

1 **First Report of Crown Rot Caused by *Fusarium redolens* on Wheat in Kazakhstan**

2 **Tuğba Bozoğlu, Göksel Özer, Mustafa İmren**, Department of Plant Protection, Faculty of
3 Agriculture, Bolu Abant İzzet Baysal University, Bolu 14030, Turkey; **Timothy C. Paulitz**,
4 United States Department of Agriculture, Agricultural Research Service, Wheat Health,
5 Genetics, and Quality Research Unit, Washington State University, Pullman, WA 99164-6430,
6 USA; **Abdelfattah A. Dababat**, International Maize and Wheat Improvement Centre
7 (CIMMYT), P.O. Box. 39 Emek, Ankara, Turkey.

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9 *Fusarium* crown rot, caused by several species within the genus, is a major constraint that
10 results in significant losses in wheat production worldwide. In June 2019, diseased wheat plants
11 with typical symptoms of crown rot, including discoloration on the first two or three internodes
12 of the stem just above the soil line and stunted, dry rotted, and discolored roots were collected
13 in several bread wheat fields during the maturity stage in Almaty, East Kazakhstan, and
14 Karaganda Regions of Kazakhstan. For each field, approximately twenty tillers were randomly
15 sampled. Symptomatic tissues were surface sterilized in 1% NaClO for 2 min, rinsed with sterile
16 distilled water three times, air-dried in a laminar flow hood, and then transferred to Petri dishes
17 containing one-fifth strength potato dextrose agar (PDA). After incubating in the dark at 23°C
18 for 5 days, 79 single-spore isolates showing cultural and microscopic characteristics of
19 *Fusarium* were obtained on PDA and Spezieller-Nährstoffarmer agar (SNA). Colonies were
20 initially white but later produced a beige to pink diffusible pigment in PDA. Microconidia that
21 formed on aerial monophialides were hyaline, 0 to 1 septum, oval- to kidney-shaped, and
22 measured 4.3 to 10.3 × 1.9 to 3.4 µm (average 7.8 × 2.6 µm), whilst macroconidia were straight
23 to slightly curved, 3 to 5 septate, and measured 18.7 to 38.8 × 2.9 to 6.6 µm (average 29.9 ×
24 4.7 µm), with foot-shaped basal cells on SNA. Chlamydospores were present on PDA. Sequence
25 analysis based on portions of translation elongation factor 1α (*TEF1*) and the nuclear ribosomal
26 internal transcribed spacer region (ITS rDNA) loci with primers EF1/EF2 (O'Donnell et al. 1998)
27 and ITS1/ITS4 (White et al. 1990) identified 29 of the 79 isolates as *Fusarium redolens* Wollenw.
28 The sequences of the five representative isolates with 99.85% of similarity to those of *F. redolens*
29 strains available in GenBank e.g., ITS (MT435063) and *TEF1* (GU250584). The *TEF1* (accession
30 nos. MW403914-MW403918) and ITS rDNA (accession nos. MW397138-MW397142)
31 sequences of the isolates were deposited in GenBank. The morphological features are
32 consistent with the described features of *F. redolens* (Leslie and Summerell 2006). To confirm

1 pathogenicity of the five isolates, five pre-germinated seeds of wheat cultivar Seri 82 were
2 placed in a 9-cm-diameter pot filled with a sterile potting mix containing equal volumes of
3 peat, vermiculite, and soil. An approximately 1-cm-diameter 7-day-old mycelial plug of each
4 isolate was individually placed in contact with the seeds. Seeds were covered with the same
5 potting mix, and then the pots were maintained for four weeks in a growth chamber at 23°C
6 with a 12-h photoperiod. The experiment was conducted twice with three replicate 15-cm pots
7 with 5 plants per pot. Controls were inoculated with sterile agar plugs using the same
8 procedure. After four weeks, all the inoculated plants showed stunted growth with brown
9 discoloration in most parts of the crown and roots, whereas no symptoms were observed in
10 the control plants. The mean severity of the disease for each isolate was between 2.1 and 2.7
11 according to the scale of 1 to 5 described by Gebremariam et al. (2015). The pathogen was
12 reisolated from crowns of diseased plants, but not from asymptomatic control tissues, and
13 identified morphologically based on the methods described above, fulfilling Koch's postulates.
14 Although several morphological features are shared by *F. oxysporum* and *F. redolens*, Baayen
15 et al. (2001) showed that these species could be easily distinguished using molecular data. The
16 pathogen was previously reported as *F. redolens* associated with crown rot of wheat in Turkey
17 (Gebremariam et al. 2015) and Saskatchewan, Canada (Taheri et al. 2011). The presence of *F.*
18 *redolens* causing crown rot is confirmed in the six wheat fields surveyed in Kazakhstan, for the
19 first time. This pathogen may pose a risk for wheat production, and further studies needed to
20 determine the impact on the crop in Kazakhstan.

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6 Corresponding authors:

7 Göksel ÖZER

8 ORCID identifier is 0000-0002-3385-2520

9 E-mail: gokozer@gmail.com

10 Abdelfattah. A. Dababat

11 ORCID identifier is 0000-0002-3172-0452

12 E-mail: a.dababat@cgiar.org