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COMBINING ABILITY FOR RESISTANCE TO BLAST DISEASE IN RICE

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The concept of combining ability in disease resistance is a novel idea to bring out the best combiners for breeding programme. Studies are available on the combining ability of rice to bacterial blight resistance[1], wheat to brown rust resistance[2], maize to *Helminthosporium mavdis*[3] and maize to brown stripe mildew[4]. Though Zenith, Tetep and Tadukan are utilized by breeders and pathologists in most of the rice-growing countries of world, as blast donors in resistance study, the efficiency of these rice varieties in combining ability for bla⁻t resistance has not yet been investigated. In the present study attention has been paid to construct superior genotypes with the aid of additive genetic variance in the self-fertilized crop, the rice for selecting the best combiners in blast resistance.

Seven rice varieties were chosen from the germplasm stock of the Central Rice Research Institute assuming a high degree of homozygosity due to inbreeding of more than 8 generations. The varieties *viz.* Zenith, Tetep and Tadukan were resistant. Jaya was moderately resistant and Ratna, Karuna and Co. 13 were susceptible to the isolate C_2 used in the present study. Seeds of parents, crosses and reciprocals (from the complete diallel set) were grown in zinc trays (80 × 80 × 10 cm) by complete random design (49 microblocks/tray) with 3 replications. Trays were filled with field soil amended with farm manure. Seeds were germinated by blotter method and 5 germinated seeds were kept in a microblock in each tray at a distance of 5 cm apart from seed to seed. Seeds of Karuna were sown surrounding the varieties close to the tray wall for detection of artificial infection. Ten g of nitrogen were applied to each tray with 15-day old seedlings.

Artificial inoculation was carried out according to Padmanabhan *et al*[5]. Seedlings (21-day old) in inoculation chambers were sprayed uniformly by an atomizer with a spore suspension of *Pyricularia oryzae*, containing approximately 10^5 spores/ml suspension. Spraying took place late in the evening. Relative humidity was maintained at above 90% by keeping the thick gunny hessian surrounding the inoculation chamber wet. Disease was rated on the 10th day after inoculation according to Padmanabhan and Ganguly[6] on the 2nd leaf from the top[7] and averaged over 5 seedlings. The combining ability was statistically analysed according to model I method I of Griffing[8]. The experiment was conducted during 1981 *rabi*.

Significant differences were observed among the genotypes for disease reaction. Table 1 shows that variation due to general combining ability (*gca*) and specific combining ability (*sca*) was highly significant for disease reaction. However, variance due to reciprocals was non-significant. The variance of *gca* was much higher than those due to *sca* suggesting that additive genetic variance was more important than non-additive variance. Effects of *gca* were estimated

Tabel 1

Analysis of variance for combining ability

Source	Df	Mss	F
Gca	6	499.9338	80.7178[a]
Sca	21	70.3594	11.3600[a]
Reciprocals	21	10.2984	1.6627
Error	96	6.1936	

[a]Significant at 1% probability

for the seven varieties for disease reaction (table 2). The lowest *gca* values were recorded in Zenith, Tetep and Tadukan *i.e.* -5.754, -5.809 and -5.782 respectively while the highest value was recorded in Co. 13 (8.140). All the *gca* values were highly significant except Jaya which was significant at 5% level. Analysis of C. D. indicates that the resistant varieties were differentiated from the susceptible ones and had almost equal *gca* values. This depicts that Zenith, Tetep and Tadukan were the best combiners to evolve blast-resistant and high-yielding rice varieties.

Sca data revealed that F_1 hybrids (table 2) showing maximum negative (maximum resistance) effects were in Tetep × Co. 13 (-8.240), Tadukan × Co. 13 (-8.217) and Zenith × Co. 13 (-8.145). Individual *sca* values in Zenith × Jaya, Tetep × Jaya, Tadukan × Karuna, Jaya × Ratna, Jaya × Karuna were insignifi-

TABLE 2

General combining ability (diagonal values) and specific combining ability effects for disease reaction at seedling stage.

Parent	Zenith	Tetep	Tadukan	Jaya	Ratna	Karuna	Co. 13
Zenith	– 5.754 (2.9)	5.537	5.311	– 0.376	– 2.183	– 6.059	– 8.145
Tetep		– 5.809 (2.4)	5.382	– 0.671	– 2.245	– 5.288	– 8.240
Tadukan			– 5.782 (2.4)	5.473	– 1.805	– 0.102	– 8.217
Jaya				– 0.505 (6.3)	0.623	– 0.102	2.228
Ratna					2.162 (14.7)	2.826	6.521
Karuna						6.530 (38.4)	3.061
Co. 13							8.140 (37.5)

C. D. at 5% for $\zeta i = 0.384$; S_{ij}' 0.958; $(\zeta i - \zeta j) = 1.084$; $(S_{ij} - S_{ik}) = 1.696$; $(S_{ij} - S_{ki}) = 1.621$

Data in parentheses represent disease index.

cant. Further it was observed that the best general combiners contributed to many F_1 hybrids with high negative effects except in a few cases.

Combining ability analysis reveals that *gca* effects seem equally important as *sca* effects. Varieties having lowest negative *gca* as highly resistant to blast at seedling stage where resistance is governed by the gene with additive and epistasis action. Incorporation of such parents in breeding programme would help to evolve synthetic groups and multilines possessing high yielding and blast resistant character. Since *sca* implies dominance, dominance × dominance and additive × dominance, a parent or cross with significant negative *sca* would be suited for heterosis breeding or composites. Due to the close *gca* effects any parent of resistant group (Tetep, Tadukan and Zenith) would solve the selection for resistance donors. If *sca* effects are to be exploited alone, crosses with high negative *sca* effects are to be selected. In that case, agronomic importance should be considered along with resistance. Besides the traditional blast resistant donors mentioned earlier, Jaya and its crosses with negative *sca* effects can be utilized for evolving high-yielding blast resistance lines.

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EFFECT OF TEMPERATURE PRE-TREATMENT AND GIBBERELLIC ACID ON GROWTH, CHLOROPHYLL AND PROTEIN IN *VIGNA RADIATA*, L. WILCZEK.

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THE change of temperature in producing a biochemical lesion may either increase the rate of breakdown or inhibit the synthesis of an essential constituent of an