Response of Summer-dormant and Summer-active-Types Tall Fescue With and Without Fungal Endophyte Infection to Plant Parasitic Nematode Exposure

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Abstract
This study sought to compare the effects of endophytes (Schedonorus arundinaceus) on the persistence of novel parasitic nematodes while others do not. Resistance to nematodes by novel endophytes in Mediterranean tall fescue is uncertain.

Introduction
Tall fescue is a cool-season perennial forage grass that covers over 35 million acres, the majority of which are in regions where annual precipitation is 35 inches or greater (Burns et al., 1979). In regions that have a continental climate, such as the Southern Plains, Mediterranean Basin origin summer-dormant tall fescue (Mediterranean) provides extended palatable and heat stress periods by invoking dormancy in response to increasing day length and temperature. Mediterranean tall fescue may expand the tall fescue adaptation zone due to their summer dormancy. Persistence of continental types is enhanced by the presence of an ergot-algal-producing endophyte, Neotyphodium coenophialum (wild), conferring resistance to insect, drought and grazing. Ergot alkaloids cause fescue toxicity in livestock. Non-ergot-algal-producing strains of N. coenophialum (novel) endophytes have been identified and placed into tall fescue selections. Some novel strains in continental tall fescue confer resistance to plant parasitic nematodes while others do not. Resistance to nematodes by novel endophytes in Mediterranean tall fescue is uncertain.

This study sought to compare the effects of four nematode types on wild endophyte-infected continental tall fescue and novel endophytes in continental or Mediterranean tall fescue. This greenhouse study was conducted with two sequential variants: Kentucky 31 (wild) and Texoma MaxQ (novel); and the Mediterranean variety Flecha AR542 (novel). Endophyte-free plants of each variety were controls. Plants were established from seed; endophyte presence in infected plants was confirmed then plants were transplanted to 7.5 inch pots. Pots were inoculated with two levels of stunt (Tylenchorhynchus spp.) low 75, high 225; spiral (Helicotylenchus spp.) low 250, high 800; and lesion (Pratylenchus spp.) low 20, high 55 nematodes. Plant roots and tops were separated, individually identified and sent directly to Oklahoma State University photo.

Methods
Three cultivars of tall fescue were tested in two sequential greenhouse experiments in 2011 at the Noble Foundation in Ardmore, OK. The cultivars were Kentucky 31+, a summer-active continental type, infected with a wild-type (MaxQ II) endophyte; and Flecha AR542, a summer-dormant Mediterranean type, infected with a novel (AR542) endophyte. Endophyte-free plants of each variety served as controls. Tall fescue plants were established from seed, placing one seed per pot in a 36-cell tray containing Metro-Mix 304 potting soil (Sun Gro Horticulture, Vancouver, British Columbia, Canada). Two 36-cell trays each were established for endophyte-infected and -free plants of each cultivar. Three 36-cell trays each were established for endophyte-infected and -free Flecha. Trays were placed in a starter room in the greenhouse facility at 73°F constant temperature and 60% relative humidity. At seven weeks after emergence, a filter was collected from each plant and submitted for endophyte testing using a polymerase chain reaction (PCR) screen. The PCR-based screen verified the presence or absence of the endophyte and distinguished the novel endophyte from the continental endophyte and thereby verified the endophyte-plant associations.

Following endophyte verification, plants were transferred to 7.5 x 7.5 x 15 cm pots containing a 50:50 mixture of Fafard No. 3 potting soil (Fine, mixed, thermic Udic Paleustolls) and Illite (Profile Products, Buffalo Creek, Ill.). A liner was placed in the bottom of each pot to prevent soil from sifting out of the pot. Prior to potting, the Renfrow soil was steam-autoclaved.

Results
Variety effect on ectoparasitic nematode populations was significant (P < 0.01) with no variety-by-nematode interaction. Flecha containing the endophyte AR542 had higher ectoparasitic nematode populations than other variety-endophyte combinations and Kentucky 31 infected with a wild-type endophyte the lowest. The AR542 novel endophyte hosted about the same nematode populations as the wild-type endophyte, consistent with the results of Bouton et al. (1998). The novel endophyte infected inoculated to testate endophytes could be contributing to reduced persistence of novel-endophyte-infected tall fescue in the western edge of tall fescue adaptability.

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