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ASORDARIA, A NEW GENUS OF THE SORDARIACEAE, AND A NEW SPECIES OF MELANOCARPUS

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Asordaria gen. nov. is introduced for Sordariaceae with ovate or broadly ellipsoidal, smooth ascospores without gelatinous sheath. The genus is based on *Asordaria tenerifae* spec. nov. Seven species of *Sordaria* are reclassified in *Asordaria* and a further species is described as *A. islandica*. *Asordaria* is considered to be more closely related to *Boothiella*, *Neurospora*, *Gelasinospora*, and *Melanocarpus* than to *Sordaria*, which is restricted to species with elongate ascospores with a gelatinous sheath. *Melanocarpus oblatus* spec. nov. is described.

An ascomycetous fungus was isolated from droppings collected by the first author in March 1986 in Las Cañadas on Tenerife (Canary Islands) at an altitude of about 2300 m. The droppings were incubated on moist filter paper in Petri dishes at room temperature. The fungus represents a Sordariaceae sensu Lundqvist (1972) and differs from *Sordaria humana* (Fuckel) Winter by smaller ascospores and from *S. arctica* Cain and *S. conoidea* Cailleux by larger, especially broader ascospores (Cain, 1957; Cailleux, 1971).

Sordaria fimicola (Rob.) Ces. & de Not., the type species of the genus, is characterized by ellipsoidal or nearly cylindrical ascospores with a distinct gelatinous sheath surrounding each ascospore but leaving clear its base with a protuberant germ pore (Fig. 1C). Such a sheath is absent in the species mentioned above, which therefore are classified in a separate genus.

ASORDARIA v. Arx, Guarro & v.d. Aa, *gen. nov.*

Coprophila; coloniae celeriter crescunt, cum hyphis radiantis, latis, crassis, septatis; ascomata erumentia vel superficialia, ampulliformia vel pyriformia, ostiolata, crasse tunicata, pigmentata; asci cylindracei, sursum truncati, unitunicati, cum refringente structura apicali, octospori; ascosporae ovatae vel ellipsoideae, aseptatae, glabrae, brunneo-nigrae, cum poro germinationis distincto praedito, sine vagina glutinosa; paraphyses absunt; anamorphosis abest. Species typica: *Asordaria tenerifae* v. Arx & Guarro.

Colonies expanding, with broad and regularly septate expanding hyphae; ascomata erumpent or superficial, large, ampulliform or pyriform, with a thick wall of dark cells (textura angularis in surface view) and a beak-like, cylindrical or conical ostiolum; asci cylindrical, unitunicate, 8-spored, with a non-amyloid ring in the truncate apex; ascospores ovate or broadly ellipsoidal, aseptate, smooth, dark brown or nearly black when mature, without gelatinous sheath, with a distinct germ pore at the attenuated end; paraphyses absent; anamorphs absent.

Type species.—*Asordaria tenerifae* v. Arx & Guarro.

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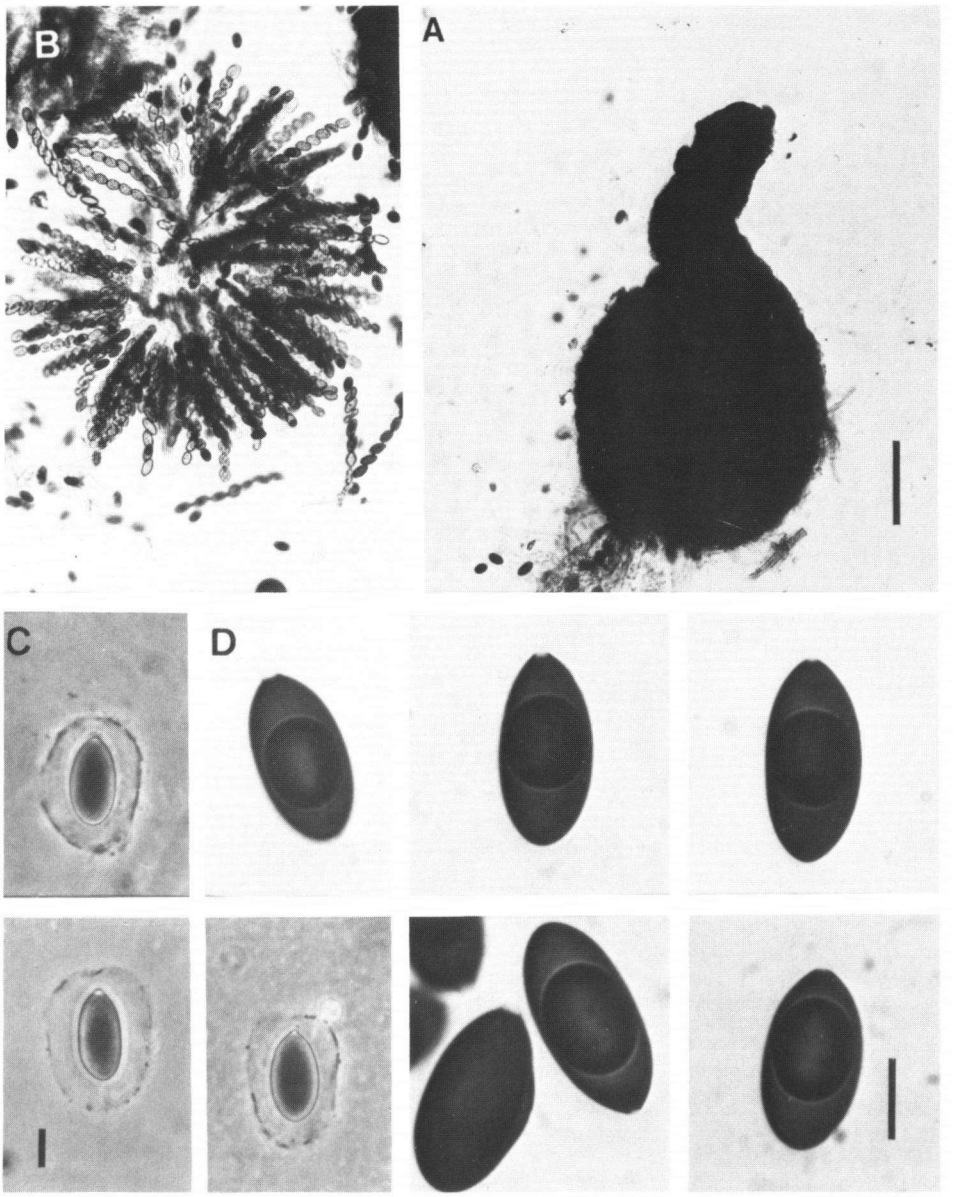

Fig. 1. *Sordaria fimicola*. — A. Ascoma. — B. Asci (bar = 100 μm). — C. Ascospores mounted in water. — D. Ascospores mounted in lactophenol (bar = 10 μm).

Species of *Asordaria* have been isolated from dung of carnivores and herbivores, mainly collected in arid and arctic regions (Sahara, Northern Canada, Iceland). They can easily be isolated, because the expanding hyphae grow quickly on wet filterpaper, on which the glossy and black ascomata develop within a few days.

The fast growing colonies with broad expanding hyphae and the unsheathed ascospores of *Asordaria* species indicate a closer relationship to *Boothiella, Melanocarpus, Gelasinospora*, and *Neurospora* than to *Sordaria* s.str. *Gelasinospora* species differ by pitted, reticulate, or alveolate ascospores with two or more or occasionally with a single germ pore. The ascomata may be ostiolate or non-ostiolate. In one and the same species, ostiolate and non-ostiolate ascomata occur in the same colony (von Arx, 1982). *Neurospora* species have longitudinally striate ascospores with two germ pores, one at each end. *Boothiella tetraspora* Lodhi & Mirza (1962) is characterized by pale, expanding hyphae, non-ostiolate ascomata with a wall of angular, unpigmented cells and by 4-spored asci without apical ring. The ascospores are similar to those of *Asordaria tenerifae* in size, shape, structure, and pigmentation.

Melanocarpus albomyces is thermophilic and has fast growing expanding hyphae. The ascomata are dark, thick-walled, non-ostiolate; the asci are cylindrical or saccate, evanescent and the ascospores are ovate or nearly spherical, usually bilaterally flattened, with a germ pore at the attenuated end.

Neurospora and *Melanocarpus* species include anamorphs with relatively large arthroconidia, which develop from branched hypha by the formation of double, bulging septa with disjunctives.

Asordaria resembles in some respects *Apodospora* Cain & Mirza (1970), which includes species with aseptate ascospores with an apical germ pore. *Apodospora*, however, differs in that the ascospores are surrounded by a gelatinous sheath. The ascomata have a thin wall composed of small cells, the asci are surrounded by filamentous paraphyses, and spherical spermatia are formed basipetally at the apex of ampulliform cells. *Apodospora* is closely related to *Podospora, Lasiosphaeria*, and other genera of the Lasiosphaeriaceae sensu Lundqvist (1972).

Achaetomium may also be confused with *Asordaria*. The ascomata of *A. globosum* Rai & Tewari, the type species, are ostiolate, thick-walled and covered with pale hyphae. The asci are cylindrical and evanescent. The ascospores are extruding as a dark, sticky mass. They are dorsiventrally flattened, round in face view, ellipsoidal in lateral view, with a basal germ pore. *Achaetomium* has to be restricted to the type species, the other species have been reclassified in *Chaetomium* by von Arx (1985) and Cannon (1986).

KEY TO THE SPECIES

1 a. Ascospores ovate or nearly spherical 2
b. Ascospores broadly ellipsoidal, attenuated, and rounded at both ends 6
2 a. Ascospores 20–25 × 16–19 µm . . . . . *A. humana*
b. Ascospores smaller 3
3 a. Ascospores 17–21 × 14–18 µm, expanding hyphae 15–20 µm broad . . . . . *A. tenerifae*
b. Ascospores smaller, expanding hyphae 8–15 µm broad 4

4 a. Ascospores 15–18 × 13–15 µm, good sporulation at 18–22 °C . . . . . *A. arctica*
b. Ascospores narrower, good sporulation at 25–30 °C 5
5 a. Ascospores 16–19 × 11–13 µm . . . . . *A. goundaensis*
b. Ascospores 12–15 × 9–12 µm . . . . . *A. prolifica*
6 a. Ascospores 25–29 × 16–19 µm; ascomata ampulliform, with a long, often curved beak *A. islandica*
b. Ascospores smaller 7
7 a. Ascospores 21–25 × 12–14 µm, ascomata pyriform . . . . . *A. sibutii*
b. Ascospores smaller 8
8 a. Ascospores 17–21 × 10–13 µm, ascomata conical . . . . . *A. conoidea*
b. Ascospores 17–21 × 11–13 µm; ascomata spherical, with a short cylindrical beak *A. mabokeensis*

Asordaria tenerifae v. Arx & Guarro, *spec. nov.*—Fig. 2

Ascomata 280–400 µm diam., 350–500 µm alta; asci 105–150 × 13–16 µm; ascosporae 17–21 × 13–18 µm. Typus ex fimo in herb. e cultura CBS 264.86.

Colonies at 28 °C on cornmeal agar with a daily growth rate of more than 10 mm, filling the Petri dish within 3–4 days, becoming dark brown or nearly black; expanding hyphae regularly and closely septate, rather thick-walled, pale brown, 15–20 µm broad; aerial hyphae floccose, much branched, septate, pale or brown, 2–5 µm broad; ascomata formed from coiled hyphae, maturing within 10 days, ampulliform or pyriform, with a spherical body and a conical or cylindrical beak, smooth or nearly so, often glossy and black in surface view, 280–400 µm in diameter, 350–500 µm high; the beak 80–120 µm broad and 80–250 µm high; ascomatal wall 35–45 µm thick, composed of several layers of isodiametrical, thick-walled, brown cells, 12–17 µm diameter, textura angularis in surface view; asci cylindrical, 8-spored, 105–150 × 13–16 µm, with a thin but rather persistent wall, with a disc and a non-amyloid ring at the truncate apex; ascospores uniseriate, ovate, aseptate, smooth, greenish brown or nearly opaque when mature, without gelatinous sheath, with a distinct germ pore at the attenuated apex, 17–21 × 13–18 µm; paraphyses absent, ostiolar pore lined with short, hyaline periphyses; anamorphs absent.

Type.—Canary Islands, Tenerife, Las Cañadas, on rabbit (?) droppings, March 1986, *J. A. von Arx* (in herb. CBS, dried cultures and slides).

Living cultures were incorporated in the CBS culture collection (CBS 264.86).

The top three ascospores in the ascus are apically attenuated with an apical germ pore. The ascospores in the basal part of the ascus are usually attenuated and porate at the base.

Asordaria arctica (Cain) v. Arx & Guarro, *comb. nov.*
Sordaria arctica Cain in Can. J. Bot. 35: 262. 1957 (basionym).

Asordaria conoidea (Cailleux) v. Arx & Guarro, *comb. nov.*
Sordaria conoidea Cailleux in Bull. Soc. mycol. Fr. 87: 620. 1971 (basionym).

Asordaria goundaensis (Cailleux) v. Arx & Guarro, *comb. nov.*
Sordaria goundaensis Cailleux in Bull. Soc. mycol. Fr. 87: 620. 1971 (basionym).

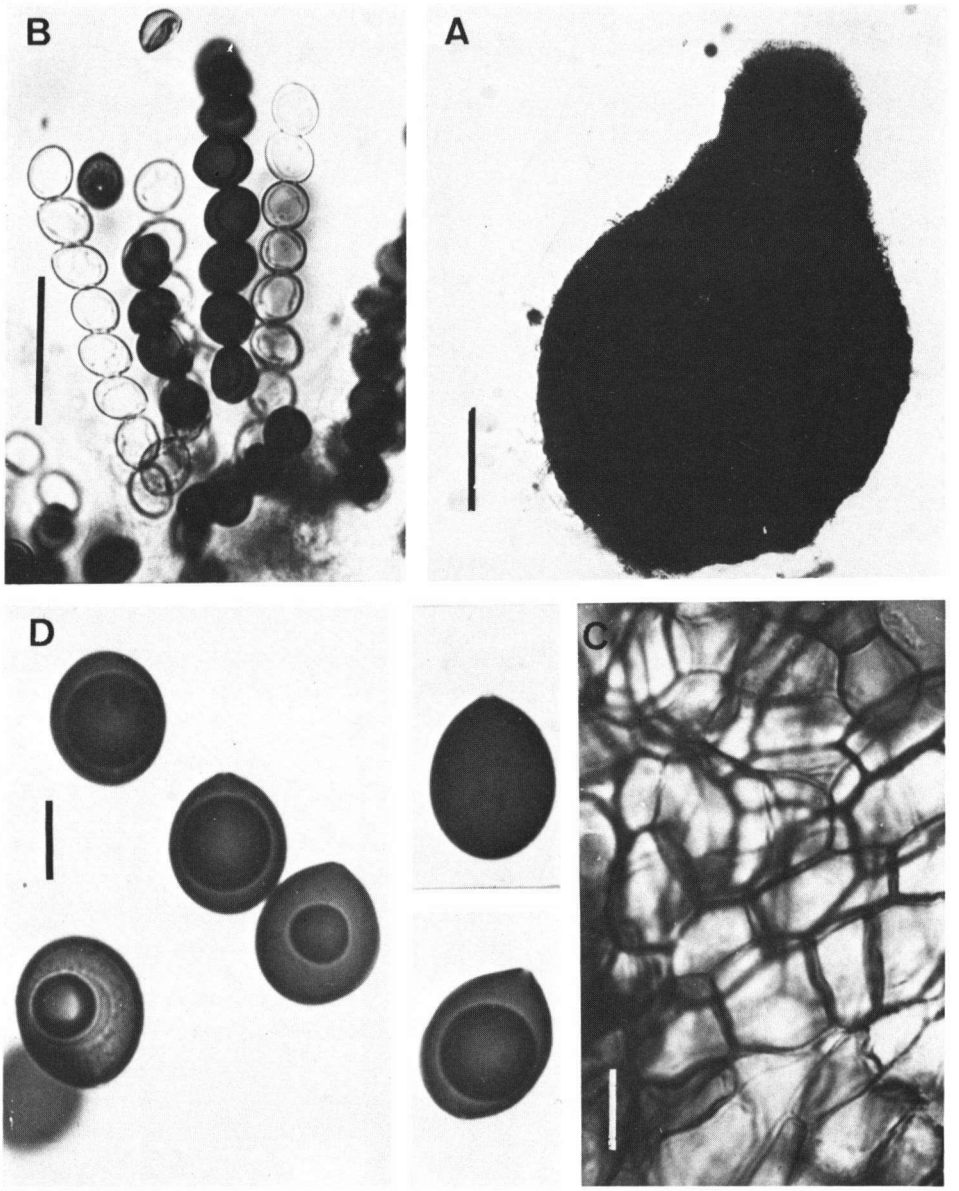

Fig. 2. *Asordaria tenerifae*. — A. Ascoma (bar = 100 μm). — B. Asci (bar = 50 μm). — C. Ascomatal wall in surface view (bar = 10 μm). — D. Ascospores (bar = 10 μm).

Sordaria goundaensis var. *latispora* Cailleux is similar to *A. arctica*, probably indistinguishable.

Asordaria humana (Fuckel) v. Arx & Guarro, *comb. nov.*

Sphaeria humana Fuckel, Fungi Rhenani no. 1801. 1866 (basionym). — *Sordaria humana* (Fuckel) Winter in Bot. Ztg 30: 835. 1872.

For further synonyms see Lundqvist (1972).

This species seems to be rather common. Eight strains maintained in the CBS Culture Collections as *Sordaria humana* have been examined. Only CBS 416.83, received from J.C. Krug and collected in Venezuela was correctly identified. The other isolates have been reidentified as *Sordaria fimicola* and *S. lappae* Potebnia.

Asordaria islandica Guarro & van der Aa, *spec. nov.*—Fig. 3

Ascomata superficialia, ampulliformia, nigra, 300–440 μm diam., collo longo, curvato praedita; asci cylindracei, unitunicati, 180–230 × 19–22 μm, octospori; ascosporae late ellipsoideae, aseptatae, glabrae, brunneo-nigrae, 25–29 × 16–19 μm, cum poro germinationes praedito, sine vagina glutinosa. Typus ex fimo ovis in herb. CBS, e cultura CBS 512.77.

Colonies at 28 °C on cornmeal agar with a daily growth rate of more than 15 mm, filling the Petri dish within 3–4 days, becoming dark brown or nearly black; expanding hyphae septate, rather thick-walled, pale brown, 10–14 μm broad, aerial hyphae floccose, branched, hyaline or pale, 2–4 μm broad; ascomata formed from hyphal coils, maturing within 8 days (at 22 °C), ampulliform or pyriform, with a spherical body and a long conical or cylindrical, often recurved or irregular beak, smooth or nearly so, glossy and black in reflected light, 300–440 μm in diameter, the beak 80–130 μm broad near its base and 300–550 μm long; ascomatal wall 30–40 μm thick, composed of several layers of irregular, flattened, 12–18 μm broad cells (textura angularis in surface view); asci cylindrical, with a short stalk and a truncate apex, 8-spored, 180–230 × 19–22 μm, with a persistent wall and a non-amyloid ring at the apex; ascospores uniseriate, ovate or broadly ellipsoidal, aseptate, smooth, greenish-brown or black when mature, without gelatinous sheath, with a distinct germ pore at the base, 15–29 × 16–19 μm; paraphyses absent; anamorphs absent.

Type.—Iceland, near Reykiavik, on sheep dung, August 1977, in herb. H.A. van der Aa (CBS, dried culture). Living cultures: CBS 512.77.

Asordaria mabokeensis (Cailleux) v. Arx & Guarro, *comb. nov.*

Sordaria mabokeensis Cailleux in Bull. Soc. mycol. Fr. 87: 620. 1971 (basionym).

Asordaria prolifica (Cailleux) v. Arx & Guarro, *comb. nov.*

Sordaria prolifica Cailleux in Bull. Soc. mycol. Fr. 87: 620. 1971 (basionym).

Asordaria sibutii (Cailleux) v. Arx & Guarro, *comb. nov.*

Sordaria sibutii Cailleux in Bull. Soc. mycol. Fr. 87: 620. 1971 (basionym).

In the course of this study, a further undescribed ascomycetous fungus was encountered in the CBS culture collection. This was maintained as *Achaetomium globosum*

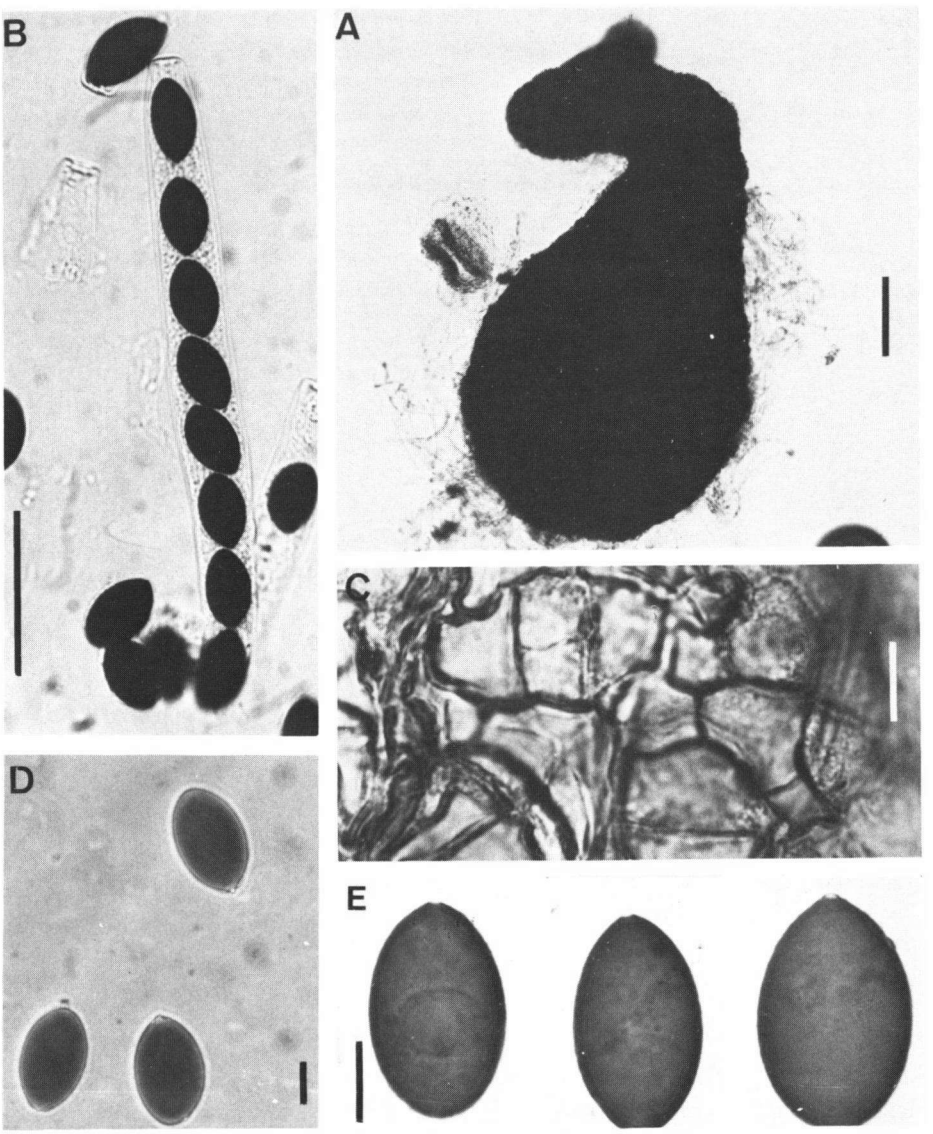

Fig. 3. *Asordaria islandica*. — A. Ascoma (bar = 100 μm) — B. Ascus and apical part of an ascus (bar = 100 μm). — C. Ascomatal wall in surface view (bar = 10 μm). — D, E. Ascospores (bar = 10 μm).

(CBS 775.85). It differs from the type of this species (CBS 332.67) in non-ostiolate ascomata, immersed in the agar medium, in bilaterally flattened, oblate ascospores and in other characters. It shows affinities to *Melanocarpus albomyces* (Cooney & Emerson) v. Arx and represents a further species of the genus *Melanocarpus* v. Arx.

Melanocarpus oblatus Guarro & v.d. Aa, *spec. nov.*—Fig. 4

Ascomata globosa vel subglobosa, immersa vel erumpentia, brunneo-nigra, crasse tunicata, 160–260 μm; asci cylindracei vel saccati, unitunicati, octospori, 50–70 × 10–15 μm; ascosporae oblatae, bilateraliter depressae, aseptatae, brunneo-nigrae, poro germinationes distinctis praeditae, 10–12 × 8–9 μm; arthroconidia cylindracea vel ellipsoidea, utrinque truncata, aseptata, hyalina, 9–18 × 3.5–6 μm. Typus: CBS 775.85, cultura exsiccata in herb. CBS.

Colonies on cornmeal agar at 28 °C with a daily growth rate of 11–12 mm, producing a red exudate and a pale aerial mycelium composed of mainly hyaline, septate, 2.5–3.5 μm broad hyphae; ascomata maturing within 14 days, immersed or semi-immersed, covered with yellow hyphae when erumpent (seen in reflected light), spherical or nearly so, discrete or aggregated, non-ostiolate, 160–260 μm in diameter; ascomatal wall dark brown, composed of flattened, 7–12 μm broad cells (textura angularis in surface view), often surrounded by brown, septate, 3–5 μm broad hyphae; asci cylindrical or obovate-saccate, evanescent, 8-spored, 50–70 × 10–15 μm; ascospores oblate, bilaterally flattened, round in face view, ellipsoidal in lateral view, dark brown when mature, smooth, unsheathed, 10–12 × 8–9 μm, with a distinct, basal (lateral) germ pore; arthroconidia occasionally formed in the aerial mycelium in short, often branched chains, cylindrical or barrel-shaped, aseptate, hyaline, 9–18 × 2.5–6(–8) μm.

Type.—The type strain CBS 775.85 was received from Upper Volta (Africa) without any data.

This fungus is mesophylic, such in contrast to *M. albomyces*, which is highly thermophilic. The anamorphs of *Melanocarpus* species are reminiscent of the *Chrysonilia* anamorphs of *Neurospora* species. They differ by small, uncoloured conidial pustules and by shorter chains of more elongate conidia. The conidia of *Chrysonilia sitophila* (Mont.) v. Arx and of other species develop in sporodochium-like, orange or red pustules and are short cylindrical.

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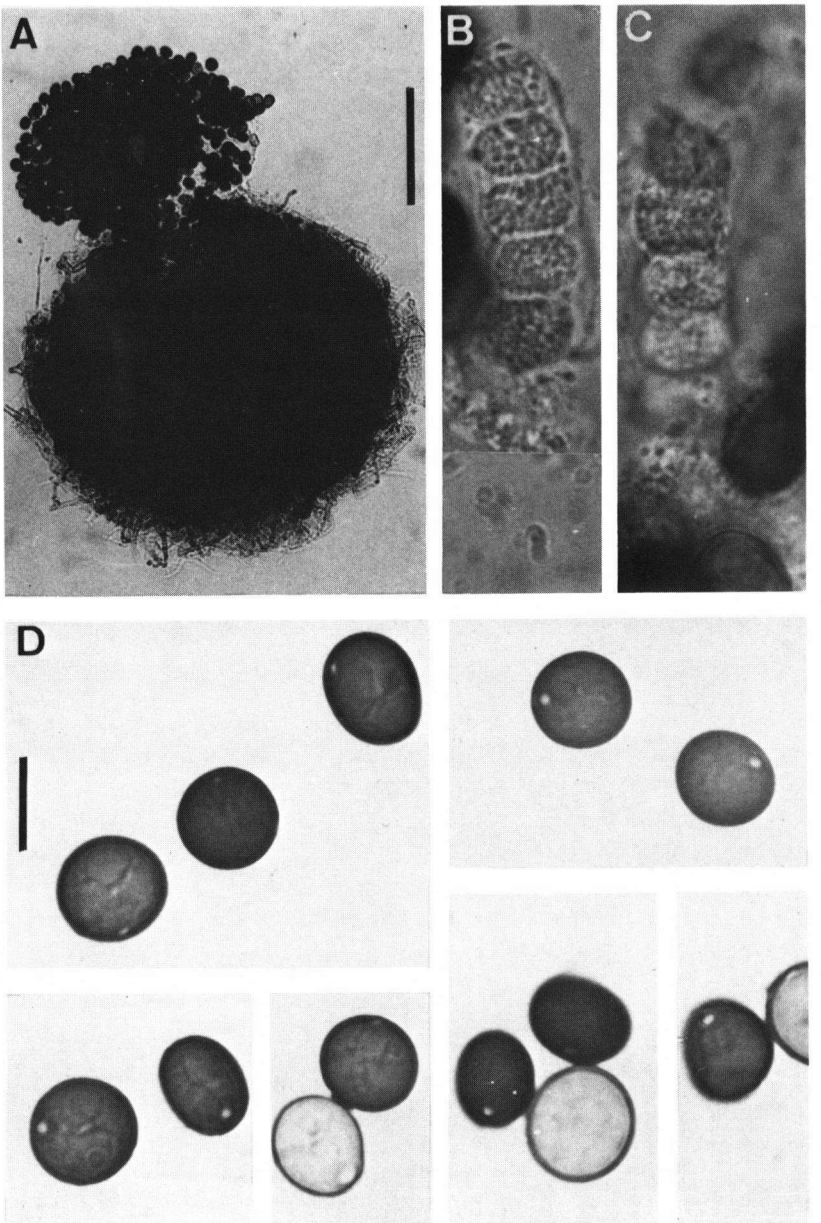

Fig. 4. *Melanocarpus oblatus*. — A. Ascoma (bar = 100 μm). — B, C. Asci. — D. Ascospores (bar = 10 μm).

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