

# Damping-Off of *Festuca arizonica* Caused by *Fusarium*

Mopuri N. Reddy<sup>1\*</sup>, Stanley H. Faeth<sup>2</sup>

<sup>1</sup>Department of Applied Microbiology, S P Mahila Visvavidyalayam, Tirupati, India; <sup>2</sup>Department of Biology, University of North Carolina at Greensboro, Greensboro, USA.

Email: \*mopuri\_nr@yahoo.com

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## ABSTRACT

We report here a damping-off disease occurring at the seedling stage, resulting in severe loss of the seedling stands caused by an important soil-borne fungal pathogen, *Fusarium oxysporum*. Endophyte-infected plants appear to be more resistant to the damping-off disease than uninfected plants.

**Keywords:** Damping-off, Endophytes, *Festuca arizonica*, *Fusarium*

## 1. Introduction

Damping-off is a very common soil-borne disease caused by fungi, usually by the species of *Rhizoctonia*, *Pythium*, *Fusarium*, *Sclerotinia*, *Sclerotium*. Damping-off disease affects seeds, germinating seeds and seedlings of many plant species, including grasses. It is a major cause of poor stand establishments in agricultural and nursery plantings.

*Arizona fescue* (*Festuca arizonica* Vasey) (Pooideae) is a perennial bunch grass native to Arizona, Nevada, New Mexico and Colorado in the USA and in northern Mexico and is an important forage grass for livestock and native vertebrates [1]. *Arizona fescue* grows in semi-arid grasslands and forests at the elevations between 2300m and 3200m. *Arizona fescue*, like many pooid grasses, is often infected (60-100% infections among populations) with the systemic, asexual and seed-borne fungal endophyte in the genus *Neotyphodium* [2]. The effects of this endophytic fungus on plant performance, competition and resistance to herbivores and pathogens has been well studied [3-5]. In general, *Neotyphodium* endophytes are thought to act mutualistically with their hosts by increasing resistance to drought, invertebrate and vertebrate herbivores and plant pathogens [3], although more recent studies show highly variable effects of infection, especially in non-agronomic, native grasses [4,5].

Although *Arizona fescue* is an important and dominant forage grass in the southwestern USA, little attention has been focused on the diseases occurring in this native grass and whether endophyte infection provides any re-

sistance to these diseases. We report here a damping-off disease occurring at the seedling stage of Arizona fescue that results in loss of the seedling stands and compare infection in endophyte-infected and endophyte-free grasses.

## 2. The Disease

In the experimental green house plots containing four plant genotypes of *Festuca arizonica* with (E+) and without (E-) *Neotyphodium* endophytes grown from seed in native soils, severe damping-off, with rapid yellowing and death of young seedlings, was observed. The disease appeared within a week after emergence of seedlings and the intensity was very severe. The disease was consistently observed to be more severe in the genotypes without (E-) endophyte as compared to those with endophyte (E+) (**Figure 1**).

The disease is characterized by light brown to slightly darkened water-soaked lesions, on hypocotyls of young seedlings, which rapidly enlarge, resulting in the rapid death of the seedlings (**Figure 1**). The young seedlings are mainly attacked at or below the soil line and the disease incidence and intensity or severity varied with the genotype.

The infected hypocotyl tissues appear soft and light to dark brown in color (**Figure 2**). The basal portions of invaded seedlings appear thinner than the areas above the lesions resulting in fall over and death of the seedling. To diagnose the disease and its causal organism, infected seedlings were carefully lifted and then excavated and



**Figure 1. Damping-off of Arizona fescue showing yellowing, collapsed, and wilted seedlings in pot 2 as compared to healthy seedlings in pot 1. A+ refers to a grass genotype associated with endophyte and A- to grass genotype without endophyte.**



**Figure 2. Symptoms on hypocotyls – brown water-soaked lesions and collapse of the seedlings.**

rinsed with sterile water so that seedlings remained intact after extraction.

### 3. Isolation and Identification of the Pathogen

The original isolations were made on PDA medium, by surface sterilization and plating the infected tissues or the lesions. Single spore isolations were obtained and tested for pathogenicity on healthy seedlings by following Koch's Postulates. To fulfill Koch's Postulates, samples of experimentally infected seedlings were removed and assayed to verify the presence of the causal agent. The re-isolated fungus was cultured on PDA and cultural characteristics were recorded and compared to the original isolate. Typical disease symptoms on hypocotyls were initiated by third day after inoculation of the seed-

lings. Eventually seedlings collapsed and died. Many seeds failed to germinate when the seeds were sown in the *Fusarium* infested soil and complete rotting of the seeds was evident when they were extracted and observed.

Based on the morphological and cultural characteristics, the pathogen was identified as *Fusarium oxysporum* and confirmed by the *Fusarium* Research Center, Pennsylvania State University, University Park PA, USA.

A search of the world literature in Biological Reviews and the Phytopathology Reviews including USDA Hand Books for occurrence of the disease on *F. arizonica* reveals that there is no report of occurrence of damping-off caused by *Fusarium oxysporum*. Hence, this may be the first report of this fungal disease on *F. arizonica*.

This pathogen may be a potential candidate for studies in testing the pathogen resistance of *Arizona fescue* and other cool-season pooid grasses associated with *Neotyphodium* endophytes. Endophytes are generally understudied relative to their interactions with plant pathogens and mycorrhizae yet hold great potential promise for pasture and turf grass improvement [3]. Our preliminary results suggest differential susceptibility to the pathogen based upon *Neotyphodium* infection of the host grass.

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