Response of Ryegrass Plant Introductions to Artificial Inoculation with *Pyricularia grisea* under Greenhouse Conditions

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ABSTRACT

Trevathan, L. E. 1982. Response of ryegrass plant introductions to artificial inoculation with *Pyricularia grisea* under greenhouse conditions. Plant Disease 66:696-697.

A total of 315 ryegrass (*Lolium multiflorum, L. perenne*) plant introductions representing 41 countries were tested for resistance to *Pyricularia grisea*. Symptoms ranged from no apparent leaf lesions to plant death. PI 231592, 231602, 287849, 287852, 298091, 303015, 303026, and 306692 were asymptomatic following double inoculations with *P. grisea*. Plant death was not correlated with number of leaf lesions.

Additional key words: ryegrass blast

One of the most widely grown, cool-season forage grasses in Mississippi is annual ryegrass (*Lolium multiflorum* Lam.). Alone or in combination with other annuals, total yearly plantings in the state average 100,000–120,000 ha. Blast of ryegrass caused by *Pyricularia grisea* (Cke.) Sacc. has occurred in epiphytotic proportions, causing significant losses in forage in Mississippi and Louisiana (2,3). Recently, isolates of the organism collected in Mississippi from crabgrass (*Digitaria sanguinalis* (L.) Scop.), ryegrass (*L. multiflorum*), St. Augustinegrass (*Stenotaphrum secundatum* (Walt.) Kuntze), spurge (*Euphorbia preslii* Guss.), smartweed (*Polygonum pensylvanicum* L.), and soybean (*Glycine max* (L.) Merr.) were found to be pathogenic to ryegrass (5). Isolates from monocotyledonous and dicotyledonous hosts were pathogenic to the ryegrass cultivars Gulf and Magnolia, which comprise most of the acreage planted in the state.

Bain (1) recommended delayed fall planting as a control measure to prevent the inoculum buildup that is necessary for severe outbreaks. However, late planting may cost the producer valuable grazing time prior to the onset of winter or may even delay grazing until warm weather in early spring.

A screening program was initiated at Mississippi State University to identify resistance in ryegrass plant introductions (PIs) to the major diseases occurring on the host throughout the state. This study is a summary of the response of PIs to artificial inoculation by *P. grisea* under greenhouse conditions.

MATERIALS AND METHODS

A total of 315 PIs representing 41 countries was planted in June 1980 in 10-cm-diameter clay pots. Seed and taxonomic speciation were provided by the USDA Regional Plant Introduction Station, Pullman, WA. Ten seeds were planted in each of two pots containing a soil:sand:peat moss (2:2:1, v:v:v) potting mixture (5); plants were thinned after emergence to five per pot. The limited amount of seed available prevented further replication. All plants were grown in the same greenhouse at a mean temperature of 25 C.

An isolate of *P. grisea* obtained from a natural infection of ryegrass at Starkville, MS, was used throughout the study. The fungus was maintained on V-8 juice agar at 25 C. For inoculation tests, sporulating cultures were obtained by streaking the organism onto V-8 juice agar and incubating in the laboratory in alternate periods of 8 hr of light and 16 hr of darkness for 10 days. Conidia were harvested by dislodging all fungal growth from the surface of cultures and filtering through cheesecloth (5). The resultant conidial suspension was sprayed onto the adaxial leaf surface of 4-wk-old plants until runoff at the rate of one plate per three plants. Pots were placed in a mist chamber in the greenhouse under natural conditions of light and a mean temperature of 25 C. All plants were observed for symptom development 72 hr after removal from the mist chamber. A disease index was calculated by counting the total number of lesions that developed on plants of a single introduction and dividing by ten.

After disease assessment, plants were clipped to the soil line and fertilized, and surviving PIs were reinoculated 4 wk later.

RESULTS AND DISCUSSION

Inoculation with a conidial suspension followed by 72 hr of misting was an

Table 1. Reaction of ryegrass plant introductions (PIs) to *Pyricularia grisea* infection by artificial inoculation under greenhouse conditions[a]

PI number
Disease index:[b] 0
231592, 231602, 287849, 287852, 298091, 303015, 303026, 306692
Disease index: 1–10
187221, 188732, 189156, 189157, 197270, 198070, 198958, 201186, 201187, 201188, 201189, 205278, 206377, 231569, 231571, 231572, 231573, 231574, 231575, 231577, 231578, 231591, 231593, 231594, 231596, 231597, 231601, 231603, 231604, 231618, 234048, 265342, 276666, 278704, 283609, 284823, 284824, 284826, 285100, 285101, 286465, 286466, 286467, 287847, 287850, 287851, 287853, 287854, 287855, 287856, 290374, 303019, 303020, 303022, 303023, 303025, 303027, 303028, 303029, 303030, 303032, 303033, 303034, 303035, 303036, 303037, 303038, 303039, 303043, 303044, 311071, 311072
Disease index: 11–50
179358, 196538, 204086, 204879, 220105, 231617, 234779, 237187, 238886, 239805, 255882, 265343, 265344, 265345, 265346, 265347, 265350, 266291, 266293, 274638, 286464, 290369, 303031, 303041, 303045, 306691, 376875, 376876
Disease index: 51–200
234442, 237183, 237184, 237185, 237186, 238939, 239804, 265341, 266111, 266292, 272119, 272121, 274637, 290373, 298092

[a] Four-week-old plants inoculated with a conidial suspension of *P. grisea* by spraying the adaxial surface of leaves until runoff, misted for 72 hr, and maintained in the greenhouse under natural conditions of light and a mean temperature of 25 C.

[b] Number of lesions on 10 inoculated plants of each PI divided by 10.

Published with the approval of the director of MAFES as Paper 4926.

Accepted for publication 21 October 1981.

The publication costs of this article were defrayed in part by page charge payment. This article must therefore be hereby marked "*advertisement*" in accordance with 18 U.S.C. § 1734 solely to indicate this fact.

0191-2917/82/08069602/$03.00/0

effective technique for testing the reaction of ryegrass to *P. grisea*. Symptoms ranged from no lesions to death of plants. Reactions of all PIs surviving the double inoculation are presented in Table 1. Disease indexes ranged from 0 to 211, with symptoms becoming apparent 24–48 hr after plants were removed from the mist chamber. Initial symptoms consisted of small, round to oval, water-soaked spots with gray centers. Leaf spots later became necrotic with chlorotic borders. In PIs that failed to survive, chlorosis expanded, causing leaf and plant dieback (5). This type of symptom development is indicative of toxin production.

Many PIs with disease indexes as low as those listed in Table 1 perished after disease ratings were made. Therefore, plant death was not closely correlated with the number of leaf lesions, and the disease index provided only a relative measure of infection for surviving plants. Because progressive development of chlorosis was commonly associated with plants that perished, there may be a correlation between toxin production and susceptibility to *P. grisea* in ryegrass.

The PIs that were more resistant to *P. grisea* were mostly from Europe. Of 315 PIs tested, eight were asymptomatic for ryegrass blast: PI 231592 from Algeria, PI 231602 from Greece, PI 287849 and 287852 from Spain, PI 298091 from Hungary, PI 303015 from Denmark, PI 303026 from France, and PI 306692 from Poland (Table 1). All asymptomatic PIs, and most of the 123 PIs that survived, were perennials (*L. perenne*). Only 20 annuals and one perennial × annual cross were among the survivors. In addition to being resistant to *P. grisea*, PI 231592, 231602, and 306692 also exhibit field resistance to rust, Drechslera leaf spot, and barley yellow dwarf (4). PI 303015 is capable of surviving both winter and summer temperature extremes in Mississippi (4).

This is the first report of resistance to *P. grisea* in ryegrass PIs. Eight sources of possible immunity to one isolate of *P. grisea* infecting ryegrass have been identified. Some of these sources have also exhibited field resistance to other pathogens causing diseases of ryegrass and adaptation to environmental conditions in Mississippi. It should be possible to select PIs for a breeding program with genes necessary to improve ryegrass production.

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