A new host for Fusarium algeriense causing crown and root rot on barley in Kyrgyzstan

Article *in* New Disease Reports · December 2022

DOI: 10.1002/ndr2.12139

5 authors, including:

Sezim Zholdoshbekova
Kyrgyzstan-Turkey Manas University
10 PUBLICATIONS **8** CITATIONS
SEE PROFILE

Tuğba Bozoğlu
Bolu Abant Izzet Baysal University
10 PUBLICATIONS **15** CITATIONS
SEE PROFILE

İsmail Erper
Ondokuz Mayıs Üniversitesi
103 PUBLICATIONS **648** CITATIONS
SEE PROFILE

Sibel Dervis
Mardin Artuklu Üniversitesi
85 PUBLICATIONS **507** CITATIONS
SEE PROFILE

Received: 11 October 2022 | Accepted: 28 November 2022

DOI: 10.1002/ndr2.12139

New Disease Reports Open Access WILEY

NEW DISEASE REPORT

A new host for *Fusarium algeriense* causing crown and root rot on barley in Kyrgyzstan

S. Zholdoshbekova[1,2] | **T. Bozoğlu**[2] | **I. Erper**[1,3] | **S. Derviş**[4] | **G. Özer**[2]

[1]Department of Plant Protection, Faculty of Agriculture, Kyrgyz Turkish Manas University, Bishkek, Kyrgyzstan

[2]Department of Plant Protection, Faculty of Agriculture, Bolu Abant Izzet Baysal University, Bolu, Turkey

[3]Department of Plant Protection, Faculty of Agriculture, Ondokuz Mayis University, Samsun, Turkey

[4]Department of Plant and Animal Production, Vocational School of Kızıltepe, Mardin Artuklu University, Mardin, Turkey

Correspondence
Department of Plant Protection, Faculty of Agriculture, Bolu Abant Izzet Baysal University, Bolu 14020, Turkey.
Email: ozer_g@ibu.edu.tr

KEYWORDS
fungal plant disease, *Hordeum vulgare*, Poaceae

After maize, wheat and rice, barley is the most widely planted and economically important cereal crop in the Kyrgyzstan's highlands (Usubaliev et al., 2013) and worldwide. In two barley fields in the Manas district of Bishkek, Kyrgyzstan, diseased plants exhibiting crown and root rot, stunting and brown discolouration on internodes were observed in 2020. Disease incidence was approximately 5% in the two fields.

Small sections of root and crown tissues from diseased plants were surface sterilised in 1% (v/v) sodium hypochlorite solution for one minute before being placed onto potato dextrose agar (PDA) amended with streptomycin (0.1 g/l). Plates were incubated at 23°C in the dark for five days in order to isolate the pathogen(s). Five *Fusarium* isolates with similar morphology were selected and purified on fresh PDA and Spezieller-Nährstoffarmer agar (SNA) plates using the hyphal tip method. After one week of incubation under a 12 hour photoperiod, pure colonies were orange-white on PDA (Figure 1). Ellipsoidal microconidia produced in false heads on monophialides were usually aseptate ($8.30 \pm 1.17 \times 2.56 \pm 0.24\ \mu$m, n = 50) and occasionally one-septate ($21.89 \pm 2.01 \times 2.95 \pm 0.30\ \mu$m, n = 50) (Figure 2). Sporodochial macroconidia were mostly 3–4 septate, measuring $43.40 \pm 2.82 \times 4.11 \pm 0.51\ \mu$m (n = 50) (Figure 3). Chlamydospores were absent.

The translation elongation factor 1α (*TEF1*) and RNA polymerase II beta subunit (*RPB2*) genes of representative isolates Fa_Hv01 and Fa_Hv02 were sequenced using primer pairs EF1/EF2 and 5f2/7cr, respectively as described by Özer et al. (2022). The sequences of the two isolates were identical to the corresponding sequences of

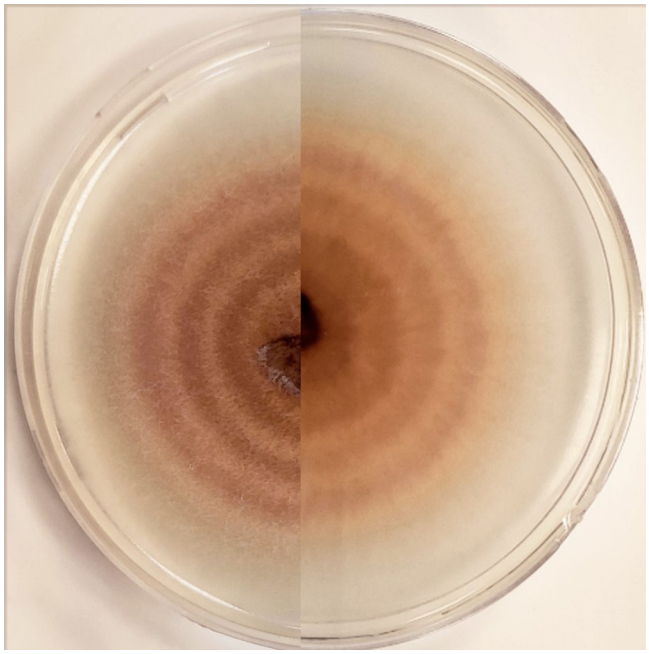

FIGURE 1 Colony morphology of *Fusarium algeriense* after seven days' growth on potato dextrose agar under a 12 hour photoperiod

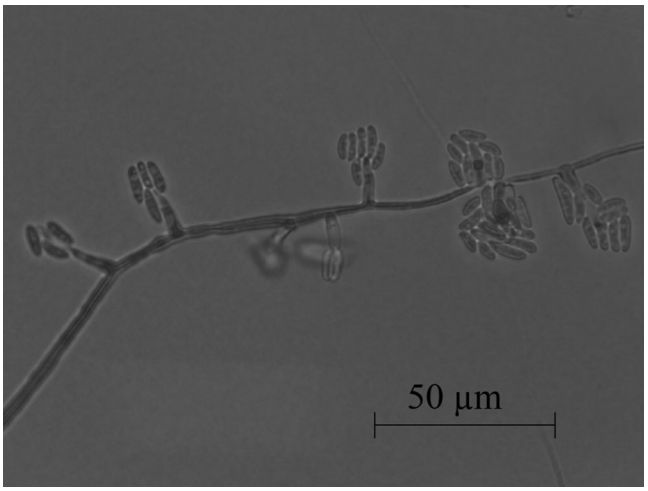

FIGURE 2 Aerial conidiophores producing 0-septate ellipsoidal conidia on monophialides

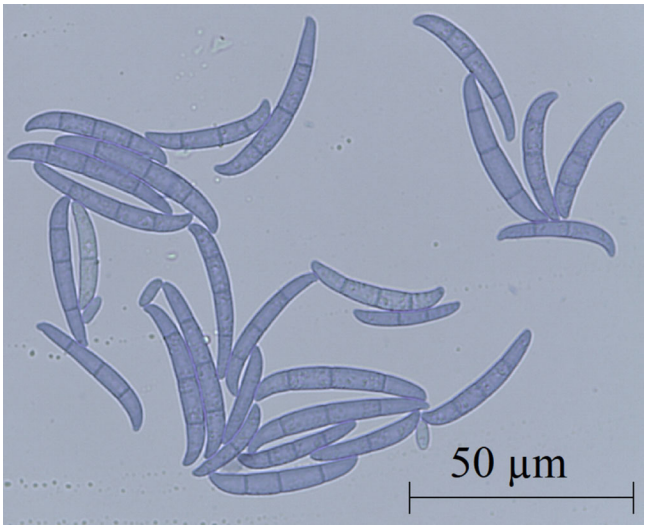

FIGURE 3 Multiseptate sporodochial conidia and 0–1-septate aerial conidia

Fusarium algeriense Laraba & O'Donnell strain NRRL 66652 (*TEF1*: GenBank Accession No. MF120515 and *RPB2*: MF120504) and were deposited in GenBank under accession numbers OP611471-OP611472 for *TEF1* and OP611473-OP611474 for *RPB2*. A multilocus phylogenetic analysis using maximum likelihood criteria based on combined *TEF1* and *RPB2* sequences with the software MEGA X confirmed that the isolates clustered with the *F. algeriense* clade in the *Fusarium burgessii* species complex (Figure 4). Morphological and molecular features were consistent with the description of *F. algeriense* by Laraba et al. (2017).

A pathogenicity assay of the Fa_Hv01 and Fa_Hv02 isolates was conducted with seeds of barley cv. Harman accordingly to Özer et al. (2022). Mycelial plugs taken from the margins of actively growing PDA colonies were used to inoculate barley seeds and sterile PDA plugs were used as controls. Each pot contained three germinated seeds with

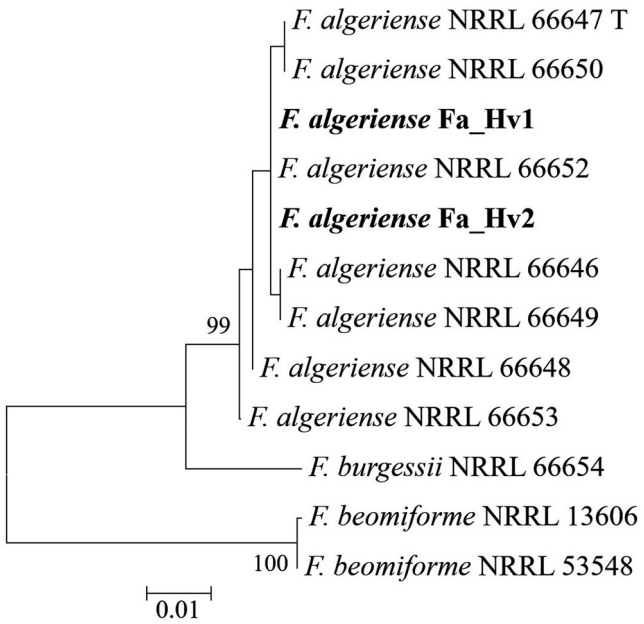

FIGURE 4 Phylogenetic tree from maximum likelihood based on combined *TEF1* and *RPB2* sequences showing the phylogenetic relationships amongst the *Fusarium burgessii* species complex. Isolates in bold are described in this study. Bootstrap values (1,000 replicates) given at the nodes. The tree is rooted with *Fusarium beomiforme* isolates. T = ex-type strain

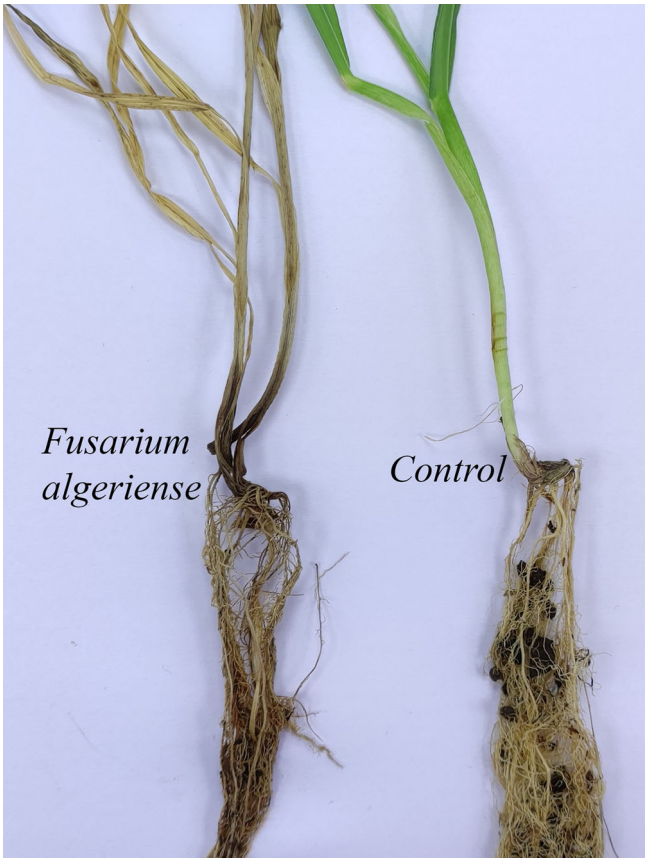

FIGURE 5 Fusarium crown rot symptoms on barley cv. Harman

three replicates. For four weeks, all pots were incubated at 23 ± 2°C. The crown and root tissues of inoculated seedlings were discoloured (Figure 5) and the pathogen was reisolated from symptomatic tissues. None of the controls displayed symptoms.

This is the first time *F. algeriense* has been associated with barley crown and root rot in Kyrgyzstan and worldwide (Farr & Rossman, 2022). The agent had previously been reported on durum wheat in Algeria (Laraba et al., 2017), as well as bread wheat in Azerbaijan (Özer et al., 2020) and Kyrgyzstan (Özer et al., 2022). These recent findings call for the need for more research into the potential of this species to cause root rot in cereals.

ORCID

S. Zholdoshbekova https://orcid.org/0000-0001-8120-0175
T. Bozoğlu https://orcid.org/0000-0002-1588-8757
I. Erper https://orcid.org/0000-0001-7952-8489
S. Derviş https://orcid.org/0000-0002-4917-3813
G. Özer https://orcid.org/0000-0002-3385-2520

REFERENCES

Farr, D.F. & Rossman, A.Y. (2022) Fungal Databases. U.S. National Fungus Collections, ARS, USDA. Available at: https://nt.ars-grin.gov/fungaldatabases/. [Accessed 08 October 2022]

Laraba, I., Keddad, A., Boureghda, H., Abdallah, N., Vaughan, M.M., Proctor, R.H. et al. (2017) *Fusarium algeriense*, sp. nov., a novel toxigenic crown rot pathogen of durum wheat from Algeria is nested in the *Fusarium burgessii* species complex. *Mycologia*, 109, 935–950. https://doi.org/10.1080/00275514.2018.1425067

Özer, G., Paulitz, T.C., Imren, M., Alkan, M., Muminjanov, H. & Dababat, A.A. (2020) Identity and pathogenicity of fungi associated with crown and root rot of dryland winter wheat in Azerbaijan. *Plant Disease*, 104, 2149–2157. https://doi.org/10.1094/PDIS-08-19-1799-RE

Özer, G., Erper, I., İmren, M., Bozoğlu, T., Özdemir, F. & Dababat, A.A. (2022) First report of crown rot caused by *Fusarium algeriense* on wheat in Kyrgyzstan. *Plant Disease*, 106, 2998. https://doi.org/10.1094/PDIS-01-22-0096-PDN

Usubaliev, B., Brantestam, A.K., Salomon, B., Garkava-Gustavson, L. & von Bothmer, R. (2013) Genetic diversity in farmer grown spring barley material from Kyrgyzstan. *Genetic Resources and Crop Evolution*, 60, 1843–1858. https://doi.org/10.1007/s10722-013-9959-2

How to cite this article: Zholdoshbekova, S., Bozoğlu, T., Erper, I., Derviş, S. & Özer, G. (2022) A new host for *Fusarium algeriense* causing crown and root rot on barley in Kyrgyzstan. *New Disease Reports*, 46, e12139. https://doi.org/10.1002/ndr2.12139