



First report of *Fusarium oxysporum* associated with apple crown and root rot in Turkey

Emel Ören¹ · Harun Bayraktar²

Received: 3 November 2023 / Accepted: 21 February 2024 / Published online: 5 March 2024
© The Author(s) 2024

Keywords *Fusarium oxysporum* · Apple · Crown and root rot

In June 2022, symptoms of apple tree decline were observed on six years-old apple trees (*Malus domestica* L.) in a commercial orchard in Tuşba district of Van province, Turkey (38°29'13.6"N 43°22'50.9"E). It had an incidence of up to 4% of the trees belonging to Scarlet Spur, Fuji, and Golden Reinders cultivars. The symptoms included crown and root rot, wilting, deciduous foliage and growth retardation. Small pieces of wood from crown of four symptomatic trees were collected, superficially disinfected with 1% NaClO for 2 min, placed onto potato dextrose agar (PDA) and incubated at 24 °C. A total of 13 isolates resembled to *Fusarium*. Cultures were white to pink with aerial mycelium on PDA. Macroconidia were hyaline, straight or slightly curved, usually 3-septate with a curved and tapering apical cell and a foot-shaped basal cell, 25.4–39.5 × 6.7–9.4 µm ($n=30$), while microconidia were elliptical, one-septate, 6.9–13.5 × 3.4–5.3 µm ($n=30$) and formed on short monophialides in false heads. Chlamydospores were produced terminal or intercalary in hyphae. According to Leslie and Summerell (2006), the fungus was identified as *Fusarium oxysporum*. The translation elongation factor 1- α (EF1- α) and the second largest subunit of RNA polymerase II (RPB2) gene regions of the representative isolate A3 were amplified (Liu et al. 1999; Geiser et al. 2004) and deposited in GenBank under accession numbers OR757269 and OR757270, respectively. BLASTn search revealed 100% sequence identity with those of the strain CBS 242.59 of *Fusarium oxysporum*. The phylogenetic analysis of the

combined sequence dataset verified the identification. To confirm the pathogenicity, the roots of five apple seedlings were wounded and dipped in 50 ml of the conidia suspension of 1×10^6 spores/ml from a 15-day-old culture. The inoculated seedlings were cultivated in a growth chamber at 25 °C. Controls were inoculated with sterile distilled water. After five weeks, the pathogen caused brown to red discolored areas on crown and root of apple seedlings. The pathogen was re-isolated and re-identified. No symptoms were observed in the control. To our knowledge, this is the first report of apple crown and root rot caused by *F. oxysporum* in Turkey.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s42161-024-01618-y>.

Funding Open access funding provided by the Scientific and Technological Research Council of Türkiye (TÜBİTAK).

Declarations

Ethical statement This article does not contain any studies with human participants or animals.

Conflict of interest All authors declare that they have no conflict of interests.

Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

✉ Harun Bayraktar
bayrakta@agri.ankara.edu.tr

¹ Diyarbakır Plant Protection Research Institute,
21110 Diyarbakır, Turkey

² Department of Plant Protection, Faculty of Agriculture,
Ankara University, 06110 Ankara, Turkey

References

- Geiser DM, del Mar Jiménez-Gasco M, Kang S, Makalowska I, Veer-
araghavan N, Ward TJ, Zhang N, Kuldau GA, O'Donnell K
(2004) Fusarium-ID v. 1.0: a DNA sequence database for identi-
fying Fusarium. *Eur J Plant Pathol* 110:473–479
- Leslie JF, Summerell BA (2006) *The Fusarium laboratory manual*.
Blackwell Publishing, Iowa, USA
- Liu YJ, Whelen S, Hall BD (1999) Phylogenetic relationships among
ascomycetes: evidence from an RNA polymerase II subunit. *Mol
Biol Evol* 16:1799–1808

Publisher's Note Springer Nature remains neutral with regard to juris-
dictional claims in published maps and institutional affiliations.