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SCREENING FOR RESISTANCE IN SUNFLOWER AGAINST *Alternaria helianthi*

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SUMMARY

Twenty sunflower (*Helianthus annuus* L.) hybrids+OPV were evaluated for their resistance to leaf blight and stem spot disease caused by *Alternaria helianthi* in the field under epiphytotic conditions at the National agricultural research centre, Islamabad, during autumn season, 1984. Only one hybrid, Suncross 25-3 was found significantly (P=0.05) highly resistant, 5 were moderately susceptible with non-significant differences in their reactions and the remaining hybids were either susceptible or highly susceptible to the disease.

Key words: *Alternaria helianthi*, leaf and stem blight, resistance *Helianthus annuus*, Pakistan.

INTRODUCTION

Leaf blight and stem spot disease of sunflower (*Helianthus annuus* L.) caused by *Alternaria helianthi* (Hansf.) Tubaki & Nishihara, has been reported as a common disease of sunflower in the United States (Carson, 1985a,b; Herr and Lipps, 1982; Morris et al., 1983) and other regions of the world (Agrawat et al., 1979; Allen et al., 1981). In the United States, it has been reported to cause damage to sunflower in Florida, Minnesota, Mississippi, Ohio, South Dakota and Wisconsin (Carson, 1982; Herr and Lipps, 1982; Sackston, 1981; Shane et al., 1981; Morris, 1983; Tretvathan and Roy, 1980). The pathogen is capable of inciting disease over a wide range of temperatures (Achimovic, 1974) and thus, constitutes a potential threat to sunflower producing regions worldwide (Zimmer and Hoes, 1978; Sackston, 1981).

Alternaria blight has been reported to cause significant yield losses in Africa, Australia, India and Yugoslavia (Allen et al., 1981; Balasubrahmanyam and Kolte, 1980a,b; Vader Westhuizen and Holtzhauzen, 1980; Zimmer and Hoes, 1978). The disease has been reported to reduce the seed and oil yields by 27 to

80 and 17 to 33 %, respectively (Balasubrahmanyam and Kolte, 1980b; Reddy and Gupta, 1977). The loss in seed germination varies from 23 to 32 % (Balasubrahmanyam and Kolte, 1980b). Yield-loss studies conducted in South Dakota (Carson, 1985a) and Australia (Allen et al., 1981) indicate that it is a potentially serious disease. Yield losses as great as 60 % after field inoculations have also been reported in South Dakota (Carson, 1985a,b). In Pakistan, it was recorded for the first time at the National Agricultural Research Centre (NARC), Islamabad, in 1982, resulting in extensive defoliation and lodging of the plants (Mirza et al., 1984).

Substantial information is available on the effective control of the disease through fungicidal sprays (Kolte et al., 1979; Saksena et al., 1979; Sackston et al., 1979) but, the most economical means for reducing the disease losses is genetic resistance. Resistance to *Alternaria* blight has been reported (Agrawat et al., 1979; Mehdi et al., 1984; Morris, 1983; Carson, 1985b; Lipps, 1986). Since, information on resistance appear to be lacking in Pakistan, therefore, studies were undertaken to evaluate reactions of sunflower cultivars to locate potential sources of genetic resistance against *Alternaria* blight disease.

MATERIALS AND METHODS

A field trial comprising 14 sunflower hybrids and 6 open pollinated varieties (OPV) (Table 1) was conducted to evaluate their resistance to *Alternaria* blight in six plots, under Barani Agriculture Research and Development Project, at NARC, Islamabad. The experiment was laid out in randomized complete block design with 3 replications. Each hybrid was sown during the first week of July 1984 in plot of two rows, 5 m in length and with row to row distance of 75 cm. The plants were spaced 25 cm apart within rows. The normal cultural and agronomic practices were applied during the entire season of the crop as recommended for sunflower.

Data on the disease intensity were assessed visually by taking two scores. First scoring was made on 10 September based on more than 10 plants per replication at seed development stage and the second scoring on 19 September using 0-9 scale, where O= no infection or no leaf blight symptoms; 1-3= resistant (necrotic flecks with chlorotic halos); 4= moderately resistant; 5-6= moderately susceptible; 7-8= susceptible, while 9= highly susceptible (with all plants blighted). Disease score for individual plants was averaged in each replication.

Data were subjected to statistical analysis by applying Duncan`s Multiple Range Test to determine the significance of differences among the cultivars.

RESULTS AND DISCUSSION

Twenty sunflower hybrids+OPV evaluated for their resistance under natural epiphytotic conditions, varied greatly in their reaction to *Alternaria* blight (Table. 1). The disease had not developed in epidemic form by 10 September at the time of first scoring and the cultivars expressed disease intensity mean score ranging from 1.8 (Suncross 25-3) to 6.5 (NK-254) with significant differences. But in the second observation, the disease progressed very rapidly by 19 September. Disease intensity mean score ranged significantly from 1.3 (Suncross 25-3) to 9.0 (IS-894, Cargil-204) and the cultivars showed significant (P=0.05) differences in their reactions.

Table 1: Reaction of sunflower hybrids/OPV to *Alternaria helianthi* during autumn season at NARC, Islamabad

S.No.	Hybrid/OPV	Disease Intensity Mean*			Disease reaction
		Ist.scoring (10 Sept)	2nd scoring (19 Sept)		
1.	Cargill-204	5.66	9.00	a**	HS
2.	IS-894	5.30	9.00	a	HS
3.	Morden-20	4.52	8.67	ab	HS
4.	NK-254	6.59	8.33	abc	S
5.	CM 588 x 591	6.09	8.33	abc	S
6.	Suncross-843	4.66	8.00	abcd	S
7.	Corona (OPV)	4.91	8.00	abcd	S
8.	Argentario (OPV)	4.16	8.00	abcd	S
9.	Saturn (OPV)	4.10	7.67	bcde	S
10.	CM 338 x 469	4.31	7.33	cde	S
11.	NK-265	4.34	7.33	cde	S
12.	SC-83 (OPV)	3.76	7.00	def	S
13.	Morden-12	4.30	7.00	def	S
14.	NK-275	4.69	6.67	ef	S
15.	Sundak (OPV)	3.76	6.00	fg	MS
16.	HO-I (OPV)	3.86	5.67	g	MS
17.	Suncross-150	3.32	5.33	g	MS
18.	NK-212	2.99	5.00	g	MS
19.	NK-2012	3.54	5.00	g	MS
20.	Suncross 25-3	1.00	1.33	h	R
	LSD (0.05)		0.95		

* Disease intensity mean of 3 replications (more than 10 plants per replication were assessed on 0-9 scale).

** Figures in column followed with the same letters did not differ significantly (P=0.05) according to Duncans Multiple Range Test.

Of the 20 sunflower hybrids+OPV, only one hybrid, Suncross 25-3, remained resistant with significant (P=0.05) differences from others. Five hybrids, NK-212, NK-2012, Suncross-150 including two OPV, HO-1 and Sundak, were found moderately susceptible, 11 susceptible and the remaining 3 highly susceptible. Hybrid Suncross 25-3 expressed high significant (P=0.05) differences from highly susceptible hybrids, IS-894, Cargil-204 and Morden-20, as well as from other susceptible and moderately susceptible cultivars.

High disease intensity in most of the hybrids+OPV can be attributed to the most favourable environments for disease development to which these were exposed and virulence of the pathogen. A wide range of infection under these conditions indicates a greater genetic variability of the hosts.

Resistance in *H. annuus* to *Alternaria* blight has been reported (Agarwat et al.1979; Morris, 1983; Islam and Maric, 1983; Mehdi et al., 1984; Carson, 1985; Lipps, 1986). *H. tuberosus* has also been reported to have resistance to this disease (Morris et al., 1983; Islam and Maric, 1983; Lipps, 1986). They have suggested that resistance could be transferable to cultivated sunflower by back cross breeding of inbred with resistant perennial species. Interspecific crosses with different *Helianthus* spp. have been accomplished in the Soviet Union (Pustovoit, 1966) and cultivars have been developed with immunity to several diseases through interspecific hybridization with *H. tuberosus* (Pustovoit and Gubin, 1974).

CONCLUSIONS

The high level of resistance expressed by the hybrid Suncross 25-3 can be relied upon and utilized for breeding resistant, high yielding sunflower cultivars and as means of control or reducing yield losses caused by this important disease. However, the efforts to locate potential sources of resistance in sunflower should be continued and interspecific hybridization of *H. annuus and H. tuberosus* for high level of resistance should be explored further.

REFERENCES

Achimovic, M. 1974. Effect of some ecological factors on sporulation of *Alternaria helianthi* (Hansf.) Taub. & Nish. and on infection of sunflower. Zastita Blija 30:59-63.

Agrawat, J.M., Chippa,H.P. and Mathur, S.J. 1979. Screening of sunflower germplasm against *Alternaria helianthi*. Indian J. Mycol. Plant Pathol. 9:85-86.

Allen, S.J., Kochman, J.K. and Brown, J.F. 1881. Losses in sunflower yield caused by *Alternaria helianthi* in Southern Queensland. Aust. J. Agri. Anim. Husb. 21:98-100.

Balasubrahmanyam, N. and Kolte, S.J. 1980a. Effect of different intensities of *Alternaria* blight on yield and oil contents of sunflower. J. Agric. Sci. 94:749-751

Balasubrahmanyam, N. and Kolte, S.J. 1980b. Effect of *Alternaria* blight on yield components, oil content and seed quality of sunflower. Indian J. Agric. Sci. 50(9):701-706.

Carson, M.L. 1982. Effects of leaf blight caused by *Alternaria helianthi* on sunflower seed yield and other agronomic traits. (Abstr.) Phytopathology 72:984.

Carson, M.L. 1985a. Epidemiology and yield losses associated with *Alternaria* blight of sunflower. Phytopathology 75:1151-1156.

Carson, M.L. 1985b. Reactions of sunflower inbred lines to two foliar diseases. Plant Dis. 69:986-988.

Herr, L.J. and Lipps, P.E. 1982. *Alternaria helianthi* on sunflower in Ohio. Plant Dis. 66:509-512.

Islam, U. and Maric, A. 1980. Contribution to the study on the biology, epidemiology and resistance of sunflower to *Alternaria helianthi* (Hansf.) Taub. & Nish. Zastita Bilja, 319(1):35.

Kolte, S.J., Balasubrahmanyam, N., Tewari, A.N. and Awasthi, R.P. 1979. Field performance of fungicides in the control of *Alternaria* blight of sunflower. Indian Agric. Sci. 49(7):555.

Lipps, P.E. 1986. Reaction of *Helianthus annuus* and *H. tuberosus* plant introductions to *Alternaria helianthi*. Plant Dis. 70:831-835.

Mehdi, S.S., Carson, M.L. and Lay, C.L. 1984. Genetic x phenotypic association of resistance to four diseases in two sunflower populations. Pages. 13-14 in: Proc. Sunflower Res. Workshop, 6th National Sunflower Association, Bismarck, ND.

Mirza, M.S., Beg, A. and Yasmin, A. 1984. First report of *Alternaria helianthi* on sunflower from Pakistan. Helia 6:33-34.

Morris, J.B., Yang, S.M. and Wilson, L. 1983. Reaction of *Helianthus* species to *Alternaria helianthi*. Plant Dis. 67:539-540.

Pustovoit, G.V. 1966. Distant (interspecific) hybridization of sunflower in the USSR. Pages. 82-101 in: Proc. Int. Sunflower Conf., 2nd. Modern, Manitoba, Canada.

Pustovoit, G.V. and Gubin, I.A. 1974. Results and prospects of sunflower breeding for group immunity by using the interspecific hybridization method. Pages. 373-381 in: Proc. Int. Sunflower Conf., 6th. Bucharest, Romania.

Reddy, P.C. and Gupta, B.M. 1977. Disease loss appraisal due to leaf blight of sunflower incited by *Alternaria helianthi*. Indian Phytopath. 30(4):569.

Saksena, H.K., Shukla, H.P. Singh, P.N. and Srirastava, S.S.L. 1979. Chemical control of *Alternaria* leaf spot of sunflower. Indian J. Mycol. Plant Pathol. 9(2):274.

Sackston, W.E. 1981. Sunflower crop and diseases: Progress, problem and prospects. Plant Dis. 65:643-648.

Shane, W.W., Baumer, J.S. and Sederstrom, S.G. 1981. *Alternaria helianthi*: A pathogen of sunflower new to Minnesota Plant Dis. 65: 269-271.

Tretvathan, L.E. and Roy, K.W. 1980. *Alternaria* leaf spot and stem disease of sunflower. Miss. Agric. For Exp. Stn Inf. Sheet 1295.

Vander Westhuizen, G.C.A. and Holtzhauzen, M.A. 1980. *Alternaria helianthi* on sunflower in South Africa. Phytophylactica 12:49-52.

Zimmer, D.E. and Hoes, J.A. 1978. Diseases. Pages 225-262 in: Sunflower Science & Technology. Agron. Monogr. 19. J.F. Carter ed: Am. Soc. Agron. Madison. WI. 505 pp.

CRIBADO PARA RESISTENCIA CONTRA *Alternaria helianthi* EN GIRASOL

RESUMEN

Veinte híbridos y variedades de polinización abierta fueron evaluadas para resistencia a las enfermedades que producían manchas foliares y en el tallo causadas por *Alternaria helianthi* en el campo bajo las condiciones del Centro Nacional de Investigación Agraria de Islamabad durante la estación de otoño de 1984. Solamente un híbrido, Suncross 25-3 se encontró significativamente (p=0.05) resistente 5 moderadamente susceptible con diferencias no significativas en sus reacciones y los restantes fueron bien susceptibles o alta ente susceptibles a la enfermedad.

CRIBLAGE POUR LA RÉSISTANCE À L'*Alternaria helianthi* CHEZ LE TOURNESOL

RÉSUMÉ

Vingt hybrides et populations de tournesol ont été évaluées pour leur résistance à l'*Alternaria helianthi* sur feuille et sur tige, en conditions d'infestation naturelle de plein champ, au National Agricultural Research Centre d'Islamabad, durant l'automne 1984. Un seul hybride, Suncross 25-3 est apparu d'un niveau signifacativement élevé de résistance (P=0.05), 5 modérément sensibles avec des différences de comportement non significatives et les autres sensibles ou fortement sensibles à la maladie.