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GENETICS OF FOOT ROT AND SEEDLING BLIGHT RESISTANCE IN WHEAT

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ABSTRACT

The genetics of resistance to foot rot and seedling blight was studied in three resistant wheat lines, CPAN 1922, E 8667 and NP 825, by crossing them with two susceptible varieties, Sonalika and Narmada 4. Studies under artificial inoculation in F_1 and F_2 generations indicated that two dominant genes for resistance in E 8667 and NP 825 are complementary to each of the two genes of CPAN 1922. E 8667 and NP 825 seem to possess the same genes for resistance. Thus, resistance is controlled by four dominant genes in wheat.

Key words: Resistance, foot rot, seedling blight, complementary genes.

Host–parasite interaction is highly specific and controlled by corresponding genes in the host and parasite.

It is necessary to have a considerable degree of built-in resistance to the disease caused by *Helminthosporium sativum* in the wheat varieties. Since several genes regulate resistance, it is also desirable to understand the pathways through which they interact. Though the importance of the diseases caused by different *Helminthosporium* species in wheat is fully realised, little work has been done to develop resistant varieties against foot rot and seedling blight. Differences in the degree of resistance were reported in different varieties, but perfect resistance was not observed [1]. Resistance is known to be genetically controlled and a lot of variability exists at the race level in the pathogen [2–4]. Therefore, in the present study an attempt has been made to identify the gene action in relation to *H. sativum* resistance.

MATERIALS AND METHODS

Three wheat lines showing resistance to seedling blight under artificial inoculation of *H. sativum* (CPAN 1922, E 8667 and NP 825) were crossed amongst themselves as well as with two susceptible varieties, namely, Sonalika and Narmada 4. The F_1 plants were grown

in earthen pots containing sterilized soil, and F_2 progenies were grown in field. Seeds were treated with the mycelial-cum-conidial suspension of the fungus before sowing following the standard procedures. For this, isolates of *H. sativum* were grown on PDA in Petri plates and incubated at 25 $\pm$ 1°C for a week. Mycelial-cum-conidial suspension was prepared by homogenising the culture in sterilized distilled water for 2 min in a blender. The suspension was examined under microscope and concentration of approximately 3000 propagules/ml was used for treating the seed. Preemergence death of the seedlings due to foot rot and seedling blight causing death were recorded about 20 days after sowing.

RESULTS AND DISCUSSION

Dominance of resistance to foot rot and seedling blight was observed in F_1 generation in all the crosses (Table 1). The F_2 generation showed segregation in the ratio of 9 resistant: 7 susceptible seedlings in the crosses between resistant and susceptible lines indicating the action of two dominant complementary genes for resistance in all the three resistant parents, viz., CPAN 1922, E 8667 and NP 825. The crosses of CPAN 1922 with E 8667 and NP 825 showed a 4-factor segregation, giving the ratio of 243 resistant : 13 susceptible. Segregation was not observed in the cross E 8667 x NP 825, where all the seedlings were resistant in F_2.

It is obvious from these results that the two dominant genes for resistance in CPAN 1922 and E 8667 were different. Since no blighted seedlings were observed in F_2 of the cross E 8667 x NP 825, it could be inferred that E 8667 and NP 825 carry the same genes for resistance. It can be interpreted that the four pairs of dominant genes, each complementing with the other three genes, determine resistance to foot rot and seedling blight caused by *H. sativum*

Table 1. Inheritance of seedling blight (*H. sativum*) resistance in R x R and R x S crosses of wheat

Cross	F_1	Total	No. of F_2 plants		Ratio tested (R : S)	χ^2	P
			R	S			
CPAN 1922 x Sonalika	R	112	64	48	9:7	0.036	0.87
CPAN 1922 x Narmada 4	R	161	98	63	9:7	1.397	0.25
E 8667 x Sonalika	R	116	59	57	9:7	1.368	0.25
E 8667 x Narmada 4	R	116	72	44	9:7	1.596	0.21
NP 825 x Sonalika	R	97	56	41	9:7	0.086	0.80
NP 825 x Narmada 4	R	89	53	36	9:7	0.394	0.54
CPAN 1922 x E 8667	R	145	142	3	243:13	2.729	0.10
CPAN 1922 x NP 825	R	184	176	8	243:13	0.205	0.66
E 8667 x NP 825	R	150	150	0	No segregation		

in the resistant parents. Foot rot and seedling blight resistance has already been reported in the variety NP 825 [5].

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