



First report of *Alternaria carthami* causing leaf spots on *Carthamus tinctorius* in Brazil

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Carthamus tinctorius (safflower) is an important commercial flower which is cultivated mainly for its seeds, from which vegetable oil can be extracted. In March 2013, approximately 50% of the safflower cv. Goiás at the Instituto Agrônomo do Paraná in Londrina (Paraná, Brazil) showed brown spots with concentric rings on leaves and elongated or irregular necrotic lesions on petioles, stems and flower heads. One distinct dematiaceous fungus was isolated from leaves showing necrotic spots. The conidia were transferred to potato carrot agar (PCA) and to V8 agar plates and a pure culture was deposited in the culture collection of the Universidade Federal de Viçosa (reference: COAD 1782).

Isolate COAD 1782 produced conidiophores that were epigenous, solitary, cylindrical, straight to slightly sinuous, 1–7 septate, dark brown, and smooth in V8 agar and PCA. Conidia were in short chains (2–3), obclavate to ovoid, golden-brown, slightly verruculose, with 5–7 transverse septa, and up to one longitudinal septum, gradually narrowing into a long beak (48–102.5 µm). The average dimensions of conidia were 65–105 × 11.5–15.5 µm and 91–166.5 × 13–20.5 µm in V8 agar and PCA, respectively.

For molecular identification, the genomic DNA was extracted from a seven-day-old pure culture, and the ITS and RPB2 regions were sequenced (GenBank Accession Nos. KP231871 to KP231874). A BLASTn search using these sequences revealed 100% similarity to the ITS and RPB2 sequences of a representative isolate of *Alternaria carthami* (KJ718133 and KJ718307, respectively). The morphological descriptions fit the molecular identification of the isolate COAD 1782 (Simmons, 2007).

Pathogenicity tests on whole plants were done using a pure culture. A conidial suspension was adjusted to 3.3×10^4 conidia ml⁻¹ using a haemocytometer and inoculated on to three safflower plants. Plants were kept in a dark humid chamber for 48 h at 24°C and then moved to a greenhouse. After 13 days, symptoms, similar to those found in the field, were observed on all plants inoculated with COAD 1782 (Fig. 1a and b).

The fungus was re-isolated from the inoculated plants and the morphology was the same as the inoculated isolate (Fig. 2). No symptoms developed in control plants sprayed with distilled water.

At least seven species of *Alternaria* are recorded from *C. tinctorius* (Farr & Rossman, 2014). *A. carthami* is known as a destructive disease of safflower and is recorded worldwide. It is also found on other hosts and has been reported on *Phaseolus vulgaris* in Brazil (Moraes & Menten, 2006). In our study, we also isolated *A. alternata* which caused leaf spots on *C. tinctorius* (Fig. 1c). Park & Lee (2003) also reported co-infection of *A. alternata* and *A. carthami* in safflower. Further studies should be conducted to investigate the interaction between these species associated with leaf spot epidemics. To our knowledge, this is the first report of *A. carthami* causing leaf spots on *C. tinctorius* in Brazil.

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References

- Farr DF, Rossman AY, 2015. Fungal Databases, Systematic Mycology and Microbiology Laboratory, ARS, USDA. Retrieved 12 January 2015 from <http://nt.ars-grin.gov/fungaldatabases/>.
- Moraes MHD, Menten, JOM, 2006. Transmission of *Alternaria* spp. by common bean seeds and its effects on physiological quality. *Summa Phytopathologica* **32**, 381–383. <http://dx.doi.org/10.1590/S0100-54052006000400012>
- Park KS, Lee SG, 2003. Leaf spot of safflower (*Carthamus tinctorius*) caused by *Alternaria carthami* and *A. alternata*. *Research in Plant Disease* **9**, 159–161. <http://dx.doi.org/10.5423/RPD.2003.9.3.159>
- Simmons EG, 2007. *Alternaria: An Identification Manual*. Utrecht, Netherlands: CBS Fungal Biodiversity Centre.



Figure 1

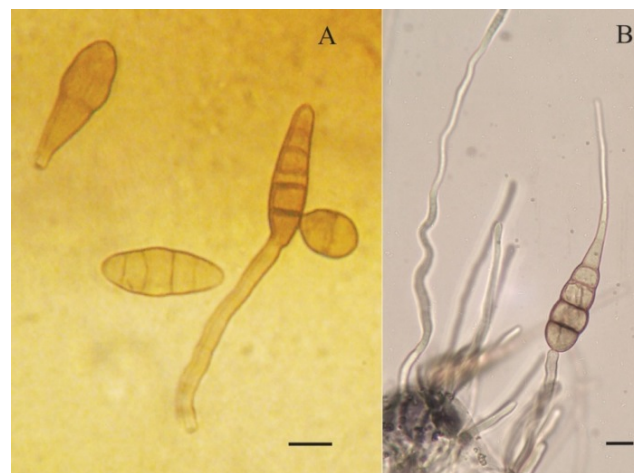


Figure 2

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