

Effect of inoculum concentration, age and degree of susceptibility of the host on bacterial leaf streak development*

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Abstract. Investigations on the effect of inoculum concentration, age and degree of susceptibility of the host on bacterial leaf streak development of rice revealed that lesion length has a linear relation with inoculum concentration and inverse relation with age of the host. Susceptibility and age of the host and inoculum concentration bear no relation with the incubation period except the lowest inoculum concentrations. However, there was a definite association between method of inoculation and incubation period. Lesion colour varied with the age of the host irrespective of the inoculum concentration.

Keywords. Inoculum concentration; bacterial leaf streak.

1. Introduction

Lesion number was found to be influenced only in the extremes of inoculum concentrations (Ou *et al* 1970). Younger plants were more susceptible and with age they became resistant (Ou *et al* 1970, Shekhawat and Srivastava 1972). According to Rao (1974) plants more than 45 days old failed to take-up infection by spray inoculation though they could readily be infected by rub inoculation. But information on the interaction between age of the host, the inoculum concentration and the degree of susceptibility of a variety and inoculum concentration under spray and rub inoculations is not available. Hence the following experiments were conducted.

2. Materials and methods

2.1. *Effect of inoculum concentration and age of the host on disease development*

Isolate 6, a virulent isolate of *Xanthomonas translucens* f. sp. *oryzicola* was used in these studies. The method of preparation of the inoculum (Devadath 1969; Devadath and Padmanabhan 1969) was as follows:

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The bacterial isolate was grown in nutrient broth (YNB) (beef extract, 3.0 g; peptone, 5.0 g; yeast extract, 5.0 g; distilled water, 1000 ml; pH 6.8) for 24 hr on a shaker at $28 \pm 1^\circ\text{C}$. The bacterial culture was centrifuged at 12,000 rpm for 10 min. The supernatant was discarded and the packed cells were washed thrice with sterile distilled water by centrifugation and finally they were suspended in sterile distilled water. Optical density (OD) of the inoculum was adjusted in Spectronic 20 at 620 nm.

Potted IR 8 plants of 30, 45, 60, 75, 90 and 105 days old grown at a fertility level of $N_{120} P_{60} K_{60}$ were rub and spray inoculated with inoculum concentrations of 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 and 1.5 OD. All the leaves in each tiller were inoculated towards the late evening to ensure congenial atmosphere for infection. Plants were covered on all sides with a cloth curtain supported by wooden pegs up to a height of 1.2 m. Cloth curtains were always kept moist by dripping water with a plastic tube with perforations on the top to maintain adequate humidity. After 24 hr the plants were shifted to the green house.

Lesion length was recorded on the 15th day of inoculation on all the leaves @ ten lesions per leaf. Fifty lesions were measured on each replicated plant and there were four replicates for each treatment. The average lesion length was then calculated. Observations were also recorded on the incubation period and lesion colour.

2.2. *Effect of inoculum concentration on disease development in resistant, moderately resistant and susceptible rice varieties*

The second leaf from the top in each of the four tillers were rub and spray inoculated with seven concentrations of the inoculum as mentioned earlier on 50 days old potted plants of BJ 1 (R), Taichung (Native) 1 (MR) and IR 8 (S). There were three replications for each treatment.

The plants were observed at 12 hr intervals for the initial symptom appearance. Lesion length and lesion colour were recorded on the 15th day of inoculation.

3. Results

3.1. *Effect of inoculum concentration and age of the host on disease development*

Lesion length, in general, decreased significantly with an increase in the age of the plant (table 1a). Rub inoculation resulted significantly in longer lesions as compared to spray inoculation. This was most obvious in plants older than 60 days. The interaction between age levels of the host and methods of inoculation was significant.

There was a significant increase in lesion length with all the concentrations of the inoculum over 0.1 OD (table 1b). The interaction between methods of inoculation and inoculum concentrations was not significant. The interaction between inoculum concentration and age levels of the host and also the interaction between methods of inoculation, inoculum concentrations and age levels of the host were not significant.

In general, the incubation period was less in rub inoculation as compared to spray inoculation. With lower inoculum concentrations, the incubation period was prolonged only on aged plants of 105 days with both methods of inoculation. But in

Table 1a. Effect of age of the host and methods of inoculation (lesion length)

Age of the host (days)	Method of inoculation		Mean
	Rub	Spray	
	Lesion length (cm)		
30	2.06	2.14	2.10
45	1.83	1.82	1.82
60	1.35	1.72	1.53
75	1.38	0.85	1.12
90	1.27	0.60	0.93
105	1.00	0.69	0.84
Mean	1.48	1.30	

		5%	1%
C.D. for age levels of the host	=	0.07	0.10
C.D. for methods of inoculation	=	0.04	0.05
C.D. for interaction between age levels of the host and methods of inoculation	=	0.10	0.14

Table 1b. Effect of methods of inoculation and inoculum concentrations on lesion length

Inoculum concentration (OD)	Methods of inoculation		Mean
	Rub	Spray	
	Lesion length (cm)		
0.1	1.34	1.16	1.25
0.2	1.46	1.23	1.35
0.4	1.45	1.30	1.38
0.6	1.52	1.29	1.40
0.8	1.48	1.33	1.41
1.0	1.56	1.39	1.47
1.5	1.57	1.41	1.49
Mean	1.48	1.30	

		5%	1%
C.D. for inoculum concentrations	=	0.08	0.10
C.D. for interaction between methods of inoculation and inoculum concentrations	=		NS

all other age levels of the host, symptoms appeared early irrespective of the inoculum concentration used.

There appeared to be a positive correlation between the colour of the lesions, age of the host and method of inoculation. Plants of 30, 45 and 60 days old, showed typical yellow lesions in both rub and spray inoculations whereas 90 and 105 days old plants showed only brown lesions in rub inoculation and reddish brown lesions in spray inoculation. The lesion colour on 75 days old plants was intermediate.

3.2. Effect of inoculum concentration on disease development in resistant, moderately resistant and susceptible rice varieties

The lesion length produced with 1.5 OD was significantly more than 1.0, 0.8, 0.6, 0.4, 0.2 and 0.1 OD levels (table 2a). No significant difference in lesion length was

Table 2a. Lesion length produced with different concentrations of the inoculum on resistant moderately resistant and susceptible rice varieties.

Inoculum concentration (OD)	Variety			Mean
	BJ 1	Taichung (Native) 1	IR 8	
	Lesion length (cm)			
0.1	0.28	0.80	1.34	0.81
0.2	0.35	0.90	1.63	0.96
0.4	0.40	0.91	1.66	0.99
0.6	0.42	0.86	1.68	0.99
0.8	0.43	0.83	1.72	0.99
1.0	0.42	0.96	1.71	1.03
1.5	0.49	1.20	1.79	1.16
Mean	0.40	0.92	1.65	
			5%	1%
C.D. for inoculum concentrations			= 0.09	0.12
C.D. for varieties			= 0.06	0.08
C.D. for interaction between inoculum concentrations and varieties			=	NS

Table 2b. Interaction between methods of inoculation and varieties in relation to lesion length.

Variety	Methods of inoculation		Mean	
	Rub	Spray		
	Lesion length (cm)			
BJ 1	0.58	0.22	0.40	
Taichung (Native) 1	0.99	0.85	0.92	
IR 8	1.72	1.58	1.65	
Mean	1.10	0.88		
			5%	1%
C.D. for methods of inoculation		= 0.05	0.06	
C.D. for the interaction between methods of inoculation and varieties		= 0.08	0.11	

observed amongst 0.2, 0.4, 0.6, 0.8 and 1.0 OD levels. Least lesion length was obtained with 0.1 OD which is significantly less than all the other levels tested.

Amongst the three host varieties, IR 8 showed maximum length of the lesion while BJ 1 showed the least lesion length. Rub inoculation resulted in more lesion length as compared to spray inoculation (table 2b). The interaction between the methods of inoculation and varieties was significant.

Irrespective of the degree of susceptibility of the variety and the concentration of the inoculum, an incubation period of 36 and 96 hr was recorded in rub and spray inoculation methods respectively.

With regard to the lesion colour, BJ 1 showed brown lesions with rub, and reddish brown lesions with spray inoculation methods. Taichung (Native) 1 showed yellow lesions with rub but brown lesions in spray where as IR 8 showed yellow lesions with both rub and spray inoculation with all the seven concentrations of the inoculum tried.

4. Discussion

Corroborating the earlier results (Ou *et al* 1970; Rao 1974; Shekhawat and Srivastava 1972) there was a corresponding decrease in lesion length with an increase in the age of the host plant. According to Rao (1974) plants beyond 45 days age failed to take up infection under spray inoculation. On the contrary, in the present investigations, it was observed that even plants of 105 days old took up infection under spray inoculation though the lesion length was remarkably reduced confirming the results of Srinivasan *et al* (1959).

There was no correlation between incubation period and the degree of resistance or susceptibility of a variety thus corroborating with the earlier reports (Seshagiri Rao 1975; Shekhawat and Srivastava 1972; Shakhawat *et al* 1972). However, there was a clear relationship between the method of inoculation and incubation period.

Lesion colour was found to be associated with the degree of susceptibility of a variety thus confirming the observations of earlier workers (Goto 1965; Rao *et al* 1968; Shekhawat *et al* 1972). The inoculum concentration did not influence the colour. Lesion colour was also influenced by the method of inoculation as earlier concluded by Seshagiri Rao (1975).

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