First report of *Fusarium torulosum* from Iran

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Received: 7 July 2018 / Accepted: 6 September 2018
# Australasian Plant Pathology Society Inc. 2018

Zagros Mountains is an extensive area of fields and rangelands at the western Iran. It is an international zone for ecological and scientific studies. Cereals are the main crops cultivated in Iran and the Middle East. Root and crown rot of these plants caused by different species of *Fusarium* are serious problems in Iran. *Fusarium* species are well-known plant pathogens with significant economic impact (Wang et al. 2011).

*Hordeum vulgare*, is the most important plant in people diet in Middle East. But this crop has been attacked by some pathogens such as *Fusarium* species. One of the most important cereal diseases worldwide is head blight caused by species from the genus *Fusarium* (Leslie and Summerell, 2006) which also causes other diseases such as root- and stem blight (Bottalico & Perrone, 2002). Various *Fusarium* species can produce different mycotoxins. Some of the common toxins produced by *Fusarium* spp. are zearalenone, zearalenols and toxins belonging to the group trichothecenes (Bottalico & Perrone, 2002).

Infected plants in which the most important symptoms of Fusarium disease are observed usually have brown to black lower taproot and lateral roots and show cortical decay or vascular discoloration. Lateral roots may also die and decompose, and secondary roots may develop above them on the upper taproot. If root rot becomes severe, infected plants may develop foliar symptoms including stunting, marginal or whole leaf chlorosis (yellowing), wilting, and defoliation. During the spring of 2015, barley (*Hordeum vulgare*) fields of Zagros Mountains in western Iran were investigated for root rot symptoms. Infected plants were transferred to laboratory. These samples showed brown to black root and symptoms of fungal rot were observed (figure1).

The tissue pieces were cultured on Nash and Snyder medium and incubated at 28°C for 5 to 7 days. After purification by hyphal tip and single spore methods, cultures transferred to PDA petridishes. About one week later, SNA, CLA and KCl media were used to produce key spores. *Fusarium* isolates were identified based on general colony characteristics, morphology of microconidia, macroconidia, conidiohyphene, chlamydospore formation, by *Fusarium* diagnostic keys (Leslie and Summerell, 2006; Nirenberg, 1995). Observations were made using brightfield microscope (Olympus BX41).

Results revealed ten *Fusarium* species as *Fusarium avenaceum*, *F. crookwellense*, *F. culmorum*, *F. longipes*, *F. nygamai*, *F. polyphialidicum*, *F. reticulatum*, *F. solani*, *F. torulosum*, and *F. tricinctum*.

*F. torulosum* was differentiated within *F. sambucinum* by Nirenberg (1995) for the first time. This species produced fluffy and white aerial mycelium that became pigmented with age, narrow concentric rings, red pigmentation on agar, macroconidia (26 ± 3 μm average length) with moderately curvature, 5-septate, apical and basal cells were pointed and foot shaped respectively. This species did not produce microconidia. Chlamydospores formed in chains and in clusters.

Amplification of Translation Elongation Factor 1-alpha (TEF) and ITS region of this isolate by EF1, EF2 and ITS1, ITS4 primers (EF1-F-ATGGGTAAAGGA(A/G)GACAAGAC and EF2-R-GGA(G/A)GTACCAGT(G/C)ATCATGTG), (ITS1- TCGTAGGTAACCTCCGG and ITS4- TCCACCGCCCTATTGATGC (White et al., 1990; O’Donnell, 1996; O’Donnell et al., 1998) and sequencing (GenBank Accession NOs. MH571958 and MG661579 respectively with 99% similarity) confirmed *Fusarium torulosum*.

Subsequently, one of the isolates was selected for pathogenicity test by pouring a spore suspension on to the disease-free barley stem (Carter et al. 2002). Control was inoculated with sterile distilled water. Inoculated seedlings in pots were kept at 28°C, and alternating 12-hour periods of light and darkness. After 3 weeks inoculated plants with

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fungal inoculums, showed general symptoms of Fusarium wilt. Infected tissues cultured on PDA and *F. torulosum* colony was isolated. This isolate was inoculated to health seedlings, and fusarium symptoms were observed. There was no disease incidence on the control plants.

*F. torulosum* macroconidia are similar to those of *F. sambucinum* and *F. venenatum* but slow growth rate and chlamydospore production of *F. torulosum* differentiate it from another ones. *F. torulosum* has been recovered from various plants including cereals, tomatoes, beet root and trees (Leslie and Summerell, 2006) and in this research isolated from barley roots that is the first report of pathogenicity *F. torulosum* on barley from Iran.

**References**


