PALAEOPHTHORA MOHGAONENSIS SINGHAI—A FOSSIL FUNGUS FROM THE DECCAN INTERTRAPPEAN BEDS OF MOHGAONKALAN, CHHINDWARA DISTRICT, M.P., INDIA

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ABSTRACT

The petrified fungus *Palaeophthora mohgaonensis* Singhai (1975) from the Deccan Intertrappean beds of Mohgaonkalan, Chhindwara District, Madhya Pradesh has been described here in detail. The fungus is intracellular and possesses both vegetative and reproductive parts *in situ*. Mycelium non-septate, branched and coenocytic. Antheridia narrow, tube-like and bent at the tip. Oogonium nearly spherical and possesses a single oosphere. Comparisons have been made both with the living and fossil forms.

INTRODUCTION

PETRIFIED fossil fungi which have been reported from the Deccan Intertrappean beds of India are not many. Sahni (1940) and Sahni and Rao (1943) reported fungal remains belonging to Perisporiaceae and Sordariaceae from the Deccan Intertrappean beds of Sausar. Chitaley (1950) described 4-celled fungal spores comparable to *Chaetosphaerites*. Dwivedi (1959) briefly described *Shuklania*—the bicelled teleutospores referable to Basidiomycetes. Lakhanpal *et al.* (1967) reported a lagenidalean fungus and Mahabale (1968) described *Diplodia rodei* belonging to Fungi Imperfecti from the Deccan Intertrappean beds of Mohgaonkalan. Trivedi and Verma (1973) have described *Stagonospora intertrappea* belonging to Fungi Imperfecti from Mohgaonkalan. Singhai (1972) described *Deccanosporium eocenum* belonging to Fungi Imperfecti and Singhai (1972, 1973-74) also described petrified fossil Fungi Imperfecti, viz., *Palaeophoma intertrappea*, *Mohgaonidium deccanii*, *Diplodia sahnii* and *Deccanodia eocenum* from Mohgaonkalan in the Deccan Intertrappean beds of India. From these beds Biradar and Mahabale (1974) described an imperfect fungus *Tetracoccosporium eocenum* and the author published a brief note of another fungus *Palaeophthora mohgaonensis* (Singhai, 1975) belonging to the family Pythiaceae. Chitaley and Yawale (1976) reported fungal remains belonging to the order Ustilaginales from the Deccan Intertrappean beds of Mohgaonkalan.

The petrified fossil fungus described here was discovered in a black chert piece from the Intertrappean beds of Mohgaonkalan. The fungus *Palaeophthora mohgaonensis* (Singhai, 1975) is described here in detail and possesses both the vegetative and the reproductive parts *in situ*.

DESCRIPTION

Class — PHYCOMYCETES
Order — PERONOSPORALES
Family — PYTHIACEAE

Genus — *Palaeophthora* Singhai, 1975

Palaeophthora mohgaonensis Singhai, 1975

Pl. 1, figs. 1-5

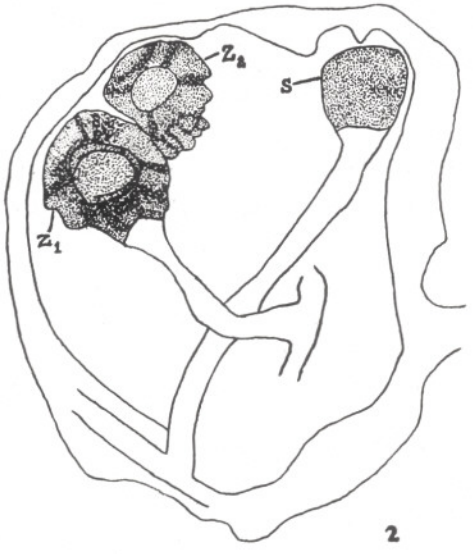
The fungus was observed, while examining chert peels, as an intracellular mycelium in parts of plant tissues. A brief note of this fungus has been published by the author in 1975. Here a full account of the type has been given.

Vegetative Structure — The mycelium branched, non-septate, probably coenocytic, branch tips bearing either sporangia or sexual organs (Pl. 1, figs. 1-3). Hyphal width ranging from 2·5 to 5 μ.

Sporangia — The sporangia mostly detached from the mycelium lying amongst its meshes (Pl. 1, fig. 4), usually dark coloured, spherical or elongate, measuring on an average 12 to 25 μ in length and 5 to 10 μ in width; completely filled with spores (Pl. 1, fig. 4); columella not present. The spores

rounded, smooth-walled, 2-3 μ in diameter. Round sporangia occasionally seen in organic connection with the hyphae attached at their tips (Pl. 1, figs. 2, 5; Text-figs. 1, 2); 7·6 μ in diameter. In one case, however (Pl. 1, fig. 5), the internal cavity of the sporangium is comparatively more distinct but this also does not indicate any columella or spores.

Sex Organs — Sex organs heterogamous, represented by antheridia and oogonia (Text-fig. 1).



TEXT-FIG. 1 — *Palaeophthora mohgaonensis* Singhai (1975), showing branched and non-septate mycelium. A spherical oogonium (**o**) with attached narrow and bent antheridia (**a**) and sporangium (**s**) at the tip of the hypha. × 855.

TEXT-FIG. 2 — *P. mohgaonensis*, showing spherical sporangium (**s**) at the tip of the mycelium. Two spherical oospores (**Z_1 & Z_2**) embedded within the cells of the plant tissue × 1045.

Antheridium — The antheridium measuring 14 × 5 μ, stalked, elongated, narrow tubular, bent at the tip and separated from the vegetative portion by a septum (Text-fig. 1).

Oogonium — The oogonium measuring 0·012 × 0·011 mm, stalked, rounded, separated from the vegetative hyphae by a septum (Text-fig. 1); an oogonial wall showing two sac-like bodies (Text-fig. 1). Each oogonium probably with a single oosphere filling up its cavity (Text-fig. 1).

At one place an antheridium was seen adhering laterally to the oogonium wall (Text-fig. 1).

Oospore (*Zygospore*) — A number of rounded bodies, seen lying isolated or attached to the mycelium and having a rough and thicker wall than the oogonia, must obviously be the oospores (zygospores) (Pl. 1, figs. 2, 3; Text-fig. 2) and measure about 11 μ in diameter.

AFFINITIES

The present fungus being characterized by the distinguishing features — branched, non-septate hyphae, sporangia at the tip of the hyphae and sexual reproduction by distinct oogonia and antheridia (i.e. heterogamous) is referable to the Phycomycetes.

The sporangia at the tip of the mycelium and the zygospores suggest reference to the order Mucorales. But the presence of distinct oogonium with single ovum, a narrow tube-like antheridium, the sporangia and thickened oospore (zygospore) and the intracellular mycelium clearly show the characters of the order Peronosporales. These characters are also seen in the order Saprolegniales. But in the order Saprolegniales, the oogonium contains one to many ovum whereas in Peronosporales there is generally only one ovum within the oogonium. Thus, the present fungus is referred to the order Peronosporales and further placed under the family Pythiaceae of Bessey (1965) as this fungus has asexual reproduction by sporangia containing spores and not by conidia.

The present fungus resembles asexual stages and sexual organs of the living genera *Pythium* and *Phytophthora*. But it can be easily differentiated from *Pythium* in the absence of vesicle which is a characteristic feature of *Pythium*. In *Phytophthora* generally the papillate sporangia are present on the tips of branches of the sporangiophores —

a feature not found in this fossil fungus under consideration. Thus, the present fungus distinctly differs from the living genera *Pythium* and *Phytophthora* (Alexopoulos, 1964). The present fungus differs from *Prophythium carbonarium* (Elias, 1965) from Upper Carboniferous in the presence of branched hyphae, distinct tube-like antheridia and rounded oogonia with single ovum and also that the sexual organs are separated by septa from the vegetative hyphae.

The present fossil fungus also differs from *Peronosporites antiquarius* W. Smith (1877) (refer Seward, 1898) from Carboniferous period in the presence of rounded oogonium possessing only one ovum and tube-like antheridia.

The present specimen, therefore, retains its individuality on the ground of its intracellular, branched and non-septate mycelium; distinct oogonia and antheridia; oospore having rough and thickened outer wall and sac-like bodies on the wall of the oogonium.

GENERIC DIAGNOSIS

Palaeophthora Singhai, 1975

Mycelium intracellular, branched, non-septate, sporangia either isolate or in organic connection at the tip of the mycelium, rounded or elongated, columella not present; sexual reproduction heterogamous represented by rounded oogonia and narrow tube-like antheridia; oogonium having sac-like bodies on its wall; oospore (zygospore) with its thick and rough outer wall.

Genotype — *Palaeophthora mohgaonensis*, Singhai, 1975.

SPECIFIC DIAGNOSIS

Palaeophthora mohgaonensis Singhai, 1975

Mycelium intracellular, 2·5 to 5 μ broad, non-septate, branched; detached sporangia 12 to 25 μ long and 5 to 10 μ broad, sporangia in organic connection at the tip of the mycelium 7·6 μ in diameter, columella absent, spores present only in detached sporangia; narrow elongated antheridia 14 × 5 μ; oogonium spherical 0·012 × 0·011 mm; oospore (zygospore) rounded with its outer rough and thick wall, 11 μ in diameter.

Locality — Mohgaonkalan, Chhindwara District, Madhya Pradesh.

Holotype — Represented by three slides in author's collection nos. 41, 64 and 80.

Horizon — Deccan Intertrappean Series.

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EXPLANATION OF PLATE

PLATE 1

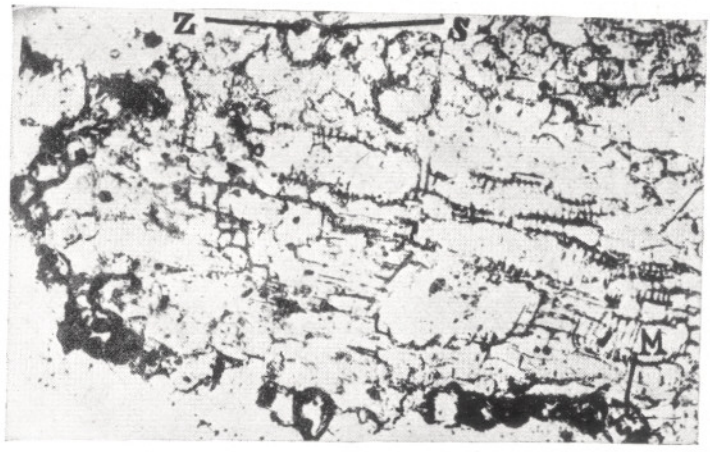
1. *Palaeophthora mohgaonensis* Singhai (1975). Plant tissue with its scalariform thickening showing intracellular fungus in the form of mycelium (M); reproductive organs: sporangia (S) and oospores (Z). × 120.

2. *P. mohgaonensis* Singhai. A spherical sporangium(s) in organic connection with mycelium and two spherical oospores (Z_1 & Z_2) embedded within the cells of the plant tissue. × 1610.

3. *P. mohgaonensis* Singhai. Two oospores with outer thick wall. × 2908.

4. *P. mohgaonensis* Singhai. Elongated sporangium profusely full of spores. × 640.

5. *P. mohgaonensis* — An empty sporangium (S) at the tip of the mycelium. × 570.



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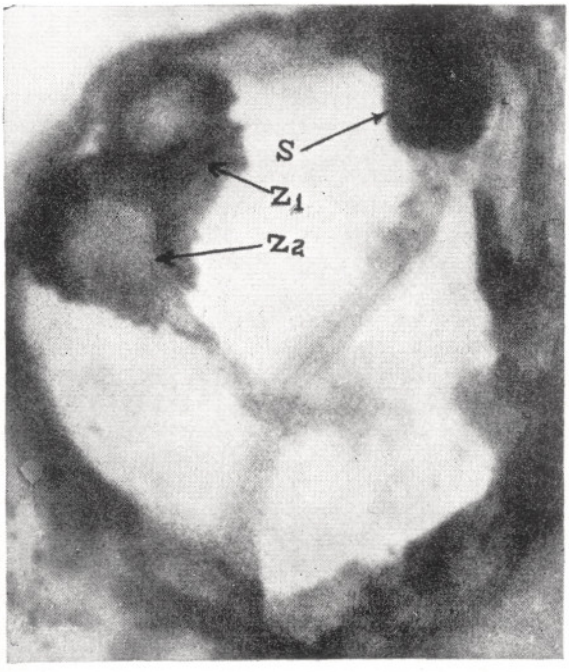

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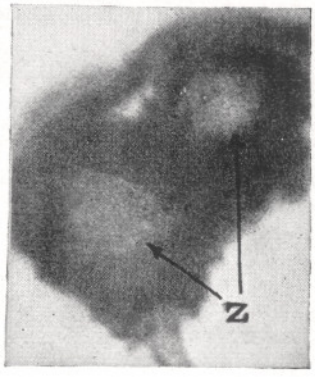

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PLATE 1