First report of *Phytophthora vexans* associated with dieback disease of apple trees in Morocco

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Symptoms of dieback disease like root rot, yellow leaves and wilting, were observed on 6–10 years old young apples trees (cv. Golden delicious) in Sais region (33°44'52" N; 5°01'13" W) during the growing season 2017–2018, with an incidence of up to 3%. Therefore, dead roots of infected plants and their surrounding soils were sampled. By using both soil baiting technique with pear fruit and surface sterilization of diseased tissue with 1% of NaClO, a fungus like *Phytophthora* spp. with white colony and non-septate hyphae was consistently isolated and purified on CMA medium. Globose or subglobose sporangia with/out papilla, 15.9 × 26.10 µm in diameter, were seen on V8 medium after incubation for 4 days. Antheridia are elongated bell-shaped with two lobes and usually attached to smooth, globose and terminal oogonia. To confirm the exact identity, the internal transcribed spacer (ITS) of isolated fungi was amplified and sequenced (Ezrari et al. 2019). The resulting sequences showed a similarity of 99% to those of *Phytophthora vexans* and were deposited in the GenBank database under the accessions MK656897, MN545593, MN545588, and MN545587. The pathogenicity bioassay with these isolates was performed on one-year-old healthy certified seedlings of apple rootstock MM 115 (Polat et al. 2017; Rodriguez-Padron et al. 2018). For each *P. vexans* isolate, 4 apple seedlings were artificially injured in stem and

collar, inoculated with a 5 mm-diameter mycelial plug, sealed with parafilm, and placed in growth chamber at 28 °C. Plants with only PDA plugs served as controls. Discolored tissues with necrotic brown lesions were observed 18 days after inoculation, turned rotted and reached the wood after 30 days, while control plants were asymptomatic and healthy. Fungal isolates were re-isolated to complete Koch's postulates. To our knowledge, this is the first report of dieback disease caused by *P. vexans* on apple trees from Morocco.

Compliance with ethical standards

Conflict of interest The authors declare no conflict of interests.

Research involving human participants and/or animals The authors declare that no human participants and animals were involved in this study.

Informed consent This manuscript is new and not being considered elsewhere. All authors have approved the submission of this manuscript.

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