g. *Z. curvata* (Fuckel) Winter (Udagawa & Horie, *1974*), of which the last two show a similar, cephalothecoid structure of the ascoma wall.

A fungus also characterized by cephalothecoid ascomata and reticulate ascospores is *Testudina terrestris* Bizz. The asci, however, are bitunicate and clavate and the ascospores are 2-celled. A possible relationship of *Leuconeurospora pulcherrima* to this dothideaceous fungus also has to be considered. *Leuconeurospora pulcherrima* is highly psychrophilous; ascomata could be obtained at temperatures between 4 and 8°C. Further all known specimens also have been collected in either alpine or northern regions (Scandinavia, Canada, Mountains of Northern Japan, Switzerland).

REFERENCES

AMES, L. M. (1963). A monograph of the Chaetomiaceae. *In* U.S. Army Res. Dev., Ser. **2**, 1–125.

ARX, J. A. VON (1972. On *Endomyces*, *Endomycopsis* and related yeast-like fungi. *In* Antonie van Leeuwenhoek **38**: 289–309.

—— (1973a). Ostiolate and nonostiolate Pyrenomycetes. *In* Proc. K. Ned. Akad. Wet., Sect. C, **76**: 289–296.

—— (1973b). The genera *Petriellidium* and *Pithoascus* (Microascaceae). *In* Persoonia **7**: 367–375.

—— (1975). Revision of *Microascus* with the description of a new species. *In* Persoonia **8**: 191–197.

BARRON, G. L., CAIN, R. F. & GILMAN, J. C. (1961a). A revision of the genus *Petriella*. *In* Can. J. Bot. **39**: 837–845.

BARRON, G. L., CAIN, R. F. & GILMAN, J. C. (1961b). The genus *Microascus*. *In* Can. J. Bot. **39**: 1609–1631.

COCHET, G. (1939). Sur un nouveau champignon arthrosporé (*Arthrographis langeroni*) agent pathogèn d'une onychomycose humaine. *In* Ann. Parasit. Hum. Comp. **17**: 98–101.

KIRILENKO, T. S. (1975). *Pidoplitchkoviella terricola*, a new ascomycete. *In* Mikrobiol. Zh. **37**: 603–605.

LOCQUIN-LINARD, M. (1975). *Faurelina*, nouveau genre d'Ascomycetes. *In* Rev. Mycol. **39**: 125–129.

—— (1977). Apropos des genres non ostiolés placés dans la famille des Microascaceae. Crèation d'un nouveau genre: *Enterocarpus*. *In* Rev. Mycol. **41**: 509–523.

MALLOCH, D. (1970). New concepts in the Microascaceae illustrated by two new species. *In* Mycologia **62**: 727–740.

MALLOCH, D. & CAIN, R. F. (1970). Five new genera in the new family Pseudeurotiaceae. *In* Can. J. Bot. **48**: 1815–1825.

—— & —— (1971). The genus *Kernia*. *In* Can. J. Bot. **49**: 855–867.

—— & —— (1973). The genus *Thielavia*. *In* Mycologia **65**: 1055–1077.

PARGUEY-LEDUC, A. & LOCQUIN-LINARD, M. (1976). L'Ontogénie et la structure des périthèces de *Faurelina fimigenes* Locquin-Linard. *In* Rev. Mycol. **40**: 161–175.

SIGLER, L. & CARMICHAEL, J. W. (1976). Taxonomy of *Malbranchea* and some other Hyphomycetes with arthroconidia. *In*: Mycotaxon **4**: 349–488.

TEWARI, R. P. & MACPHERSON, C. R. (1971). A new dimorphic fungus, *Oidiodendron kalrai*: morphological and biochemical characteristics. *In* Mycologia **63**: 602–611.

UDAGAWA, S. & FURUYA, K. (1973). The genus *Leuconeurospora*. *In* J. Jap. Bot. **48**: 111–116.

UDAGAWA, S. & HORIE, Y. (1974). Notes on some Japanese Ascomycetes XII. *In* Trans. mycol. Soc. Jap. **15**: 105–112.