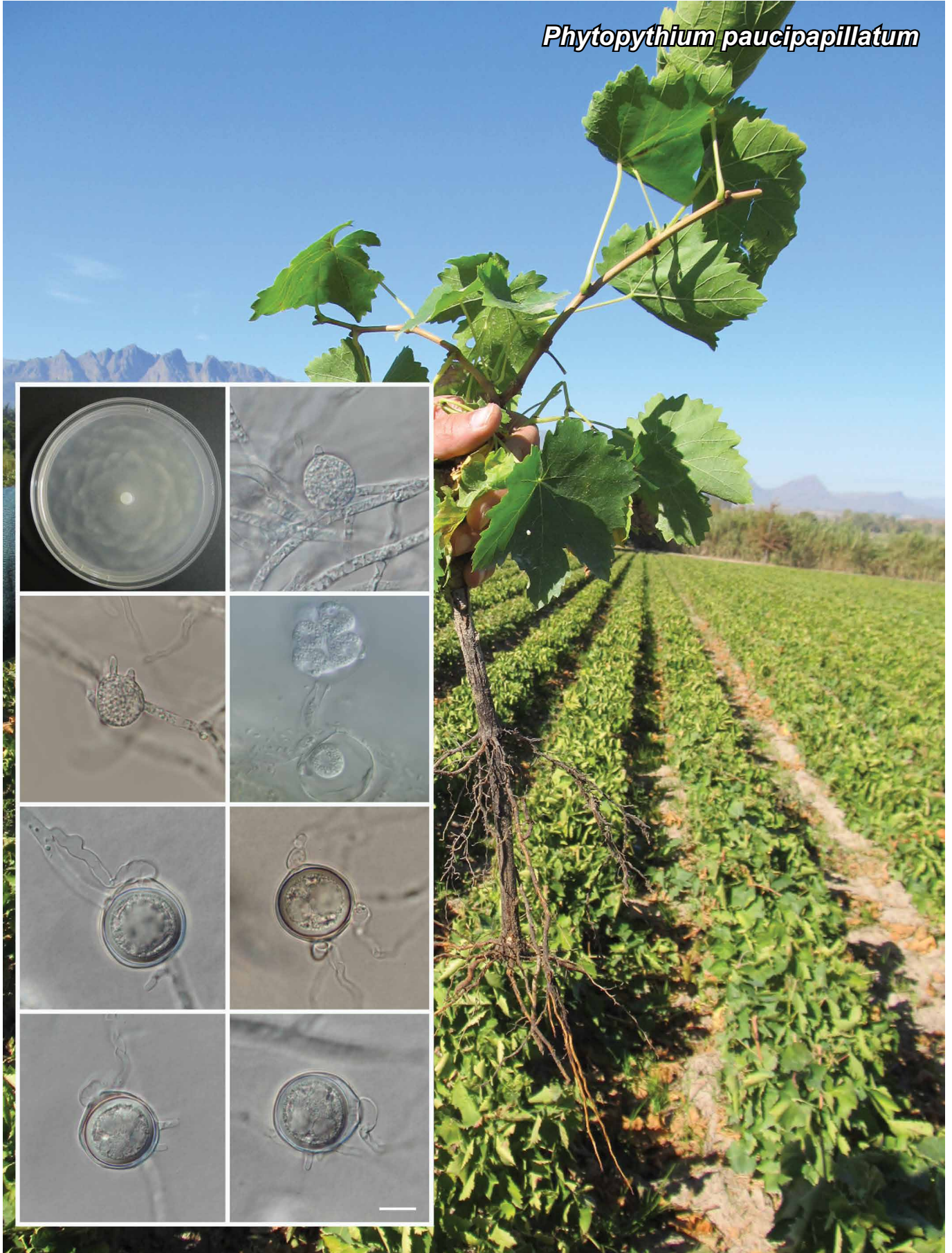


Phytophthium paucipapillatum



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***Phytophythium paucipapillatum* S.D. Langenhoven, W.J. Botha & L. Mostert, sp. nov.**

Etymology. The specific epithet refers to the sparsely papillated sporangia and oogonia.

Classification — *Pythiaceae*, *Pythiales*, *Oomycetes*.

Hyphae up to 5 µm thick, lacking hyphal swellings. *Sporangia* apical, unilaterally intercalary or perpendicular on sporangiophore, some sporangia clustered in groups of 3–5 at apex of sporangiophore, connected by short hyphal segments. *Sporangia* globose, subglobose, ovoid, obovoid, limoniform to ellipsoid or distorted shapes, 15–34 µm diam, most 19–25 µm diam. *Sporangia* mostly apapillate germinating directly, some papillate, internally proliferating with extended proliferation. *Papilla* apical or subapical, close to sporangiophore, 4–5 µm. *Zoospores* biflagellate, differentiated extrasporangially in an ephemeral vesicle, released through discharge tubes 3.7–5 µm wide, 7.5–11 µm long. *Zoospore cysts* spherical, 9–11 µm diam. *Oogonia*, small globose terminal, intercalary, some unilaterally intercalary, (18–)20–23(–26) (av. 22) µm diam, some oogonia ornamented with one to three short, blunt papillae. *Antheridia* up to three per oogonium, mostly monoclinal, or occasionally declinal at a distance. *Antheridia* applied lengthwise to oogonium wall with a central fertilisation tube, antheridial cell 4–5 × 11–20 µm with an undulating contour and one to several constrictions; some antheridia applied broadly apical to oogonium. *Oospores* plerotic or nearly so, (14–)18–20(–23) (av. 20) µm diam, wall thickness 0.9–1.9 µm. Occasionally two oospores per oogonium. Ooplast 7–13 µm diam. Aplerotic index 76.9 %, ooplast index 54.4 %, oospore wall index 45.2 %.

Cultural characteristics — Colony growth pattern on potato dextrose agar (PDA) and potato carrot agar (PCA) rosaceous, corn meal agar (CMA) slight aerial mycelium with coarsely radiate pattern and numerous micro tufts of aerial mycelium. Grows on PARP and PARPH selective media. Cardinal temperatures: min 10 °C, opt 25 °C, max 30 °C on PCA. Average growth rate at the optimum temperature was 8.55 mm/d for the STE-U isolates and 7.44 mm/d for MAFF 241149 on PCA. Growth study on CMA, min 10 °C, max 30 °C or between 30 °C and 35 °C for STE-U isolates and the MAFF isolate, respectively. The optimum growth temperature was 25 °C for STE-U 7843, 7844, 7847 and MAFF 241149. The optimum temperature for STE-U 7845, 7846 and 7848 was 30 °C. The average growth rate for the STE-U isolates with optimum growth temperatures at 25 °C and 30 °C were 9.77 mm/d and 10.63 mm/d, respectively. The average growth rate for the MAFF isolate was 8.79 mm/d.

Colour illustrations. Grapevine nursery, Wellington, South Africa. Colony growth on corn meal agar; sub-globose papillate sporangium; young, terminal multipapillate sporangium; zoospore discharge into a vesicle with a zoospore remaining in the sporangium; intercalary oogonium with monoclinal antheridium; oogonium with three antheridia attached; oogonia with papillation on its surface. Scale bar = 10 µm.

Typus. SOUTH AFRICA, Western Cape Province, Wellington, *Vitis* sp. asymptomatic roots (*Vitaceae*), May 2013, S.D. Langenhoven (holotype and culture ex-type stored in a metabolically inactive state CBS 144082 = STE-U 7843; *COI* and ITS sequences GenBank KX372742 and KX372749, MycoBank MB819417).

Additional materials examined. SOUTH AFRICA, Western Cape Province, Wellington, grapevine roots (STE-U 7844, STE-U 7845, STE-U 7846, STE-U 7847, STE-U 7848). – JAPAN, Nagano, uncultivated soil, collection date and collector unknown (as *Ovatisporangium* sp. 5, culture MAFF 241149).

Notes — *Phytophythium paucipapillatum* sp. nov. was isolated from a nursery grapevine in South Africa. The inclusion of *Ovatisporangium* sp. 5 isolate MAFF 241149 in the species *P. paucipapillatum* is supported by morphological and phylogenetic data. Phylogenetically, *P. paucipapillatum* isolates formed a well-supported monophyletic clade with ITS (96 % bootstrap support and posterior probability of 1.0) and *COI* (99 % bootstrap support and posterior probability of 0.99). *Phytophythium paucipapillatum* was distinct from, but related to *P. chamaehyphon*, *P. helicoides*, *P. fagopyri* and *Phytophythium* sp. WJB-3 (of which only ITS is available). Morphological characteristics unique to *P. paucipapillatum* isolates were the plerotic and applerotic oospores, compared to the mentioned closely related species with exclusively applerotic oospores (Van der Plaats-Niterink 1981, McLeod et al. 2009, Baten et al. 2015). In addition, *P. paucipapillatum* is the only species with oogonial ornamentation as compared to *P. chamaehyphon*, *P. helicoides*, *P. fagopyri* and *Phytophythium* sp. WJB-3. Furthermore, the oogonia of *P. paucipapillatum* sometimes contain two oospores, unlike those of the above mentioned closely related species (including *Phytophythium* sp. WJB-3). Regarding internal proliferation, no nested proliferation was observed in *P. paucipapillatum*, as compared to *P. chamaehyphon*, *P. fagopyri* and *P. helicoides* – all of which display internal, nested proliferation. Furthermore, no internal proliferation has been observed for *Phytophythium* sp. WJB-3.

Supplementary material

FP1168-1 Maximum likelihood phylogeny of the internal transcribed spacer-nuclear ribosomal DNA region displaying species of the genus *Phytophythium*. Maximum likelihood analyses were performed in PhyML v. 3.3 (Guindon et al. 2010) under the best model (GTR+I+G for both ITS and *COI*) as estimated using the Akaike Information Criterion in jModelTest v. 2 (Darriba et al. 2012). Support values were calculated from 100 bootstrap replicates. Maximum likelihood bootstrap percentages and Bayesian posterior probability values are indicated at the nodes. Support values less than 60 % bootstrap or 0.60 posterior probability are omitted or indicated with ‘-’.

FP1168-2 Maximum likelihood phylogeny of the cytochrome c oxidase subunit 1 (*COI*) gene region displaying species of the genus *Phytophythium*. Both trees have been lodged in TreeBASE (study S22566).

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