HELIA, **15**, Nr. 16, p.p. 91-96 (1992)

SCREENING SUNFLOWER INBRED LINES FOR CHARCOAL ROT (*Macrophomina phaseolina*) RESISTANCE.

Akhtar Beg

Pakistan Agricultural Research Council
P.O. box 1031, Islamabad – Pakistan

SUMMARY

Eighty sunflower inbred, almost all registered in Crop Science, U.S.A, as parental lines, were tested at Agricultural Research Centre, Islamabad, during the autumn season of 1990 for charcoal rot resistance. The lines were artificially inoculated with *Macrophomina phascolina* prepared on PDA by toothpick method when plants started flowering. Infection was measured on pith by splitting the stalk, near maturity, 35 days after infection. None of the line showed resistance, however, differencs in infection volume exhibited relative susceptibility. Inbred lines HA–89, HA–224, HA–232, HA–288 and HARI had less than 20 cm pith infection.

Key words: *Heliantus annuus*, charcoal rot, *Macrophomina phaseolina*, inbred lines, resistance

INTRODUCTION

Sunflower is grown in Pakistan during two seasons, spring season in which crop is usually planted by 1st week of February and is ready for harvesting in mid–May. The temperatures during February are low and gradually rise till May. The maximum temperature is around 40°C from the middle of May to the end of June; later, temperatures start getting gradually low and winter temperature starts from the beginning of November. Winter usually remains relatively dry to July. This is the scenario in sunflower growing areas located in the centre of the country called the cotton zone.

Pakistan's main sunflower growing season is February to May. The reason to adapt the sunflower crop to this season is that previous to this period the land is occupied by cotton and rice crops and during spring this land is fallow.

Second sunflower growing season is from July to October. This is the period when monsoon rains occur throughout the country. Thus due to availability of moisture, most farmers, specially small farmers of rainfed areas grow impotant summer crops like corn, sorghum, groundnut, pulses as well as millet, and very little area comes under sunflower.

The problem of charcoal rot usually prevails during spring season mostly in rainfed areas. In cotton and rice fallow areas where irrigation water is available, charcoal rot does not develop when soils are wet or when soil is not dry for at least three weeks and the temperature is high.

It is the rainfed area where rains during spring do not occur and temperature gets higher during April and May, where charcoal rot appears in higher quantity. Experience shows that variety NK–212 has a certain amount of resistance to charcoal rot and that is

why this variety is popular in rainfed areas and also grown on a large acreage in irrigated areas. Varieties like C–204 & C–206, which are major varieties used by Cargill Co., are severely affected by charcoal rot during spring in drought conditions.

It may be mentioned that the target for last year's sunflower production in the country was 150,000 acres and this year, 1990–91, it is 200,000 acres. Most of the area will be planted in spring.

MATERIAL AND METHODS

Eighty sunflower inbred lines received from Dr. Thomas Gulya, sunflower pathologist, USDA Northern Crop Science Lab., Fargo ND, USA, were planted during the summer season (autumn) 1990 at National Agricultural Research Centre (NARC), Islamabad, Pakistan. Each entry was planted on July 15, in a plot consisting of 2 rows spaced 75 cm apart and 5 m in length with plant to plant distance of 20 cm, thus each row had 25 plants.

Fertilizer dose at the rate of 100 kg N–56 kg P_2O_5 per ha was applied at the time of soil preparation, and soil was prepared one week before sowing. No pre– or post–emergence herbicide was applied in the trials, however, hand hoeing was done regularly to remove all sorts of weeds. No irrigation was applied during the growth period of the trial as there were sufficient rains due to monsoon season. Rainfall during the growing season occurred from July to October.

Culture of *Macrophomina phaseolina* was prepared in PDA medium with tooth–picks placed in Petri dish. Plants of each inbred lines were inoculated at anthesis stage, at the beginning of flowering, using toothpick method. Plants were inoculated about 20 cm above soil surface.

Data on disease symptoms and severity were recorded at maturity 35 days after inoculation in the first fortnight of October, when the plants were mature and ready for harvest. The data were taken by splitting the inoculated stalks longitudinally and measuring the length of rotted pith in each stalk. The infection data are reported in the table attached.

RESULTS AND DISCUSSIONS

The inbred lines supplied by Dr. Gulya were tested in rainfed conditions during autumn and these trials received monsoon rains. Therefore, there was no severe natural infection of charcoal rot on other trials and the commercial crop this year. Even our susceptible variety C–204 was free from charcoal rot in the autumn season although it usually gets 60–70% infection in rainfed areas in spring due to which its yield is reduced by 50 percent.

In the trial, as shown in the table, some of the lines express certain degree of resistance, such as HA–89, HA–224, HA–232, HA–234, HA–288 and HARI. They have less than 20 cm pith infection but the rest of the lines have more than 20 cm infection area. Some lines have higher susceptibility, i.e., 42–46 cm pith infection.

REACTION OF SUNFLOWER LINES TO INOCULATION WITH CHARCOAL ROT (*Macrophomina Phaseolina*) AT NATIONAL AGRICULTURAL RESEARCH CENTRE (NARC) ISLAMABAD, PAKISTAN, DURING AUTUMN 1990
AVERAGE INFECTED AREA OF 5 INOCULATED PLANTS

Inbred lines Pith with infection ranging from 6 to 20 cm

S.No.	*Line No.*	*Pith area rotted in cm*
1.	HA 89	6.60
2.	HA 61	14.00
3.	HA 60	17.00
4.	HA 232	17.50
5.	HA 288	17.50
	HA R1	18.25
6.	HA 224	18.33
7.	HA 234	19.00
8.	HA 207	20.00
9.	HA 300	20.00
Inbred lines with Pith infection ranging from 20 cm to 30 cm		
S.No.	*Line No.*	*Pith area rotted in cm*
10.	HA 852	20.40
	R3	22.40
11.	HA 308	22.50
12.	RHA 279	22.50
	ND BLYS	23.50
13.	HA 113	23.75
14.	HA R4	23.80
15.	HA 303	25.00
16.	HA 124	25.00
17.	RHA 273	25.00
18.	HA 305	25.00
19.	HA 316	25.00
20.	RHA 265	26.50
21.	ND BLOS	26.50
22.	HA 822	26.80
23.	HA 304	27.00
24.	HA 307	27.00
25.	HA 312	27.00
26.	HA 339	27.14
27.	HA 302	27.50
28.	HA 853	27.80
29.	HA–R 2	28.80
30.	DM–2	29.00
31.	RHA 295	30.00
32.	HA 335	30.00

Inbred lines with pith infection ranging from 30cm to 40cm		
S.No.	*Line No.*	*Pith area rotted in cm*
33.	ND LBLYS	30.20
34.	BLPL2	30.31
35.	HA R5	31.00
36.	ND–BLPL2	31.25
37.	HA 821	31.80
38.	HA 301	32.00
39.	RHA 271	33.00
40.	DM–1	33.30
41.	ND–ERYS	34.50
42.	HA 306	35.00
43.	HA 850	35.00
44.	DM–3	35.00
45.	RHA–278	35.40
46.	RHA–266	36.00
47.	RHA–854	36.00
48.	RHA–274	36.20
49.	HA 338	36.60
50.	RHA 299	37.50
51.	ND–01	38.50
52.	HA 851	39.00
53.	RHA 855	40.00
54.	RAA 856	40.00
Inbred lines with pith infection ranging over 40 cm		
55.	ND–LRLYS	41.0
56.	ND–MTC	45.6

CONCLUSION

From the trial it is concluded that selection of inbred lines can be made for resistance to charcoal rot, but so far none of the lines are resistant. To save the crop of sunflower from severe attacks of this disease, it should always be irrigated when the temperatures are high and rains are absent.

SELECCION DE LINIAS PURAS DE GIRASOL POR RESISTENCIA A PODREDUMBRE CARBONOSA *(Marcrophomina phaseolina)*.

RESUMEN

Ochenta líneas de girasol, casi todas registradas en Crop Science, U.S.A., como líneas parentales, fueron ensayadas en el centro de Investigación Agrícola de Islamabad durante el otoño de 1990 por resistencia a la podredumbre carbonosa. Las líneas se inocularon artificialmente con *Macrophomina phaseolina* preparada sobre PDA por el método del mondadientes, al inicio de la floración. Se midió la infección de médula abriendo longitudinalmente el tallo, proximamente a la maduración, a los 35 días de la infección. Ninguna de las líneas mostró resistencia; sin embargo, la diferencia en el volumen de infección indicó la susceptibilidad relativa. Las líneas puras HA–89, HA–224, HA–232, HA–288 y HARI tienen menos de 20 cm de infección de médula.

SCREENING D'HYBRIDES ET DE LIGNÉES DE TOURNESOL PORTANT SUR LA RÉSISTANCE AU CHARBON DE LA RACINE *Macrophomina phaseolina.*

RÉSUMÉ:

18 inbred de tournesol presque tous enregistrés dans le Crop Science Journal ,U.S.A, comme lignées parentales ont été testés Centre de Recherches Agricoles d'Ismalabad au cours de l'automne 1990 pour déterminer leur résistance au charbon de la racine. Les lignées ont été artificiellement inoculées avec *Macrophomina phaseolina* par la méthode du cure dent (préparé sur PDA) appliquée au stade début floraison. L'infection a été estimée sur la moelle 35 jours aprés inoculation (stade proche de la maturité) en ouvrant la tige. Aucune lignée n'a montré de résistance cependant, des différences portant sur le volume de moelle infectée ont montré des sensibilités relatives. Les lignées HA-89, HA-224, HA-232, HA-288 et HARI ont présenté moins de 20 cm de moelle infectée.