Inheritance of white rust resistance in Indian mustard (*Brassica uncea* L.) Czern & Coss.

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Abstract

Inheritance of white rust resistance in P_1, P_2, F_1, F_2 and backcross generation of two crosses of *Brassica juncea* revealed that one gene with complete dominance conferred resistance to white rust. A segregation ratio of 3 resistant : 1 susceptible in F_2 generations of these crosses further confirmed that white rust resistance is governed by a single dominant gene which can easily be transferred by backcrossing from a resistant to susceptible genotypes.

Key words: Indian mustard, white rust, inheritance

Introduction

Indian mustard (*Brassica juncea* (L.) Czern and Coss.) is predominantly cultivated species in India. Due to its higher seed yield and adaptation, it is widely cultivated under different agro-climatic conditions and cropping patterns. The species of *Brassica* are altered by a number of diseases. Among these white rust (*Albugo candida*) is most important and widely distributed in tropical and temperate climates (Saharan and Verma, 1992). Appreciable losses were caused by *Albugo candida* to seed yield up to a tune of 17 to 37 per cent (Kolte, 1985). Chemical control of this disease is costly and hazardous to human beings besides creating environmental pollution. So, cultivation of resistant varieties is the only feasible way. So, keeping in view the above facts the inheritance studies of white rust resistance were undertaken in the present investigation.

Material and Methods

The experimental material comprised of four Indian mustard genotypes namely, UDN69, RH 8113 resistant to white rust and RH 9624 and Bio-902 susceptible to white rust. Two crosses UDN 69×RH 9624 and RH 8113×Bio-902 were attempted during Rabi 1999 at CCS Haryana Agricultural University, Hisar, India and six generations (P_1, P_2, F_1, F_2, B_1 and B_2) were developed during winter 2000. The six generations were evaluated for white rust resistance by growing in compact family block design replicated thrice with the spacing of 30 and 15 cm between row and within row, respectively. For artificial inoculation, inoculum suspension (white rust infected leaves were crushed in sterilized distilled water) was sprayed twice on all the generations first at 45 days and second at 60 days after sowing. To maintain humidity in the field, the crop was irrigated twice, after 45 and 60 days after sowing. To assess the resistance against white rust in the parents, F_1's, F_2's and back cross progenies, symptom severity grades designated with numerical values of 0-5, were given on the basis of visual observations. The per cent disease intensity was calculated by the method described by Gemawat and Prasad (1969).

$$\text{Per cent disease intensity} = \frac{\text{Sum of all numerical ratings}}{\text{Total no. of leaves observed} \times \text{highest ratings}} \times 100$$

Results and Discussion

The perusal of the data presented in Table 1 indicated that the parental lines UDN 69 and RH 8113 were resistant whereas, RH 9624 and Bio-902 were susceptible to white rust. The disease intensity in susceptible parents was also less due to unfavorable environment for white rust but it was much higher than resistant parents.

The F_1 progenies of these crosses showed complete resistance to white rust which indicated complete dominance of resistance in F_1 transferred from resistant parents. Segregation in F_2 for resistance and susceptible reaction in both the crosses showed perfect fit into the ratio of 3R:IS. Similar ratios were also observed by Adhikari et. al (2003) while working on *Albugo Candida* and supported the hypothesis of a single dominant gene control of the resistant against *Albugo candida*. This is also in corroborative of the results reported by Chauhan and Raut (2002) that strains derived from *B. napus* had a single dominant resistant gene. Backcross to susceptible parents exhibited perfect fit into the ratio of 1R: IS in both the crosses. Backcross with resistant parents showed complete resistance.

From the F_1's, F_2's and backcrosses analysis it was evident that the resistance to white rust is controlled by single gene with complete dominance. Although the monogenic and complete dominance is evident from the present analysis, the role of few modifier involved in the expression of white rust resistance can not be excluded as is evident from susceptible reaction under scores which tended towards the resistance categories. Similarly, Paladhi et al., (1993); Sridhar and Raut (1996) and Bansal et al., (1999) reported that resistance to white rust in rapeseed and mustard was governed by single dominant gene.

Conclusions

The results of the present study indicated that resistance to the disease is simply inherited and could easily be incorporated into susceptible but high yielding locally adapted cultivars through backcross. Since *Brassica juncea* is an amphidiploids of putative parents *B. campestris* and *B. nigra* (L.) koch, the alleles controlling the disease reaction to white rust could be located in either genome.

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Table 1: Observed segregation in *Brassica juncea* and Chi-square for back cross and F_2's reaction to *Albugo candida*

Parent/crosses	Score*						Total	P value	Percent disease intensity
	Resistant			Susceptible					
	0	1	2	3	4	5			
UDN69	66	78	6	-	-	-	150	-	3.00
RH9624	4	28	96	16	6	-	150	-	9.73
RH8113	84	66	0	0	0	0	150	-	2.20
Bio-902	12	30	60	32	16	0	150	-	10.33
F_1 hybrids									
UDN69XRH9624	98	52	-	-	-	-	150	-	1.73
RH8113xBi0-902	90	60	-	-	-	-	150	-	2.00
F_2 hybrids									
UDN69×RH9624	188	246	118	48	-	-	600	0.30-0.10	5.20
RH8113x Bio-902	224	252	104	20	-	-	600	0.30-0.10	4.33
Backcross to resistant parents									
UDN69xRH9624	280	20	0	-	-	-	300	-	1.33
RH8113xBio-902	254	46	0	-	-	-	300	-	3.06
Back cross to susceptible parents									
UDN69xRH 9624	48	108	96	36	12	-	300	0.20-0.02	30.40
RH8113x Bio-902	50	100	92	30	28	-	300	0.10-0.10	32.40

* 0= symptoms absent, 1=very small pustules of white rust (up to 3% leaves of the total plant), 2=small pustules of white rust (up to 10% leaves) of total plant, 3= Big pustules of white rust (up to 11-25% leaves) of total plant, 4=Bigger pustules of white rust (26-40% leaves) of total plant, 5= very big pustules of white rust (more than 50% leaves) of total plant