

IS THERE A DIFFERENCE BETWEEN THE STEM RUST PATHOGENS FROM TALL FESCUE AND PERENNIAL RYEGRASS?

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The fungus that causes stem rust in grasses and cereals is *Puccinia graminis*. Within this species, there exist distinct populations that differ in morphology and/or in the host species they can infect. The pathogen that infects cool-season grasses is a subspecies known as *Puccinia graminis* subspecies *graminicola*.

The host range of *P. graminis* subsp. *graminicola* populations from perennial ryegrass or tall fescue in Oregon has not been evaluated. For optimum progress in research on resistance breeding and epidemic management, it is important to know whether the rust pathogen affecting tall fescue is the same as that affecting perennial ryegrass, and whether the population(s) can infect other grass seed crops in the region as well.

Procedures

Stem rust inoculum. Rust spores (urediniospores) were collected from multiple-cultivar field plantings in two years at each of two locations near Corvallis. Separate collections were made from tall fescue and perennial ryegrass. To eliminate the possibility that a population used for experimental inoculations could contain contaminating spores from the other host, each population was passed sequentially through two increases on highly susceptible cultivars of the appropriate host under controlled conditions in a greenhouse.

Host plants. Certified seed of cool-season grass crop species was obtained from breeders or seed companies. Seed of annual bluegrass (*Poa annua*) was obtained from a field collection. The following hosts were chosen because they are commonly grown in the region and/or have a known susceptibility to rust diseases: perennial ryegrass (*Lolium perenne*), annual ryegrass (*L. multiflorum*), tall fescue (*F. arundinacea*), creeping red fescue (*F. rubra* subsp. *rubra*), Chewings fescue (*F. rubra* subsp. *commutata*), sheeps fescue (*F. ovina* subsp. *hirtula*), hard fescue (*F. brevipila*), orchardgrass (*D. glomerata*), and Kentucky bluegrass (*Poa pratensis*). Seed of cereal grains (oats, cereal rye, barley, wheat) was obtained from the USDA ARS Cereal Disease Laboratory, who provided cultivars known to be fully susceptible to stem rust. Grasses, grown from seed in a greenhouse, were 3-4 months old when inoculated. Cereal grain plants were 7 days old.

Inoculation. For each of the two rust populations, we prepared a suspension of 5×10^6 spores per ml Soltrol (a light mineral oil). One ml suspension was applied per 50 plants, and there were 14 plants of each cultivar inoculated with each rust population.

Disease assessment. At 10 d and 17 d after inoculation, we recorded the infection incidence (% of plants that were infected).

Results

Host range. Under greenhouse conditions, the inoculum from perennial ryegrass could infect not only perennial ryegrass, but also orchardgrass, annual ryegrass, Kentucky bluegrass, creeping red fescue and Chewings fescue (Figure 1). It caused only limited infection (low incidence and/or small pustules) on tall fescue, sheep's fescue, annual bluegrass, barley and cereal rye.

The inoculum from tall fescue had a host range (Figure 1) that included itself, orchardgrass, perennial ryegrass, annual ryegrass, creeping red fescue and Chewings fescue. There was no sign of infection on *Poa* species or the cereal grains tested.

Infection development rate. In most cases infection development was slower for hosts infected by the tall fescue population of *P. g.* subsp. *graminicola* than for the same hosts infected by the perennial ryegrass population of the pathogen (Figure 1).

Conclusions

Results of these experiments demonstrate that there is genetic variability within *P. g.* subsp. *graminicola* in western Oregon, evidenced by differences in host range. The inoculum obtained from perennial ryegrass had a different, and wider, host range than inoculum obtained from tall fescue. In each case, inoculum consisted of the population that had been collected from diverse, field-grown cultivars at two locations and in two years, so each inoculum may include a diversity of genotypes all adapted to the particular host species. Further study would be required to determine whether the populations used are representative of populations on these two grasses throughout the region, and whether other identifiable subgroups of the pathogen occur on one or both hosts. Nonetheless, it is clear that there are subgroups that differ in important ways within the morphological subspecies.

The host range of rust pathogens in nature is generally narrower than that determined in greenhouse inoculations, and it is unlikely that cereal rye, barley, annual bluegrass, or sheep's fescue can support a *P. g.* subsp. *graminicola* population of the perennial ryegrass type in the field. Further, it appears unlikely that the population from perennial ryegrass could be supported on most tall fescue varieties in the field. In contrast, the rust spores produced on tall fescue could cause infections on either tall fescue or perennial ryegrass.

The primary conclusion of this study, that there are subgroups of *P. g.* subsp. *graminicola* differentially adapted to perennial ryegrass and tall fescue in Oregon, is important for research and implementation of disease management in these crops. In testing for host genetic resistance, the appropriate population of the pathogen must be used. Disease management approaches that are related to sources of inoculum should also be based on knowledge of the existence and host ranges of pathogen populations adapted to the different hosts.

ERRATUM¹

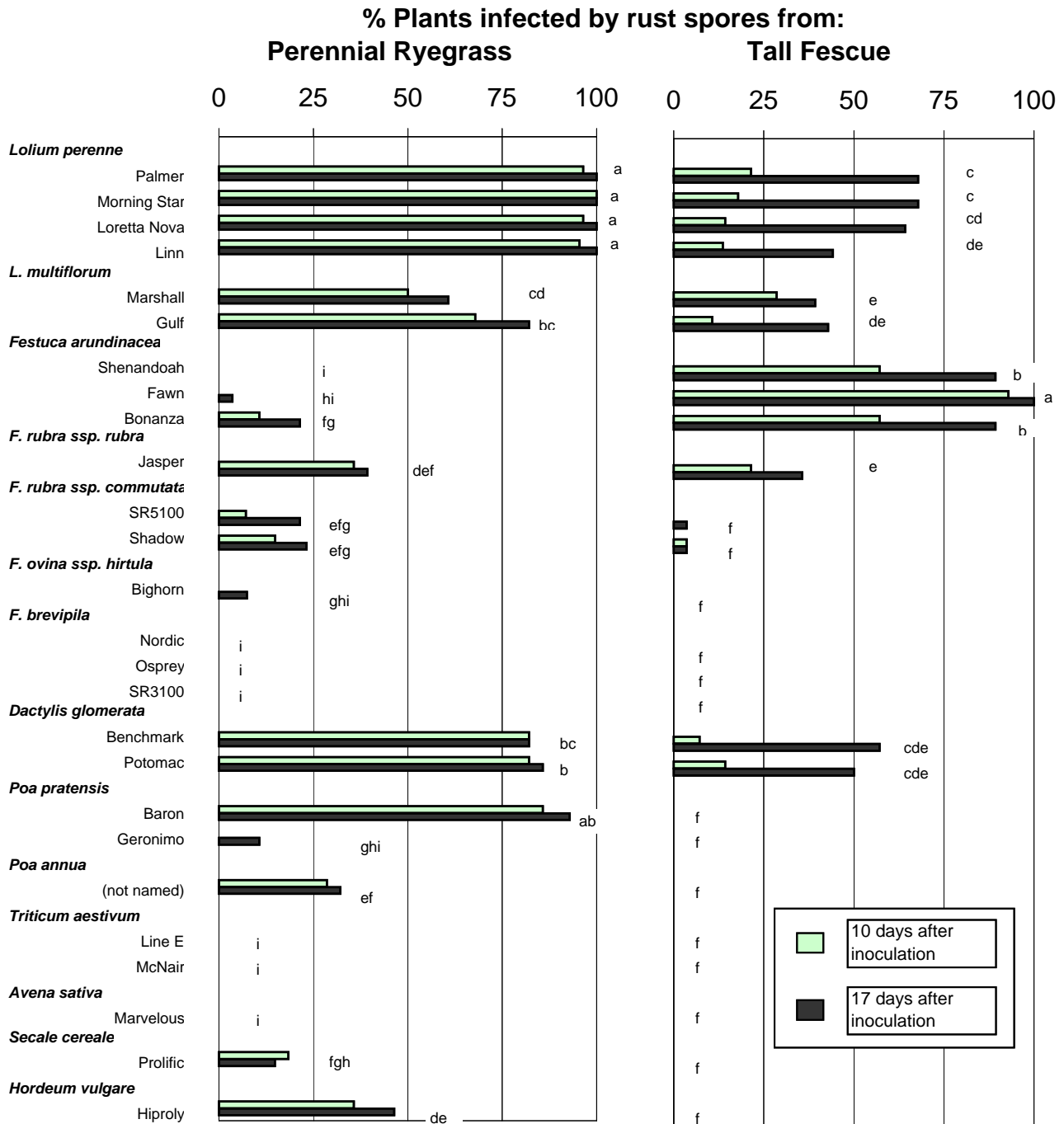


Figure 1. Incidence of stem rust (% plants infected) on indicated cultivars of grass species inoculated with urediniospores of *P. graminis* subsp. *graminicola* that had been produced on either perennial ryegrass or tall fescue. Incidence was assessed at 10 and 17 days after inoculation. Within an inoculum treatment, 17-day incidence bars with the same letter to the right are not significantly different ($P < 0.05$).

¹ This figure should have accompanied the article by W.F. Pfender, "Is There a Difference Between the Stem Rust Pathogens from Tall Fescue and Perennial Ryegrass?" on p. 22-23