Phytophthium sindhum
**Phytophthora** Abad, de Cock, Bala, Robideau, Lodhi & Lévesque, *gen. nov.*


*Etymology.* Phylogenetically between *Pythium* and *Phytophthora*.

Sporangia globose to ovoid, often with papilla and often proliferating internally (*Phytophthora*-like). Zoosporangium discharge is *Pythium*-like: the sporangium forms a discharge tube through which the contents moves out and forms a vesicle at the tip with an undifferentiated mass of protoplasm which then differentiates into biflagellate zoospores. Most species have large, smooth oogonia, thick-walled oospores, and 1–2 elongate or lobate antheridia, laterally applied to the oogonium. *Phytophthora* comprises the *Pythium* species from clade K in Lévesque & de Cock, and is morphologically and phylogenetically between *Pythium* and *Phytophthora*.

**Type species.** *Phytophthora sindhun.* MycoBank MB517068.

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**Phytophthora sindhun** Lodhi, Shahzad & Lévesque, *sp. nov.*

Sporangia globosa, terminalia, unilateraler intercalariae vel intercalaria, proliferentia, 15 × 20–35 × 40 µm, saepe cum papilla. Tubi emittentes brevisim, 5 × 8 µm diam. Zoosporae incystatae 10 µm diam. Oogonia globosa, laevia, terminalia et unilateraler intercalaria intercalaria, 30–39 (av. 34.5) µm diam. Oogonia plerunque monospora (99 %) raro bispora. Oospore wall very thick, ranging from 4–5 (av. 4.5) µm diam. Indice aplerotico 91 %, indice parietis 59 %.

*Etymology.* Name refers to the province Sindh from where this species was frequently isolated.

*Sporangia* globoso, terminalis, occasionally unilateralis intercalaria vel intercalaria, proliferans et of variable size, ranging from 15 × 20–35 × 40 µm; under stress conditions they germinate directly via several germ tubes; a papilla is frequently associated with the sporangia; abundant zoosporangium discharge occurred at room temperature after washing, followed by half an hour cold shock; discharge tubes are very short, 5 × 8 µm; zoospores after encystment up to 10 µm diam. Oogonia globosa, smooth, laterally on a short stalk, occasionally terminal and unilaterally intercalaria; 30–39 (av. 34.5) µm diam; oogonia are mostly monosporous (> 99 %) but occasionally bisporous. *Antheridia* diclinus as well as mononoclinus, elongate, more or less lengthwise applied but crook necked, making narrow apical contact with the oogonium. *Oospores* are smooth, mostly perlotic or nearly plerotic, occasionally aplerotic, 30–38 (av. 34) µm. Oospore wall very thick, ranging from 4–5 (av. 4.5) µm.

*Culture characteristics — Phytophthora sindhun* produces thick, white, cottony growth on potato-dextrose agar (PDA), on potato-carrot agar (PCA) white aerial mycelium, on cornmeal agar (CMA) submerged mycelium and on cornmeal-dextrose agar (CMDA) a light rosette pattern. Colony diameter after one day at 25 °C on PDA 28.5 mm, PCA 28 mm, CMA 28.5 and CMDA 37.5 mm. The optimum growth temperature was 35 °C but it could not grow at 40 °C.

*Holotypus. Pakistan,* Sindh, District Sanghar, Shahpur Chakar, 25°55’ N, 68°58’ E, banana rhizosphere, 20 Nov. 2005, M. Lodhi, CBS 124518 (cryo-preserved). Ex-type culture also deposited as DAO 238986 in the CFCF. GenBank HM244825 (ITS & LSU) and HM244822 (Cox1), MycoBank MB517069. Additional strains are listed in Table 1 (see MycoBank).

*Colour illustrations.* Collection site in Pakistan, banana field; Proliferating sporangium in water culture, swimming zoospores in a vesicle; Sporangium with 2 papilla; Oospora with monoclinous antheridium. Scale bars = 10 µm.

Maximum likelihood analysis using GTR model with PhyML² of the LSU (D1-D3, alignment length 1 384 bp) with close to 100 *Phytophthora* species, 150 *Pythium* species and *Phytophthora sindhun* showed a strong bootstrap support (1 000 replicates) for *Phytophthora* *sindhun* sp. nov. and for the *Pythium* clade structure proposed by Lévesque & de Cock (for more detailed tree see MycoBank MB17089).


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**Phytophthora Clades A – J**

Maximum likelihood analysis using GTR model with PhyML² of the LSU (D1-D3, alignment length 1 384 bp) with close to 100 *Phytophthora* species, 150 *Pythium* species and *Phytophthora sindhun* showed a strong bootstrap support (1 000 replicates) for *Phytophthora* *sindhun* sp. nov. and for the *Pythium* clade structure proposed by Lévesque & de Cock (for more detailed tree see MycoBank MB17089).


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