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REVISION OF MICROASCUS WITH THE DESCRIPTION OF A NEW SPECIES

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(With one Text-figure)

The genus *Microascus* is redescribed. It now comprises species with ostiolate, dark ascomata and small, asymmetrical, one-celled, smooth, yellow ascospores with a single germ pore at the base. The conidial states fit *Scopulariopsis* or *Wardomyces*. A key is given to 11 accepted species and two similar species of *Kernia* and *Chaetomium*. A fungus isolated from soil in West Africa is described as *Microascus senegalensis*. A list of 7 excluded or doubtful species is added.

The Microascaceae sensu Malloch (1970) represent a natural group of Ascomycetes related to the Ophiostomataceae and the Melanosporaceae. The family is characterized mainly by the ascospores which are small, 1-celled, smooth, dextrinoid when young, yellowish or reddish brown when ripe, and often have one or two germ pores. The ascomata are usually dark, spherical or flask-shaped and ostiolate or non-ostiolate. Malloch (1970) distinguished the genera *Kernia*, *Lophotrichus*, *Petriella*, *Petriellidium* and *Microascus*. The last-mentioned genus, however, proved to be heterogeneous, as was shown by von Arx (1973a, b). Typical *Microascus* species form ascomata with a cylindrical ostiolum, have small, short, often curved or angular ascospores with an often prominent germ pore and include a *Scopulariopsis*-conidial state. Von Arx (1973a) classified species without conidial states, such as *Microascus nidicola*, in a new genus *Pithoascus*, which also is characterized by thick-walled, inconspicuously ostiolate or non-ostiolate ascomata and by narrow ascospores in which no germ pores could be observed. The genus *Pithoascus* was described in detail by von Arx (1973b), comprising six soil-borne or entomogenous species.

The genus *Microascus* was monographed by Barron & al. (1961) and again by Morton & Smith (1963). The former authors accepted 13 species, the latter reduced this number and accepted only 10, of which, however, *M. lunasporus* and *M. pedrosoi* are doubtful.

The following concept of the genus and species is based on a study of all cultures present in the CBS-collection (see CBS, List of Cultures, 1972), supplemented with a number of strains sent by Dr. G. F. Orr (Dugway) and with some freshly isolated strains.

MICROASCUS Zukal

Microascus Zukal *in* Verh. zool.-bot. Ges. Wien **35**: 339. 1888.
Fairmania Sacc. *in* Annls mycol. **4**: 276. 1906.
Nephrospora Loubière *in* C.r. hebd. Séanc. Acad. Sci., Paris **177**: 211. 1923.
Peristomium Lechmère *in* Bull. trim. Soc. mycol. Fr. **29**: 307. 1913.

Colonies rather spreading, soon becoming brown by pigmented aerial mycelium; ascomata superficial or immersed at the base, spherical or flask-shaped, with a papilla-like or cylindrical ostiolum, brown or black, often hairy or setose, especially around the ostiolum, with a pseudoparenchymatous wall composed of 3–6 layers of isodiametric or slightly flattened, dark cells; asci numerous, clustered or catenulate, often in vertical rows, obovoid or broadly clavate, 8-spored, evanescent; ascospores asymmetrical, often reniform, heart-shaped or triangular, one-celled, smooth, dextrinoid when young, yellowish or straw coloured when mature, with a single, small, but often prominent germ pore at the base.

CONIDIAL STATE.—*Scopulariopsis* or *Wardomyces*.

TYPE SPECIES.—*M. longirostris* Zukal.

Ascospores with 2 germ pores, as indicated by Malloch (1970), could never be observed. In some species the germ pore is rather indistinct, but its position can be observed during ascospore germination; a single germ tube is formed.

Freshly isolated strains often form mainly the ascigerous state and hardly any conidia. Such strains can be recognized as *Microascus*, delimited from *Pithoascus* by the size and shape of the ascospores and by cultural characters, especially the formation of aerial mycelium. After many transfers the strains may become mainly conidial.

KEY TO THE SPECIES (derived from Barron & al., 1961)

1a. Ascospores triangular or quadrangular in planar view 2
b. Ascospores reniform, falcate or heart-shaped in planar view 5
2a. Ascospores triangular or quadrangular in planar view, often nearly square; colonies spreading, becoming dark . . . . . *M. pyramidus*, p. 193
b. Ascospores triangular in planar view; colonies rather restricted. 3
3a. Ascospores 8–12 µm long, brown. . . . . *Chaetomium trigonosporum*, p. 193
b. Ascospores shorter than 7 µm, yellow. 4
4a. Ascospores 3–5 µm in size . . . . . *M. trigonosporus*, p. 193
b. Ascospores 5–7 µm in size. . . . . *M. trigonosporus* var. *macrosporus*, p. 193
5a. Ascospores about twice as long as broad, usually planoconvex 6
b. Ascospores less than twice as long as broad, usually concavo-convex 7
6a. Ascospores 5–7 × 2.5–4 µm; conidia 3.5–5 × 2–3 µm, thin-walled . . *M. cinereus*, p. 194
b. Ascospores 7–9 × 4–4.5 µm; conidia 4.5–5.5 × 3.5–4.5 µm, rather thick-walled, brown *M. senegalensis*, p. 194
7a. Ascospores 3–4 × 2.5–3.5 µm . . . . . *M. longirostris*, p. 193
b. Ascospores 4–7 µm long 8
8a. Ascomata 500–700 µm in diameter, with an elongated beak; conidial state belonging to *Wardomyces* . . . . . *M. giganteus*, p. 193
b. Ascomata smaller; conidial state belonging to *Scopulariopsis* 9
9a. Ascomata non-ostiolate; conidia narrow, 4–12 × 2–4 µm. . . *Kernia hippocrepida*, p. 194
b. Ascomata usually ostiolate; conidia usually wider or shorter 10
10a. Conidia finely striate, 4–7 × 3–4 µm; ascospores heart-shaped in planar view, 5–7 × 5–7 µm, ascomata with an often inconspicuous ostiolum . . . . . *M. singularis*, p. 193
b. Conidia not striate; ascospores usually smaller; ascomata with a distinct ostiolum 11
11a. Colonies greyish; ascospores 4–6 × 3.5–5.5 µm; conidia broadly pyriform or nearly spherical, 3–5 µm in diameter . . . . . *M. cirrosus*, p. 193
b. Colonies usually white; conidia 6–10 µm long 12
12a. Ascomata 200–500 µm in diameter; conidia 7–10 × 2–3.5 µm . *M. albo-nigrescens*, p. 194
b. Ascomata less than 200 µm in diameter; conidia 6–8 × 5–6 µm . . *M. manginii*, p. 194

1. MICROASCUS LONGIROSTRIS Zukal

Microascus longirostris Zukal *in* Verh. zool.-bot. Ges. Wien **35**: 339. 1885.
Microascus variabilis Massee & Salmon *in* Ann. Bot. **15**: 313. 1901.
DESCRIPTIONS.—Barron & al., 1961; Udagawa, 1963; Morton & Smith, 1963; Corlett, 1963.

2. MICROASCUS GIGANTEUS Malloch

Microascus giganteus Malloch *in* Mycologia **62**: 731.1970.
DESCRIPTION.—Malloch, 1970.

3. MICROASCUS TRIGONOSPORUS Emmons & Dodge

Microascus trigonosporus Emmons & Dodge *in* Mycologia **23**: 313. 1931.
DESCRIPTIONS.—Barron & al., 1961; Udagawa, 1962; Morton & Smith, 1963; Corlett, 1963.

4. MICROASCUS TRIGONOSPORUS Emmons & Dodge var. MACROSPORUS Orr

Microascus trigonosporus Emmons & Dodge var. *macrosporus* Orr *apud* Barron & al *in* Can. J. Bot. **39**: 1617. 1961.
M. triangulisporus Orr in litt. (CBS, List of Cultures p. 152. 1972).
DESCRIPTION.—Barron & al., 1961.

5. CHAETOMIUM TRIGONOSPORUM (Marchal) Chivers

Bommerella trigonospora Marchal *in* Bull. Soc. bot. Belg. **24**: 164. 1885. — *Chaetomium trigonosporum* (Marchal) Chivers *in* Mem. Torrey bot. Club **14**: 166. 1915.
DESCRIPTION.—Udagawa, 1970.

This species is intermediate between *Microascus* and *Chaetomium*. The *Scopulariopsis* conidial state and the triangular, young dextrinoid ascospores point to *Microascus*, the fasciculate, narrowly clavate, stalked asci and the at maturity brown ascospores to *Chaetomium*. The ascomata are covered with rather numerous, dark, septate, straight, stiff setae.

6. MICROASCUS PYRAMIDUS Barron & Gilman

Microascus pyramidus Barron & Gilman *apud* Barron & al. *in* Can. J. Bot. **39**: 1618. 1961.
Microascus staurosporus Orr *in litt.* (CBS, List of Cultures, p. 152, 1972).
DESCRIPTION.—Barron & al., 1961.

7. MICROASCUS CIRROSUS Curzi

Microascus cirrosus Curzi *in* Boll. Staz. Patol. veg. Roma **10**: 302. 1910.
Microascus desmosporus sensu Morton & Smith (1963); non *Microascus desmosporus* (Lechmère) Curzi
DESCRIPTIONS.—Barron & al., 1961; Udagawa, 1962; Morton & Smith, 1963 (as *M. desmosporus*); Corlett, 1966.

8. MICROASCUS SINGULARIS (Sacc.) Malloch & Cain

Fairmania singularis Sacc. *in* Annls mycol. **4**: 276. 1906. — *Microascus singularis* (Sacc.) Malloch & Cain *in* Can. J. Bot. **49**: 859. 1971.
Microascus doguetii F. Moreau *in* Revue Mycol. **18**: 177. 1953.
DESCRIPTIONS.—Barron & al., 1961; Udagawa, 1963 (both as *M. doguetii*).

9. KERNIA HIPPOCREPIDA Malloch & Cain

Kernia hippocrepida Malloch & Cain *in* Can. J. Bot. **49**: 856. 1971.
DESCRIPTION.—Malloch & Cain, 1971.

This cleistothecial species may be close to *Microascus albo-nigrescens*. *Kernia nitida* (Sacc.) Nieuwland and other typical species of the genus *Kernia* differ by symmetrical, usually ovoid ascospores.

10. MICROASCUS MANGINII (Loubière) Curzi

Nephrospora manginii Loubière *in* C.r. hebd. Séanc. Acad. Sci., Paris, **177**: 211. 1923. — *Microascus manginii* (Loubière) Curzi *in* Boll. Staz. Patol. veg. Roma **11**: 60. 1931.
DESCRIPTIONS.—Barron & al., 1961; Udagawa, 1963; Morton & Smith, 1963.

11. MICROASCUS ALBO-NIGRESCENS (Sopp) Curzi

Acaulium albo-nigrescens Sopp *in* Skr. VidenskSelsk. Christiania, Mat.-naturv. Kl. **11**: 70. 1912. — *Microascus albo-nigrescens* (Sopp) Curzi, l.c.
DESCRIPTION.—Barron & al., 1961.

12. MICROASCUS CINEREUS (Emile-Weil & Gaudin) Curzi

Scopulariopsis cinerea Emile-Weil & Gaudin *in* Archs Méd. exp. Anat. path. Paris **28**: 452. 1919. — *Microascus cinereus* (Emile-Weil & Gaudin) Curzi *in* Boll. Staz. Patol. veg. Roma **11**: 60. 1931.
Microascus griseus Mathur & al. *in* Sydowia **16**: 47. 1962 (publ. 1963).
Microascus lunasporus Jones *in* Mycologia **28**: 503. 1936.
Microascus pedrosoi Fuentes & Wolf *in* Mycologia **48**: 63. 1956 and **48**: 446.
Microascus reniformis Orr *in litt.* (CBS, List of Cultures, p. 152, 1972).
DESCRIPTIONS.—Barron & al., 1961; Udagawa, 1962; Morton & Smith, 1963; Corlett, 1966.

The synonymy of *M. lunasporus* is based on the description, that of *M. griseus* on a study of the type strain. *M. desmosporus* is discussed under "Excluded species".

13. **Microascus senegalensis** v. Arx, *sp. nov.*—Fig. 1.

Coloniae in agaro farina maydis addita 33 °C in dies 1.5–2 mm crescunt, primum albae, deinde dilute brunneae, e hyphis 1.5–3 μm crassis, hyalinis vel dilute pigmentatis constant; ascomata aggregata vel discreta, superficialia vel parte immersa, sphaerica, nigra, 180–250 μm diam., ostiolo cylindrico, 50–80 μm longo, 40–50 μm crasso, levi praedita; paries 9–14 μm crassus e 3–4 stratis cellularum crassitunicatarum, obscure viridi-brunnearum; asci plerumque in seriebus verticalibus dispositi, ellipsoidei vel late clavati, deorsum truncati, 15–22 × 4–11 μm, evanescentes, octospori; ascosporae reniformes, primum dextrinoideae, maturitate luteolae vel stramineae, 7–9 × 4–4.5 μm, poro germinationis basilari exiguo praeditae; cellulae conidiogenae cylindricae, annellatae, 6–20 μm longae, 2–2.5 μm crassae; conidia basipetalia catenulata, obovoidea vel late clavata, basi truncata, fere levia, flavo-brunnea, 4.5–5.5 × 3.5–4 μm. Typus: CBS 277.74, isolatus e terra mangrovae, Joal in Senegal, Feb. 1974.

Colonies on cornmeal-agar at 33 °C growing daily 1.5–2 mm, at first white, later light brown, composed of 1.5–3 μm wide, hyaline or slightly pigmented hyphae; ascomata aggregated, discrete, superficial or slightly immersed at the base, spherical,

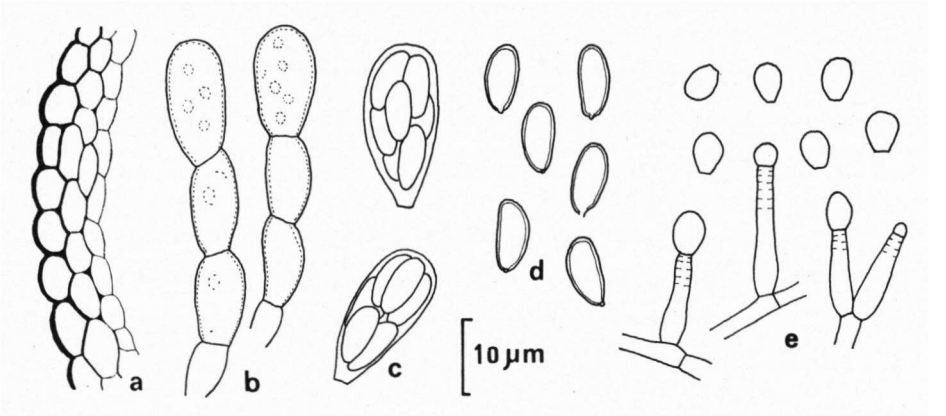

Fig. 1. *Microascus senegalensis*. — a. Part of the ascoma wall. — b. Catenulate asci. — c. Mature asci. — d. Ascospores. — e. Conidiogenous cells and conidia.

black, 180–250 µm in diameter, with a cylindrical, 50–80 µm long, 40–50 µm broad, smooth ostiolum; wall of the ascomata 9–14 µm thick, composed of 3–4 layers of thick-walled, dark greenbrown, 4–6 µm sized cells; asci usually borne in vertical rows, ellipsoidal or broadly clavate, truncate at the base, 15–22 × 4–11 µm, evanescent, 8-spored; ascospores reniform, dextrinoid when young, yellowish or straw coloured when mature, 7–9 × 4–4.5 µm, with a small, prominent germ pore at the base; conidiogenous cells usually arise solitarily on vegetative hyphae, cylindrical, elongating, with annellations, 6–20 µm long, 2–2.5 µm broad; conidia borne in basipetal succession, obovoid or broadly clavate, truncate at the base, smooth or nearly so, yellowbrown, 4.5–5.5 × 3.5–4 µm.

TYPE.—CBS 277.74, isolated from mangrove soil, Joal, Senegal, Feb. 1974.

The species is close to *Microascus cinereus*; it can be distinguished by larger ascospores with a prominent germ pore and by shorter but broader conidia. It shows its optimal development on cornmeal-agar at temperatures between 33 and 36°C, whereas *M. cinereus* usually shows optimal growth at 30°C.

EXCLUDED AND DOUBTFUL SPECIES

d e s m o s p o r u s. — *Microascus desmosporus* (Lechmère) Curzi *in* Boll. Staz. Patol. veg. Roma, N.S., **11**: 60, 1931. — *Peristomium desmosporum* Lechmère *in* Bull. trim. Soc. mycol. Fr. **29**: 309. 1913 (name based on 2 different fungi).

Lechmère (1913) distinguished 2 varieties; the type strains of both are maintained in the CBS collection. *Peristomium desmosporum* var. *oidium* (CBS 125.14) proved to belong to the *Phialophora mutabilis* (Beyma) Schol-Schwarz group. In most of the cultures only catenulate chlamydospores develop, as described by Lechmère. Phialoconidia could be observed only occasionally. *Peristomium desmosporum* var. *verticillatum* (CBS 125.14) represents the *Scopulariopsis* conidial state of *Microascus cinereus*; ascomata could not be observed.

exsertus. — *Microascus exsertus* Skou *in* Antonie van Leeuwenhoek **39**: 529. 1973. — *Pithoascus exsertus* (Skou) v. Arx *in* Persoonia **7**: 373. 1973.

This species is characterized by elongated navicular or falcate ascospores without a germ pore and by the absence of any conidial state. It differs from the other species of the genus *Pithoascus* by its irregularly spreading colonies.

intermedius. — *Microascus intermedius* Emmons & Dodge *in* Mycologia **23**: 313. 1931. — *Pithoascus intermedius* (Emmons & Dodge) v. Arx *in* Proc. K. Ned. Akad. Wet. (C) **76**: 292. 1973.

nidicola. — *Microascus nidicola* Massee & Salmon *in* Ann. Bot. **15**: 313. 1901. — *Pithoascus nidicola* (Massee & Salmon) v. Arx *in* Proc. K. Ned. Akad. Wet. (C) **76**: 292. 1973.

This species has been chosen as type of the genus *Pithoascus* v. Arx. A description is given by von Arx (1973b).

niger. — *Microascus niger* (Sopp) Curzi *in* Boll. Staz. Patol. veg. Roma **11**: 60. 1931.

This species has been discussed by Thom (1930), Curzi (1931) and Barron & al. (1961). The species name is based on *Acaulium nigrum* Sopp, which has been placed in the synonymy of *Scopulariopsis asperula* (Sacc.) Hughes by Morton & Smith (1963).

schumacheri. — *Microascus schumacheri* (Hansen) Curzi *in* Boll. Staz. Patol. veg. Roma **11**: 60. 1931. — *Pithoascus schumacheri* (Hansen) v. Arx *in* Proc. K. Ned. Akad. Wet. (C) **76**: 292. 1973.

No cultures or specimens of this species could be examined.

stysanophorus. — *Microascus stysanophorus* (Mattirolo) Barron & al. *in* Can. J. Bot. **39**: 1621. 1961. — *Melanospora stysanophora* Mattirolo *in* Nuovo G. bot. ital. **18**: 121. 1886.

Microascus stysanosporus Curzi *in* Boll. Staz. Patol. veg. Roma **11**: 60. 1931.

This species could not be studied. It has been discussed by Barron & al. (1961); its taxonomic position, however, is doubtful. The fungus discussed by Doguet (1957) as *Microascus stysanophorus* has no conidial state and may belong to *Pithoascus schumacheri* or *P. nidicola.*

REFERENCES

ARX, J. A. VON (1973a). Ostiolate and non-ostiolate pyrenomycetes. *In* Proc. K. Ned. Akad. Wet. (C) **76**: 289–296.

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

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

CORLETT, M., (1963). The developmental morphology of two species of *Microascus*. *In* Can. J. Bot. **41**: 253–266.

—— (1966). Developmental studies in the Microascaceae. *In* Can. J. Bot. **44**: 79–88.

CURZI, M., (1931). Rapporti fra i generi *Microascus* e *Scopulariopsis*. *In* Boll. Staz. Patol. veg. Roma, N.S. **11**: 55–60.

DOGUET, G., (1957). Organogénie du *Microascus stysanophorus*. *In* Bull. trim. Soc. mycol. Fr. **73**: 165–178.

LECHMÈRE, E., (1913). Description de quelques moisissures nouvelles provenant de la Côte d'Ivoire. *In* Bull. trim. Soc. mycol. Fr. **29**: 303–331.

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

MALLOCH, D. & CAIN, R. F., (1971). The genus *Kernia*. *In* Can. J. Bot. **49**: 855–867.

MORTON, F. J. & SMITH, G., (1963). The genera *Scopulariopsis*, *Microascus* and *Doratomyces*. *In* Mycol. Pap. **86**: 96 pp.

THOM, C., (1930). The Penicillia. Williams & Wilkens Co., Baltimore, Maryland.

UDAGAWA, S., (1962). *Microascus* species new to the mycoflora of Japan. *In* J. gen. appl. Microbiol. **8**: 39–51.

—— (1963). *Microascus* in Japan. *In* J. gen. appl. Microbiol. **9**: 137–148.

—— (1970). Notes on some Japanese Ascomycetes IX. *In* Trans. mycol. Soc. Japan **10**: 103–108.