

RESEARCH ON THE RESISTANCE OF SUNFLOWER INBREDS TO MACROPHOMINA PHASEOLI, ASHBY

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INTRODUCTION

Charcoal rot of sunflower induced by *Macrophomina phaseoli*, Ashby is widely distributed in some regions of Yugoslavia. In order to determine the sources of resistance to the fungus, we tested a number of inbreds using various inoculation methods in different climatic conditions. The experiments carried out in the course of three consecutive years indicated differences in resistance among the examined sunflower genotypes.

However, some genotypes brought largely variable results in different localities because of limited possibilities to control the environmental factors (air temperature, soil moisture, preinoculation stress on host).

On the other hand, reliable information on the degree of resistance of the examined breeding materials were obtained when applying Hsis method for sorghum in a greenhouse, in spite of the weakness of the plants grown there.

Selected inbreds were checked for resistance additionally, in conditions which offered more control over the factors affecting the induction of infection and the course of the disease but maintaining a normal plant growth. This paper reports the results of our investigation conducted in semi-arid conditions of Iran.

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MATERIALS AND METHODS

The investigation was performed during the growing season of 1979 at the Seed and Plant Improvement Institute, Karaj, Iran. Conditions were favorable for the development of the disease. Experiments were conducted in conditions of irrigation (furrow irrigation) to the stage of full flowering. Usual measures of soil cultivation and crop care were applied in the course of the experiments. The planting in field was performed on a severely infected soil, in a plot in which sunflowers were grown six times on ten years. The experiments were carried out according to the system of randomized blocks in three replications. Twelve plants were inoculated in each replication.

The following two inoculation methods were used: the toothpick method (Young, 1943) and USBI method (Sackston and Chan, 1967). Seven-day-old cultures of *M. phaseoli* cultivated on PDA were used for the preparation of inoculi.

Evaluations of the degree of resistance were performed at the stage of physiological maturity, by severing the basal part of the stem. Inbreds which were found to be free of disease symptoms or the symptoms were expressed slightly were marked as resistant.

The results were statistically processed.

RESULTS

A statistical analysis showed a large variability in the resistance to charcoal rot among the examined genotypes.

The results in Table 2 show that there were no significant differences in resistance between the resistant tester, S-31, and the lines derived from the crossings between CM-90-RR and high-oil lines from Soviet varieties (group B). The material derived at Novi Sad from the Canadian line 953-88 (group Sc) showed an increased variability. Its degree of resistance may be compared to that of the resistant line S-451 (Hessa).

Favorable conditions for the induction of infection, i.e., high temperatures, water stress after flowerings, high density of microsclerotia in soil, and the application of "unwounded basal stem inoculation" method brought high percentages of infected plants with the susceptible testers S-200 and S-1.214 (92 and 96%, respectively).

On the basis of the results presented in Table 3, it should be pointed out that the descendants of interspecific hybrids, obtained by

crossing *H. tuberosus* with VNIIMK 8931, proved to be resistant to *Macrophomina phaseoli*. Still, it is necessary to improve the agronomic characters of these lines.

In addition to these inbreds, the inbreds of Argentine origin (Pehuan INTA, Ciro), with only mild symptoms and the percentage of non-attacked plants ranging from 75 to 90%, were classified as resistant.

As the resistance of the examined materials was evaluated on the basis of the average percentage of infected plants, all lines inoculated by the toothpick method were classified as susceptible. The mildest symptoms were found with lines originating from interspecies hybrids.

All examined lines will be included into the further work on the resistance to the agent of charcoal rot through a series of backcrossings.

CONCLUSIONS

The examined inbreds differed significantly in the resistance to charcoal rot.

The descendants of interspecific hybrids were resistant to *Macrophomina phaseoli*.

The lines of Argentine origin (Pehuan, Ciro) showed a high resistance.

The crosses between CM-90-RR and high-oil inbreds of Soviet origin showed a high degree of resistance.

Domestic lines originating from the Canadian line 953-88 were resistant.

The agronomic characters of these lines should be improved.

ABSTRACT

Sunflower inbreds of different genetic origins were tested in field in order to determine their resistance to *Macrophomina phaseoli*, *Ashby*. Experiments were performed during the growing season of 1979 at the Seed and Plant Improvement Institute, Karaj, Iran.

The following two inoculation methods were used:

1. Toothpick method (Young, 1943), and
2. U.S.B.I. method (Sackston and Chan, 1967).

Differences were found among the examined inbreds in the resistance to *Macrophomina phaseoli*.

The progenies of interspecific hybrids obtained by crossing *H. tuberosus* with *H. annuus* proved to be resistant to *Macrophomina phaseoli*. However, the agronomic characters of these inbreds require improvements.

Inbreds which showed only mild symptoms of the disease were classified as resistant. The inbreds of Argentine origin (Pehuan INTA, Circo) showed a high degree of resistance ranging from 75 to 90%.

The collected data suggest that in addition to the above inbreds the breeding material derived from a cross between Sunrise and Texas Wild Annual (Putt and Sackston, 1957) has a high degree of resistance (70-90), comparable with the resistance of the tester S-451 (Hessa).

It may be concluded that all examined inbreds can serve as a possible source of resistance to *Macrophomina phaseoli*.

TABLE 1

Precipitation and air temperatures during the vegetation period of 1979
Loc. Karaj, 1977 - Alt. 1321 m.

Climatic conditions	Vegetation months						Total from IV-IX	Total from I-XII	Mean air IV-IX	T° C I-XII
	IV	V	VI	VII	VIII	IX				
precipitation in mm	9,4	12,5	20,0	0,0	0,0	0,0	41,90	276,50		
Mean monthly temperature of air T° C	16,5	18,0	23,1	28,9	25,6	23,9			22,67	15,57

TABLE 2

Resistance of sunflower inbreds of different genetic origin to Macrophomina phaseoli under artificial inoculation
Loc.: Karaj, 1979

Entry number	Unwounded stem base			Resistance
	Total no. of plants	No. of infected plants	Percentage of susceptible plants	
B - 50.2.1.1	54	6	11.1	R
B - 76.1.1.1	48	5	10.4	R
B - 82.2.2.1	51	6	11.8	R
B - 116.3.2.1	53	7	13.2	R
Sc - 59.4.1.3	56	3	5.4	R
Sc - 60.8.2.1	54	2	3.7	R
Sc - 1140.9.4.1	53	4	7.5	R
Sc - 1145.15.1.3	55	2	3.6	R
S - 30	54	5	9.3	R
S - 200	52	48	92.3	S
S - 451	46	4	8.9	R
S - 1214	52	50	96.2	S

R = Resistant
S = Susceptible

TABLE 3

Best sunflower inbred lines with respect to Macrophomina resistance
Loc.: Karaj, 1979

Entry number	Unwounded stem base			Resistance
	Total no. of plants	No. of infected plants	Percentage of susceptible plants	
<i>Pehuan</i>				
R-91.3.1.4.2	52	5	9.6	R
R-92.3.2.3.1	55	5	9.1	R
Ciro R-93.6.2.2.1	49	6	12.2	R
ISH R-63.4.1.2.1	53	1	1.9	R
R-63.4.2.2.2	55	0	0.0	R
R-63.4.3.4.2	54	1	1.9	R
S-31	54	5	9.3	R
S-200	52	48	92.3	S
S-451	46	4	8.9	R
S-1214	52	50	96.2	S

R = Resistant
S = Susceptible