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GAMSIELLA, A NEW SUBGENUS OF MORTIERELLA
(MUCORALES: MORTIERELLACEAE)

R. K. Benjamin

Abstract.—*Mortierella multidivariata* is described and placed in a new subgenus, *Gamsiella*, of *Mortierella*. It is distinguished from species of subgenus *Mortierella* in having repeatedly divaricately branched sporangiophores. Large numbers of sporangia develop simultaneously on slender, attenuate pedicels arising from the ultimate branches of the sporangiophore. The sporangium of *M. multidivariata* forms two subglobose, finely sculptured sporangiospores. Mostly terminal, globose, spiny chlamydospores are formed in slender, secondary, intra- or extrahyphal hyphae that arise from living segments of the ageing aerial mycelium. Classification of the Mortierellaceae is summarized briefly. The type and only known strain of *M. multidivariata* originated from a rotting stump in Moscow, USSR.

The fungus being described here was isolated by Carmen Stoianovitch from detritus taken from a rotting stump in Sokolniki Park, Moscow, U.S.S.R., by L. S. Olive while he was attending the XIIth International Botanical Congress in Leningrad in July, 1975. Dr. Olive correctly recognized it as a probable member of the Mortierellaceae, and I am grateful to him for giving it to me for study. I received the isolate in October, 1975, and since that time it has been maintained in culture on a variety of media where it has shown no loss of vigor or capacity to sporulate after repeated transfer.

The description of the new fungus has been prepared from cultures on YpSs agar (per liter of water: $K_2HPO_4 \cdot 3H_2O$, 1.3 g; $MgSO_4 \cdot 7H_2O$, 0.5 g; yeast extract, 4 g; soluble starch, 15 g; agar, 15 g) and PYED (per liter of water: peptone, 1 g; dextrose, 0.5 g; yeast extract, 1 g; agar, 15 g) at a pH of ca. 6.5.

Mortierella Coemans subgenus *Gamsiella* Benjamin, subgen. nov.

Hyphae substratae tenues ramosae hyphis aeriis tenuibus ramosarum emittentes. Sporangiphora successive bi- vel tridivariata ramosa ex amplificacionibus intercalaribus lateralibus hypharum aeriarum genita. Rami ultimi sporangiis terminalibus bisporis in pedicellis elongatis subtilibus attenuatis parientes. Sporangia noncolumellata; paries fugax.

Species typica: *Mortierella multidivariata* Benjamin.

Substrate hyphae slender, branched, giving rise to slender, branched aerial hyphae that form intercalary, lateral enlargements which become sev-

eral times successively di- or tridivariately branched, the ultimate branches forming two-spored sporangia on slender, elongate, attenuate pedicels. Sporangia noncolumellate; wall fugacious.

Etymology.—Named for W. Gams, mycologist; student of Mortierellaceae

Mortierella multidivariata Benjamin, sp. nov.

Coloniae arachnoideae in YpSs vel PYED 8–9 cm in diametro in 5–6 diebus (22–24 C), albae, fortiter odoratae. Sporangiphora bis vel quinques bi- vel tridivariata ramosa ex hyphis aeriis exorientia. Rami sporangiophororum ovoidei, prope cylindrati, vel clavati, in longitudine et latitudine variabiles, 10–30 μm longi, 3–7 μm in diametro ad basin, 6–12(–15) μm in diametro ad medium vel extremum. Rami ultimi sporangiophororum 2–3 ramis elongati attenuati, 20–70 μm longi, 1.5–2.5 μm lati ad basin, 1 μm lati ad apicem, gigantes. Ramuli attenuati ad apicem sporangia bispora facientes. Sporangia ovoidea, 11–18 \times 9–16 μm ante maturescentia. Sporangiosporae hyalineae subhemisphaericae vel subglobosae, distincte asperae, 7.7–11.2 μm in diametro transverso, 6–14 μm in diametro polari. Chlamydosporae e hyphis aeriis exorientes, plerumque globosae, 10–26 μm in diametro, crassitunicatae; murus cum processibus rotundatis vel acuminatis 1–3 μm altis. Zygosporae non observatae.

Holotypus.—Cultura (RSA 2152) desiccata in herbario RSA conservata.

Colonies developing rapidly at room temperature (22–24 C) on YpSs and PYED agars, reaching a diameter of 8–9 cm in 5–6 days, white and remaining so in age, consisting of delicate, branched substrate hyphae (2–)3–5(–7) μm wide, and branched, arching, aerial hyphae 3–5(–7) μm wide; turf well developed, more or less obscuring the agar surface except near the center of the colony, to ca. 2–5 mm high, collapsing in age; with a marked garliclike odor. Sporulation beginning within 36–48 h; abundant, Sporangiphores arising as enlarged lateral outgrowths of aerial hyphae, becoming successively 2–5 times di- or trivariately branched, the successive branches ovoid, nearly cylindrical, or clavate, variable in length and width, mostly 10–30 μm long, 3–7 μm wide at the base, 6–12(–15) μm wide near the middle when ovoid or near the tip when clavate, usually becoming irregularly septate in age and devoid of contents when sporangia are mature; residual protoplasm typically forming cell segments that may be converted directly into smooth, thick-walled chlamydospores or more commonly, giving rise to slender intra- or extrahyphal branches that mostly form terminal, rough-walled chlamydospores. Ultimate branches of sporangiophores giving rise usually to two or three slender, attenuate branchlets, 20–70 μm long, 1.5–2.5 μm wide at the base, 1 μm wide at the tip, that bear single, two-spored sporangiola. Sporangiola ovoid, 11–18 \times 9–16 μm at time of spore cleavage. Sporangiolar wall fugacious at maturity. Sporangiospores hyaline, typically

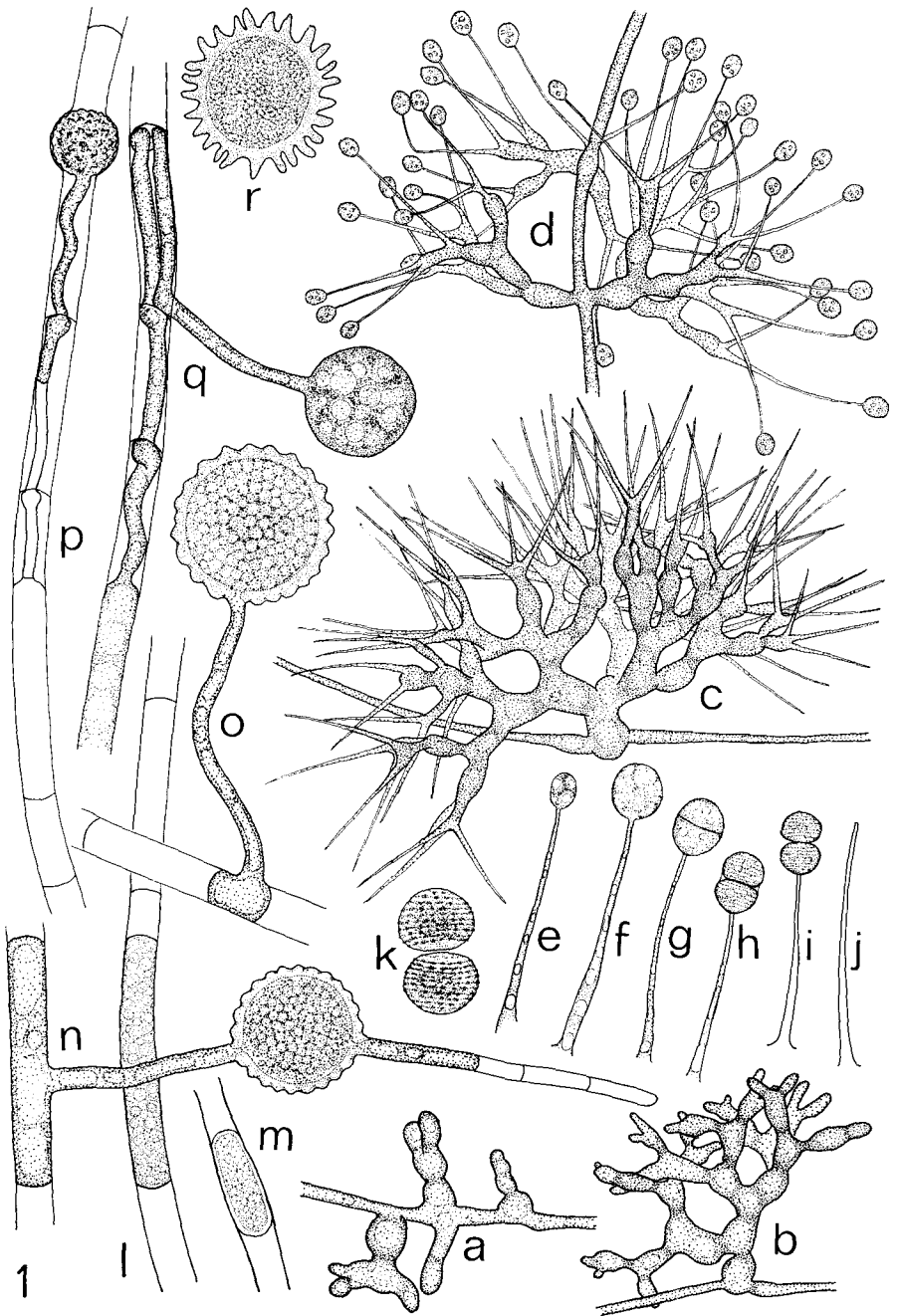
subhemispherical prior to release from the sporangial wall, then subglobose, less strongly rounded in the region of mutual contact during development, 7.7–11.2 μm in transverse diameter, 6–10 μm in polar diameter; distinctly roughened, the surface irregularities consisting of a succession of delicate, latitudinally oriented ridges and depressions. Substrate and aerial hyphae becoming irregularly septate in age and mostly devoid of contents; living cell-segments of aerial hyphae rarely forming smooth, thick-walled chlamydospores in place, typically giving rise to slender intra- or extrahyphal branchlets, highly variable in length, that form terminal, rarely intercalary, rough-walled chlamydospores. Chlamydospores formed by secondary hyphae thick walled, white, pale brownish yellow in age, mostly globose, 10–26 μm in diameter, bearing rounded or pointed projections 1–3 μm high; projections separate from one another or variably united at the base and forming a coarse, irregular reticulum. Zygospores not observed.

Holotype.—A dried culture of RSA 2152 deposited in the herbarium of the Rancho Santa Ana Botanic Garden, Claremont, Calif. Isolated by Carmen Stoianovitch from detritus from a rotting stump in Sokolniki Park, Moscow, U.S.S.R., collected in July, 1975, by L. S. Olive (R75-38). Living cultures have been deposited in the culture collections of NRRL, ATCC, CBS, and IMI.

Observations

Colony.—Following point inoculation of a quantity of spores in the center of a plate of YpSs or PYED in a Petri dish, the colony of *Mortierella multidivariata* develops at a rate of about 1 cm each 24 h, often with little or no aerial hyphae being formed prior to ca. 36–48 h when a white, cottonlike aerial mycelium rapidly develops and sporulation begins. On these media the turf is moderately dense and varies from 2 to about 5 mm deep. The central region, ca. 1–2 cm in diameter, of the colony may give rise to relatively few sporulating aerial hyphae and often contrasts sharply with the periphery. The rate of growth is nearly the same on ME agar (2% malt extract) and ME-YE agar (per liter of water: malt extract, 3 g; yeast extract, 3 g; peptone, 5 g; dextrose, 10 g; agar, 15 g). On ME the turf is lax and scarcely exceeds a height of 1 mm, but sporangiophore production is excellent. On ME-YE the turf is dense over the entire colony and reaches a height of as much as 1 cm; sporulation is abundant. Vegetative development and sporulation as observed in the laboratory under ordinary day-night conditions are not noticeably changed in cultures grown in continuous light or dark.

Substrate hyphae are at first continuous. Lateral branches arise from the advancing feeder hyphae at frequent intervals and more or less at right angles and in turn become irregularly and highly branched. As the colony



advances radially and as aerial hyphae develop, the senescent submerged hyphae in the older parts of the colony gradually become abundantly septate and essentially devoid of contents.

Like the substrate hyphae, the aerial hyphae are initially continuous and as they elongate tend to become recumbent and bifurcate repeatedly. The interval between successive bifurcations may be relatively great, often between 0.5 and 1 mm. Whenever a hypha meets the agar surface, a branch develops at the point of contact, penetrates the agar, quickly ramifies, and assumes the habit typical of substrate hyphae. With the development of sporangia and chlamydospores, the hypha gradually loses its contents and becomes irregularly septate. Thus, once sporulation begins, an aerial hypha soon ceases elongating unless it, stolonlike, reestablishes contact with the nutrient substrate.

Sporangiophores, sporangiola, and sporangiospores.—Sporangiophores of *Mortierella multidivariata* arise progressively along the ramifying hypha. As new sporangiophores are appearing, those initiated earlier are in various stages of development from young to intermediate to mature. The first indication of the formation of a sporangiophore is the appearance of an intercalary, often unilateral, enlargement of an aerial hypha (Fig. 1a, 2k). From this enlargement a short branch develops which gives rise to two or often three secondary branchlets (Fig. 1a). Similar ramifications of these and successive branches result in an up to five times divaricately branched structure composed of ovoid, nearly cylindrical, or clavate branches (Fig. 1b, 2l). Finally, from the apices of the ultimate branches of the sporangiophore there arise usually two or three elongate, slender, attenuate branchlets (Fig. 1c) at the tips of which are formed single sporangiola (Fig. 1d-f; 2a, b).

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Fig. 1. *Mortierella multidivariata*.—a. Early stages of development of sporangiophores from aerial hypha.—b. Median stage of development of a sporangiophore showing repeatedly divaricate branching pattern.—c. Late stage of development of a sporangiophore showing elongate, attenuate, terminal branchlets prior to sporangiole formation.—d. Sporangiophores showing simultaneous development of sporangiola.—e-i. Five stages of development of pedicellate sporangiola.—j. Sporangiolar pedicel after detachment of sporangiole.—k. Pair of mature sporangiospores.—l. Living cell segment within ageing aerial hypha showing two adventitious septa.—m. Smooth-walled chlamydospore in aerial hypha.—n-o. Late stages of development of intercalary and terminal chlamydospores forming in slender secondary hyphae arising laterally from living cell segment of primary aerial hypha.—p. Secondary intrahyphal hypha that has perforated two adventitious primary hyphal septa prior to formation of terminal chlamydospore within the primary hypha.—q. Intrahyphal hypha that perforated two septa, then looped back alongside itself after contacting a third septum, and finally emerged laterally through the wall of the primary hypha. The emergent hypha is forming a terminal chlamydospore.—r. Optical section of a mature chlamydospore showing wall prominences. (a-d, $\times 360$; e-j, $\times 600$; k-r, $\times 1,080$)

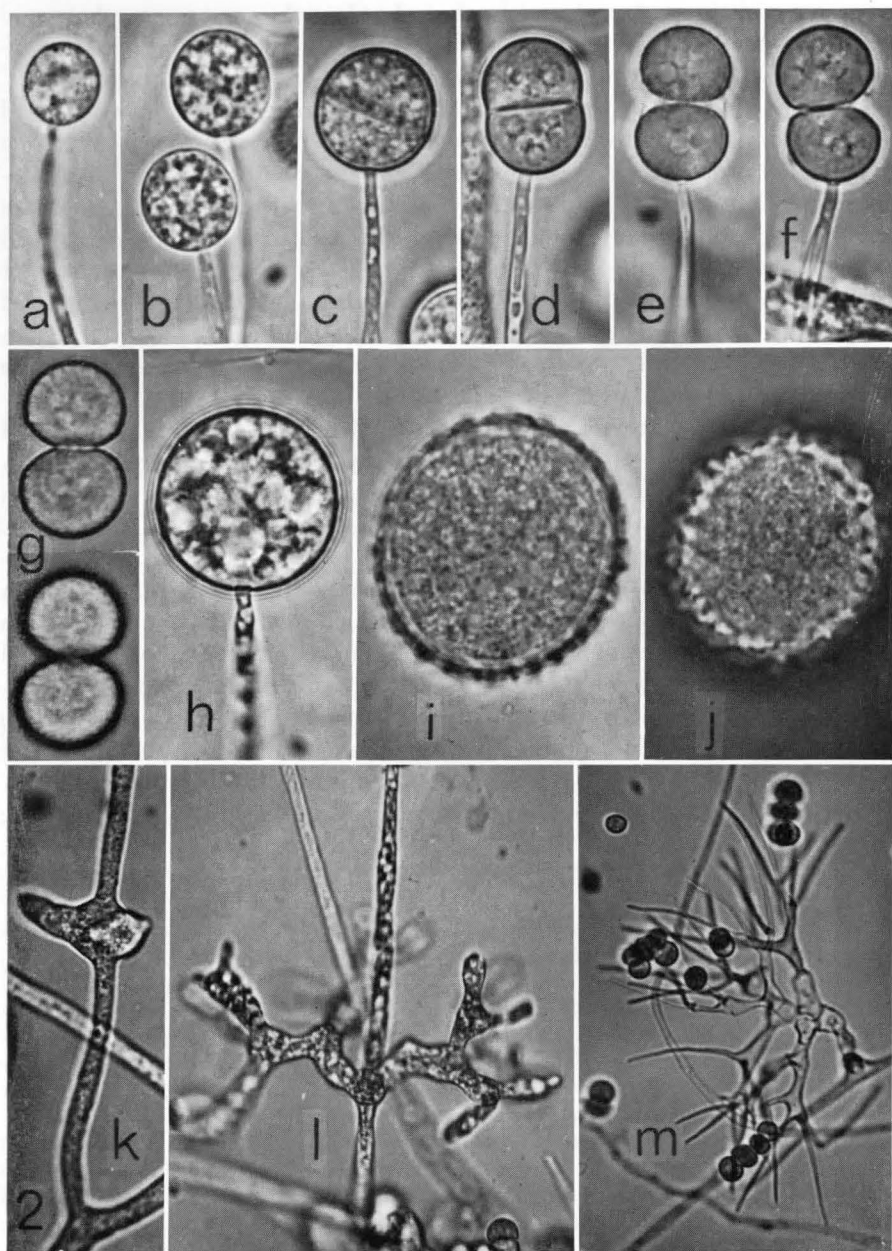


Fig. 2. *Mortierella multidivariata*.—a-f. Six stages of development of sporangia. —g. Pair of sporangiospores shown in optical section (above) and in upper surface view (below).—h. Immature chlamyospore developing terminally on secondary aerial hypha.—i-j. Mature chlamyospore in optical section and in median, upper surface view,

All sporangiole-bearing branchlets arise simultaneously on a given sporangiophore. At definitive size, the sporangiole measures about $11-19 \times 9-16 \mu\text{m}$, and its contents are separated into two nearly equal parts by more or less transverse cleavage (Fig. 1g; 2c, d). The two subglobose sporangiospores differentiate within the thin, still-persistent wall (Fig. 1h; 2e). If undisturbed, the paired spores may remain attached to each other for some time. They will, however, separate readily in water mounts.

Sporangiospores of *M. multidivariata* have delicately sculptured walls. The surface of the less-rounded part of each spore where it was in contact with its partner during development is less sculptured than the remainder of the wall which is marked by a succession of latitudinally oriented ridges and depressions (Fig. 1h, i, k; 2g). Dimensions of the mature sporangiospores, $7.7-11.2 \times 6-10 \mu\text{m}$, are considerably less than those of the incipient spores at the time of their delimitation in the immature sporangiole.

During sporangiophore development and prior to maturation of sporangiole the hypha subtending the sporangiophore and the sporangiophore itself are nonseptate. The protoplasm of these structures at first has a finely granular appearance and contains numerous small vacuoles (Fig. 2k). As the branched sporangiophore develops, it receives the protoplasm of its subtending hypha for a considerable distance on either side of its point of origin. As protoplasm moves into the enlarging sporangiophore the hypha gradually becomes highly vacuolate and septa may be laid down progressively at irregular intervals as it empties.

Likewise, as sporangiole develop at the apices of the pedicels terminating the distal branches of the sporangiophore, the latter becomes increasingly vacuolate and ultimately is nearly devoid of contents (Fig. 1i, j; 2m). This emptying of the sporangiophore, too, often is accompanied by random cross wall formation.

Chlamydospores.—Chlamydospores have been observed in *Mortierella multidivariata* only in aerial hyphae and sporangiophores. Although most of the protoplasm in the aerial hyphae moves into the developing sporangiophores, some often remains behind and is isolated here and there by cross walls. This results in numerous living cell segments of variable size in both the ageing hyphae (Fig. 1l) and otherwise mature and mostly empty sporangiophores. In many fungi, including Mortierellaceae, such parcels of protoplasm typically form thickened walls and are converted directly into chlamydospores. In *M. multidivariata* these living cells only rarely form such chlamydospores (Fig. 1m), usually sending out slender hyphae that

respectively.—k. Early stage of development of a sporangiophore from an aerial hypha.—l. Median stage of development of a sporangiophore as viewed from above.—m. Mature sporangiophore after release of sporangia. (a-j, $\times 1,300$; k, $\times 600$; l, $\times 450$; m, $\times 300$) (All photographs from aqueous mounts of living fungi.)

develop terminal, thick-walled, sculptured chlamydo-spores like those found in several other Mortierellaceae (Fig. 1n-r; 2h-j).

These secondary, chlamydo-spore-forming hyphae usually arise laterally from the living cell segment (Fig. 1n, o). The chlamydo-spore commonly is terminal (Fig. 1o); only occasionally is it intercalary (Fig. 1n). As the chlamydo-spore matures, it receives the protoplasm of its mother cell and supporting hypha which eventually are empty. Not infrequently, the secondary hypha arises from the end of the living cell segment and grows longitudinally through the primary hypha, often penetrating several of the adventitious septa that had been formed earlier following evacuation of the hypha during sporangiophore formation. These intrahyphal hyphae may form chlamydo-spores within the parental hypha (Fig. 1p) or they may penetrate the primary hyphal wall and then develop a chlamydo-spore on the outside (Fig. 1q).

The mostly globose chlamydo-spores formed by secondary hyphae range in size from 10 to 26 μm ($\bar{x} = 18 \mu\text{m}$; based on a 200-spore random sample) when mature and have a wall 1–2.5 μm thick (Fig. 1r; 2i, j). The surface projections range in length from 1 to 3 μm . The spore reaches definitive size and its wall begins to thicken before it has received its complement of protoplasm from its parental cell and supporting hypha. Septa may form in the latter as evacuation occurs (Fig. 1n).

Comments

Recent treatments of Mortierellaceae (Hesseltine and Ellis, 1973; Linnemann in Zycha et al., 1969; Milko, 1974) have recognized as many as five genera: *Mortierella* Coemans (1863), *Haplosporangium* Thaxter (1914), *Dissophora* Thaxter (1914), *Aquamortierella* Embree & Indoh (1967), and *Echinosporangium* Malloch (1967). Chalabuda (1968, 1973) proposed a new genus, *Actinomortierella*, for several species of *Mortierella* in which lateral branches of the sporangiophore arise from a subapical enlargement of the sporangiophore stalk. Gams (1969) adopted this name only as one of his sections of *Mortierella* subgen. *Mortierella*. *Herpocladium* Schröter (1886; the name earlier had been proposed for a subgenus of liverworts and the fungus was unnecessarily renamed *Herpocladiella* by Schröter in 1893) has been included in the family but now is generally disregarded as a *nomen dubium* (Linnemann in Zycha et al., 1969). *Naumoviella* Novotel'nova (1950) and *Carnoya* Dewèvre (1893) also have been proposed as genera in the family but have been treated as synonyms of *Mortierella* by Hesseltine (1955) and Milko (1974). *Gongronella* Ribaldi (1952) was considered by its author to belong to Mortierellaceae but the studies of Hesseltine and Ellis (1961, 1964) have shown that it is best classified in the Mucoraceae possibly allied to *Absidia* van Tieghem.

Linnemann (Zycha et al., 1969) included *Echinosporangium* in Mortierellaceae but not *Aquamortierella* as did Hesseltine and Ellis (1973). *Echinosporangium transversalis* Malloch, the type and only species of the genus, was placed, along with *Saksenaea vasiformis* Saksena, also representing a monotypic genus, in a separate family, Saksenaeaceae, by Ellis and Hesseltine (1974). Although the two species have little in common to suggest their close relationship to one another, their separation from Mortierellaceae and other mucoralean families seems justified. *Aquamortierella elegans* Embree & Indoh still is known only from its description based on liquid-preserved material originally collected in New Zealand on a midge larva in water. This species has a large multispored, apophysate sporganium often with a small, hemispherical columella. It is unique in having sporangiospores bearing apical, hyaline appendages that may be an adaptation that aids in water dispersal. Until *A. elegans* is isolated and studied in the living condition its possible relationship to Mortierellaceae cannot be confirmed or denied.

When *Dissophora decumbens* was described by Thaxter in 1914 it was, characteristically, lucidly illustrated by its author and its validity as a distinct taxon never has been questioned, although it has not again been reported. It was characterized as having a creeping, mostly unbranched, robust, continuously elongating fertile axis giving rise to a succession of divergent, simple, once- or twice-septate branchlets bearing terminal, non-columellate, multispored sporangiola. A second species, *D. nadsonii*, was described by Phillippow in 1932 but its status as a good species still is in doubt (Linneman in Zycha et al., 1969).

Thaxter distinguished *Haplosporangium* from *Mortierella* because the aerial hyphae of the two species he recognized, *H. bisporale* and *H. decipiens*, develop variably elongate, terminal or intercalary enlargements which, by septation, form few or many segments each giving rise laterally to one or several small, broad-based sporangiophores bearing 1- or 2-spored sporangiola on slender, threadlike terminations. The simple sporangiophore may give rise distally to one or more secondary sporangiola on slender lateral branchlets. Björling (1936) transferred Thaxter's species to *Mortierella* because of their apparent intergradation with several species of *Mortierella* having simple or sparingly branched sporangiophores. Gams (1969, 1977) has adopted Björling's point of view and treats *Haplosporangium* as another of his sections of *Mortierella* subgenus *Mortierella*.

Mortierella, as conceived by Linnemann (1941; Zycha et al., 1969) and Gams (1969, 1976, 1977) is one of the largest and most diverse genera of Mucorales. Its species are ubiquitous inhabitants of soil and some are among the most commonly encountered fungi from this source; 75 taxa currently are recognized (Gams, 1977). Most species still are without known sexual states and zygospore characteristics are not used in classifying the genus.

The long-held notion that *Mortierella* spp. are homothallic and form zygospores invested with a hyphal mantle (Brefeld, 1876, 1881; Dauphin, 1908; Dixon-Stewart, 1932; Ellis, 1940; van Tieghem, 1876) has been dispelled in recent years with the discovery of heterothallic and naked-zygospore species (Chien, Kuhlman, and Gams, 1974; Gams and Williams, 1963; Gams, Chien, and Domsch, 1972; Kuhlman, 1972, 1975; Williams, Gray, and Hitchin, 1965). The utility of zygospore characteristics in classification can be assessed only after much additional study. Many species of this genus are refractory objects of study in the laboratory, often growing well but sporulating poorly or not at all on nutrient-rich media commonly employed in the culture of other saprobic Mucorales. Production of sporangiophores often is obtained only on nutrient-poor agar media prepared from extracts of soil, grass, cherries, potatoes, carrots, etc. (Turner, 1956; Gams, 1969), and many isolates form only chlamydospores under all cultural conditions and thus cannot be identified (Gams and Domsch, 1969); only three species currently are distinguished on the basis of chlamydospore characteristics alone (Gams, 1977).

Although there still is a lack of unanimity, current systems of classification of *Mortierella* stress the asexual structures, especially the sporangiophore, and the genus is subdivided into a number of smaller, presumably related groups. Linnemann in her most recent treatment (Zycha et al., 1969) recognized 11 sections, whereas Gams (1969, 1976) until recently (Gams, 1977) recognized 10. A small number of species in which the sporangiophores arise directly from the substrate mycelium and lack a garliclike odor have been placed in a separate section, *Isabellina* Linnem. (Zycha et al., 1969; Gams, 1969, 1976). In all other species, the sporangiophores arise from a usually delicate, white, often fluffy aerial mycelium; cultures often are accompanied by a garliclike odor. In her classification, Linnemann emphasizes height and branching of the sporangiophore as well as the presence or absence of "stylospores," a term first used in *Mortierella* by van Tieghem (1875) for spiny-walled, aerially produced chlamydospores and later often applied by others to unispored sporangia borne on diminutive sporangiophores. Gams (1969, 1976, 1977) places prime emphasis on branching or nonbranching of the sporangiophore and the character of the sporangium. In his recent classification, Gams (1977), for the first time, recognized subgenera in *Mortierella*. He established subgenus *Micromucor* for species formerly treated as section *Isabellina* and included all other species of the genus in subgenus *Mortierella*. Gams retains, with emendations, five of Linnemann's section: *Stylospora* Linnem., *Mortierella* (= *Polycephala* Linnem.), *Alpina* Linnem., *Hygrophila* Linnem., and *Spinosa* Linnem.; abandons five: *Ambigua* Mehrotra, *Minutissima* Linnem., *Elongata* Linnem., *Mutabilis* Linnem., and *Dichotoma* Linnem.; and recognizes an additional four: *Actino-*

mortierella (Chalab.) Gams, *Simplex* Gams, *Schmuckeri* Gams, and *Haplosporangium* (Thaxt.) Gams.

Gams distinguishes three sections of *Mortierella* subgen. *Mortierella* in which the sporangiophore always is unbranched: 1. Sect. *Simplex*. Sporangiophore often relatively large, exceeding 200 μm in height; one-spored sporangia may occur along with many-spored sporangia. 2. Sect. *Alpina*. Sporangiophores small, under 150 μm in height, sometimes arising from a swollen segment of the subtending hypha; sporangia usually many spored. 3. Sect. *Schmuckeri*. Sporangiophores always small, very slender, under 150 μm in height, radiating in all directions from subtending hypha; sporangia one spored. The sporangiophore of other sections is branched, and its absolute height is not regarded as an important taxonomic character. In three of these sections the branching pattern is racemose: 4. Sect. *Mortierella*. Sporangiophores often large and with swollen base; lateral branches short, slender, arising above the middle of the primary axis; sporangia many spored. 5. Sect. *Actinomortierella*. Sporangiophores relatively large; lateral branches slender, arising from a subapical vesicle or swelling of the sporangiophore; sporangia many spored. 6. Sect. *Haplosporangium*. Sporangiophores arising from enlarged segments of the subtending hyphae, always small, usually less than 100 μm high, with a swollen base that tapers gradually toward the attenuate apex; lateral branches short, slender, attenuate; sporangia one or two spored. Cymose branching of the sporangiophore characterizes the last three sections: 7. Sect. *Hygrophila*. Sporangiophores basitonically branched; sporangia few to many spored. 8. Sect. *Stylospora*. Sporangiophores basitonically branched; sporangia one spored, often ornamented. 9. Sect. *Spinosa*. Sporangiophores meso- or acrotonically branched; sporangia many spored, usually with a minute columella.

Gams (1969) reviewed briefly the variety of chlamydospores that may be found in the mycelia of species of *Mortierella*. These vary from small, undifferentiated, smooth-walled spores formed singly or in clusters to often very large, globose, lobate, or fimbriate spores that may reach diameters of 100 μm or more. The most distinctive type of chlamydospore associated with the aerial hyphae of a number of species of *Mortierella*, exemplified by such species as *M. polycephala* Coemans, *M. biramosa* van Tiegh., *M. strangulata* van Tiegh., and *M. tuberosa* van Tiegh., is borne, usually terminally, on slender branches, typically is globose, and often bears spinelike or wartlike processes. These are the "stylospores" of van Tieghem (1875). Gams accepts the term stylospore only as the basis for the sectional name *Stylospora* and recommends discarding it as an appellation for aerially formed chlamydospores. I agree with this suggestion, for the term was coined originally by the Tulasnes (1861) for conidia formed acrogenously on simple conidiophores inside pycnidia.

Stalked, globose, more or less spiny chlamydospores are the kind most commonly found in *Mortierella multidivariata*. Their development from secondary hyphae derived from isolated living cell segments of a hypha follows soon after the formation of sporangiophores. When mature, they are easily detached from their fragile hyphal supports and are readily dispersed by air currents. Their spiny walls undoubtedly greatly increase their surface area and thus their buoyancy. Undifferentiated chlamydospores formed within the substrate or aerial hyphae of many fungi are generally regarded as a type of propagule whose function, if any, is primarily that of perennation (Griffiths, 1974). In *M. multidivariata* and many other species of *Mortierella*, however, there has evolved a type of chlamydospore whose characteristics would appear to facilitate easy and rapid dispersal comparable to that of sporangiospores.

In its vegetative and reproductive characteristics and garlicklike odor, *Mortierella multidivariata* resembles many species of subgen. *Mortierella*. Unlike many, however, it sporulates readily on a variety of nutrient-rich media and has proved extremely stable in culture. The sporangiophore of species of *Mortierella* subgen. *Mortierella* consists basically of an upright axis bearing a terminal sporangium; it may remain unbranched or by racemose or cymose branching give rise to few or many secondary branches each bearing a terminal sporangium. Fertile branches arise sequentially or, if formed more or less simultaneously, develop after the primary sporangium has been delimited. The progressively developed, multidivariolate sporangiophore of *M. multidivariata* reaches definitive size before giving rise to an often large number of stalked sporangia simultaneously. It is this unique character of the sporangiophore of *M. multidivariata* that has led me to give the fungus subgeneric status.

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