

PYTHIUM ULTIMUM VAR. ULTIMUM, A NEW RECORD FROM PAKISTAN

A. MUBEEN LODHI, A. QAYOOM, S. SHAHZAD AND A. GHAFFAR

*Pest & Disease Research Lab., Department of Botany,
University of Karachi, Karachi-75270, Pakistan.*

Abstract

A *Pythium* species without sporangia and zoospores, having terminal as well as intercalary oogonia with a few papilla, monoclinous but occasionally diclinous antheridia and aplerotic oospores was isolated from the rhizosphere of date palm. This species is identified as *P. ultimum* var. *ultimum* Trow and appears to be a new record from Pakistan.

Introduction

Pythium is a complex genus containing over 120 species that grow in a variety of terrestrial and aquatic habitats (Plaats-Niterink, 1981; Dick, 1990). *Pythium* species such as *P. aphanidermatum*, *P. debaryanum*, *P. myriotylum* and *P. ultimum* cause damping-off, root rot, seedling blight and stem rot of many plants (Kucharek & Mitchell, 2000). *Pythium ultimum* var. *ultimum* was first isolated and described by Trow (1901), who considered it non-parasitic. Lehman & Wolf (1926) identified it as a soybean parasite. *P. ultimum* var. *ultimum* is one of the most common soil borne species that has a worldwide distribution and causes diseases on a number of plants (Plaats-Niterink, 1981; Hancock, 1977; Johnson, 1971). During the present studies on Oomycetous fungi of Sindh, a *Pythium* species isolated from the rhizosphere of date palm growing in Khaipur, Sindh closely resembled *P. ultimum* var. *ultimum* with few exceptions. The culture has been deposited at the Karachi University Culture Collection (KUCC) as KUCC-OOP-03019. It appears to be the first report of *P. ultimum* var. *ultimum* from Pakistan (Sultan *et al.*, 1997; Abdul-Haq & Shahzad, 1998). The species is described and illustrated herein.

Materials and Methods

Soil samples were collected at random from a depth of 0-5 inches of soil from the date palm field and mixed to obtain a composite sample. Isolation was done by baiting technique (Harvey, 1925). Soil sample kept in a polyethylene bag was moistened by the addition of sterile water and mixed thoroughly to get a paste like consistency. With the help of a sterilized teaspoon, the soil was placed at one side in each of the three sterilized Petri plates and 10-15 ml sterilized water was added. Two grass blades (3 cm long) were placed in each Petri plate, one near the soil and the other away from the soil. The Petri plates were incubated at room temperature. After 5-8 days faint halo of fungal threads were observed on the baits. The baits were rinsed in sterilized water to remove soil particles, and placed into fresh sterilized Petri plates half-filled with sterile water and fresh baits were added. After 2 days of incubation, the baits colonized by Oomycetous fungi were transferred on the corn-meal agar (CMA) medium amended with 100 ppm PCNB for purification.

Radial growth and colony characteristics were observed on potato dextrose agar (PDA), corn-meal agar (CMA), potato-carrot agar (PCA) (Plaats-Niterink, 1981) and corn-meal dextrose agar (CMDA) (Lodhi *et al.*, 2004) at 25°C. Water culture of fungi was prepared by adding an inoculum disc and grass blades to sterile water in a Petri plate and incubating at 25°C. Cold shocks for zoospore releases were given by incubating the culture in a refrigerator for a few hours and then incubating at room temperature. The fungus was identified after reference to Sparrow (1960), Plaats-Niterink (1981) and Dick (1990). Biometric values viz., aplerotic index, ooplast index and wall index were determined after Shahzad *et al.*, (1990).

Morphological characters (Fig. 1)

Main hyphae up to 7 μ m wide. Sporangia and zoospores not observed. Hyphal swellings of varying size. Oogonia smooth with occasionally a few papilla, globose intercalary as well as terminal (17-)20-24(-26) (av. 22) μ m in diameter. Antheridia 1-2 per oogonium, crook necked, closely monoclinous, occasionally diclinous, mostly emerging very close to the oogonial stalk. Oospore single, globose aplerotic, (15-)19-22(-24.5) (av. 19.9) μ m in diameter. Ooplast 6-10(av. 8.9) μ m in diam. Oospore wall thin, 1 μ m in thickness.

Biometric values: Aplerotic index 72.9%, Ooplast index 13% and Wall index 27.4%.

Colony characteristics: The *P. ultimum* var. *ultimum* produces cottony aerial mycelial growth on CMA and PDA, radiate pattern on PCA and thick cottony and superficial growth on CMDA. Daily growth rate at 25 °C on PDA 3.3 cm, PCA 3.7 cm, CMA 4 cm and CMDA 4.7 cm.

Discussion

In the group of homothallic species of *Pythium* producing smooth walled oogonia and no sporangia and zoospores, there are two species viz., *P. ultimum* var. *ultimum* and *P. violae*. *P. violae* differs from our isolate by having larger oogonia and oospore, more number of antheridia per oogonium and branched antheridial stalk.

Plaats-Niterink (1981) also mentioned that *P. ultimum* var. *ultimum* rarely produces zoospores at 5 °C. Under this condition, within a group of *Pythium* species producing smooth, globose, non proliferating sporangia, our isolate is more close to *P. ultimum* var. *sporangiiferum*, *P. okanoganense*, *P. macrosporum* and *P. irregulare*. Our isolate of *P. ultimum* var. *ultimum* closely resembles *P. ultimum* var. *sporangiiferum* but differs in regular production of sporangia and zoospores, by these species at room temperature. *P. okanoganense* differs from our isolate by producing proliferating sporangia, monoclinous antheridia originating at a distance below the oogonia, swollen antheridial stalk and large, almost plerotic oospores. *P. macrosporum* differs from our isolate by having only crook necked diclinous antheridium and larger Oospores. *P. irregulare* is characterized by its irregular, occasionally ornamented oogonia and sessile antheridia.

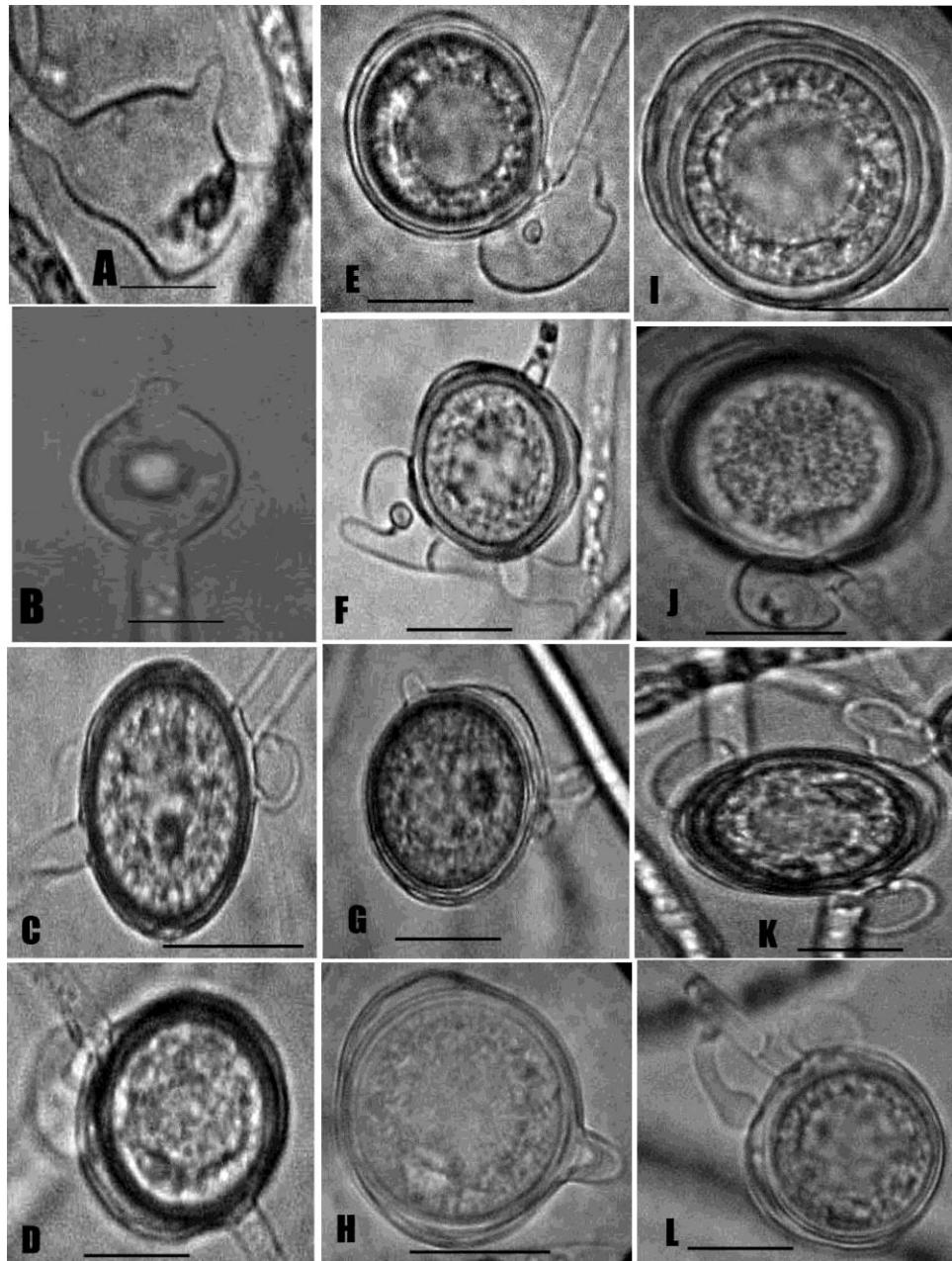


Fig.1. Sexual and asexual structures of *P. ultimum* var. *ultimum*. A & B, hyphal swellings; C-E, intercalary and terminal oogonia with closely monoclinous antheridia; F-H, Oogonia with papille; I-J, aplerotic Oospore; K-L, closely monoclinous antheridia. Scale bar = 10 μ m

P. ultimum var. *ultimum* has also been viewed as a synonym of *P. debaryanum* (Drechsler 1927; Plaats-Niterink, 1981). Both species have androgynous antheridial branches, but in *P. debaryanum* these branches are long and originate at some distance from the oogonial cell. However, in our isolate mostly monoclinous antheridium originate from immediately below the oogonium. *P. debaryanum* is considered to be a valid taxon by Dick (1990).

Acknowledgements

This work was carried out under the Indigenous Ph.D. Programme sponsored by the Higher Education Commission, Pakistan which is gratefully acknowledged.

References

Abdul-Haq, M. and S. Shahzad. 1998. Oomycetes from soil of Bajour Agency, FATA, Pakistan. *Pak. J. Bot.*, 30: 305-306.

Dick, M.W. 1990. *Keys to Pythium*. Department of Botany, School of Plant Sciences, University of Reading, Reading, U.K. 64 pp.

Drechsler, C. 1927. *Pythium ultimum* and *Pythium debaryanum*. *Phytopathology*, 17: 54-55.

Hancock, J.G. 1977. Factors affecting soil populations of *Pythium ultimum* in the San Joaquin Valley of California. *Hilgardia*, 45: 107-122.

Harvey, J.V. 1925. A study of the water molds and pythiums occurring in the soil of Chapel Hill. *J. Elisha Mitchell Scient. Soc.*, 41: 151-164.

Johnson, T.W.Jr. 1971. Aquatic fungi of Iceland: *Pythium*. *Mycologia*, 63: 517-536.

Kucharek, T. and D. Mitchell. 2000. Diseases of agronomic and vegetable crops caused by *Pythium*. *Plant Pathology Fact Sheet, University of Florida*, <http://128.227.207.24/takepub/FactSheet/pp53.pdf>. 53pp.

Lehman, S.G. and F.A. Wolf. 1926. *Pythium* root rot of soybean. *J. Agric. Res.*, 33: 375-380.

Lodhi, A.M., S. Shahzad and A. Ghaffar. 2004. Re-description of *Pythium adhaerens* Sparrow. *Pak. J. Bot.*, 36(2): 453-456.

Plaats-Niterink, A.J. Vander. 1981. *Monograph on the genus Pythium. Studies in Mycology No.21*. Centraalbureau voor Schimmelcultures, Baarn. 242 pp.

Shahzad, S., R. Coe and M.W. Dick. 1990. Biometry of oospores and oogonia of *Pythium* (Oomycetes): the independent taxonomic value of calculated ratios. *Bot. J. Linn. Soc.*, 108: 143-165

Sparrow, F.K. 1960. *Aquatic Phycomycetes*. 2nd ed. Ann Arbor, The University of Michigan Press. 1187 pp.

Sultan, A., S.H. Iqbal and A.N. Khalid. 1997. *Fungi of Pakistan*. Sultan Ahmed Mycological Society of Pakistan, Deptt. of Botany, Uni. of Punjab, Lahore 54590, Pakistan. 248 pp.

Trow, A. H. 1901. Observations on the biology and cytology of *Pythium ultimum* n. sp. *Ann. Bot.*, 15: 269-313.

(Received for publication 10 January 2005)