



First report of *Phytophthora austrocedri* causing phloem lesions and bronzing on *Cupressus sempervirens* in northern Iran

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In 2016, the Qazvin Agricultural and Natural Resources Research Center received reports of foliage bronzing of Italian cypress (*Cupressus sempervirens*) in a public park in Qazvin city, Iran. Symptomatic, fully-bronzed foliage of trees had an orange-brown colored lesion in the phloem around the stem collar (Figs. 1-2). Phloem samples taken from the lesion edges (Green *et al.*, 2016) were plated on a *Phytophthora*-selective medium (synthetic mucor agar) and incubated at a temperature of 17–27°C in the dark. Resulting mycelial growth was transferred to V8 agar medium. The colony on V8 agar was white with coralloid hyphae (Fig. 3) and very slow growing (less than 0.5 mm per day). Formation of sporangia appeared on V8 agar with a width and length (µm) of (28.4) 31.5–44.7 (46.1) and (39.9) 46.7–73.5 (79.7), respectively. Homothallic oospores appeared on corn meal agar with a diameter (µm) of (21.7) 24.1–40.2 (46.5).

The internal transcribed spacer region was amplified using ITS1/ITS4 primers (White *et al.*, 1990) and sequences of a representative strain were compared with related species retrieved from GenBank, resulting in 99% sequence identity with *Phytophthora austrocedri* (GenBank Accession Nos. JQ346530 and KJ49066; Green *et al.*, 2015 & 2016). The ITS sequence of our isolate was deposited in GenBank (MF480422). According to colony morphology and sequencing of the ITS region, the isolate was identified as *P. austrocedri* (syn=*P. austrocedrae*; Greslebin *et al.*, 2007).

Pathogenicity tests were performed using 15 replicate shoots (c. 40 cm long) of Italian cypress. Mycelia plugs (roughly 5 mm), derived from the margins of an actively growing 20-day-old culture of the *P. austrocedri* isolate on V8 agar, were used to inoculate the shoots by placing the plug on wounded points under the bark. In order to maintain humidity, inoculation points (centre of each shoot) were coated with paraffin film and wrapped with aluminum foil. The shoots were incubated at 17°C in the dark after placing in sealed plastic bags containing a damp cotton wall ball. Fifteen shoots were inoculated with sterile V8 agar as controls. After ten weeks, orange-brown phloem lesions ranging from 20–100 mm in length appeared on the inoculated shoots. The pathogen was reisolated from all of the infected shoots, whereas control shoots remained symptom-free.

Phytophthora austrocedri has been reported to be a pathogen on *Juniperus communis* and *Chamaecyparis* spp. (Green *et al.*, 2015). To the authors' knowledge, this is the first report of *P. austrocedri* causing lesions in the phloem on *Cupressus sempervirens* in northern Iran or *Cupressus* species worldwide. The origin of *P. austrocedri* in Iran is unknown. As Italian cypress is only planted in Iran in parks, the potential of this pathogen spreading to nurseries and orchards around of Qazvin city is not high. However, the host range of *P. austrocedri* has not been studied extensively and there is concern that other economically important species, such as surrounding pistachio gardens could be at risk, since they are susceptible to other *Phytophthora* spp. (Saremi *et al.*, 2008). Studies will need to be conducted to determine if these local hosts are susceptible.

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Figure 1



Figure 2



Figure 3



Figure 4

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