Pak.J.Bot., 24(2):183-186, 1992.

PRELIMINARY EVIDENCE FOR SPECIFICITY BETWEEN FACTORS CONTROLLING LATENT PERIOD IN WHEAT CULTIVARS AND BROWN RUST ISOLATES

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Abstract

Latent period was measured in number of days from inoculation to flecking and sporulation in five bread wheat cultivars inoculated with 25 isolates of *Puccinia recondita* Rob. ex Desm. A differential interaction between the cultivars and the parasite isolates indicated the presence of genetic specificity between factors controlling latent period in both the host and the parasite. Depending upon the host: parasite combination, differences of one to two days were observed in the latent period required by brown rust under the conditions of this study.

Introduction

Wheat (*Triticum aestivum* L. em. Thell.) cultivars vary greatly for resistance to the rust disease. Similarly the parasite, *Puccinia recondita* Rob. ex Desm., populations contain variants capable of producing disease in host cultivars possessing different genes for resistance. According to Day (1974), and Ellingboe (1981) these fundamental observations date back to the early years of the present century. Van der Planck (1963) recognised two types of resistance, "vertical", conditioned by single genes; and "horizontal", controlled by more than one genes. The latter is also considered to denote field or partial resistance.

Because of the polygenic nature of horizontal resistance (*sensu* Van der Planck, 1963, 1968) its study, compared to that of the monogenic type, is rather difficult. Aslam (1972) proposed that this type of resistance could be measured through studying its individual components such as infectivity, incubation (latent) period and sporulation etc., in the host and relating them to their corresponding components of pathogenicity in the parasite. He further suggested presence of specificity between the respective host:parasite characters.

Quantitative differences in field or partial resistance of barley to brown rust caused by *P.hordei* Otth., have been documented by Chamberlain & Doodson (1972). Clifford & Clothier (1974) similarly reported existence of differential interactions regarding infection frequency between isolates of *P.hordei* and barley cultivars. Aslam & Schwarzbach (1980) put forward experimental evidence indicating presence of genetic specificty between host infectivity and parasite infectivity in cultivars of barley and different isolates of *P. hordei*. Earlier Parlevliet (1976) had described similar differences for latent period between host cultivars and parasite isolates in the *Hordeum*: *P. hordei* host-parasite system.

The existence, or otherwise of any specificity for latent period between wheat varieties and isolates of *P.recondita* is reported here.

Material and Methods

Latent period was studied in seedlings of 5 cultivars of wheat viz., Pavon 76, Blue Silver, WL-711, Khushal 69, and LU-26, all of which give a high infection type against *P. recondita* in the seedling stage, but show varying levels of resistance in the field, against 25 different cultures of the parasite isolated from brown rust samples collected from commercially grown wheat fields in different parts of Pakistan.

Single pustule cultures from each sample were established on wheat variety Morocco. Five seedlings of each test cultivar grown in 7 cm plastic pots were inoculated in the first leaf stage with fresh uredospores of individual isolates by brush technique. The test, with four replications, was repeated twice. After 24 h incubation in the dark under near 100% r.h. the inoculated plants were transferred to a glasshouse bench where the mean temperature during the period of study remained at 232°C, with ca. 80% r.h. Plants were checked daily till the appearance of sporulating lesions. Latent period in each case was measured as the number of days from inoculation to the appearance of flecks and sporulating pustules.

Table 1. Days to flecking (F) and sporulation (S) after inoculation of wheat cultivars with *Puccinia recondita*.

Isolates	Cultivars.									
	Pavon 76.		Bl.Silver		WL-711		Khushal 69		LU-26	
	F	S	F	S	F	S	F	S	F	S
1.	5	8	4	7	4	6	5	7	5	7
2.	4	7	5	8	4	7	3	6	3	6
3.	5	8	4	7	3	6	4	7	4	7
4.	3	6	4	7	4	7	3	6	3	6
5.	5	8	3	6	3	6	5	7	5	7
6.	4	7	5	8	3	6	3	6	3	6
7.	5	8	4	7	3	6	4	6	4	6
8.	5	8	4	7	3	6	3	6	3	6
9.	5	8	4	7	3	6	4	6	4	6
10.	4	7	3	6	3	6	4	6	4	6
11.	5	8	3	6	5	7	3	6	3	6
12.	4	7	3	6	4	7	5	7	5	7
13.	4	7	5	8	3	6	5	7	5	7
14.	4	7	5	8	5	7	3	6	3	6
15.	4	7	5	8	4	6	3	6	3	6
16.	3	6	5	8	5	7	3	6	3	6
17.	5	8	4	7	5	7	3	6	3	6
18.	4	7	3	6	3	6	4	6	4	6
19.	5	8	3	6	5	7	5	7	5	7
20.	3	6	5	8	3	6	5	7	5	7
21.	3	6	5	8	3	6	5	7	5	7
22.	4	7	5	8	4	6	3	6	3	6
23.	3	6	4	7	5	7	4	6	4	6
24.	4	7	5	8	5	7	4	6	4	6
25.	3	6	4	7	4	6	3	6	3	6

Result and Discussion

Data on the number of days to flecking and sporulation indicate differences in latent period in all host cultivar: parasite isolate combinations (Table 1). The length of the latent period in the test cultivars appears to be reflected in their field response to leaf rust. Pavon 76 which exhibited the longest latent period also possesses the highest field resistance to the disease. Wheat *cvs* WL-711, LU-26 and Khushal 69, in which shorter latent periods were noted, support a relatively faster rate of leaf rust development resulting in their comparably lower field resistance to the disease. Parlevliet & Kuiper

Table 2. Some examples of reversed host cultivar-parasite isolate interaction affecting days to flecking and sporulation after inoculation.

Isolates	Cultivars							
	Pavon 76		Blue Silver		WL-711		Khushal 69	
	F	S	F	S	F	S	F	S
1	5	8	4	7	4	6	5	7
24	4	7	5	8	5	7	4	6
				WL-711		LU-26		
			F	S	F	S		
			1	4	6	5	7	
			24	5	7	4	6	
	Pavon 76		Blue Silver		WL-711		Khushal 69	
	F	S	F	S	F	S	F	S
5	5	8	3	6	3	6	5	7
16	3	6	5	8	5	7	3	6
				WL-711	LU-26			
			F	S	F	S		
			5	3	6	5	7	
			16	5	7	3	6	
	Pavon 76		Blue Silver		WL-711		Khushal 69	
	F	S	F	S	F	S	F	S
10	4	7	3	6	3	6	4	6
25	3	6	4	7	4	6	3	6
				WL-711	LU-26			
			F	S	F	S		
			10	3	6	4	6	
			25	4	6	3	6	

(1985) also observed a similar direct correlation between the length of latent period and "partial resistance" of barley cultivars to leaf rust in the field.

All host cultivar: parasite isolate, interactions affecting latent period appear to be strongly differential even if one accepts a reversed ranking (Scott *et al.,* 1979) of responses (Table 2) as an undoubted measure of differentiality.

Genetic analysis of leaf rust resistance in the test cultivars showed presence of the gene Lr13 in *cvs* Pavon 76, Blue Silver, WL-711, and LU-26, and that of Lr1 in Khushal 69 (Hussain *et al.,* 1988). In addition to Lr13, LU-26 also carries Lr1, which is contributed by one of its parents, Khushal 69. All cultivars exhibited high reaction in the seedling stage to all the cultures of the parasite indicating ineffectiveness of the gene (s) for resistance present in them. Any observed differences in latent period, therefore, seem to be independent of the resistance conditioned by the indicated major gene (s). In the absence of a low infection type in any of the 125 interactions in (Table 1), all the observed effects, therefore, are of quantitative nature.

It is possible that the observed quantitative differences are due to specific gene-for-gene relationship (*sensu* Flor, 1955) for quantitative interactions of low magnitude as suggested by Parlevliet & Zadoks (1977). Parlevliet & Kuiper (1985), and Parlevliet *et al.,* (1985) suggested the presence in barley cultivars of a number of "minor genes" affecting latent period of barley leaf rust. Conventional genetic studies are needed to elucidate the exact nature of the genetic control for latent period in the *Triticum: Puccinia recondita* host-parasite system.

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(Received for Publication 7 July 1991)