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INHERITANCE OF RESISTANCE IN BARLEY TO THE CEREAL CYST NEMATODE, *HETERODERA AVENAE*

by

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Summary. The F_1, F_2 and backcross (BC_1 and BC_2) progenies of cross combinations DL 482 x RD 2052 and DL 482 x C 164 were tested against the pathotype-I (Delhi population) of *Heterodera avenae*. The F_1 of both the cross combinations were resistant suggesting that resistance was dominant. In F_2, the plants segregated into 3 Resistant: 1 Susceptible ratio thus suggesting a monogenic dominant control of resistance over susceptibility. The backcross (BC_1) with the susceptible parent, DL 482 gave 1 Resistant: 1 Susceptible ratio which confirmed the monogenic dominant nature of resistance in the two barley cultivars 'RD 2052" and 'C 164'. The backcross (BC_2) gave all the resistant plants, further confirming the results obtained in the F_2 generation.

The cereal cyst nematode, *Heterodera avenae* Woll., causes molya disease of wheat and barley in India and is the most destructive pest in the North-western parts of India (Swarup *et al.*, 1982).

One of the effective and economical methods of managing the nematode population is the use of resistant cultivars. Concerted efforts have been made for the last three decades to locate sources of resistance in wheat, but so far none of the Indian genotypes was found resistant. On the contrary, plenty of sources of resistance have been identified in barley (Bhatti *et al.*, 1976; Dhawan and Sethi, 1983; Pankaj and Dhawan, 1991).

Intensive and concerted research efforts on the genetics of resistance in barley against *H. avenae* have been made outside India (Cook, 1974; O'Brien *et al.*, 1979; Giebel, 1982; Nielsen, 1982; Osipova, 1989). However, scarce information is available about the Indian barley germplasm (Yadav *et al.*, 1987). The present investigation was initiated to study the mode of inheritance of resistance in two barley (*Hordeum vulgare* L.) cultivars to *H. avenae*.

Materials and methods

Three barley cultivars, two resistant (RD 2052 and C 164) and a susceptible (DL 482) were used. Information regarding their pedigree, maturity period and source is given in Table I. Seeds of the three cultivars were sown separately in three microplots with seven rows in each plot (2.5 x 1.5 m) for crossing programme, in the genetics field of the Indian Agricultural Research Institute, New Delhi. The susceptible cultivar (DL 482) was taken as a female parent for crossing.

The cross combinations viz., DL 482 x RD 2052 and DL 482 x C 164 were made at I.A.R.I., New Delhi. Seeds from the above two crosses were collected separately. In the off-season of 1990 at Wellington, Nilgiris, Southern India, the seeds from each cross were sown separately to

TABLE I - *Features of the parental material used.*

Parents	Pedigree	Maturity (days)	Reaction to *H. avenae*	Source
DL 482	K 125 X 5413	130-135	Susceptible	Division of Genetics, IARI New Delhi, India
RD 2052	RD 137 X PL 101	125-130	Resistant	A.R.S., Durgapura, Jaipur (Raj.), India
C 164	C 155 X C 141	135-140	Resistant	Dept. of Plant Breeding, H.A.U., Hissar, Haryana, India

raise F_1 generation. Both the F_1s were used as female parents, and were pollinated with their respective parents (P_1 and P_2) to obtain backcrosses (BC_1 and BC_2). During winter season of 1990 (Oct.-Nov.), BC_1 and BC_2 of the two cross combinations were tested alongwith F_1s and F_1s for their reaction to the nematode at Delhi.

Seeds were sown in 10 cm. earthen pots containing 500 cm^3 of sterilized soil and sand mixture (1:1 ratio) and kept under greenhouse conditions. About 500 freshly hatched second-stage juveniles of *H. avenae* (pathotype-l) were released around each plant after two weeks of seed germination. Observations on the final cyst population per pot was ascertained 90 days after nematode inoculation following the procedure of Cobbs sieving and decantation method.

Based on number of cysts formed, the plants were accordingly categorised as: 0-4 cysts/plant (resistant); 5-9 cysts/plant (moderately resistant) and more than 10 cysts/plant (susceptible).

Results and discussion

F_1 of the crosses showed a resistant reaction and the F_2 plants segregated into 3 Resistant: 1 Susceptible ratio thereby suggesting a monogenic dominant behaviour of resistance in both the resistant cultivars (Tables II and III). Further the backcrosses with the susceptible (DL 482), in both the cross combinations showed 1 Resistant: 1 Susceptible ratio, confirming the monogenic nature of resistance. Whereas, that with the resistant parents RD 2052 and C 164 in the cross combinations DL 482 x RD 2052 and DL 482 x C 164, respectively, gave all resistant progenies, confirming the results of the above study on the inheritance of resistance to *H. avenae* in barley.

Our results are in confirmity with those of O'Brien *et al.* (1979), Nielsen (1982), Yadav *et al.* (1987) and Osipova (1989) who have also reported that the resistance to *H. avenae* is governed by a single dominant gene.

The mean number of cysts on the roots of the susceptible parent DL 482 was greater than that of mean number of cysts on the resistant parents as well as F_1 progeny (Tables II and III). The distribution of the number of cysts for the F_1 progeny of DL 482 x RD 2052, was between that of the two parents. But in case of the cross DL 482 x C 164 the mean number of females on F_1 was slightly greater than that of the resistant parent, C 164.

Among the two cultivars, C 164 is low yielding and susceptible to lodging. The inherent potential of these genotypes for resistance against *H. avenae* can easily be transferred to other promising and agronomically suitable cvs. following backcross method or pedigree selection method.

TABLE II - *Mode of segregation for nematode resistance in the parents in different generations of the cross DL 482 x 2052 and number of cysts/plant.*

Source Parent/Cross	Generation	Number of plants/ families		Total plants observed	X^2	Mode of segregation	Number of cysts per plant	
		Resistant	Susceptible				Mean	Range
DL 482 (S)	P_1	–	10	10			53.20	40-70
RD 2052 (R)	P_2	10	–	10			2.30	1-5
DL 482 x RD 2052	F_1	10	–	10			3.10	1-5
	F_2	41	11	52	0.409^{ns}	3:1	8.65	0-62
(DL 482 x RD 2052) x DL 482	BC_1	29	23	52	0.692	1:1	13.35	0-55
(DL 482 x RD 2052) x RD 2052	BC_2	51	1	52			2.86	0-13

TABLE III - *Mode of segregation for nematode resistance in the parents in different generations of the cross DL 482 x C 164 and number of cysts/plant.*

Source Parent/Cross	Generation	Number of plants/ families		Total plants observed	X^2	Mode of segregation	Number of cysts per plant	
		Resistant	Susceptible				Mean	Range
DL 482 (S)	P_1	–	10	10			53.20	40-70
C 164 (R)	P_2	10	–	10			1.30	0-3
DL 482 x C 164	F_1	10	–	10			1.50	0-4
	F_2	38	14	52	0.101^{ns}	3:1	11.73	0-59
(DL 482 x C 164) x DL 482	BC_1	27	25	52	0.384^{ns}	1:1	11.15	1-36
(DL 482 x C 164) x C 164	BC_2	52	–	52			2.20	0-5

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