A TAXONOMIC STUDY OF THE MUCORALES IN TAIWAN I

On section Sphaerosporus¹ of the genus *Mucor*

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It is the purpose of this paper to present a preliminary regional survey of the fungal flora of the Mucorales of Taiwan.

Mucorales is one of the peculiar orders in phycomycetous fungi, because of its non-motile spores (aplanospores) and most members of the order are heterothallic. It is mere the fact that very little has been done in the way of the taxonomic study of the entire order, in Taiwan.

Pioneer works on mycofloristic study in Taiwan was initiated by the late K. Sawada and he published first volume "Descriptive Catalogue of Taiwan Fungi Vol 1" on 1919. He reported eight species of Mucorales in his volumes on 1942. In 1932, Adachi & Hiraibayashi reported one species, *Mucor javanicus* Wehmer which was found from soil of Yangmingshan. As yet, it has never been studied about mucoraceous fungi by any investigator from Taiwan except Sawada, Adachi & Hiraibayashi who had studied before the end of World War II. In spite of Sawada's work covering wide range of fungi, our knowledge of the mycoflora of Mucorales is still fragmentary.

In this paper, the author presents 7 species of *Mucor* which are reported belonging in the Sphaerosporus section. A key to the species of the genus *Mucor* in this section is also provided. It will be a newly found from this island.

Section Sphaerosporus
Seven species were observed.

A KEY TO THE SPECIES OF THE GENUS MUCOR IN THE SPAHEROSPORUS GROUP

1. Sporangiospores finely echinulate or verrucose, columellae with well projections on the upper surface, bluish ................. *M. plumbeus*

1. Sporangiospores smooth, columellae without projections on the upper surface................................................. 2

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2. Sporangiospores usually 4 μ diam, thermophilic. \textit{M. pusillus}
2. Sporangiospores usually larger than 4 μ diam, not thermophilic

3. Sporangiophores repeatedly branched with always a side branch arising immediately below the septum or columella, sporangiospores globose

3. Sporangiophores sometimes branched but not always with a side branch arising immediately below the septum or columella.

4. Sporangiospores less than 8 μ in diam.
4. Sporangiospores more than 8 μ in diam.

5. Colonies and sporangia grayish black, sporangiospores 3-6 μ in diam

5. Colonies and sporangia grayish olive, sporangiospores 5-7 μ in diam.

6. No giant cells in the substrate, columella-globose or ovoid.
6. Giant cells in the substrate, columella-subperipheral or dome-shaped

\textit{Mucor dispersus} Hagem 1910


Turf white, very dense, variable in height 1.5-2.5 cm; mycelium branched in monopodial clusters 4-7 μ diam, usually soon collapsing, with short bent circinate often secondarily branched branches; the primary as well as secondary branches terminating in a sporangium; sporangia on primary sporangiophores small 30-49 μ in diam; columella hemispherical or dome-shaped, 16-18 X 19-22 μ with a small collarette; sporangia of the side branches forming sporangiola, usually monospores, have echinate walls and are borne on sporangiophores of various sizes 15-30 μ without diffuent wall and translucent spore mass, frequently very small with 2-4 spores; sporangiospores 6-9 μ in diam, spherical or slightly elongate sometimes rounded or angular; smooth; chlamydospores and gemmae absent; zygospores not observed.

Habitat: -Isolated from soil.


Notes: -This species was isolated from many localities, and is very easily recognized with its side branches of sporangiophores bearing echinate walls and circinate nature. Present fungus was found to be very abundantly distributed in this island.

F64-9-1, F64-10-1, F66-19-2, F66-98-1 (1 June, 1966 H. Indoh)
M11810, M11811, M11821 (1 April, 1967 C.-Y. Chien).

\textit{Mucor globosus} Fischer 1892


\textit{Mucor heterosporus-sibiricus} Schostakowitsch 1897

\textit{M. Sphaerosporus} Hagem 1908
\textit{M. macrosporus} Pisppek 1929

\textit{M. sphaerosporus} var. \textit{major} Naumov 1954

\textit{M. turfosus} Neophytova 1955

\textit{M. kurssanovii} Milko & Belyakova 1967
Turf at first white, later becoming yellowish brown with age. Up to 20 mm in height; sporangiophores erect, densely branched, long and up to 20-24 μ in diam; sporangia globose, 90-mostly (100 X 100) - 125 μ in diam, sometimes up to 180 μ in diam. Sporangial wall diffusent, first pale gray, later yellowish brown with age; columellae free, brownish, oval to oblong or pyriform, 55-90X100-75 μ long; sporangiospores globose, 4.2-7.7 μ in diam, yellowish in mass; mycelial gemmae with oil drops, frequent; zygospores not observed.

Habitat: -isolated from soil.
Specimen: Taipei Pref., Yangmingshan M11891
Notes: - Only one strain was isolated. This fungus showed the characteristics of diffusent wall and sporangia more than 100 μ in diam are easily distinguished from other species of Sphaerosporus group.

*Mucor jansensis* Lendner 1908

Colonies on PDA and SMA at 25°C short velvety, becoming gray to dark gray or brownish black at maturity and with white margin; sporangiophores 2.5-6 mm in height, branched mostly in corymbs or in sympodia terminating in sporangia; sporangia 38-mostly (50 X 50) - 60 μ in diam. Globose, deep bluish black with finely granular wall; sporangial wall persistent but fragile; columellae round with a wide flattened base, subacute, sometimes elongate and conic, tinted deep blue or gray. 18-24 μ in diam, sporangiospores round to short oval, usually 5.2 μ rarely 3-4.2 μ in diam; chlamydospores and gemmae not found; zygospores not observed.

Habitat: -isolated from soil.
Specimen: -Taipei Pref., Yangmingshan, M11872, T12068 (30 Mar., & 1 April, 1967 C.Y. Chien).
Notes: - This species was isolated twice from this island. There is no any different could be seen from the SMA medium, and a test for zygospores the writer did not find it.

*Mucor lamprosporus* Lendner 1908


*Mucor bedranchi* Schmidt 1925

Colonies on PDA and SMA about 3 cm in height at 25°C forming a dense thick felt, pale gray; sporangiophores branched in groups or in sympodia, branches alternate, recurved or circinate bearing minute sporangia; sporangia of two types, globose, mostly 50-60 μ (max. 90 μ), and wall diffusent, circinate or recurved, small, 30-40 μ in diam, with few spores, caducous; columellae spherical to ovoid, 20-26 X 28 μ in diam; sporangiospores globose, colorless, hyaline, mostly 10 or 7-12 μ in diam; gemmae and zygospores not observed.

Habitat: -isolated from soil.
Specimen: Taipei; Yangmingshan F64-23-1 (1 Oct., 1964 H. Indoh).
Notes: - This species is closely related to *Mucor dispersus* but differs from it in the formation of giant cells in the substrate. The giant cells of *Mucor dispersus* are abundant and those *Mucor lamprosporus* are absent.
Mucor petrinsularis Naumov 1915
Mucor petrinsularis Naumov var. ovalisporus Smith 1957
Turf about 20 mm high, at first white later bright gray or brown; sporangiophores erect, stout, glassy hyaline, sympodially branched with a side branch arising immediately below the columella; sporangia brown up to 100 μ in diam; sporangial wall tears irregularly at maturity so that the spores lie as if spread on a dish; columellae pear-shaped, often b rawnished, 50 μ high; sporangiospores globose with very few short oval one 5.2-9 μ in diam, seldom oval and then more than 10 μ in diam; chlamydospores, gemmæ and zygospores not observed.
Habitat: Isolated from soil and dung.
Taipei Pref.: Kuangsinshan Taipei Zoological Garden.
Notes: This species is easily recognized from its erect, branched sympodially with a side branch arising immediately below the septum. It seems very common in this island.
Mucor plumbeus Bonorden 1864
Mucor spinosus Van Tieghem 1876, Ann. Sc. nat. 6 ser. 4, 390.
M. spinescens Lendner 1908, Mucor. Suisse, S. 89.
Turf mouse gray, about lcm deep; sporangiophores erect, lcm or more long, branched in groups or in sympodia, all the branches terminated by sporangia; sporangia 100-260 μ in diam, deep brown or black; sporangial wall smooth, colorless, diffuent, incrusted, leaving basal collarette; columellae free, oval or pear-shaped, furnished at their summit with a variable number of spines, irregular, often swollen at the tip, pale brown in colored, 22-55 X 16-80 μ wide; sporangiospores globose, equal, 5.2-8 μ, exceptionally 9-12 μ, gray blue with a dotted wall; chlamydospores formed either on the mycelium or the sporangiophores as in Mucor racemosus; gemmæ present as yeasts; zygospores not observed.
Habitat: Isolated from soil.
Specimen: - Taipei: T12078
Notes: It is known that none of this strain from various parts of the world produced zygospores.
Mucor pusillus Lindt 1886
Mucor muridera Sacc. & Sinig 1913
M. buntingii Lender 1930
M. hagemii Naumov 1935
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I on section Sphaerosporus of the genus Mucor

Colonies on PDA and SMA at 37°C about 2 mm in height, at first white with unbranched sporangiophores; sporangiophores slightly smoky, later brown, with strongly branched 5.2-18 μ in diam, always a septum below the sporangium; sporangia 50-80 μ in diam, bright grey later brown with more or less quickly diffusent margin; columellae oval or pear shaped bluish brown; large up to 30-45 μ often with a collarette; sporangiospores globose to subglobose, occasionally oval, 2.8-3.8 μ often mixed with crystalline pieces of the sporangial wall; zygosporoepes not observed.

Habitat: Isolated from soil.


Notes: This species was reported recently by Sardhoy for homothallic, thermophilic and pathogenic either on plants or animals. In this investigation, the writer did not see any zygosporoep formation on either PDA or SMA media.
Fig. 1-4. *Mucor dispersus*. 1. Mature sporangium. 2. Extreme of columella shape. 3. Circinately borne sporangiophore with two echinulate sporangioles, each sporangiole containing one sporangial spore. 4. Columella with spherical sporangiospores. All X 350.

Fig. 5-8. *Mucor globosus*. 5. Mature sporangium. 6. Columella. 7 & 8. Sporangiospores. All X 350.

Fig. 18-20. *Mucor petrinsularis*. 18. Sporangio-phere showing a side branch arising immediately below the septum, and the sporangial wall tears irregularly. X 350. 19. Sporangiospores and sporangial walls with needle-shaped crystals of calcium oxalate. X 900. 20. Columella with basal collarette and sporangiospores. X 350.

中文摘要

臺灣毛黴菌目的分類學上之研究 I

關於毛黴菌屬圓型孢子毛黴菌亞屬

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本文之目的是記錄臺灣毛黴菌目的霉類誌所作之初步調查。在本文中，著者僅記錄毛黴菌中關於圓型孢子毛黴菌亞屬的7種特徵。這7種圓型孢子毛黴菌亞屬的檢索表亦被列出，其將成爲臺灣霉類誌上新的記載。