A DOMINANT GENE IN RICE FOR RESISTANCE TO WHITE-BACKED PLANTHOPPER AND ITS RELATIONSHIP TO OTHER PLANT CHARACTERISTICS

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SUMMARY
The inheritance of resistance to white-backed planthopper, Sogatella furcifera Horvath, was investigated in a rice, Oryza sativa L. cultivar N22. Resistance to the white-backed planthopper in the cross IR30 × N22 appears to be governed by a single dominant gene - designated Whph. The classification for various characteristics of 397 F₃ families of the IR30 × N22 cross confirmed earlier results about the monogenic dominant control of resistance to brown planthopper, green leafhopper, and bacterial leaf blight, and about the monogenic recessive control of short stature. Additionally, the genes governing plant height and resistance to white-backed planthopper, brown planthopper, green leafhopper, and bacterial leaf blight were found to segregate independently of each other in these 397 F₃ families.

INTRODUCTION
The white-backed planthopper (WBP), Sogatella furcifera Horvath, is one of the important insect pests of rice, Oryza sativa L. It occurs in most rice-growing areas in Asia and causes considerable damage to the rice crop. WBP caused 'hopperburn' in rice crops in Malaysia (YUNUS & ROTHSCHILD, 1967) and in Indonesia and India (KHUSH, 1977a).

Screening several hundred rice cultivars from the germplasm bank of the International Rice Research Institute (IRRI) showed several to have WBP resistance (PATHAK, 1972; IRRI, 1974). A few of these cultivars are now used as donors for WBP resistance in the IRRI rice improvement program, the major objective of which is to develop rices with multiple disease and insect resistance and short stature (KHUSH & COFFMAN, 1977).

The IRRI rice improvement program has produced several cultivars and numerous breeding lines with semidwarf stature and resistance to the brown planthopper (BPH), the green leafhopper (GLH), the bacterial leaf blight (BLB), and virus diseases (KHUSH, 1977b). The inheritance of resistance to various diseases and insects and linkage relations of genes for disease and insect resistance with important agronomic

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and grain quality traits (Sujadi & Khush, 1977) are also being studied at IRRI.

The present study investigated the inheritance of resistance to WBP in the rice cultivar N22 and ascertained the relationship between the recessive gene sdl for semidwarf stature (Foster & Rutger, 1978) and genes for resistance to WBH, BPH, GLH, and BLB.

**MATERIALS AND METHODS**

The F1, F2, and F3 progenies from the cross IR30 x N22 were used to determine the mode of inheritance of resistance to WBP. IR30 is an improved plant type cultivar and is homozygous for the semi-dwarf stature gene sdl, BPH resistance gene Bph 1, GLH resistance gene Glh 3, and BLB resistance gene Xa 4. IR30 is, however, susceptible to WBP. N22 (IRRI Accession no. 4819), on the other hand, is resistant to WBP, has a tall stature and is susceptible to BPH, GLH and BLB.

The F2 and F3 populations of this IR30 x N22 cross, therefore, segregated for plant height and for resistance to BLB, WBP, GLH, and BPH. The F1, F2, and F3 populations were evaluated for WBP resistance, whereas F3 families were evaluated for the other characteristics.

The reactions to the WBP were determined by the bulk seedling test (Athwal et al., 1971). Seven-day-old F1, F2, and F3 rice seedlings grown in seed boxes were infested with 2nd and 3rd instar WBP nymphs. TN1 was used as a susceptible check; N22 was the resistant check, and the test materials were scored when the TN1 plants were killed. The F1 and F2 populations were scored on the individual plant basis, whereas the F3 populations were scored on a family basis. Each F3 family was classified as homozygous resistant, segregating, or homozygous susceptible. Resistance to GLH and BPH was evaluated in a similar way using F3 families. The clipping technique (Kauffman et al., 1973) was used to assess the reaction of F3 lines to BLB.

The F2 populations from two different F1 plants of IR30 x N22 were grown in the field. A random sample of 397 and 352 plants from these two F2 populations was harvested, and thus, 749 F3 families were evaluated for WBP resistance. However, only 397 F3 families originating from one F2 population were evaluated for plant height and resistance to GLH, BPH, and BLB.

Seeds from each F2 plant were divided into four sets of 3-g samples each. Three seed sets were used to determine the reaction of these lines to WBP, GLH, and BPH. The fourth set was planted in the field to study plant reaction to BLB. Plants at the maximum tillering stage (45 days after seeding) were inoculated with the BLB isolate PX061 and were scored 14 days after inoculation. These families were also classified for plant stature at flowering (90 days after seeding).

The data were analyzed to determine the mode of inheritance and to ascertain whether any two traits were associated with each other.

**RESULTS**

*Inheritance of resistance to white-backed planthopper.* The F1 progenies were resistant to WBP, indicating that WBP resistance of N22 is dominant. The F2 population showed 774 resistant and 279 susceptible seedlings, while among the 749 F3 lines, 199