New Hosts of *Pyricularia oryzae*

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ABSTRACT

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Cross-inoculation studies using *Pyricularia oryzae* isolates from grass weeds and rice showed several rice cultivars were susceptible to isolates from *Rottboellia exaltata, Echinochloa colona,* and *Leersia hexandra.* Similarly, *Brachiaria distachya, E. colona, Leptochloa chinensis, R. exaltata*, and *L. hexandra* were susceptible to some isolates originating from rice. Of the five grass weeds susceptible to *P. oryzae, B. distachya* and *R. exaltata* are previously unreported.

Additional key words: host range

Blast, caused by *Pyricularia oryzae* Cav., is a serious disease of rice (*Oryza sativa* L.), especially rice that is grown in temperate regions or as an upland crop in the tropics. In a previous study of the host range of *P. oryzae* in the Philippines, *Brachiaria mutica* (Forsk.) Stapf and *Panicum repens* L. were reported as hosts of the fungus (13). Subsequently, several workers cross-inoculated isolates from rice and grass weeds but were unable to show cross-infection (F. L. Nuque, *personal communication*). There is no unanimity in the literature regarding the cross-pathogenicity of *Pyricularia* species occurring on rice and grass weeds, and the information on the host range of *P. oryzae* is conflicting (1,12). Some mycologists have considered the fungus attacking certain grasses to be *P. grisea*, a species distinct from the rice blast organism (10,11). The modern view is that because the two species are difficult to distinguish, they should be regarded as one (20) and should be referred to by the most widely used name, *P. oryzae* (7). Results from some cross-inoculation studies (1,6) showed *P. oryzae* readily infects several grass weeds. Kato and Yamaguchi (5) found rice isolates that could attack numerous grass species, but none of their isolates originating from grass weeds could infect rice. Other workers (5,9,11,14,17) have reported that the pathogenicity of isolates is largely restricted to the host from which the isolates were obtained.

Wild collateral hosts of the blast pathogen may be epidemiologically important, not only as alternate means of survival where one annual rice crop is grown but also because the ability to parasitize grass weeds may be a fitness requirement for new variants in the fungus population. This study sought to confirm and further investigate the existence of *P. oryzae* isolates able to infect grass weeds and rice cultivars in the Philippines.

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MATERIALS AND METHODS

Collection and isolation. Grass weeds and rice showing typical blast symptoms were collected in the field from late 1982 to early 1984. Infected tissues were cut into 5-cm sections and placed on bent-glass rods on moist filter paper in petri dishes, then incubated for 24 hr. Lesions were examined with a dissecting microscope, and conidial masses were picked using capillary tubing and transferred to prune-agar slants. For storage, pure cultures of the original isolates were transferred to sterile sorghum grains and allowed to colonize the grains. This substrate was then dried thoroughly at 35 C and kept in vials at 4 C. About 100 isolates were collected from rice and the noncultivated grasses *B. mutica, Eleusine indica* (L.) Gaertn., *Panicum repens, Pennisetum purpureum* (Schumach.), *Dactyloctenium aegyptium* (L.) Willd., *Digitaria ciliaris* (Retz.) Koch, *Echinochloa colona* (L.) Link, *Leersia hexandra* Sw., *Rottboellia exaltata* L.f., and *B. distachya* (L.) Stapf.

Inoculum production. To revive stored cultures, a colonized sorghum grain was placed on a prune-agar slant, where it grew for 7 days. Ten milliliters of prune liquid were then poured into the slant culture, and the surface of the culture was rubbed with a transfer needle. This suspension of mycelial fragments and conidia was poured onto plates containing oatmeal agar. The plates were incubated at about 27 C for 7 days. The fungal growth then was scraped with a rubber policeman and the plates were exposed under a fluorescent light for 3 days before harvesting conidia for inoculum. Inoculum was prepared by pouring distilled water into the petri dish and gently scraping the surface regrowth of the isolate with a sterilized rubber policeman. The conidial suspension was filtered through four layers of cheesecloth. The conidial concentration was measured with a hemacytometer and adjusted by dilution with a 1% gelatin solution to obtain a final concentration of 50,000 conidia per milliliter in 0.5% gelatin.

Inoculation. Plants were grown in 10-cm-diameter plastic cups in a greenhouse with three pots per replicate and three replicates per inoculation. Rice and grass weed seedlings were inoculated about 3 wk after sowing. Rhizomes of some grass weeds were used instead of seed, and shoots originating from the rhizomes sometimes were trimmed to allow a new leaf to extend before inoculation.

The 100 isolates collected from rice and grass weeds were tested on the host from which the isolate originated and on several blast-susceptible rice cultivars by the sheath-injection-inoculation method (8). Isolates with a strong pathogenic reaction were selected and used in further spray-inoculation tests with 12 rice cultivars and the grass weeds. The conidial suspension was sprayed onto the plants until runoff, and the plants were placed inside a dew chamber at 25 C for 24 hr before being transferred to a high-humidity room at 25–30 C. Each inoculation was repeated at least three times.

Disease assessment. Susceptibility of the test plants was assessed by examining the leaves for blast symptoms. Seven days after inoculation, infection was rated as 0 = no infection; 1 = small brown specks of pinhead size; 2 = 1.5-mm brown specks; 3 = small, roundish to slightly elongated, necrotic gray spots about 2–3 mm in diameter with brown margins; 4 = typical blast lesions, elliptical, longer than 3 mm; and 5 = typical blast lesions infecting 50% or more of the leaf area. Also, the presence or absence of sporulation on lesions was recorded after incubation for 24 hr in a moist chamber at 27 C.

RESULTS AND DISCUSSION

Several isolates attacked both rice and grass weeds (Table 1). Because the isolate from *B. distachya* produced only type 2 lesions on the rice cultivars Denorado and IR442-2-58, it was not considered pathogenic to rice. However, the isolate from *R. exaltata* produced sporulating lesions on rice, with type 3 lesions occurring on Aichi Asahi and type 4 lesions on IR442-2-58 (Table 1). *B. distachya* and *R. exaltata* were susceptible to rice isolate NBG-A8401, with *B. distachya* showing typical blast lesions. The lesions on *R. exaltata* and *B. distachya* sporulated abundantly during incubation. Both grass weeds are commonly present in upland fields at the International Rice Research Institute experimental farm, and as collateral hosts of the pathogen, they can provide inoculum for infection in upland rice grown there. *B. distachya* and *R. exaltata* have not been reported previously as *P. oryzae* hosts.

Three other grasses, *L. hexandra, L. chinensis* (L.) Nees, and *E. colona*, also were susceptible to *P. oryzae* (Table 1). Lesions from those hosts sporulated profusely during incubation. In India (18), Vietnam (6), and Brazil (16), *L. hexandra* is a host of *P. oryzae*. However, in Thailand (3,4) and in the previous report from the Philippines (13), *L. hexandra* was not a host. *L. chinensis* also has been found susceptible to *P. oryzae* in Vietnam (5), but the previous report from the Philippines (13) indicated it was not a host of the pathogen. *E. colona* has been reported as a host in Vietnam (6) and in Brazil (16). In Thailand and in the Philippines, *E. colona* was not considered a host of the blast fungus because *E. colona* isolates were pathogenic only to *E. colona* (3,4,13).

B. mutica, D. ciliaris, P. repens, and *P. purpureum* were not susceptible to *P. oryzae* from rice in this study, although isolates from those grasses readily infected their original hosts (Table 1). Those grasses were reported as hosts of the rice blast pathogen by others (2,3,13,15), and the failure of the tested *P. oryzae* isolates to infect them and rice could be due either to differences between the isolates used in this study and those used by others (1) or to differences between ecotypes of the grass weeds

Table 1. Disease produced by selected isolates of *Pyricularia oryzae* on various grasses and rice cultivars[a]

	Disease rating[b]												
	Rice isolates			Grass isolates[c]									
Test plant	43	2017	NBG-A8401	Bd-A8401	Bm-A8309	Da-A8201	Dc-A8301	Ec-A8401	Ei-A8309	Lh-A8401	Pr-A8202	Pp-A8201	Re-A8401
Brachiaria distachya	0	0	4	4	0	0	0	0	0	0	0	0	0
B. mutica	0	0	0	0	4	0	0	0	0	0	0	0	0
Dactyloctenium aegyptium	0	0	0	0	0	4	0	0	0	0	0	0	0
Digitaria ciliaris	0	0	0	0	0	0	4	0	0	0	0	0	0
Echinochloa colona	0	0	4	0	0	0	0	4	0	0	0	0	0
Eleusine coracana	0	0	0	0	0	0	0	0	4	0	0	0	0
E. indica	0	0	0	0	0	0	0	0	4	0	0	0	0
Leersia hexandra	0	0	4	0	0	0	0	0	0	5	0	0	0
Leptochloa chinensis	3	4	4	0	0	0	0	0	4	0	0	0	0
Panicum repens	0	0	0	0	0	0	0	0	0	0	4	0	0
Pennisetum purpureum	0	0	0	0	0	0	0	0	0	0	0	4	0
Rottboellia exaltata	0	0	3	0	0	0	0	0	0	0	0	0	4
Oryza sativa L.													
cv. Aichi Asahi	4	4	5	0	0	0	0	0	0	3	0	0	3
cv. Denorado	3	4	4	2	0	0	0	3	0	2	0	0	0
cv. IR442-2-58	4	4	5	2	0	0	0	0	0	4	0	0	4

[a] Based on three replicated trials.

[b] Disease rating scale: 0 = no infection; 1 = small brown specks of pinhead size; 2 = 1.5-mm brown specks; 3 = small, roundish to slightly elongated, necrotic gray spots, about 2–3 mm in diameter with brown margins; 4 = typical blast lesions, elliptical and longer than 3 mm; and 5 = typical blast lesions infecting 50% or more of the leaf area.

[c] Bd-A8401 from *B. distachya*, Bm-A8309 from *B. mutica*, Da-A8201 from *Dactyloctenium aegyptium*, Dc-A8301 from *Digitaria ciliaris*, Ec-A8401 from *Echinochloa colona*, Ei-A8309 from *Eleusine indica*, Lh-A8401 from *Leersia hexandra*, Pr-A8202 from *Panicum repens*, Pp-A8202 from *Pennisetum purpureum*, and Re-A8401 from *Rottboellia exaltata*.

tested (12). Also, in the fungus population on some hosts, the frequency of races able to attack both rice and other grass weeds may be low, and extensive sampling would be necessary to detect such races.

The isolate from *E. indica* was pathogenic on *E. indica, E. coracana,* and *L. chinensis.* Although it could infect more than one species of grass weed, it was not pathogenic to any of the 12 rice cultivars tested. Isolates of *Pyricularia* from *E. indica* can be fertile in mating tests with *P. oryzae* from rice (19), but there are no reports of isolates from *E. indica* being pathogenic to rice. Isolates from rice, however, have been reported to attack *E. coracana* (L.) Gaertn. (13).

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