Indian J. mycol. Res., 27(1), 25-30(1989)
Printed in India

RELATION OF PLANT TYPE WITH DISEASE RESISTANCE AGAINST BACTERIAL LEAF BLIGHT OF RICE

BY

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In the present study an attempt was made to find out relationship of thirteen plant characters, considered to be yield attributes with incidence of bacterial leaf blight. Incidence of brown spot did not influence bacterial leaf blight. Among the thirteen morphological characters significant negative relationship obtained in respect of leaf angles. Days to flower, height of plant, number of effective and non-effective tillers, dimension of flag leaf, panicle length, grain density, spikelet sterility, grain weight individually did not influence bacteria leaf blight.

Key words : Plant type, Disease resistance, Bacterial leaf blight, Rice

INTRODUCTION

Rice (*Oryza sativa* L.) the most important cereal in South East Asia, including India suffers from attack of a large number of diseases. The disease situation in rice was rapidly changed particularly with the shift to new high yielding dwarf indica varieties and adoption of new pakage of practices for their effective exploitation. Severe incidence of a number of new diseases on rice have been noticed (Khatua, 1980). The present situation definitely indicates the need of integrated management with emphasis on use of resistant varieties. As the rice crop is attacked by a large number of diseases, a variety thus will require resistance against a number of them under varying agroclimatic conditions. But it is quite likely that high degree of vertical resistance which may be desirable from both theoretical and practical stand point against major diseases can not possibly be incorporated into a single variety, hence attention has to be paid to broad based multiple horizontal resistance against major pathogens which will enable a variety to be moderately to fairly resistant to major pathogens. Field or horizontal resistance is dependent to a large extent on expression of morphological characters with which it may be linked in direct or indirect manner.

Singh and Nanda (1975) found negative correlation of yield with incidence of bacterial leaf blight. Inheritance of plant height was not found to be linked in any way with susceptible genes against bacterial leaf blight disease of rice (Moseo *et al.*, 1975). Kiryu and Mizuta (1955) found that rice varieties having few, short, narrow

leaves with less horizontal spread of leaves were most resistant to bacterial leaf blight No correlation was observed by Devadath *et al.* (1980) between development of this disease and leaf characterers, only leaf angle was noted to play an important role in the build up of the disease. Comprehensive study relating plant characters with disease resistance is lacking. The present study was undertaken with the objective of finding out existence of relationship, if any, between some characters including reaction towards brown spot, determining plant type and yield potential in a number of varieties with incidence of bacterial leaf blight. Influence of a factor both in the plant type as a whole and when considered individually has been studied

MATERIALS AND METHODS

Present investigation consisted of five discreet field experiments on rice conducted during both Kharif (July-November) and boro (January-June) from 1975 to 1977 in the Teaching Farm at Mohanpur-Mondouri of the Bidhan Chandra Krishi Viswavidyalaya, West Bengal. Fifty one cultivars of rice including both tall and dwarf high yielding indicas and japonicas having different grades of resistance against bacterial leaf blight were taken for the study. Usual cultivation practices were followed in all the seasons.

Randomised block design was followed in all the experiments with three replications. Each block (replication) was divided into two sub-blocks. One sub-block was meant for tall varieties and other for dwarf varieties. In each replication, seedlings of each variety were transplanted in four consequitive rows of four metre length, with a spacing, row to row 25 cm and plant to plant 15 cm. On each side of each block, there was plot of two metre width along the length for planting of highly susceptible variety (Taichung Native 1). Rows in these plots were arranged in opposite direction to the main block of experimental varieties.

Observations were recorded for incidence of bacterial leaf blight, brown spot disease and thirteen plant characters (shown in Table-2). Standard evaluation system as developed by International Rice Research Institute (Annonymous, 1975) was used for disease scoring at dough stage. In case of brown spot whole plant (hill) was taken into account in disease scoring and flag leaves in bacterial leaf blight. Grain density meant number of grain per centimetre length of the panicle. Score values for spiklet sterility was assigned using 0-9 scale (Annonymous, 1975). Angle of leaf was measured with the help of protractor within 24 hours of flower emergence.

Statistical analysis of the recorded data were carried out for proper interpretation. Coefficient of correlation (r) was calculated using formula described by Chandel (1970). The multiple linear regression analysis on the observed data had been done on Burroughs B 6738 computer system, using BASIS, the Burroughs advance

statistical analysis system, to find relationship of incidence of bacterial leaf blight with brown spot (X_1) and thirteen plant characters (X_2—X_{14}). This programme performed multiple linear regression by fitting an equation of the form $Y = A_0 + A_1X_1 + A_2X_2 + \ldots \ldots A_n X_n$ where

Y = the dependent variable

A = constant, X_1 to X_n the independent variables

Regression coefficient and partial correlation coefficient (r_p) were determined using the same computer system.

Significance of correlation coefficient (r), regression coefficient, partial regression coefficient (r_p) were tested by t test (Chandel, 1970).

RESULTS AND DISCUSSION

Results of the study with fifty one varieties of rice including tall and dwarf 'indica', dwarf 'japonica' and thirteen plant characters normally considered as yield attributes were presented after statistical analysis, in Tables 1 and 2 Data presented in Table 1 showed existence of a good relationship between the plant morphological characters and incidence of bacterial disease caused by *Xanthomonas campestris* pv *oryzae*. This was evident from the figures of multiple correlation coefficients which were significant in all cases except in one season. Where though not significant, similar trend was noticed. The values were, however, found to

Table 1. *Multiple correlation coefficient for relation of bacterial leaf blight disease with brown spot and thirteen plant characters*

Seasons	Multiple correlation coefficient	F ratio	Confidence level
K I	0.63240	1.713	90.39
K II	0.70328	2.516	98.70
K III	0.75630	3.436	99.85
B I	0.69469	2.131	99.21
B II	0 82594	3.219	99.22

K I Kharif crop at Mohanpur, 1975. K II Kharif crop at Mondouri, 1975. K III Kharif crop at Mondouri, 1976. B I Boro crop at Mondouri, 1976. B II Boro crop at Mondouri 1977.

differ in different seasons, indicating the role of environmental factors in these characters. These factors have a direct influence on development of plant morphological characters, consequently they exert an influence on the disease through host and also direct through pathogens which are equally affected by them regarding their perpetuation, multiplication, and spread.

Analysis of the data showed that the two diseases namely bacteriai leaf blight and brown spot functioned more or le s independently and did not show relationship or interdependence. Of the other thirteen characters studied considered to be yield attributes, significant relationship to bacterial leaf blight was recorded in respect to leaf angles only. Other characters in association with leaf angel

Table 2. *Summarised statistical findings showing relationship of fourteen plant characters with iucidence of bacterial leaf blight.*

Plant characters	Season	Correlation coefficient (r)	t values for r	Partial correlation coefficient (r_p)	t values for r_p	Regression coefficient	t values for regression coefficient
1	2	3	4	5	6	7	8
Reaction towards brown spot (X_1)	K I	0.068	0.476	0.080	0.485	0.075	0.465
	K II	0.002	0.019	0.267	1.666	0.243	1.667
	K III	0.136	0.958	0.217	1.334	0.286	1.334
	B I	0.109	0.128	0.213	1.224	0.172	1.236
	B II	0.131	0.785	0.314	1.523	0.224	1 518
Days to flower (X_2)	K I	-0.009	0.063	0.072	0.435	0.009	0.435
	K II	-0.118	0.830	0.239	1.483	0.032	1.483
	K III	-0.002	0.015	0.037	0.223	0.004	0 223
	B I	0.195	1.331	-0.053	0.303	-0.011	0.303
	B II	0.106	0.766	-0 393	1.964	-0.095	1.957
Height of the plant (X_3)	K I	-0.119	0.841	-0.045	0 271	-0.006	0 271
	K II	-0.205	1.469	-0.213	1.307	-0.035	1.307
	K III	-0.097	0.684	-0.172	1.047	-0.015	1.048
	B I	-0.229	1.577	-0.352	2.130	-0.049	2.129
	B II	-0.278	1.687	-0.134	0.624	-0.021	0.621
Number of total tiller (X_4)	K I	0.346*	2,430	0.272	1.699	0.221	1.699
	K II	0.082	0.579	0.091	0.551	0.085	0.551
	K III	0.338*	2.517	-0.019	0.116	-0.017	0.116
	B I	0.169	1.488	0 002	0.013	0.001	0.013
	B II	0.049	0.289	-0.258	1.231	-0.149	1.227
Percentage of non effective tillers (X_5)	K I	0.177	1.258	-0.125	0.756	-0.049	0 756
	K II	0.101	0.711	-0.244	1.513	-0.114	1.513
	K III	0.049	0.343	0.015	0.093	0.004	0 090
	B I	0.102	0.688	0.204	1.178	0.031	1.177
	B II	0.201	1.196	0.407*	2.053	0.104*	2.045
Length of flag leaf (X_6)	K I	-0.113	0.796	-0.062	0.371	-0.024	0.371
	K II	-0.143	1.009	-0.093	0.561	-0.018	0 562
	K III	-0.053	0.370	0.006	0.039	-0.0003	0 004
	B I	-0.035	0.237	-0.076	0.441	-0.028	0.433
	B II	-0.075	0.436	-0.171	0.799	-0.130	0.797

Contd.→

1	2	3	4	5	6	7	8
Breadth of flag leaf (X_7)	K I	0.145	1.026	0.087	0.526	0.934	0.526
	K II	0.275	2.006	0.172	1.046	2.217	1.047
	K III	0.195	1.396	0.232	1.432	2.482	1.432
	B I	0.262	1.821	0.357*	2.169	3.778*	2.168
	B II	0.243	1.459	0.282	1.351	3.464	1.347
Angle of flag leaf (X_8)	K I	-0.521**	4.268	-0.299	1.883	-0.048	1.884
	K II	-0.482**	3.854	-0.438**	2.923	-0.072*	2.294
	K III	-0.596 *	5.190	-0.522**	3.673	-0.083*	3.673
	B I	-0.496**	3.827	-0.395**	2.435	-0.056	2.434
	B II	-0.524**	3.586	-0.475**	2.482	-0.078*	2.473
Angle of Second leaf (X_9)	K I	-0.316	2.328	0.003	0.021	0.002	0.021
	K II	-0.176	1.253	0.327*	2.073	0.174*	2.073
	K III	-0.236	1.702	0.290	1.750	0.133	1.821
	B I	-0.350*	2.504	0.085	0.485	0.038	0.485
	B II	-0.259	1.561	0.245	1.162	0.117	1.158
Angle of third leaf (X_{10})	K I	-0.244	1.764	-0.003	0.021	-0.001	0.021
	K II	-0.195	1.389	-0.221	1.362	-0.069	1.362
	K III	-0.138	0.975	-0.099	0.594	-0.026	0.597
	B I	-0.261	1.811	0.080	0.455	0.025	0.455
	B II	-0.180	1.096	-0.060	0.279	-0.022	0.278
Panicle length (X_{11})	K I	0.092	0.647	0.029	0.029	0.029	0.176
	K II	0.091	0.638	0.134	0.809	0.194	0.810
	K III	0.116	0.817	-0.061	0.364	-0.058	0.364
	B I	0.043	0.287	-0.015	0.083	-0.010	0.083
	B II	0.165	0.978	0.325	1.581	0.371	1.576
Grain density (X_{12})	K I	-0.121	0.841	0.092	0.555	-0.191	0.555
	K II	-0.234	1.688	0.246	1.520	-0.565	1.520
	K III	-0.222	1.594	-0.140	0.851	-0.275	0.851
	B I	-0.009	0.062	-0.190	1.095	-0.383	1.095
	B II	-0.142	0.833	-0.281	1.349	-0.619	1.345
Spikelet sterility (X_{13})	K I	0.173	1.229	0.156	1.013	0.270	1.013
	K II	0.256	1.854	0.215	1.320	0.303	1.321
	K III	-0.194	1.387	-0.344*	2.199	-0.602*	2.200
	B I	0.125	0.842	0.170	0.978	0.304	0.978
	B II	0.352*	2.192	0.451*	2.160	0.707*	2.313
1000 grain weight (X_{14})	K I	-0.195	1.396	-0.108	0.651	-0.050	0.651
	K II	-0.068	0.479	-0.124	0.752	-0.064	0.752
	K III	-0.259	1.880	-0.244	1.506	-0.115	1.511
	B I	-0.083	0.565	-0.147	0.841	-0.053	0.840
	B II	-0.194	1.152	0.109	0.504	0.069	0.502

** Significant at 1% level, * Significant at 5% level

contributed towards disease resistance, which was evident from the significant value of multiple correlation coefficient, but individually these characters could not influence the disease. But in a similar study with brown spot of rice, Khatua and Chattopadhyay (1986) obtained significant relationship of the disease with a number of plant characters, namely, days to flower, height, number of effective tillers, flag leaf dimensions, leaf angles. Findings of Moseo *et al.* (1975) in respect of height of the plant was similar with the findings of present investigation. Angle of flag leaf showed significant value in respect of correlation, partial correlation and regression coefficient, but in the negative direction, similarly in case of second leaf, but not strongly so, and third leaf did not show any significant relationship. Negative values might have a relational explanation in the nature of pathogen which is a vascular parasite. Narrow angle probably presents greater opportunity of easier translocation. Devadath *et al* (1980) obtained somewhat different results. The difference might be due to the difference in method and time of recording leaf angles. Leaf angles gradually change after emergence. In the present study leaf angle was measured within twenty four hour of emergence of flag leaf.

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(Accepted for publication November 8 1988)