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Influence of Host-Nutrition on Resistance in Rice to *Pyricularia oryzae*

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Resistance of the rice variety, Te-tep to *Pyricularia oryzae* Cav., race IC.17 (L&O) was not altered by the different levels of nitrogen, phosphorus, potassium and silicon used in the culture solution. Susceptibility in the rice variety, Co.13 was also not altered by the different levels of these nutrients.

Key Words: **Host-nutrition**, *Oryza sativa* L., *Pyricularia oryzae* Cav., **Resistance**

Introduction

The influence of host-nutrition on resistance in plants of rice (*Oryza sativa* L.) to *Pyricularia oryzae* Cav. has been reported by Padmanabhan (1953) and Padmanabhan et al. (1973), Sridhar (1970). The present investigation was undertaken to find out the reaction of the plants of the resistant variety, Te-tep grown at different levels of nitrogen, phosphorus, potassium, and silicon employing the culture-solution for host-nutrition and utilising a specific culture of the pathogen *P. oryzae*, race IC.17 (Ling & Ou 1969) aided by uptake studies.

Materials and Methods

The rice varieties Te-tep and Co. 13, resistant and susceptible respectively to *P. oryzae*, IC. 17 (L&O) as per Padmanabhan et al. (1970) were taken up for study. The plants were grown in porcelain pots of 4-l capacity with culture-solution as described by Patnaik and Gaikwad (1969). Four separate experiments were conducted to study the effect of increasing concentrations of individual host-nutrient viz. nitrogen (1.43, 2.85, 5.70 and 8.55 mM/l), phosphorus (0.16, 0.32, 0.96 and 1.60 mM/l), potassium (0.51, 1.02, 2.04, and 3.06 mM/l) and silicon (0.036, 0.18, 1.80 and 3.60 mM/l) on the reaction of plants to a culture of *P. oryzae* IC. 17 (L & O). The levels of nutrients which were adopted for each nutrient as a constant while testing the effect of the other nutrients were 2.85 mM/l of nitrogen, 0.32 mM/l of phosphorus, 0.51 mM/l of potassium and 0.18 mM/l of silicon.

The seedlings were raised in shallow earthern pans containing equal amounts

of soil and sand for treatments other than that of silicon. Plastic petri dishes were used for raising the seedlings with silicon-free nutrient solution for the experiment involving silicon. Fifteen-day old seedlings were utilised for transplanting to wicker-mesh supports which were boiled in water and coated with paraffin-wax. Each treatment combination consisted of six pots, of which three served as three replications. Three pots with six plants each were utilised for inoculation with the pathogen and the other three for the purpose of collection of leaf samples consisting of two leaves from the apex of the plant for chemical analysis. At the time of weekly changes of the culture solution the pots as well as the wicker-mesh supports and the roots of the plants were thoroughly washed before adding fresh culture-solution. The initial *p*H of the culture solution was adjusted to 4.8. Five days after inoculation of the plants, leaf-blade samples were collected from the set of un-inoculated plants, dried at 75°C for 48 hr and ground in a Wiley mill. The powdered samples were utilised for chemical analysis. While the first three nutrients were estimated as per Piper (1950) silicon was estimated as recommended by Nayar et al. (1975). The plants were inoculated four weeks after transplanting. The pathogen was subcultured on oatmeal agar medium with thiamine and biotin and incubated for sporulation. A conidial suspension was prepared in sterile distilled water and it was sprayed at a concentration of 2×10^{-4} conidia/ml using a De Vilbiss atomiser. Scoring of the infection was carried out ten days after inoculation using the third leaf from the apex. The score chart of Padmanabhan and Ganguly (1959) was followed as a standard. The number of lesions in the infected leaf was recorded for each plant. The interpretation of the host-reaction was made by the present author as follows: Absence of spots, reddish flecks (A) and minute reddish spots with no differentiation (B) were deemed as resistant reaction. Circular lesions with a central ashy zone and purplish margin (C) broadly spindle-shaped lesions with central ashy zone and marginal zones (D, E) were classified as susceptible reaction of the host.

Results and discussion

The plants of the resistant variety Te-tep revealed immunity at the end of the incubation period at all levels of nitrogen, phosphorus, potassium and silicon. The plants of the susceptible variety showed typical lesions in all the treatments. The number of lesions observed in the different treatments are presented in (table 1).

Krishnaswamy (1952) and Padmanabhan et al. (1973) reported that resistance in rice to *P. oryzae* (in blast-resistant varieties) was not altered by higher levels of nitrogenous fertilization, adopting different sets of criteria. Sridhar (1970) noted moderate resistance in plants of certain blast resistant varieties when they were subjected to higher levels of nitrogenous fertilization, while resistance remained unaltered when the plants were raised under such levels in one resistant variety. In the present study plants of the susceptible variety revealed 'C' type lesions at the end of the incubation period at the level of 1.43 mM/l of nitrogen while 'D' and 'E' type lesions in plants raised at the level of 2.85, 5.70 and 8.55 mM/l of nitrogen. 'E' type of lesions were common to all the inoculated plants at the three levels of nitrogen. The uptake of nitrogen was proportionate to the levels of nitrogen applied, both in the resistant and the susceptible variety (table 1). Otani (1952) has shown a close

Table 1 *Chemical constituents in the leaves of plants grown at increasing concentrations of nutrients (mean of three replicates) and the mean of the number of lesions per replication*

Chemical constituent	Nutrients supplied in mM/l	Nutrients in percentage			Mean values of lesions	
		Varieties			Varieties	
		Co.13	Te-tep	Mean	Co.13	Te-tep
Soluble nitrogen	1.43	0.306	0.231	0.269	22.67	Nil
	2.85	0.354	0.300	0.327	53.33	,,
	5.70	0.420	0.375	0.398	56.33	,,
	8.55	0.441	0.423	0.432	57.67	,,
		C.D. for treatment at 5% level = 0.013			C.D. for treatment at 5% level = 2.88	
Total nitrogen	1.43	2.224	1.905	2.065	22.67	Nil
	2.85	3.156	2.665	2.911	53.33	,,
	5.70	3.824	3.745	3.785	56.33	,,
	8.55	3.918	3.861	3.890	57.67	,,
		C.D. for treatment at 5% level = 0.067			C.D. for treatment at 5% level = 2.88	
Phosphorus	0.16	0.194	0.181	0.188	32.00	Nil
	0.32	0.377	0.320	0.349	54.67	,,
	0.96	0.480	0.400	0.440	57.00	,,
	1.60	0.667	0.467	0.567	56.33	,,
		C.D. for treatment at 5% level = 0.013			C.D. for treatment at 5% level = 3.74	
Potassium	0.51	1.369	1.356	1.363	54.67	Nil
	1.02	1.808	1.876	1.842	54.33	,,
	2.04	1.902	1.996	1.949	51.33	,,
	3.06	2.192	2.121	2.157	41.33	,,
		C.D. for treatment at 5% level = 0.086			C.D. for treatment at 5% level = 2.54	
Silicon	0.036	5.150	5.090	5.120	52.33	Nil
	0.180	5.560	5.300	5.430	53.00	,,
	1.800	6.320	6.190	6.260	36.33	,,
	3.600	7.940	8.210	8.080	35.33	,,
		C.D. for treatment at 5% level = 0.346			C.D. for treatment at 5% level = 4.10	

correlation between severity of blast disease and soluble nitrogen content in the host. At higher levels of nitrogen more number of lesions were noticed in the susceptible variety (table 1). Ganguly et al. (1954) reported greater intensity of blast at higher levels of nitrogenous fertilization. The inoculated plants of susceptible variety showed D and E type of lesions with different levels of phosphorus, potassium and silicon, the latter type being common to all the inoculated plants. The effect of these nutrients on susceptibility/resistance in rice to *P. oryzae* has been reviewed by Ou (1972). The uptake of phosphorus, potassium and silicon has been proportionate to the concentration of the nutrients under which the plants of resistant and susceptible varieties were raised (table 1). At higher levels of phosphorus more number of lesions were noticed whereas less number of lesions were noticed at higher levels of potassium or silicon in the susceptible variety. Suzuki (1965) reported reduction in disease intensity due to *P. oryzae* in rice at higher levels of silicon nutrition. In interpretation of results obtained by different investigators *vis-a-vis* the present findings, the concept of resistance and the methods and materials adopted in such studies have to be taken into account. The results obtained in the present study suggest that the nutrients do not have a discernible role in resistance in rice to *P. oryzae*.

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