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Research Article

Evaluation and Identification of Alternaria leaf spot resistant sunflower genotypes

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Abstract:
All India coordinated sunflower entries belonging to advance hybrid trial were screened initially by infector row technique under field conditions followed by green house conditions by artificial inoculation during 2007 and 2008 for *Alternaria* leaf blight resistance. The study indicated that field screening alone is not dependable for assessing the disease resistance, especially when the disease pressure is less because of chances of disease escape. The present study clearly shows that green house assay is particularly useful when field screening is ineffective due to unfavourable environmental conditions or co-presence of other foliar pathogens.

Key words:
Sunflower, leaf blight, *Alternaria,* screening, resistance

Introduction

Sunflower is an important oilseed of our country. The major constraint in profitable sunflower cultivation is the susceptibility to *Alternaria* leaf and stem blight caused by *Alternaria helianthi.* The disease appears in Karnataka, Uttar Pradesh, Maharastra, Bihar, Andhra Pradesh, Haryana and Tamil nadu and causes 27 to 80 per cent reduction in seed yield. It significantly reduces both seed yield and oil content besides leading to germination losses (Reddy and Gupta, 1977; Hiremath *et al.,* 1990). The control of the disease using fungicides is not practicable under Indian conditions. In such a situation, the development and cultivation of resistant cultivars offer the most economic means of disease management. Further, the disease development is highly dependent on environmental conditions and growth stages of the crop causing epidemics during rainy season (Bhaskaran and Kandaswamy 1980; Allen, 1983 a and 1983b; Jeffrey *et al.,* 1984). The disease exerts considerable effect on plant height, stem girth, head diameter, seed yield, seed weight, hull content and oil content. The pathogen *A.helianthi* produces a specific toxic metabolite in culture which produces a typical symptom of the disease when inoculated on the leaves (Kumar *et al.,* 1991). It is also reported that the toxin inhibits the seed germination as well as root and shoot growth under *in vitro* conditions (Islam and Marić, 1980). Host resistance is one of the economical and effective management options for this disease. Breeding for disease resistance requires an efficient screening technique, genetic sources for resistance and appropriate transfer of resistance genes into improved cultivars. Wild species of sunflowers serve as potential sources for several desirable characteristics including disease resistance (Seiler, 1992). Significant variation has been reported in wild *Helianthus* species with regard to the sensitivity to *A. helianthi* and perennial wild *Helianthus* species conferring resistance to this pathogen were identified (Morris *et al*., 1983; Lipps and Herr, 1986; Sujatha *et al.,* 1997).Even though source of absolute resistance for this dreaded disease has not been identified, there is considerable scope for utilizing tolerant genotypes in resistant breeding programmes. Screening for

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disease resistance should be done under high disease pressure to get a reliable resistant source. Hence, it is important that the materials have to be screened under field as well as glass house conditions. Keeping in view the importance of *Alternaria* leaf spot in sunflower, the present study was carried out to assess the correlation between artificial and field screening and identify *Alternaria* leaf spot tolerant genotypes.

Material and Methods

All India coordinated entries received from Directorate of Oilseeds Research, Hyderabad during kharif 2007 and 2008 were used in the present study. The test entries were screened initially by infector row technique. In this technique, *Alternaria* leaf spot susceptible cultivar Morden was used as infector row. The infector row was sown 15 days prior to the sowing of test entries. The infector row was sown in between 5 rows of test entries and all around the plot for maintaining uniform disease pressure throughout the field. The test entries *viz*., 14 entries during 2007 and 24 entries during 2008 along with Morden as susceptible check were sown during July. Regular agronomic practices were followed. The incidence of *Alternaria* leaf spot was scored on 60 days after sowing. All the field tested entries were tested under artificial conditions also. For this, each entry was planted in mud pots at the rate of 2 plants/pot. For each entry, 5 pots were used and 3 replications were maintained. Appropriate uninoculated control was maintained for each entry.

The spore suspension of *A. helianthi* was prepared from 9 day old virulent culture maintained on PDA and filtered through two layers of sterile muslin cloth to remove residual mycelia. Haemocytometer was used to count spores and adjust with sterile water to obtain a concentration of 106 spores/ml. Few drops of Tween-20 were added to spore suspensions for enhancing stickiness. The spore suspension was kept agitated to prevent settling down of conidial mass. The plants kept in glass house were sprayed with spore suspension on 30 days after sowing and covered with polythene cover for 24 hours for maintaining high humidity. The control plants were sprayed with sterile water. The disease score was carried out 20 days after inoculation and expressed as per cent Disease Index.

Results and Discussion

Kharif 2007

Leaf spot incidence was less in entries Sunbred-00997 (2.4 %), 64S99 (2.8 %) and KBSH-44 (3.4 %) when compared to other entries under field conditions during *kharif* 2007 (Table 1). In rest of entries leaf spot incidence ranged between 5.8 - 16.8 per cent. The highest incidence of 16.8 per cent was recorded in PAC-1091. The susceptible check, Morden recorded 18.6 per cent disease incidence.

All these entries were also screened under green house conditions under pot culture by artificially inoculating 30 days old plants. The incidence was more in all the entries when compared to field screening as the disease pressure was very high under artificial conditions. 64S99 recorded least leaf spot incidence of 3.6 % followed by KBSH-44 (5.6 %). Bisco-210, KBSH-1, KBSH-55 and Sunbred-00997 also recorded low leaf spot incidence and ranged between (7.2 % - 9.3 %). Maximum incidence of 21.4 per cent was observed in PAC-1091. Incidence of disease in check variety Morden was 48.2 per cent.

Kharif 2008

PAC-337 and MDSFH-411 were free from *Alternari*a leaf spot incidence Leaf spot incidence was less in entries Raja-333 (2.6 %), Suryakiran (2.5 %) and Sunbred-19012 (3.2 %) when compared to other entries under field conditions (Table 2). It was observed in the range of 2.4 - 8.3 per cent in other entries. In general, the incidence was less during 2008 when compared to 2007.

All these entries were screened under green house conditions in pot culture by artificially inoculating with 9 day old culture of *Alternaria helianthi* on 30 day old plants. 64S99 has recorded the least leaf spot incidence of 7.5 per cent followed by PAC-337 (8.1 per cent). KBSH-58 recorded the highest incidence of 26.8 per cent.

The field screening alone is not dependable for assessing the disease resistance, especially when the disease pressure is less because of chances of disease escape. Some sunflower genotypes showed low disease incidence in detached leaf technique, but showed more blight intensity in green house assay and there was no definite trend of association with field score in the case of *Alternaria* leaf blight (Shaik and Ravikumar, 2003). Normally, *Alternaria* leaf blight infection will be higher under high humidity of 80-90 per cent, temperature of 25^{o}C and can be simulated in glass house conditions. Similarly, the optimum conditions determined for lesion development in case of *Alternaria* blight of Paulownia trees were incubation at 25-30 ^{o} C with 98-199 per cent relative humidity (Pleysier *et al*., 2006). The use of optimum inoculum concentration will not only reduce the chance of over looking susceptible plants but will also discriminate between various levels of resistance (King, 1994; Surujdeo-Maharaj *et al*, 2003). The present study clearly shows that green house assay is particularly useful when field screening is ineffective due to

unfavourable environmental conditions or co-presence of other foliar pathogens.

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Table1. Screening of Advance Hybrid Trial entries (Kharif 2007) against *Alternaria* leaf spot under field conditions

Sl.No.	Entries	Alternaria PDI	
		Field condition	Artificial condition
1	LSFH-05-36	13.5	15.6
2	PAC-361	16.7	18.4
3	Sunbred-00997	2.4	9.3
4	BSFH-4	5.8	10.8
5	MDSFH-404	17.4	15.8
6	64S99	2.8	3.6
7	JKSFH-238 (Surya)	12.6	18.2
8	K-642	15.8	13.6
9	Bisco-210	4.2	7.2
10	PAC-1091	16.8	21.4
11	Bisco-209	12.0	10.6
12	KBSH-1	8.6	7.9
13	KBSH-44	3.4	5.6
14	KBSH-55	5.6	8.6
	Morden (Check)	18.6	48.2

Table2. Screening of Advance Hybrid Trial entries (Kharif 2008) against *Alternaria* leaf spot under field conditions

Sl.No.	Entries	Alternaria PDI	
		Field condition	Artificial condition
1	PAC-337	0	8.1
2	MDSFH-411	0	12.4
3	Raja-333	2.6	18.3
4	MRSF-1144	4.3	10.4
5	KBSH-44	3.1	17.8
6	Suryakiran	2.5	15.1
7	LSFH07-03	3.3	12.7
8	Sunshine	4.5	19.3
9	PAC-1091	4.1	10.0
10	SF-204	2.2	14.9
11	KBSH-58	7.4	26.8
12	NSSH-621	3.7	8.6
13	Sunbred-19012	3.2	16.4
14	PAC-336	3.3	11.2
15	LSFH-05-36	2.8	15.7
16	PAC-361	4.1	17.3
17	Sunbred-00997	3.6	14.1
18	BSFH-4	8.3	21.9
19	MDSFH-404	5.1	13.6
20	Bisco-210	5.7	19.4
21	KBSH-1	10.2	22.3
22	Bisco-209	3.7	9.1
23	KBSH-55	8.5	11.9
24	64S99	2.4	7.5
	Morden (Check)	12.6	37.1