Interaction among resistant rice genotypes, whitebacked planthopper *Sogatella furcifera* (Horvath), and egg parasitoid *Anagrus* nr. *flaveolus*

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Ecological approaches such as the use of resistant varieties are major components of pest management in rice. Rice cultivars resistant to whitebacked planthopper (WBPH) *Sogatella furcifera* (Horvath) (Hemiptera: Delphacidae) are important in integrated pest management. A study was carried out to elucidate the interactions between rice genotypes resistant to WBPH and its egg parasitoid *Anagrus* nr. *flaveolus* (Hymenoptera: Mymaridae). Ten rice genotypes—PSBRc 10, Babawee, IR36, IR72 (resistant), A5174, A5368, A5301, A5372 (moderately resistant), IR26 (susceptible), and TN1 (highly susceptible)—were used in the screenhouse and microplot experiments.

In the screenhouse experiment, 30-, 40-, and 60-d-old potted plants of selected genotypes with WBPH eggs were exposed in the field for natural egg parasitization and the percentage of parasitization was calculated (Otake 1967). Each genotype was replicated five times. In the microplot trial, the selected test genotypes were raised in microplots (100 × 100 × 60 cm) in three replications under unprotected conditions. A sample of 25 tillers was taken at random on 30-, 45-, and 60-d-old plants, observed for parasitized and unparasitized WBPH eggs, and the percentage of parasitization was determined (Otake 1977). The data obtained were analyzed using pooled analysis of variance.

The results of the screenhouse experiment revealed that parasitization of the WBPH eggs by the egg parasitoid *A.* nr. *flaveolus* was more on resistant genotypes than on susceptible TN1 on 30-d-old plants (Table 1). Parasitization was highest on resistant genotype Babawee with 56.8% parasitization, five times more than with susceptible TN1, which had 12.0%. Resistant genotypes PSBRc 10, A5301, A5372, and IR72 had 41.2%, 38.8%, 35.2%, and 34.0% parasitization, respectively. On 45-d-old plants, parasitization on resistant genotypes ranged between 13.2% and 41.8%, whereas on susceptible TN1 it was 7.6%. On resistant genotypes, parasitization by *A.* nr. *flaveolus* was two to six times higher.

The parasitization on 60-d-old plants showed a trend similar to that of the 30- and 45-d-old plants. Resistant genotypes Babawee (21.0%) and PSBRc 10 (19.8%) had six to seven times more parasitization than susceptible TN1 (3.8%). As plant age increased, parasitization by *A.* nr. *flaveolus* decreased. Parasitization was higher on Babawee (39.9%) and was five times more than on susceptible TN1 (7.8%).

In the microplot trials using different ages, the parasitization of WBPH eggs by the egg parasitoid *A.* nr. *flaveolus* on selected rice genotypes ranged from 20.9% to 48.0% (Table 2). On 30-d-old plants, resistant genotypes Babawee (48.0%), IR72 (43.8%), PSBRc 10 (43.4%), A5368 (41.9%), and A5372 (40.2%) had the highest parasitization. Susceptible IR26 had the lowest parasitization (24.3%), significantly different

Table 1. Parasitization of WBPH eggs by *Anagrus* nr. *flaveolus* on different rice genotypes (screenhouse experiments).[a]

Genotype	Parasitization (%) – Age of plant: 30-d-old	45-d-old	60-d-old	Mean
IR36	27.6 ef	25.8 efg	14.4 jk	22.6 D
IR72	34.0 bcd	23.6 fgh	12.0 kl	23.2 D
Babawee	56.8 a	41.8 b	21.0 ghi	39.8 A
PSBRc 10	41.2 b	33.6 d	19.8 hi	31.5 B
A5174	21.4 ghi	13.2 jk	7.4 lm	14.0 E
A5301	38.8 bc	31.0 de	17.8 ij	29.2 BC
A5368	30.4 de	24.0 fgh	11.4 kl	21.9 D
A5372	35.2 cd	26.0 efg	13.0 cdjk	24.7 CD
IR26	17.8 ij	12.0 kl	9.2 kl	13.0 E
TN1	12.0 kl	7.6 lm	3.8 m	7.8 F

[a]Mean of five replications. In a column, means followed by the same small letter are not significantly different at $P = 0.05$ by Duncan's multiple range test. In a column, means followed by the same capital letter are not significantly different at $P = 0.05$ by DMRT.

Table 2. Parasitization of WBPH eggs by *A.* nr. *flaveolus* on different rice genotypes (microplot experiment).[a]

Genotype	Egg parasitization (%) Age of plant 30-d-old	45-d-old	60-d-old	Mean
IR36	39.2 b-f	33.1 efg	24.3 h	32.2 AB
IR72	43.8 ab	35.6 def	25.4 h	34.7 A
Babawee	48.0 a	38.3 b-f	23.4 h	36.6 A
PSBRc 10	43.4 abc	39.6 b-f	26.5 h	36.5 A
A5174	39.4 b-f	36.6 c-f	21.1 h	32.4 AB
A5301	39.9 b-f	39.1 b-f	25.8 gh	35.0 A
A5368	41.9 a-d	38.6 b-f	22.8 h	34.4 A
A5372	40.2 b-e	36.7 b-f	20.9 h	32.6 AB
IR26	24.3 h	26.7 gh	28.0 gh	26.3 B
TN1	34.4 b	32.8 fg	26.7 gh	31.3 AB

[a]Mean of three replications. In a column, means followed by the same small letter are not significantly different at $P = 0.05$ by Duncan's multiple range test. In a column, means followed by the same capital letter are not significantly different at $P = 0.05$ by DMRT.

from susceptible TN1 (34.4%). Parasitization on resistant genotypes ranged from 33.1% to 39.6% and all were on a par among themselves, except for IR36 on 45-d-old plants. Susceptible IR26 and TN1 recorded 26.7% and 32.8% parasitization, respectively, and were significantly different among themselves and from other resistant genotypes. On 60-d-old plants, there was no significant difference in the extent of parasitization between resistant and susceptible genotypes. Parasitization on resistant genotypes ranged between 32.2% and 36.6%, whereas that on susceptible TN1 was 31.3%.

The high level of parasitization on the resistant genotypes could be attributed to the smaller number of eggs per hill and number of eggs per egg mass compared with those on susceptible TN1. The resistant rice plants also slowed down the growth rate of WBPH, thereby making it available to natural enemies for a longer time and increasing its mortality. Price et al (1980) reported that the longer life cycle of the host can be successfully exploited by the natural enemies.

Chantarasa et al (1984) described an inverse density-dependent relation between parasitization and size of host egg mass. Moreover, the adult parasites spent more time on the resistant genotypes locating the feeding and oviposition sites, during which time more eggs were parasitized (Price 1986).

References

Chantarasa S, Hirashima Y, Miura T, Holling CS, Hassell MP, Varley GC. 1984. Ecological studies on *Anagrus incarnates* Haliday (Hymenoptera: Mymaridae), an egg parasitoid of the rice planthoppers. I. Functional response to host density and mutual interference. J. Fac. Agric. Kyushu Univ. 29:59-66.

Otake A. 1967. Studies on the egg parasites of the smaller brown planthopper, *Laodelphax striatellus* (Fallen) (Hemiptera: Delphacidae). I. A device for assessing the parasitic activity. Bull. Shikoku Agric. Exp. Stn. 17:91-103.

Otake A. 1977. Natural enemies of the brown planthopper. In: The rice brown planthopper. Taipei (Taiwan): Food and Fertilizer Technology Center for the Asian and Pacific Region. p 42-57.

Price PW. 1986. Ecological aspects of host plant resistance and biological control: interactions among three trophic levels. In: Boethel DJ, Eikenbery RD, editors. Interaction of plant resistance and parasitoids and predators of insects. Chichester (England): Ellis Horwood Limited. p 11-30.

Price PW, Bouton CE, Gross P, McPheron BA, Thompson JN, Weis AE. 1980. Interactions among three trophic levels: influence of plants on interactions between insect herbivores and natural enemies. Annu. Rev. Ecol. Syst. 11:1141-1165.