

Species of *Mucor* from India-I

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With plates XLI and XLII.

During the isolations of Mucorales in India in our laboratory a number of species of *Mucor* have been isolated. They are being studied in detail and nine of the species are being described here. Two media, one synthetic viz., SMA* and another non-synthetic, viz., PDA+ were selected for their study. Descriptions of the species are given below:

M. pusillus Lindt, Arch. exp. Pathol. u. Pharm. 21: 272, 1886 (Figs. 1—4, Plate XLI).

Colonies on SMA and PDA low, grayish; thermophilic, growing well at 37° C; sporangiophores arising from aerial hyphae, erect, branched sympodially, often with a septum below the sporangium; sporangia globose, 33.9—113 μ in diam.; wall incrusted, fragile; columellae oval or pear shaped, brown, 20—50 $\times$ 10—45 μ ; sporangiospores globose, sometimes oval, 2.2—4.4 μ . Zygospores not seen.

From India it is being described for the first time. Isolated from the forest soil of Gorakhpur, pH 7.5.

Description based on the culture No. MX 2, deposited in the BSM Culture Collection, Botany Department, University of Allahabad, and at NRRL, Peoria, Illinois, U.S.A.

M. jansseni Lendner, Muc. d. l. Suisse, 3: 88, 1908 (Figs. 5—13, Plate XLI).

Colonies on SMA and PDA blackish; sporangiophores much branched sympodially; sporangia globose, blackish, 20—75 μ average 45 μ ; wall incrusted, fragile; columellae globose to oval, gray, 10—45 $\times$ 10—42.5 μ ; sporangiospores globose, rarely oval, 3.3—6.6 μ , mostly 3.3 μ . Chlamydo-spores numerous terminal or intercalary single or in chain.

This species has been isolated from the forest soil, pH 6.4, of Panchmarhi, rotten papaya fruit, mouse dung and rotten almond. From

*) SMA-Dextrose—40 gm; Asparagine—2 gm; KH_2PO_4 —0.5 gm; $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ —0.25 gm—Thiamine chloride—0.5 mg; agar—20 gm; distilled water—1,000 ml. pH—6.

**) PDA-Potato (Peeled and sliced)—200 gm, Dextrose—20 gm; agar—20 gm, distilled water—1,000 ml.

India it has earlier been reported by Agnihothrudu (1957) from rhizosphere soil of pigeon pea (*Cajanus cajan*), Madras.

Description based on the culture No. MX 4, deposited in BSM Culture Collection, Botany Department, University of Allahabad, and at NRRL, Peoria, Illinois, U.S.A.

M. plumbeus Bonorden, Abh. naturf. Ges. Halle 8: 109, 1864.

(Figs. 14—20, Plate XLI).

Colonies on SMA and PDA low, mouse gray; sporangiophores erect, upto 1 cm. long, branching cymose with a septum just at the point of origin of a branch, with all branches ending into a sporangium; sporangia globose, brown to black in colour, 30—120 μ , usually 75 μ in diam.; wall incrustated, diffluent leaving a basal collarette; columellae oval or pear-shaped, with variable number of spines at the apex, often coloured, brown, 10—75 $\times$ 7.5—50 μ ; sporangiospores globose to subglobose, smooth to roughened, light brown in colour, 4.4—8.8 μ , usually 6.6 μ . Chlamydospores numerous terminal and intercalary, single or in chain, formed in mycelium, oval, globose or elongate, 12.5—27.5 $\times$ 7.5—22.2 μ . Zygospores not seen.

This species has been isolated from the soil of Allahabad, pH 6.8 and Kulu, pH 7.5.

From India it has earlier been reported by Thakur and Norris (1928) from soil, Madras. Later on, Agnihothrudu (1957) reported it from rhizosphere soil of pigeon pea (*Cajanus cajan*) as *Mucor spinescens* Lendner, which Zycha considers to be a synonym.

Description based on culture No. MX 5, deposited in the BSM Culture Collection, Botany Department, University of Allahabad, and at NRRL, Peoria, Illinois, U.S.A.

M. genevensis Lendner, Muc. d. l. Suisse, 3: 80, 1908.

(Figs. 21—27, Plate XLI).

Colonies on SMA and PDA at first low, later becoming high due to the formation of sporangiophores, white; sporangiophores erect, branched symphydially with a septum above the origin of each branch; sporangia globose, brownish, 10—45 μ , wall diffluent; columellae pyriform to ovoid, 15—38 $\times$ 30.4 μ ; sporangiospores ovoid to ellipsoidal, 5.5—12.1 $\times$ 2.2—4.4 μ . Homothallic. Zygospores numerous produced near the substrate, spherical or slightly compressed, blackish brown, 41.8—83.6 μ , exospore echinulate. Oidia abundant spherical to ovoid, single or in series.

This species has been isolated from the forest soil of Manda, pH 6. From India it has earlier been listed by Rai and Mukerji (1961) from soil, Lucknow.

Description based on the culture No. MX 3, deposited in BSM

Culture Collection, Botany Department, University of Allahabad, and at NRRL, Peoria, Illinois, U.S.A.

M. javanicus Wehmer, Zentralbl. f. Bakt. II, 6: 610, 900.

(Figs. 28—34, Plate XLI).

Colonies on SMA and PDA, high, at first white later yellowish; sporangiophores erect, branched irregularly; sporangia globose, dark brown, $30-80\ \mu$ in diam., mostly $52.5\ \mu$; wall hyaline, roughened and fragile; columella globose to oval, mostly hyaline, sometimes filled with brownish contents, $6-60 \times 6-50\ \mu$, mostly $45\ \mu$ in diameter; sporangiospores elliptic and hyaline, $3.3-12.4 \times 2.2-9.3\ \mu$. Chlamydospores numerous in mycelia and sporangiophores, globose to oval, single or in chains, $6.24-30 \times 3.1-15\ \mu$.

This species has been isolated from the garden soil, pH 7.5 and mouse dung at Allahabad. From India it has been reported by Butler et al. (1913—1914) from the ferment used for rice beer brewing, Khasi Hills, Assam. Later on, Raizada (1957) reported from soil, and goat's dung, Allahabad.

Description based on the culture No. MX 16, deposited in BSM Culture Collection, Botany Department, University of Allahabad, and at NRRL, Peoria, Illinois, U.S.A.

M. fragilis Bainier, Ann. Sc. Nat. 6. Ser. 19: 208, 1884.

(Figs. 1—5, Plate XLII).

Colonies on SMA and PDA high, at first white, later turning grayish; sporangiophores erect, $8.8-13.2\ \mu$ in diam., branched sympodially, with a septum just below the origin of a branch; sporangia globose, brownish black, $15-90\ \mu$, mostly $60\ \mu$ in diam., wall punctate and fragile; columellae globose to oval, hyaline, $10-57 \times 10-51.5\ \mu$, average $32 \times 30.4\ \mu$; sporangiospores oval to somewhat elliptical, hyaline, $4.6-9.9 \times 2.2-6.6\ \mu$ on PDA and on SMA, $4.4-13.2 \times 3.3-9.9\ \mu$, mostly $6.6 \times 4.4\ \mu$. Chlamydospores globose to oval formed on mycelium, $10-34.2 \times 26.6\ \mu$.

This species has been isolated from a garden soil of Allahabad, pH 6.8; from soil of Allahabad University agricultural farm pH 8; and mouse dung collected at Allahabad. From India it has been reported by Ghosh and Dutta (1962) from soil, Cuttack, Orissa; and Sak-sena and Sarbhoy (1962) from soil, Allahabad.

Description based on the culture No. MX-17, deposited in BSM Culture Collection, Botany Department, University of Allahabad, and at NRRL, Peoria, Illinois, U.S.A.

M. lausannensis Lendner, Mucor. Suisse, 3: 75, 1908.

(Figs. 6—10, Plate XLII).

Colonies on SMA and PDA high, white; sporangiophores simple or branched cymosely; sporangia globose, brown, $15-90\ \mu$, mostly $75\ \mu$

in diam.; wall incrusted, fragile; columellae globose to oval, hyaline, 10—49.4 μ in diam., mostly 30 μ ; sporangiospores oval to elliptical, 4.4—13.2 $\times$ 3.3—5.5 μ , average 7.7 $\times$ 5.5 μ . Chlamydospores oval to elongate, upto 16 μ in diameter.

This species has been isolated from the soil of Gorakhpur, pH 7.5 and the soil of Allahabad University agricultural farm, pH 8.2. From India it has been earlier reported by Mehrotra and Sarbhoy (1960) from soil, Allahabad.

Description based on culture No. MX-35, deposited in BSM Culture Collection, Botany Department, University of Allahabad, and at NRRL, Peoria, Illinois, U.S.A.

M. luteus Linnemann, Inaug. dissertation, 1936.

(Figs. 11—14, Plate XLII).

Colonies on SMA and PDA high, yellowish brown; sporangiophores erect, unbranched or little branched, smooth-walled, 5.5—15 μ in diameter; sporangia globose, brown, 15—60 μ , mostly 45 μ in diam.; wall diffuent, hyaline, leaving a collar at the base of the columella; columellae globose to oval, hyaline, 12.5—45 μ , mostly 33 μ in diameter; sporangiospores oval, reniform to elliptical, mostly elliptical, 5.5—15.4 $\times$ 2.2—8.8 μ .

This species has been isolated from soil, pH 6, of Manda; pH 7.5 of Allahabad, and pH 6.8, of Gorakhpur. From India it has been earlier reported by Roy and Dwivedi (1962) from soil of grass plots, Varanasi, and Saxena and Sarbhoy (1963) from soil, Allahabad.

Description based on culture No. MX-36, deposited in BSM Culture Collection, Botany Department, University of Allahabad, and at NRRL, Peoria, Illinois, U.S.A.

M. hiemalis Wehmer, Ann. mycol. 1: 39, 1903.

(Figs. 15—17, Plate XLII).

Colonies on SMA and PDA high, white; sporangiophore unbranched, rarely branched with a short side branch; sporangia spherical, brownish yellow, 30—90 μ , mostly 40—45 μ in diam., sporangial wall smooth, diffuent, leaving a short collar at the base; columellae globose to oval, hyaline, 11—55 $\times$ 11—45 μ , mostly 32 $\times$ 25 μ ; sporangiospores hyaline, variously shaped, oval, elliptical or reniform, 4.4—11 $\times$ 3.3—6.24 μ , mostly 7.7 $\times$ 5.5 μ .

This species has been isolated from soil, pH 8.2, of Allahabad University agricultural farm; the rhizosphere soil of *Lycopersicum esculentum*, *Allium cepa*, *Trigonella foenum graecum*, *Daucus carota*, *Hibiscus esculentus*, and *Brassica oleracea*; and dung of mouse and cow. From India it has been reported by Ajrekar and Rajulu (1931) from dung of zebra and camel, Bombay; Ghatak and Roy (1939)

from soil, Chinsurah Farm (West Bengal); and Saksena and Sarbhoy (1963) from soil, Allahabad.

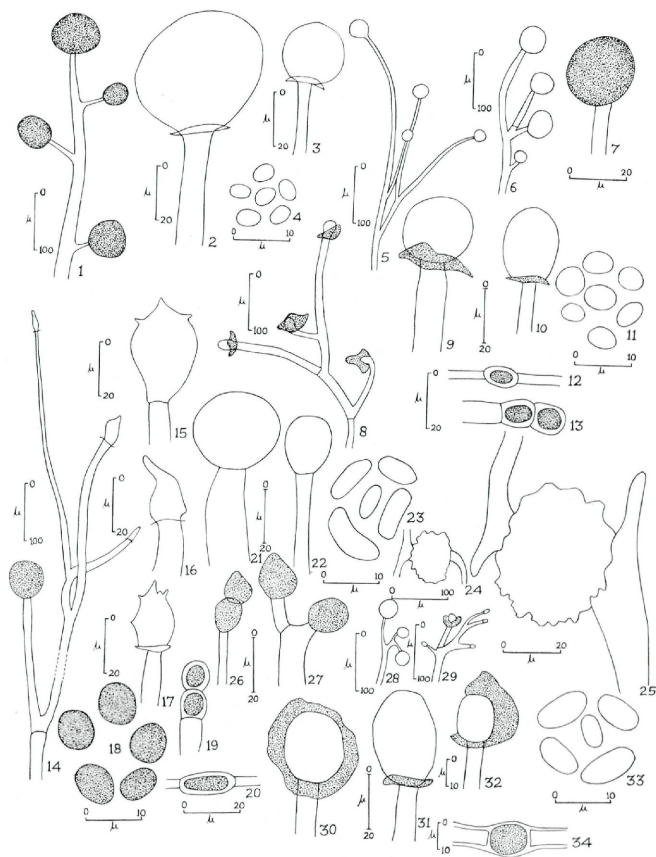
Description based on culture No. MX-89, deposited in BSM Culture Collection, Botany Department, University of Allahabad, and at NRRL, Peoria, Illinois, U.S.A.

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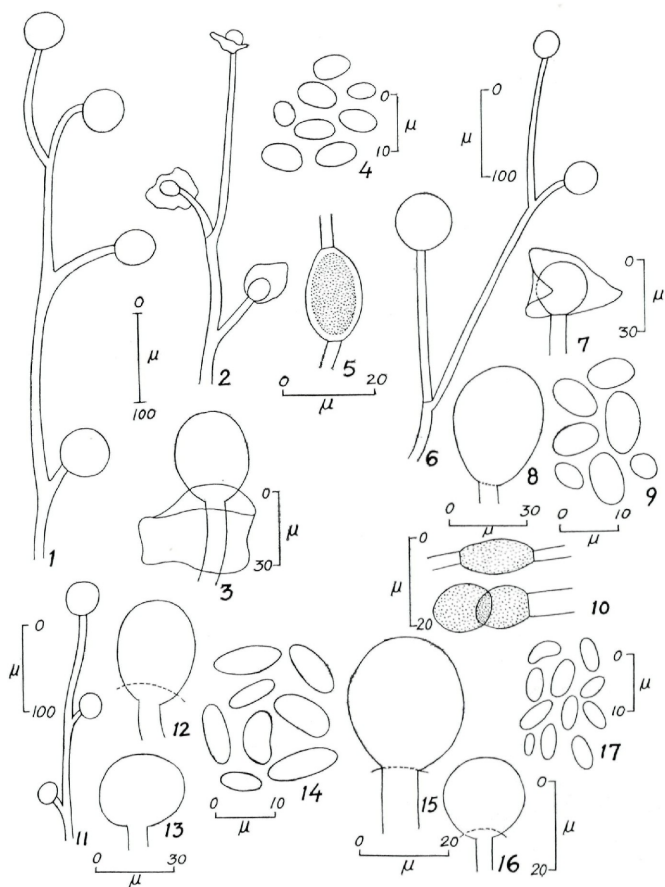


Plate XLI.

Figs. 1—4 *Mucor pusillus* Lindt 1. A portion of a sporangiophore showing the branching pattern. 2—3. Apical parts of two sporangiophores showing columellae. 4. Sporangiospores.

Figs. 5—13 *M. jansseni* Lendner 5—6. Upper portions of two sporangiophores showing the branching pattern. 7. An enlarged sporangium. 8. A portion of a branched sporangiophore with columellae at the tip of each branch. 11. Sporangiospores. 12—13. Chlamydospores.

Figs. 14—20 *M. plumbeus* Bonorden 14. A portion of a sporangiophore showing the branching pattern. 15—17. Three columellae with the spines at their tips. 18. Sporangiospores. 19—20. Intercalary and terminal chlamydospores.

Figs. 21—27 *M. genevensis* Lendner 21, 22. Upper portions of the sporangiophores showing columellae. 23. Sporangiospores. 24. A zygospor. 25. An enlarged zygospor. 26, 27. Chlamydospores.

Figs. 28—34 *M. Javanicus* Wehmer 28, 29. Upper portions of two sporangiophores showing columellae. 30—32. Columellae. 33. Sporangiospores. 34. Chlamydospores.

Plate XLII.

Figs. 1—5 *M. fragilis* Bainier 1. A portion of a sporangiophore showing the branching pattern. 2. A portion of a sporangiophore with the columellae at the tips of branches. 3. Columella. 4. Sporangiospores. 5. Chlamydospore.

Figs. 6—10 *M. lausannensis* Lendner 6. A portion of a sporangiophore showing columellae. 4. Sporangiospores. mydospores.

Figs. 11—14 *M. luteus* Linnemann 11. A portion of a sporangiophore showing the branching pattern. 12—13. Columellae. 14. Sporangiospores.

Figs. 15—17 *M. hiemalis* Wehmer 15—16. Columellae. 17. Sporangio-

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