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## INHERITANCE OF LATENT PERIOD 50 AND INFECTION EFFICIENCY WITH PUCCINIA RECONDITA TRITICI

Z. JERKOVIĆ, Vojislava MOMČILOVIĆ and R. JEVTIĆ

Institute of Field and Vegetable Crops, 21000 Novi Sad,  
Yugoslavia

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The inheritance, action and number of genes for length of the latent period 50 and infection efficiency are the most important characters of the incomplete resistance of wheat to *Puccinia recondita tritici*. They were investigated in progenies of cross *Karl x Little Club*. These varieties are extremely different in both characters. It is possible that some genes have a pleiotropic effect on increasing the length of the latent period 50 and decreasing the infection efficiency.

### INTRODUCTION

Incomplete resistance to *Puccinia recondita tritici* is more often an expression of genes interaction of the parasite-wheat variety than complete resistance in our conditions. The interaction of some 35 known major genes for resistance to the mentioned parasite with genes for virulence/avirulence in different environment conditions is expressed through complete or incomplete resistance (Odinstova and Mikhailova, 1988; Brodny *et al.*, 1986). That indicates the same genetic background of both types of resistance from the aspect of the plant. It is well known that accumulation of genes with expression through incomplete resistance can result in complete resistance (Parlevli *et al.*, 1988). In this paper, using a few models for genetics analysis of the quantitative

characters, our intention was to investigate the mode of inheritance, action and number of genes in the incompletely resistant variety Karl which differs from the standard for susceptibility, Little Club.

## MATERIAL AND METHODS

The variety Karl was selected as the resistant parent after long term field investigation in Kansas, and during the last three years in Yugoslavia. Single crossing was performed in 1990 and FB1, FB2 and F2 seed produced in 1991.

The latent period 50 (LP50) length and infection efficiency (IE) were determined at the seedling stage under controlled conditions (15°C, relative humidity over 80% and day/night regime 16/8 h). Monopustule culture of the virulent type of strain 77 was selected for inoculation in the settling tower (Johnston and Browder, 1966; Jerković *et al.*, 1989). Parents and all progenies were inoculated and grown together under the same conditions. The dominantly additive model with six parameters was used to determine the mode of gene action (Mather and Jinks, 1982). The number of genes where the parents were different was calculated according to the formulae of Bjarke and Line (1988).

## RESULTS AND DISCUSSION

In all segregating generations, a difference occurred in infection type which was identical to the parental type (4). That was expected because Little Club is extremely susceptible. All pustules on that variety occurred after eight days so the variance of the LP 50 was small (Table 3). In the progenies of such combinations, gene accumulation, which could result in changes of infection type, was not possible (Parlevliet, 1988). These were no transgressive segregations for the same reasons (Table 1).

Table 1. Inheritance of the infection in progenies of the hybrid Karl x Little Club

Generation	LP 50 (days)							
	8.5	9	9.5	10	10.5	11	11.5	12
P1								
P2	100				13,3		60	26,6
F1			40	60				
F1b1P1		20	20	20	40			
F1b1P2	20				20		20	40
F2	8	11	16	6	17	5	22	15

LP 50 length was inherited intermediately while higher IE dominated (Tables 1 and 2). Additive gene action was significant according to the dominantly additive model.

Table 2. Inheritance of the infection efficiency in progenies of the hybrid Karl x Little Club

Generation	IE								
	2	4	6	8	10	12	14	16	18
P1			11		33	11	11	22	11
P2	73	27							
F <sub>1</sub>			20	20	40	20			
F <sub>1</sub> b <sub>1</sub> P1	20	40	20			20			
F <sub>1</sub> b <sub>1</sub> P2	100								
F <sub>2</sub>	54	23	7	7	6	1	1	1	

Dominant gene action and double genic interallelic interactions for both characters were not significant (Table 4). In previously published research when a similar method was applied susceptibility dominated in the progenies and the gene action was additive (Jacobs and Broers, 1989; Lee and Shaner, 1986).

Table 3. Means and variances of LP 50 and IE in progenies of the cross Karl x Little Club

Generation	LP 50		IE	
	X	V	X	V
P1	11.50	0.200	1.80	1.72
P2	8.56	0.006	11.45	13.25
F <sub>1</sub>	8.80	0.051	8.68	15.05
F <sub>1</sub> b <sub>1</sub> P1	10.90	1.740	1.08	0.77
F <sub>1</sub> b <sub>1</sub> P2	9.90	0.340	5.04	9.55
F <sub>2</sub>	10.42	1.340	3.33	8.52

Table 4. Estimated values of the gene effects for the cross Karl x Little Club

Parameters	Estimated values		S		t	
	LP50	IE	LP50	IE	LP50	IE
m = means	1.89	7.70				
d = additive genes	1.47	4.82	0.228	1.93	6.45*	2.50*
h = dominant genes	1.45	-18.47	12.70	31.07	0.11	0.59
Epistasis:						
i = additive x additive genes	0.01	-1.80	5.46	8.11	0.01	0.13
j = additive x dominant genes	-0.94	-1.73	2.92	7.5	0.32	0.23
l = dominant x dominant genes	1.92	19.45	7.42	19.41	0.26	1.00

In spite of controlled conditions, the influence of the environment in the total phenotypical variance was very high for IE. One of reasons could be the relatively low percent of germinated spores on the observed leaf area (55% spores per 100 mm<sup>2</sup>).

The varieties differed according to gene number: 2.8 (3) for LP50 length and 3 for IE. High frequencies of plants with LP50 and IE between parental values in the F<sub>2</sub> and progenies from backcrosses, were connected with the small number of genes which control the characters. It may be supposed that all expressed genes are accumulated in Karl.

## CONCLUSION

Genes for LP50 length and IE have additive gene action in the variety Karl. The first character was inherited intermediately while the higher IE partially dominated. The varieties are different in three genes for both characters of incomplete resistance to *Puccinia recondita tritici*. According to the similarity in action and the number of genes which control LP50 and IE, it is possible that the same genes have a pleiotropic effect on prolongation of the LP50 and decrease of the IE.

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NASLEDIVANJE LATENTNOG PERIODA 50 I USPEŠNOSTI INFEKCIJE  
SA *Puccinia recondita tritici*

Z. JERKOVIĆ, Vojislava MOMČILOVIĆ i R. JEVTIĆ

Institut za ratarstvo i povrtarstvo, 21000 Novi Sad, Jugoslavija

Izvod

U radu su proučavani nasleđivanje, delovanje i broj gena za dužinu latentnog perioda 50 i uspešnost infekcije, kao najvažnijih karaktera nekompletne otpornosti pšenice prema *Puccinia recondita tritici*, u potomstvima iz ukrštanja sorti Karl i Little Club. Geni za dužinu latentnog perioda 50 i uspešnost infekcije deluju aditivno, nasleđivanje je intermedijarno za prvi, a viša uspešnost infekcije dominira za drugi karakter. Sorte se razlikuju po tri gena za oba karaktera nekompletne otpornosti. Moguće je da geni imaju pleiotropni efekat.

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