Response of Cultivars and Wild Species of Rice to Yellow Dwarf Disease

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ABSTRACT

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Of 80 rice cultivars tested for resistance to yellow dwarf disease under field conditions, 58 showed symptoms in the main crop and 77 in the second growth (ratoon) crop. Twenty-two cultivars showed no symptoms in the main crop, and three showed no symptoms in either the main or second growth crop. *Nephotettix virescens* was used to transmit the agent in laboratory inoculations of 16 wild *Oryza* spp. *O. alta, O. australiensis, O. brachyantha, O. eichingeri, O. grandiglumis, O. latifolia, O. officinalis,* and *O. ridleyi* were resistant to yellow dwarf. None of the 42 species tested that were outside the genus *Oryza* became infected.

Rice yellow dwarf is prevalent in most of the rice-growing areas of the world (9). Continuous cultivation of rice throughout the year has increased the incidence and economic importance of the disease (5). Mycoplasmalike organisms have been associated with rice yellow dwarf (3,7), and at least three leafhoppers of the genus *Nephotettix* can transmit the yellow dwarf agent (9). Rice is grown as a ratoon or second growth crop in some parts of India (8). Under these conditions, the disease can limit rice production. Identification of resistance to the disease in genetically compatible sources would aid in control. We report the results of our search among rice cultivars and some related species for resistance to yellow dwarf.

MATERIALS AND METHODS

Rice cultivars and selections were grown during 1979 at the Main Research Station in Hebbal, Bangalore, India. Each cultivar was transplanted in seven rows of 40 seedlings each. The incidence of yellow dwarf was determined 20 days before harvest in the main crop and 15 days after harvest in the second growth.

Thirty seeds of each of 16 wild species of *Oryza* (obtained from International Rice Research Institute, Manila, Philippines) were sown individually in pots (10.2 × 15.2 cm) filled with soil. Second instar nymphs of healthy leafhoppers, *Nephotettix virescens* (Distant), were collected from stock colonies and transferred to rice plants diseased with yellow dwarf for a 2-day acquisition feeding. Thirty days later, the leafhoppers were enclosed in cylindric cages on individual rice seedlings at the rate of 6–10 insects per seedling. The insects were kept on the seedlings for 2–3 days and then killed with an insecticide.

Inoculated seedlings were kept in the glasshouse and observed for symptom development. Rice seedlings and 42 plants other than *Oryza* spp. were also inoculated with the yellow dwarf agent by exposure to infective *N. virescens* following the method of Morinaka and Sakurai (4).

RESULTS

Of the 80 cultivars tested for resistance under field conditions, 58 showed symptoms of yellow dwarf in the main crop and 77 in the second growth. Twenty-two cultivars showed no symptoms in the main crop, and three (MR-363, Gamasolu, HY-256) showed no symptoms in either the main or the second growth (Table 1). Disease incidence was 0–15% in the main crop and 0–71.5% in the second growth crop. Incidence was greatest in the main crop of variety IET-3626 (15%) and in the second growth of variety I-Sona (71.5%).

Of the 16 *Oryza* spp. tested by exposure to infective *N. virescens*, the following did not develop symptoms, nor was the yellow dwarf agent recoverable from them by back inoculation to rice seedlings using healthy *N. virescens*: *O. alta* Swallen, *O. australiensis* Domin., *O. brachyantha* A. Cheval., *O. eichingeri* Peter, *O. grandiglumis* Prodoehl., *O. latifolia* Desv., *O. officinalis* Wall., and *O. ridleyi* Hook. The following were susceptible to yellow dwarf: *O. barthii* A. Cheval., *O. minuta* Presl, *O. nivara* Koen., *O. perennis* Moenvch, *O. punctata* Kotschy, *O. rufipogon* Griffith, *O. rufipogon* × *O. nivara* and *O. sativa* L. f. *spontanea* Rosch. The incubation period in these species varied from 45 to 100 days. None of the 42 species representing 28 genera other than *Oryza* showed symptoms of yellow dwarf when exposed to infective *N. virescens*.

DISCUSSION

Kurosawa (2) reported on the basis of symptoms that all the Japanese rice cultivars he examined after harvest were affected by yellow dwarf. Hashioka (1) tested 331 rice cultivars in the field and found that 151 showed mild symptoms and the rest showed severe symptoms of yellow dwarf. None of the 34 cultivars tested by Muniyappa and Ramakrishnan (6) by exposure to infective vectors was resistant to yellow dwarf.

In our study, 22 rice cultivars that had not been tested previously appeared to be resistant to yellow dwarf in the main crop. Three of these (MR-363, Gamasolu, and HY-256) did not show symptoms in the second growth, and could be recommended wherever this is practiced. The *Oryza* spp. that were resistant to yellow dwarf could also be used in breeding programs to develop resistant varieties.

None of the grasses inoculated with the

Table 1. Incidence of yellow dwarf disease in main and second growth crops of rice cultivars

Cultivar	Incidence (%)[a]	
	Main crop	Second growth
MR-363	0	0
Gamasolu	0	0
HY-256	0	0
IET-1785	0	1.07
MR-272	0	2.86
IET-2501	0	2.50
MR-377	0	2.50
MR-359	0	0.71
MR-365	0	1.42
IET-2911	0	1.42
MR-292F	0	5.71
IET-3280	0	2.87
IET-3305	0	2.14
KMP-42	0	2.50
83 KMP-42(A)-57	0	3.21
A-90	0	4.28
Y-4	0	3.93
HY-26-10	0	3.21
HY-258	0	1.42
M-161	0	2.14
IR-2941-8-1	0	1.78
RP-974-5-7-6-2	0	1.07
IET-2254	0.36	1.07
K-44-1	0.36	2.50
HY-249-17	0.36	1.42
IR-2863-31-3	0.36	1.78
RP-894-61-1-107	0.36	2.50
M-141	0.36	2.14
IET-2295	0.71	2.86
IET-5850	0.71	2.14
A-67	0.71	3.57
IET-2490	0.71	2.14
IR-4427-315-2-3	0.71	5.71

[a] Based on number of plants showing symptoms in seven rows (280 plants).

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yellow dwarf agent developed symptoms, which suggests that rice or other *Oryza* spp. are the primary source of inoculum.

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